It’s a game of give and take: Modeling behavior in a give-or-take-some social dilemma

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Abstract

We investigate a new give-or-take-some (GOTS) dilemma paradigm that merges traditional give-some and take-some dilemmas. In this hybrid social dilemma, individuals can choose to give or to take resources from a shared resource pool. Previous empirical work by McCarter, Budescu, and Scheffran (2011) found that the composition of the group and the individuals’ endowments influenced their tendency to give and/or take. We reanalyze results from two experiments from McCarter, Budescu, et al. (2011) using the new paradigm and propose a simple model of individual behavior based on the players’ perceptions of their relative standing in the group and their perception of fair allocations. We also use these data to fit the model at the individual level and use it to provide a general framework for interpreting the group results.

Keywords

social dilemmas, collective action, resource management, give-some dilemma, take-some dilemma, environmental uncertainty, strategic uncertainty, social uncertainty

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At a small, private university is a shared database containing names of (potential) donors. Each school’s office of advancement is encouraged to contribute names to the list that then may be taken and used by any advancement office in attempt to raise money for their respective school (Lindahl & Conley, 2002).

In the villages of Eastern Europe, it was a custom before the New Year for a messenger to go from house to house with a sack. Those who could afford it put coins in the sack; those who were poor took coins from the sack. No one was embarrassed because he was poor. Every family had money to buy the things they needed to celebrate the holiday (Jewish Outreach Institute, 2008).

During the early history of The Church of Jesus Christ of Latter-day Saints, member families would voluntarily contribute crops, livestock, and other provisions to a community storehouse. There, member families in

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need would request food and provisions from
the storehouse to live on (Geddes, 1924).

These examples highlight that many benefits we
enjoy in organizations and other collectives
depend on proper management of shared
resources. However, it is well known that the
management of shared resources often intro-
duces social dilemmas. Social dilemmas are group
decisions-making situations with three basic
properties: (a) individuals face choices between
multiple actions, (b) choice of the self-maximization
action always results in greater benefit for an indi-
vidual, but (c) if all, or enough, individuals chose
the self-maximization action, the result is less
beneficial than if all had acted to maximize the
collective benefits (Dawes, 1980; Liebrand, 1983).
For example, in the case of the shared database it
is in each school's interest to contact as many
donors as possible, but if they all do, they may
exhaust the donors' resources (not to mention
their good will).

The traditional social dilemma paradigm, while
useful in addressing simple resource management
problems, is limited in its application to more
complex resource management situations. For
instance, the social dilemma paradigm traditionally views shared-resource management as either a
common-pool resource dilemma or a public-
goods dilemma (Dawes & Messick, 2000), but in
many instances managing shared resources entails
aspects of both dilemmas simultaneously.

Returning to the first example, the database of
potential donors is a common-resource pool from
which schools harvest contact information (at a
fixed cost) to supply research funds and scholar-
ships to their faculty and students, respectively.
But, this shared database is also a public good: it is
maintained by the contributions of contact informa-
tion (of the benefactors) by the various schools
at the university. This limitation underscores a
conversation among social dilemma scholars
stretching across three decades (e.g., Cross &
Guyer, 1980) with little empirical research. In this
article we discuss the burgeoning research on a
hybrid social dilemma termed the give-or-take-
some (GOTS) dilemma where individuals can give
and/or take resources from a shared resource, and
we model the results from two recently published
experimental studies of the GOTS dilemma
(McCarter, Budescu, and Scheffern 2011).

We begin by reviewing the literature germane
to hybrid social dilemmas. Next, we describe in
some detail the experiments and results recently
published by McCarter et al. (2011). Our key
contribution in the current article is the develop-
ment of a new family of models that describes
the behavior of the individual players in the
GOTS dilemma. We use the data from the
McCarter et al. (2011) experiments to fit the
model and present several simulations using the
model and its estimated parameters to illustrate
other group-level predictions of the model. We
conclude with a discussion of the implications of
these models in relation to hybrid social dilem-
as and conflict management.

Brief literature review

Social dilemmas

The social psychological research literature on
social dilemmas distinguishes between give-some
(GS) dilemmas and take-some (TS) dilemmas. In
GS dilemmas, actors' choose between withholding
resources for private use or giving resources

toward the development or sustaining of a good
that is nonexcludable and nonrival: a public good
(Olson, 1995). A nonexcludable good can be used
by anyone regardless of whether the actor helped
to create or sustain it; the nonrival property implies
that one's enjoyment of the good does not sub-
tract from someone else's enjoyment of the good
(Kollock, 1998). Cooperation in this social
dilemma occurs when actors choose to give
toward the public good, and defection occurs
when the actor chooses not to give, or give little,
toward the public good. Typical examples are
public radio and television in the USA: They are
available to everyone to enjoy, but their financial
existence depends on voluntary contributions of
(a typically quite small minority of) listeners and
viewers. Another example are shared power pools
in the northeast of the USA (Wren, 1967) to
which partnering power companies may contribute generated energy that can be used by other companies irrespective of how much they contribute and without diminishing each other’s enjoyment of accessible power.

TS dilemmas are structurally similar to GS dilemmas. In fact, they are a mirror image since they capture consumption from a shared resource (Au & Budescu, 1999; van Dijk & Wilke, 2000). One key difference is that the collective good is rival; that is, one’s consumption of the good lessens the others’ ability to enjoy the good (Kollock, 1998). Actors are considered cooperative in the TS dilemma when they refrain from overconsuming, and defection refers to cases where the actors overharvest the common good. Typical examples include natural resources such as fisheries where fishermen risk overharvesting a stock of fish beyond its ability to replenish and water reserves that run the risk of being exhausted because of excessive consumption by the consumers.

In both TS and GS dilemmas it is in each actor’s self-interest to defect—either give too little, or take too much—and widespread individual defection can lead to collective ruin, because the value of the shared resource is diminished or even lost; for example, not enough sustenance in the storehouse to satisfy pioneer-family needs.

Assumptions and limitations of the social dilemma paradigm

The traditional social dilemma paradigm is based on several assumptions that—while useful for explaining behavior in simple resource management problems—limit its use in more complex resource management problems. The first assumption is homogeneity of actor roles—in TS all players are potential takers, and in GS all actors are potential givers—and the natural corollary that all actors know their roles. The dichotomy between GS or TS dilemmas is useful when trying to simplify interdependent interaction in collective action where all the actors are either givers or takers of resources. Examples include the study of processes of coalition formation within organizations and the way they shape the use and depletion of shared resources (Mannix, 1991) or the giving (or pooling) of resources to create value in interorganizational partnerships (McCarter & Northcraft, 2007; Rutte, 1990; Schneider, 1989; Zeng & Chen, 2003).

However, in many resource management problems, there is role ambiguity or lack of information (or certainty) about what constitutes appropriate behavior of a person in a particular situation (e.g., Rizzo, House, & Lirtzman, 1970). While uncertainty about what others should (and will) do has always been a key issue in social dilemma research, the traditional paradigms assume the alternatives are restricted to only one type of behavior; that is, uncertainty about how much the players will give in GS situation, or about how much they will harvest in a TS scenario. Hybrid social dilemmas introduce an additional layer of uncertainty involving roles to decision makers: before an individual answers the question “how much should I give to (or take from) the shared resource”, he/she needs to decide “should I give or take?”

A second assumption is that cooperating—giving more toward a good’s provision, or taking less from the commons—is desirable; and, conversely, defecting—giving less, or taking more—is undesirable for effective collective action. This valence assumption is a product of the definition of the two distinct social dilemma paradigms, and has been useful in understanding a variety of collective action problems and their potential resolutions. An example includes the effect of allowing communication among actors which was shown to increase workgroup cohesion, decrease free riding and, consequently, create value for all in a workgroup (Rutte, 1990). However, as noted in Schelling’s (1960) seminal work on mixed-motive conflict, high contributions toward, and under-consumption of, collective resources do not always result in ideal outcomes. Excessive contributions and restraint may lead to unwanted surplus and wasted resources. Recent empirical research on coordination in social dilemmas has relaxed this assumption with a special focus on coordination under the homogenous role assumption (van Dijk, Wilke, Wilke, & Metman,
A hybrid social dilemma paradigm complements existing social dilemma paradigms by continuing to examine how to provide/maintain shared resources while also bringing efficiency and group inequality to the fore of investigation.

The third assumption is that environmental and social uncertainties are independent factors (Wit, van Dijk, Wilke, & Groenenboom, 2004). This assumption has been useful in the analysis of real-world social dilemmas where certain parameters of the social dilemma and the actors involved are not known with certainty; for example, the population of whales in the oceans (Suleiman & Budescu, 1999) or whether the collective provided benefits outweigh the private costs of contributing (McCarter, Rockmann, & Northcraft, 2010).

These assumptions may limit the ecological validity and explanatory power of the traditional social dilemma paradigm in several ways. The dichotomous classification of forms limits the paradigm’s usefulness in investigating resource management problems where resources are being supplied and consumed by the actors simultaneously or sequentially. The assumption that actors can all only give/not give, or only take/not take does not fit many real-world resource management problems, where the actors have a choice between giving resources or taking resources or doing a little of both (possibly at different times). The assumption that environmental uncertainty is exogenous and that the actors do not contribute to its magnitude may also be too restrictive and unrealistic, as shall be shown in what follows (van Dijk et al., 1999). Relaxing this assumption, hybrid social dilemmas blur this independence: uncertainty, typically assumed to be externally imposed may, in fact, result from social behavior.

In the next section we present a hybrid social dilemma—the give-or-take-some (GOTS) paradigm—that overcomes these limitations by allowing actors to both supply to and make requests from the same resource pool and, as a consequence, making environmental uncertainty endogenous to the dilemma.

The GOTS dilemma paradigm

The concept of hybrid social dilemmas is not totally new (see Cross & Guyer, 1980, p. 32), but previous research only considered various combinations of elements typical in TS dilemmas. In this section we combine elements of TS and GS dilemmas to introduce the new GOTS dilemma.

Setup The game involves a group of \( n \) players which are endowed with nonnegative endowments, \( e_i (e_i \geq 0 \text{ and } i = 1,..,n) \). Endowments are private resources; for example, money, energy, goods, or ideas. Without any loss of generality, hereafter we refer to them as “points.”

Information The size of the group, \( n \), the distribution of the endowments in the group, \( e_i (i = 1..n) \), and all the rules of the game are known to all actors.

Actions Each player \( i \) in the group can “contribute” \( c_i \geq 0 \) points, and/or “request” \( r_i \geq 0 \) points. This mimics real-world GOTS dilemmas where, for example, companies can give and take resources from a shared power pool. Let \( (c_i - r_i) \) be the player’s “net” action for a given period. If it is positive the actor contributes to the common resource; if it is negative the actor makes a request from the resource; if it is 0 the actor takes, effectively, no action.

Protocol of play The current investigation focuses on a simultaneous protocol (see Budescu, Au, & Chen, 1997): all players take actions simultaneously, privately, anonymously, and without communicating with the others. Of course, other protocols can be implemented.

Payoffs We assume that there are no shared resources in the pool of points before, or in the absence, of the players’ actions. The pool mediated outcomes depend on the total amount of net contributions, \( T = \Sigma (c_i - r_i) \), of the group. Consider two distinct cases:
(a) If the total net contributions meet the requests, that is, $T \geq 0$, all requests are granted. In addition to the portion of the endowment not contributed, or the amount requested, every player in the group receives a positive bonus. In this case we model a fixed bonus, $b$, but one could generalize the paradigm and make the bonus a function of the group’s action (e.g., a function of $T$).

(b) If the total net contributions are not sufficient to accommodate the requests, that is, $T < 0$, the requests are not granted, the contributions are lost, and the bonus is not provided.

The individual payoff function can be written as:

$$P_i = (e_i - c_i) + \gamma (r_i + b),$$

where $\gamma = 1$ if $T \geq 0$ and $\gamma = 0$ if $T < 0$.

In principle, the bonus, $b$, needs not be of the same nature as the resources. In many situations the mere satisfaction experienced by all members of the groups when everyone’s needs are fulfilled efficiently (with no waste and other penalties) is a major part of the bonus. For example, in the power pool example the bonus may consist of concrete monetary benefits (e.g., some tax breaks) to be shared by all, but it also reflects nonmonetary components such as the sense of security shared by all the members. For the purpose of modeling, however, we express it in comparable units and incorporate it in the payoff function. For simplicity, we analyze only the case where this bonus $b$ is fixed, but one can easily extend the model to allow for differential bonuses for various players or for bonuses that are linked to final pool size.

From the perspective of those participants who contribute resources ($c_i > r_i$), this is a GS dilemma with an unknown provision threshold (Wit & Wilke, 1998), whose value depends on the behavior of the other contributors and harvesters. The provision threshold is a random variable that can take any value between 0, where no participant makes any request, and $(\sum e_j - \epsilon)$ when the total amount contributed matches the total endowments of the other $(n-1)$ members of the group. These calculations assume that no player will ever request an amount that exceeds the total resources (endowments) of the group. Of course, under certain circumstances certain players may choose to do so as a way of expressing their unhappiness with the group and prevent the provision of the bonus (Rapoport, Budescu, & Suleiman, 1993).

From the perspective of those who request resources ($c_i < r_i$), this is a TS dilemma with an uncertain pool (Rapoport, Budescu, Suleiman, & Weg, 1992), whose size depends on the amount of total contributions. The pool can take any value between 0, when no participant makes any contribution, and $(\sum e_j - \epsilon)$ when the other $(n-1)$ participants contribute all their endowments.

**Empirical research on hybrid social dilemmas**

McCarter et al. (2011) report two experiments using the GOTS dilemma. They were primarily interested in how structural factors—such as group size and distribution of endowments—influence resource allocation behavior. The primary outcome variables of interest were the provision of the shared resource (i.e., whether total contributions met [or exceeded] total requests), the degree of inequality among group members after subjects made their decisions (relative to the variability of the endowments), and the efficiency of the solution (i.e., the discrepancy between the total group’s contributions and total requests).

In Experiment 1, 120 subjects played a series of 16 independent GOTS dilemmas. The distribution of high- and low-endowed players, the size of the group, and the bonus for total contributions meeting total requests were varied across the games (or rounds). However, the subject’s endowment reset to its original value in each round and they remained in a high- or low-endowment position in each game. The 16 rounds involved different compositions of 12 players (A…L) separated into two, independent subgames. These different compositions of high- and low-endowed players
Table 1. Assignment of the 12 players (6 \( n_h \) players with 100 points, and 6 \( n_l \) players with 50 points) to two subgames on every round

<table>
<thead>
<tr>
<th>Round</th>
<th>Player (and endowment)</th>
<th>( n_h/n_l )</th>
<th>Subgame</th>
<th>Bonus in subgame and round</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A  B  C  D  E  F  G  H  I  J  K  L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1  1  1  1  1  1  1  1  1  1  1  1</td>
<td>6/6</td>
<td>–</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>1  1  1  1  1  1  1  1  2  2  2  2</td>
<td>5/3</td>
<td>1/3</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>1  1  1  1  1  2  1  1  2  2  2  2</td>
<td>4/2</td>
<td>2/4</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>1  1  2  2  1  1  1  1  1  1  2  2</td>
<td>2/5</td>
<td>4/1</td>
<td>36</td>
</tr>
<tr>
<td>5</td>
<td>1  1  1  1  1  1  2  1  1  2  2  2</td>
<td>5/2</td>
<td>1/4</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>1  1  2  2  1  1  1  1  1  1  1  2</td>
<td>3/5</td>
<td>3/1</td>
<td>31</td>
</tr>
<tr>
<td>7</td>
<td>1  1  1  1  2  1  1  1  1  1  1  2</td>
<td>2/4</td>
<td>2/2</td>
<td>25</td>
</tr>
<tr>
<td>8</td>
<td>1  1  1  1  1  2  1  1  1  2  2  2</td>
<td>5/1</td>
<td>1/5</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>1  1  1  1  1  1  2  1  1  1  1  1</td>
<td>5/5</td>
<td>1/1</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>1  1  1  1  2  1  1  1  2  2  2  2</td>
<td>3/3</td>
<td>3/3</td>
<td>25</td>
</tr>
<tr>
<td>11</td>
<td>1  1  1  1  2  1  1  1  1  2  2  2</td>
<td>4/3</td>
<td>2/3</td>
<td>21</td>
</tr>
<tr>
<td>12</td>
<td>1  1  1  1  2  1  1  1  1  2  2  2</td>
<td>3/2</td>
<td>3/4</td>
<td>20</td>
</tr>
<tr>
<td>13</td>
<td>1  1  1  1  1  2  1  1  1  1  2  2</td>
<td>5/4</td>
<td>1/2</td>
<td>22</td>
</tr>
<tr>
<td>14</td>
<td>1  1  1  1  1  1  2  1  1  1  2  1</td>
<td>4/5</td>
<td>2/1</td>
<td>28</td>
</tr>
<tr>
<td>15</td>
<td>1  1  1  1  1  1  2  1  1  1  2  2</td>
<td>5/5</td>
<td>1/6</td>
<td>25</td>
</tr>
<tr>
<td>16</td>
<td>1  1  1  1  1  1  2  1  1  2  1  2</td>
<td>1/1</td>
<td>5/5</td>
<td>25</td>
</tr>
</tbody>
</table>

Games played as a function of \( n_h \) and \( n_l \) players

<p>| ( n_l ) = number of players with low (50) endowments |
|---|---|---|---|---|---|</p>
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n_h ) = Number of players with high (100) endowments</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>–</td>
<td>–</td>
<td>–</td>
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</tr>
</tbody>
</table>

Note: Data from McCarter et al. 2011, Experiment 1.

generated 31 games. The bonus varied from one game to another as a function of the group composition and it was determined by the formula:

\[
b = \frac{100 - [(n_h \times 100) + (n_l \times 50)]}{(n_h + n_l)}. \tag{1}
\]

The top panel of Table 1 summarizes the 31 games where \( n_l \) denotes the number of players with the low endowment and \( n_h \) denotes the number of players with the high endowment. Every row (except the first) describes two subgames: A player involved in Subgame 1 is given the value of 1 in Table 1 and those involved in Subgame 2 are given the value of 2. For example in Round 3, half the players (A, B, C, D, G, and H) play Subgame 1 and the other half (players E, F, I, J, K, and L) are in Subgame 2. The table also presents the ratio of \( n_h \) to \( n_l \) players, 4/2 and 2/4, for Subgames 1 and 2 respectively, and the bonuses (\( b = 17 \) and \( b = 33 \), respectively). The various combinations of \( n_l \) and \( n_h \) players created 26 unique
games, which are displayed in the bottom panel of Table 1.

At the group-level, Experiment 1 found that (a) group size positively affected the inequality of outcomes among group members (measured by the ratio of the variance of the payoffs to the variance of the endowments) and the likelihood of creating the public good, but it also reduced the amount of wasted resources; (b) increasing the size of the bonus increased provision rate; (c) asymmetry in the distribution of initial wealth of the group members induced higher levels of inequality of the final outcomes. Analyses of individual-level behavior revealed that (d) the tendency to give or take varied as a function of the composition of the group and the endowment levels: The modal action of players with low endowments was to request while players with high endowments were inclined to contribute. Further, the tendency to contribute was positively (negatively) related to the number of low (high) endowed players. Lastly, (e) the tendency to act according to one’s endowment was not universal: A minority of participants opted for the opposite action, or decided to neither give nor request, suggesting perceived ambiguity regarding the appropriate action.

McCarter et al. (2011) invoked March’s (1994) logic of appropriateness framework to interpret the endowment–choice of action relationship. This framework maintains that individuals make decisions based on logics of perceived appropriateness in addition to logics of consequences (Messick, 1999). In regard to resource allocation behavior in social dilemmas, the framework predicts that environmental cues—such as an individual’s endowment level—will influence how a situation is framed to an individual and what role that individual plays in that situation (Weber, Kopelman, & Messick, 2004). McCarter et al. (2011) hypothesized that actors with low (high) endowments used their relative endowment as a cue to determine whether it is more appropriate to request (contribute) resources from (to) the shared pool.

Experiment 2 sought to test this hypothesis by varying the variance of the endowment (since there were only two levels of endowments—high and low—this amounts to manipulating the difference between the two levels). If the logic of appropriateness framework applies, then increasing the difference between high- and low-endowed players would increase the salience of the endowment cue, making low-endowed players more inclined to take and high-endowed players more inclined to give. A group of 144 subjects played three GOTS games embedded in a three-way mixed design involving $n = 8$ players: 3 (group compositions with $n_l = 2, 4, 6$ and, correspondingly, $n_h = 6, 4, 2$) x 2 (endowments: low and high) x 3 (variance of endowments), where group composition and endowments were between-subject factors and variance of endowments was a within-subject factor. After playing the three games, the subjects answered a short questionnaire involving self-reports about the factors that they considered in making their decisions (across all rounds played). The survey used 7-point Likert scales and asked about their concern with the fairness of the outcomes, the just distribution of outcomes, the equality of outcomes, the extent to which players who started with less (more) points made requests from (contribution to) the joint pool, their personal payoff, the total group’s payoff, and the outcome of players with similar (and different) endowment.

The nine games played in Experiment 2 are listed in Table 2. As predicted, players with high endowment contributed in most (77%) of the cases, while players with low endowments mostly made requests (in 70% of the games). The tendency for low-endowed players to take and high-endowed players to give increased as the difference between (and the variance of) their endowments increased and, it may be inferred that the appropriate action became more salient.

A special feature of the second experiment was the use of “observers” (Dawes, McTavish, & Shaklee, 1977; Rapoport et al., 1992): 28 of them predicted how the players should have behaved, and 34 of them judged how they actually did behave in all nine games (all the observers were ignorant of the actual decisions made). On average, the observers predicted the players’ actual
actions quite well: the observers’ predicted contributions and requests correlated 0.96 with actual amounts contributed and requested. More importantly, the actual decisions were correlated with the actions that were judged to be appropriate in each context.

In summary, this empirical research primarily focused on understanding the dynamics of individual-level decisions—for example, why do some players choose to give and some take resources from a shared resource pool—and what are the factors that affect these tendencies. In the next sections we use data from the two experiments in McCarter et al. (2011) to fit a model at the individual level and use it to provide a general framework for making sense of the results.

In the remainder of this article, we describe a simple (some may call it naïve) model of behavior in the GOTS dilemma that provides a general framework for making sense of the results.

Consider \((n_l + n_h) = n\) players with endowments, \(e_i (e_i > 0)\), and let \(M_e\) be the average endowment in the group \((M_e = \sum_{i=1}^{n} e_i / n)\). Assume that all players are motivated to obtain the bonus and achieve an efficient solution, where the contributions match the requests, such that \(T = \sum_{i=1}^{n} (c_i - r_i) = 0\). Consistent with the appropriateness logic, we assume that the players’ actions are a function of their relative endowments. More precisely, assume that the player’s net contribution is proportional to his/her relative endowment, so it is:

\[
(c_i - r_i) = \lambda (e_i - M_e),
\]

where \(M_e\) is the mean endowment in a particular situation, \(\lambda\). The parameter, \(\lambda\), measures the player’s anticipated change in inequality as a result of the GOTS interaction. In other words this is the change that he/she consider appropriate and fair in a given situation. Naturally, if all players have identical \(\lambda_s\)s, solutions are guaranteed to be efficient for any value of \(\lambda\). Table 3 provides an illustrative example for a group with \(n = 6\) players, and a particular distribution of endowments, with a mean endowment of \(M_e = 125\). It is easy to verify that within each column (i.e., for a fixed value of \(\lambda\)) the net contributions add to 0.

### Table 2. The nine games in Experiment 2

<table>
<thead>
<tr>
<th>Variance of endowments</th>
<th>(N_l)</th>
<th>(N_h)</th>
<th>(e_l)</th>
<th>(e_h)</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>625</td>
<td>2</td>
<td>6</td>
<td>107</td>
<td>165</td>
<td>15</td>
</tr>
<tr>
<td>2500</td>
<td>2</td>
<td>6</td>
<td>63</td>
<td>178</td>
<td>29</td>
</tr>
<tr>
<td>5625</td>
<td>2</td>
<td>6</td>
<td>29</td>
<td>193</td>
<td>41</td>
</tr>
</tbody>
</table>

Note: Data from McCarter et al. 2011.
It is useful to consider the implications of various values of this free parameter: If $\lambda = 0$ no one contributes or requests, so the original inequality in endowments is preserved. If $\lambda = 1$ all players end up with the same amount, $(M_e + b)$, erasing the original inequality. Values of $\lambda$ within the $(0–1)$ range reduce the original inequality to various degrees (proportional to $\lambda$), while values of $\lambda$ outside the $(0–1)$ range increase inequality, in different ways: If $\lambda < 0$ the inequality is increased in the original direction—the final payoffs of the players with low (high) endowments are lower (higher) than their original endowments. When $\lambda > 1$ the inequality reverses direction—players with low (high) endowments obtain payments higher (lower) than $M_e$.

Of course, $\lambda$ may vary across players reflecting their different views on what constitutes a fair and appropriate solution, so we rewrite the model with individual $\lambda$s as:

$$ (c_i - r_i) = \lambda_i(e_i - M_e), \quad (3) $$

where $\lambda_i$ measures the $i$th player’s anticipated change in inequality as a result of the GOTS interaction. These individual differences may reflect the participants’ subjective perceptions of the sources of asymmetry between themselves and others. They could be related to personality factors, perceptions of status, seniority, and needs as well as historical factors such as property rights and entitlement norms (Suleiman, Rapoport, & Budescu, 1996). Such individual differences can explain various patterns of inefficiency (Wade-Benzoni, Tenbrunsel, & Bazerman, 1996).

If, for example, the values of $\lambda_i$ of the players with high endowments are lower than those of the players with low endowments chances are that $T < 0$, and the bonus will not be provided. Conversely, if values of $\lambda_i$ of the players with high endowments are higher than those of the players with low endowments, chances are that $T > 0$, and the bonus will be provided but inefficiently (with overcontributions that will be wasted).

In addition to individual differences, $\lambda$ could be affected by situational factors (and expectations triggered by them) such as the composition of the group, the size of the potential bonus, et cetera, such that $\lambda$ is sensitive to the specific situation:

$$ (c_i - r_i) = \lambda_i(e_i - M_e). \quad (4) $$

The parameter value can be inferred from the players’ behavior, that is, the amount that a player contributes or requests on every decision he/she faces.

**Experiment 1**

We calculated the $\lambda$ value implied by each of the (120 subjects x 16 games =) 1,920 individual decisions observed in Experiment 1 of McCarter et al. (2011) where each player’s endowment was fixed (low = 50 or high = 100) in all 16 rounds but the mean endowment changed from round to round as a function of the group’s composition. We summarized the estimates in Table 4 in ways that are consistent with several versions of models 2, 3, and 4. The two situational variables (endowment level and group composition) included in the table were selected based on a series of analyses (not reported here) involving all other factors in the design.

The top panel ignores individual difference and reports group-level estimates so the overall estimate (0.11) is based on all 1,920 decisions. Similarly, the other mean values in Table 4 are based on all cases with the same features (e.g., 960 cases for each endowment, 600 cases where $n_i > n_h$, 600 cases where $n_i < n_h$, 720 instances where $n_i = n_h$, etc.). On average, there is a tendency towards reducing inequality ($0 < \lambda_{est} < 1$), but it is not uniform. In particular note that players with high endowments shy away from contributing, thus increasing inequality ($\lambda_{est} < 0$), especially if $n_i < n_h$. The bottom panel of the table assumes constant parameters values for each player (i.e., we assumed that each of the 120 players had his/her own constant $\lambda$ for all 16 decisions and used the mean
individual $\lambda$s in our calculations) but allows for individual differences. The overall pattern of estimated parameters is quite similar to the top panel (identical ordering), but the variances are reduced quite drastically suggesting that much of the variability is due to within-individual variability.

Both panels capture a clear interactive pattern: The actions taken by the low players suggest that they expect the highest levels of equality to be achieved in symmetric groups ($n_h = n_l$), and they act most cautiously (i.e., they request less) when there is an excess of players with low endowments that is, $n_l > n_h$ (this is also the case with the highest variance). In sharp contrast, the players with high endowments are most willing to contribute (and act toward reduction of inequality) when there is an excess of players with low endowments (i.e., $n_l > n_h$), and become increasingly conservative as the number of players with high endowments increases (note also the corresponding increase in variance). This pattern suggests that all players are most cautious—contribute less and request less—when the number of people in their in-group increases. Thus, it appears that they are more concerned about proper coordination of actions in their in-group, and this trend is more pronounced among the high players, probably because contributions are viewed as losses and, as such, are affected by loss aversion (Kahneman, Knetsch, & Thaler, 1991). This asymmetry also explains why we observed the highest levels of provision, and the most efficient solutions, in groups with asymmetric compositions, where $n_l > n_h$. This group composition

### Table 3. An example of a one-shot GOTS dilemma with $n = 6$ actors and various perceptions of fairness ($\lambda$)

<table>
<thead>
<tr>
<th>Player ($i$)</th>
<th>Endowment $= e_i$</th>
<th>Predicted net contributions for various values of $\lambda$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>250</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>0</td>
</tr>
</tbody>
</table>

$M_i = 125$

### Table 4. Estimates of the parameter $\lambda$ (and standard deviations) as a function of the player’s endowment and group composition

#### Panel 1: Group-level estimates

<table>
<thead>
<tr>
<th>Player endowment</th>
<th>$n_h &lt; n_l$</th>
<th>$n_h = n_l$</th>
<th>$n_h &gt; n_l$</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 (Low)</td>
<td>0.08 (1.80)</td>
<td>0.53 (1.03)</td>
<td>0.39 (0.39)</td>
<td>0.31 (1.38)</td>
</tr>
<tr>
<td>100 (High)</td>
<td>0.17 (1.13)</td>
<td>0.04 (1.40)</td>
<td>−0.37 (2.72)</td>
<td>−0.10 (2.03)</td>
</tr>
<tr>
<td>Overall</td>
<td>0.11 (1.61)</td>
<td>0.29 (1.25)</td>
<td>−0.12 (2.29)</td>
<td>0.11 (1.75)</td>
</tr>
</tbody>
</table>

#### Panel 2: Individual-level estimates

<table>
<thead>
<tr>
<th>Player endowment</th>
<th>$n_h &lt; n_l$</th>
<th>$n_h = n_l$</th>
<th>$n_h &gt; n_l$</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 (Low)</td>
<td>−0.01 (1.02)</td>
<td>0.53 (0.68)</td>
<td>0.49 (0.75)</td>
<td>0.31 (0.68)</td>
</tr>
<tr>
<td>100 (High)</td>
<td>0.25 (0.93)</td>
<td>0.04 (0.97)</td>
<td>−0.49 (1.81)</td>
<td>−0.10 (1.08)</td>
</tr>
<tr>
<td>Overall</td>
<td>0.12 (0.98)</td>
<td>0.29 (0.87)</td>
<td>−0.05 (1.51)</td>
<td>0.11 (0.93)</td>
</tr>
</tbody>
</table>

*Note: Data from McCarter et al., 2011, Experiment 1.*
Table 5. Poorness of fit measured by mean absolute deviation (and standard deviation) as a function of the player’s endowment and the model used to estimate $\lambda$.

<table>
<thead>
<tr>
<th>Model used to estimate $\lambda$</th>
<th>Player endowment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Mean individual</td>
<td>0.95 (0.62)</td>
</tr>
<tr>
<td>Individual</td>
<td>0.79 (0.58)</td>
</tr>
<tr>
<td>Situation-specific individual</td>
<td>0.64 (0.47)</td>
</tr>
</tbody>
</table>

Note: Data from McCarter et al., 2011, Experiment 1. Based on individual-level estimates (see bottom panel of Table 4).

induces reduced requests and more generous contributions.

To illustrate the effect of the various models, we summarize in Table 5 their poorness of fit, as measured by the mean absolute difference between the $\lambda$s estimated in each single decision and for various versions of $\lambda_{\text{est}}$ (see Table 4).

$$\text{MAD} = \frac{\sum \text{Decisions}}{|\lambda - \lambda_{\text{est}}|/\# \text{ of Decisions}}$$

The top row uses a common $\lambda_{\text{est}} = 0.11$ (as implied by Model 2), the second row uses different $\lambda_{\text{est}(i)}$ for each player (consistent with Model 3), and the last row uses different estimates for each individual for the three group compositions listed in Table 1, $\lambda_{\text{est}(ij)}$ (in the spirit of Model 4). In each case we report results for all 120 players as well as by endowment. Clearly the fit improves (and the interindividual variance decreases) as $\lambda_{\text{est}}$ becomes more (player and/or situation) specific. The fit is always better (and the interindividual variance is smaller) for the players with low endowments.

Table 6. Estimates of the parameter $\lambda$ inferred from the judgments of appropriate behavior as a function of the player’s endowment, group composition, and variance of endowments

<table>
<thead>
<tr>
<th>Group composition</th>
<th>Variance of endowments</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endowment</td>
<td>$n_j$</td>
<td>$n_h$</td>
</tr>
<tr>
<td>Low</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td></td>
</tr>
</tbody>
</table>

Note: Data from McCarter et al., 2011, Experiment 2; $n = 28$ judges.
appropriate actions (McCarter et al., 2011). Table 6 presents the mean estimates of the parameters for the 18 cases, as inferred from the latter sample (i.e., judgments of appropriateness). The estimated $\lambda$s are relatively high (compared to the values in Tables 4 and 7) and closer to 1, suggesting that the observers think it is appropriate to strive for equal outcomes to all. A three-way (repeated measurements) ANOVA of these estimates reveals several regularities: the values of $\lambda$ increase as the variance of the endowments is reduced ($F[2, 26] = 6.10, p = 0.007$), suggesting that the expectation of equality is more pronounced when the endowments are more similar. There is a strong interaction between the players' endowments and the group's composition ($F[2, 26] = 9.87, p < 0.001$): The estimates increase as a function of the number of players in the in-group with similar endowments (i.e., as a function on $n_l$ for players with low endowments, and as a function on $n_h$ for players with high endowments), and they are most similar between endowment conditions in the symmetric case ($n_l = n_h = 4$). Although the estimates that are judged appropriate for the players with low and high endowments are not significantly different, those for the high-endowment players are closer to 1 in seven of the nine games (this split is significantly higher than chance by a one-sided sign test: $Z = 1.67; p < .05$), suggesting that the observers expected the players with high endowments to do more to achieve the intragroup equality.

Table 7 presents the mean estimates of the parameters as inferred from the actual individual decisions. Compared to the observers’ judgments of appropriateness (see Table 6) the estimated $\lambda$s are more homogenous. Indeed in a three-way ANOVA of these estimates with two between-subjects factors (endowments and group composition) and one within-subject factor (variance of endowments) none of the effects is significant suggesting a, more or less, constant (i.e., invariant across conditions) perception of a fair solution. There are, however, several interesting empirical patterns. First, consistent with the appropriateness judgments, in a majority of cases (seven of the nine games) the $\lambda$s inferred from the decisions of the players with high endowment are closer to 1, suggesting that they are taking a more active role towards achieving equality. The differences between the two roles are also reflected in the slightly different patterns they display. Players with low endowments expect the most equal outcomes in the symmetric case ($n_l = n_h = 4$) where coordination is relatively easy, and they are most cautious and expect the highest levels of inequality when there are many potential requesters and few potential contributors ($n_l = 6; n_h = 2$). The most natural explanation is that the players with low endowments will have a hard time coordinating and, therefore, may be reluctant to contribute, especially when the number of potential requesters is larger, and the risk of a “rogue” requester correspondingly increases. On the other hand, players with high endowments expect the highest reduction in inequality will be achieved when there are many potential contributors and relatively few potential requesters ($n_l = 2; n_h = 6$) where coordination is relatively easy, chance of “rogue” requests are lower, and equality can be achieved at a low cost.

Finally, consider the variance of the estimates which is clearly affected by the composition of the groups and the variance of the endowments. The variance peaks in cases where actions are perceived as hard to coordinate, namely when there are many players in one's in-group. In fact the variance is a monotonic function of this number (see the variance of the $\lambda$s of the $n_l = 6$ players with low endowments, and of the $\lambda$s of the players with high endowments when $n_h = 6$). Also note that the variability of the various players' $\lambda$s decreases as the variance of endowments increases, and the appropriate action becomes more salient and obvious.

We correlated the mean estimated $\lambda$ of each player (across the three games) with the postdecision ratings of factors that were considered while making decisions. There were significant correlations between the estimated $\lambda$s of the players with high endowments and their reports of concern with (a) the fairness of the outcomes ($r = 0.38; p < 0.01$); (b) just outcomes ($r = 0.35; p < 0.01$); and (c) equality of outcomes ($r = 0.33; p < 0.01$).
These correlations provide partial support to our interpretation of the parameter λ as a measure of perceived fairness. Most other correlations were positive, but nonsignificant.

Predicting group results of GOTS games

Many social scientists working in this domain study collectives—organizations, committees, communities and societies—and seek to understand how they solve social dilemmas. We have argued that, ultimately, collective decisions are determined by aggregating the individual decisions (especially when the individuals make decisions separately and without communication, and when they involved many dispersed decision makers). In this paper we developed, and tested on a small scale, a model of how individuals act when they are part of such collectives. In this section we illustrate how one can use this model of individual behavior to make predictions about selected group outcomes. To achieve this goal we use simulations inspired by the two experiments we described and analyzed. We simulate a variety of collectives of fixed size (n = 12) and consider different distributions of high- and low-endowed players (see more details below). In these simulations we assume that (a) the actors with high and low endowments exhibit slightly different patterns of behavior (as we found in both studies), and (b) independence between the n = 12 players in each group. We rely on the distribution of the individual parameters, that is, λs, estimated in the second study, and use the model to derive predictions about some of the group-level measures that were the focus of the first study.

We simulated games involving n = 12 actors and considered all 11 possible group compositions (n_i = 1, n_h = 11; n_i = 2, n_h = 10; … n_i = 10, n_h = 2; n_i = 11, n_h = 1). In all cases we set e_i = 1 and manipulated the within-group variance in endowments by setting e_h = r (where r = 2, 3, 4, or 5). In other words, the high endowments are r times higher than the low endowments. This manipulation drives the within-group standard deviation of the endowments, 

$$SD = \frac{(r-1)}{(n_i + n_h)} \sqrt{n_i \cdot n_h},$$

which is proportional to the difference between the endowments, (r - 1).

A vast majority of the individuals act as predicted by the appropriateness logic: 78% of the players with low endowments make net requests in a majority of the three games and, conversely, net contribution to the pool is the modal action (82%) of the players with high endowments. To estimate the individual parameters we averaged the λs estimated for each player in the three games (i.e., across the three levels of variance of endowments). Consistent with the results in Table 7, the players with high endowment have higher values (mean = 0.5 compared to 0.3 for the low players).

---

Table 7. Estimates (standard deviations) of the parameter λ inferred from the players’ decisions as a function of the players’ endowment, group composition, and variance of endowments

<table>
<thead>
<tr>
<th>Endowment</th>
<th>Group composition</th>
<th>Variance of endowments</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>625</td>
<td>2,500</td>
</tr>
<tr>
<td>Low</td>
<td>n_i n_h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 6</td>
<td>0.27 (0.88)</td>
<td>0.41 (0.29)</td>
<td>0.38 (0.22)</td>
</tr>
<tr>
<td>4 4</td>
<td>0.62 (1.62)</td>
<td>0.30 (0.78)</td>
<td>0.53 (0.52)</td>
</tr>
<tr>
<td>6 2</td>
<td>−0.32 (2.02)</td>
<td>0.18 (0.98)</td>
<td>0.26 (0.74)</td>
</tr>
<tr>
<td>Mean</td>
<td>0.19 (1.60)</td>
<td>0.30 (0.79)</td>
<td>0.39 (0.54)</td>
</tr>
<tr>
<td>High</td>
<td>n_i n_h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 6</td>
<td>0.50 (2.19)</td>
<td>0.69 (0.87)</td>
<td>0.54 (0.82)</td>
</tr>
<tr>
<td>4 4</td>
<td>0.31 (1.39)</td>
<td>0.37 (0.93)</td>
<td>0.35 (0.77)</td>
</tr>
<tr>
<td>6 2</td>
<td>0.46 (0.70)</td>
<td>0.62 (0.30)</td>
<td>0.50 (0.27)</td>
</tr>
<tr>
<td>Mean</td>
<td>0.42 (1.53)</td>
<td>0.56 (0.76)</td>
<td>0.46 (0.66)</td>
</tr>
</tbody>
</table>

Note: Data from McCarter et al., 2011, Experiment 2; n = 24 players in each condition (row) of the table.
We also found that they were also more variable (SD = 0.8 compared to 0.6 for the low players).

We simulated 5,000 games in each of the (11 compositions x 4 endowment configurations =) 44 conditions. In each game we selected randomly \( n_l \) values of \( \lambda \) from a normal distribution with a mean of 0.3 and a standard deviation of 0.6, and drew randomly \( n_h \) values of \( \lambda \) from a different normal distribution with a mean of 0.5 and a standard deviation of 0.8. We determined each player’s action according to the model (Equation 1) and his/her individual parameter (selected from these distributions), and calculated three of the group-level outcomes analyzed in Experiment 1. Specifically, we determined whether (a) the public good was provided; (b) how the within-group inequality changed; and (c) how (in)efficient was the group solution. To measure provision rate we, simply, tested whether the total contributions are sufficient to satisfy all the requests. We measured inequality by the logarithm of the ratio (Variance of the final payoffs / Variance of the original endowments). Negative values suggest reduction in the inequality in the group after the GOTS interaction, positive values imply an increase in the inequality in the group, and 0 indicates no change in the level of inequality. We defined the group’s outcome inefficiency as the absolute difference between requests and contributions, relative to the total group endowments. This quantity is 0 for perfectly efficient solutions and increases monotonically as a function of the mismatch between the two actions (without distinguishing between over- and underprovisions).

Figures 1–5 summarize the results, averaged across these 5,000 simulations. The figures pertain to the three distinct dependent group variables, but have the same structure: each curve presents results for a different within-group variance in endowments \( (r = 2, 3, 4, \text{ or } 5) \), as a function of the number of players with low endowments \( (n_l = 1, 2, …11) \) out of the total 12 actors in the group.

Figure 1 shows that the public good will be provided in a majority of cases, simply because the players with high endowments operate with higher concern for equality than the players with low endowments. The provision rate peaks in the cases where the two groups are roughly equal (i.e., \( n_l \approx n_h \)) and where it is easy to invoke simple heuristics that facilitate coordination. This finding is consistent with van Dijk and Wilke’s (1995) work on coordination in social dilemmas: without communication, individuals use various structural cues of the game to coordinate how much to give or to take. Indeed, simple heuristics for allocating resources are more difficult to apply in situations where parties are dissimilar; for example, such as in terms of wealth and influence (Messick & Rutte, 1992).

Figure 2 shows that the inequality will be reduced almost always and that this will be more...
pronounced as the number of players with low endowments (who move closer to the mean) increases. This may seem somewhat counterintuitive but Figure 3, that displays the behavior of this variable separately for the cases where the public good was provided and those where it was not, indicates clearly that this is due mostly to cases where the public good was provided. When the public good is not provided the inequality is reduced only slightly due to the wasted (and non-refundable) contribution, whereas in cases where the good is provided most players move closer to the common mean. Both the provision rate and the change in inequality are, essentially, insensitive to the difference in endowments and are driven, almost exclusively, by the group composition.

Figure 4 summarizes the inefficiency of the outcomes and shows that it is magnified by higher discrepancies between the two levels of endowment. Figure 5 displays the behavior of this variable separately for the cases where the public good was provided and those where it was not. In the former case (Figure 5a) inefficiency is due to overcontributions, and in the latter (Figure 5b) it is due to excess demand. Although the pattern in the two plots is quite similar, it is clear that most inefficiency is due to excessive contributions (these also happen to be a majority of the cases, as shown in Figure 1). Generally, the inefficiency increases as the number of players with low endowments increases but, interestingly, there is a clear dip for cases where there is only one “privileged” player with high endowment and there is little need to coordinate.

To summarize, the simulations illustrate the usefulness of the model as a tool for understanding the dynamics of the GOTS dilemma. The simulations indicate which factors affect the various group variables and allow us to test the model’s sensitivity to the various individual parameters. To illustrate this point we reran the simulations assuming the two players have the same mean \( \lambda \) (we randomly selected \( n_j \) values of \( \lambda \) from a
normal distribution with a mean of 0.4 and a standard deviation of 0.6, and \( n_h \) values of \( \lambda \) from a normal distribution with the same mean and a standard deviation of 0.8). Figure 6 shows the rate of provision in the 5,000 simulated games. This seemingly minor change yields a flat line with a mean provision rate of 50% for all within-group variances of endowments (compare this pattern with Figure 1).

**Final remarks about GOTS**

Many real-world, resource management problems entail actors caught within a trap of having to give to, or take from, a shared resource in ways that induce conflicts and tensions between the benefits for the individual and the collective. Our work was inspired by the observation that the traditional social dilemma paradigm cannot address properly resource management problems where actors may give, take, or do a little of both in sequence or simultaneously. The GOTS dilemma provides a new powerful paradigm that merges the give-some and take-some dilemmas and will allow researchers to extend the analysis to many complex collective action problems and engender new theoretical and practical insights. We conclude with a discussion of some of its unique features.

Social dilemma research has always assumed, implicitly, that environmental uncertainty and social uncertainty are distinct (Wit et al., 2004). The GOTS paradigm focuses on situations—such as the three examples introducing this article—where the environmental uncertainty the actors face is a function of the behavior of others within the group. In other words, the behavior of one subset of actors can be conceptually viewed as determining the external environment for the others. In this spirit, McCarter et al. (2011) suggest that a more appropriate and accurate distinction is between uncertainty due to internal (under the control of the various players) and external
(outside their control) sources. Our work has focused exclusively on uncertainty from internal sources but it is easy to imagine generalizations including also external sources. For instance, the number and composition of the collective of actors utilizing shared resources is fluid: actors come and go from the collective, thereby making the size of group (and, possibly the distribution of the available resources and needs) uncertain at various points in time. Uncertainty about whether actors will give or take resources can create a challenge for groups trying to achieve collective action in a GOTS dilemma, but uncertainty about the number of individuals that could give or take may make a complex task nearly impossible to manage effectively (Au & Ngai, 2003). Indeed, group size uncertainty was identified by Baden (1998) as a key factor that hindered collective action among pioneer families in The Church of Jesus Christ of Latter-Day Saints: congregations contributing their goods to a common storehouse were uncertain about the number of new, convert families that would be arriving (through missionary efforts) and whether they would have much or be in need.

The conflict induced by the ambiguity of the player’s role comes to the fore in many GOTS dilemmas where actors may give, take, or do both. A good example is the power plant that pools its resources with other power plants to create a shared power pool. Before considering the standard questions about how much energy will be supplied and requested, one may have to address the question who will supply energy and who will consume energy from the pool. Such ambiguity about others’ intentions suggests that actors could request from the shared pool to defend themselves against the perceived stinginess of (potential) contributors or gluttony of (potential) harvesters (McCarter, Mahoney, & Northcraft, 2011). Role ambiguity in the GOTS dilemma underscores the importance of the perceived structure of the social dilemma. Tenbrunsel and Northcraft (2010) remind us that there is a difference between the actual social dilemma and what individuals perceive it to be. Perhaps players who identify strongly with a given role (e.g., someone in need) may perceive their impact on providing the public good less than those who identify with a different role (e.g., someone in a position to give)? One could use this insight to optimize outcomes. For example, our model predicts (see Figures 4–5) that fewer resources are wasted when there is only one player with a high endowment. This suggests that one way to achieve efficiency, without changing the group composition, is to cause players to perceive themselves as unique and critical for the provision of the public good.

The duality of roles in the GOTS dilemmas also highlights the fact that social dilemmas are often multiattribute problems since not all participants must contribute and consume the same items, and the bonus can be of a totally different nature. The UN peace-keeping forces provide an excellent illustration—some countries contribute troops and others contribute money, the recipients benefit from a combination of the two (well-equipped and supplied troops), and the common bonus for all is the more abstract “peace.” Similarly, in organizations, various departments contribute/demand various things (manpower, information, expertise, contacts, etc.) that are required for the achievement of their common goal—the organization’s success. This realization opens the door to a totally new class of solution to these pervasive social dilemmas that rely not on simple give/take exchanges, but also on appropriate interattribute tradeoffs.

The GOTS paradigm illustrates the fact that, often, solutions to social dilemmas do not depend on optimization (maximizing contributions or minimizing consumption), but require proper matching of behavior to environmental and social constraints. This is also true in GS and TS dilemmas with environmental uncertainty (where one expects a close match between contributions and the unknown provision threshold, or requests and the uncertain pool size, respectively), but it is particularly salient in this context because this match can be achieved by adjusting requests, contributions, or both. The GOTS paradigm allows multiple solutions and, as such, provides a new tool to study perception of fairness.
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Notes

1. We use the terms actor and player interchangeably throughout the paper.
2. This formal notation of the GOTS dilemma is borrowed from McCarter, Budescu, et al. (2011).
3. Note that if \( n \geq 3 \) knowledge of the distribution does not compromise anonymity, since the players cannot associate endowments with individual “others.”
4. This particular notation allows for the possibility that a participant decides to take a particular action (say contribute a certain amount), but then “adjusts” the original decision by some corrective action (requesting some amount).
5. This is the difference between the high endowment and the mean endowment in the group.
6. \( \lambda_{\sigma} = (c_i - r_i)/ (c_i - M_{\sigma}) \).
7. The only dilemma involving \( n = 12 \) players in our studies was Game 1 in Experiment 1 (see Table 1) where \( n_1 = n_2 = 6 \) and \( r = 100 / 50 = 2 \).
8. We do not include the bonus in this calculation but since all players either get the bonus (if it is provided) or do not (if not provided). Thus, the within-group variance of the payoffs is not affected by this omission.

References


