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Voluntary contributions by consent or dissent

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ABSTRACT

We study games where voluntary contributions can be adjusted until a steady state is reached. In *consent games* contributions start low and can be increased; in *dissent games* contributions start high and can be decreased. The equilibrium prediction is free riding in consent games but as much as social efficiency in dissent games. We test it experimentally and confirm that the dissent mechanism yields substantial welfare improvements over the consent mechanism. With experience, subjects contribute on average less than 30% of the endowment in consent games but more than 60% in dissent games. Generally, subjects match the *lower* of the opponents' contributions: they do not follow when single opponents increase contributions in consent games, but follow when single opponents decrease contributions in dissent games. This asymmetry in the conditional cooperation is predicted by heterogeneity of egoistic and inequity averse types, with individual types being private information.

1. Introduction

In many public goods settings, provision levels are determined by several actions spanning across time. Interim actions cumulatively form the "stock" of cooperation, and when changes in cooperation are prohibitively costly they are considered "irreversible" (Lockwood and Thomas, 2002). Lockwood and Thomas give the example of nuclear disarmament between warring parties as irreversible acts of cooperation towards peace, arguing that "cooperation would be measured by the extent of disarmament, which may be very difficult to reverse, as complex weapons, once destroyed, may be difficult to rebuild" (p. 341). A large literature investigates such games where positive actions are irreversible and the stock can be accumulated. For example, Admati and Perry (1991), Compte and Jehiel (2003), Fershtman and Nitzan (1991), and Marx and Matthews (2000) studied the accumulation of contributions to public goods and projects, and Gale (2001), Lockwood and Thomas (2002), and Romano and Yildirim (2005) studied accumulation in general. In the context of public goods, the theoretical prediction is that the accumulation process generally involves delay and that outcomes are socially inefficient.

Less analyzed are games where negative actions are irreversible and result in the decumulation of the stock of cooperation, i.e. cooperation can be withdrawn. A prime example is environmental preservation, following Arrow and Fisher (1974) who assert that "[the] irreversible transformation of the environment [results in] a loss in perpetuity of the benefits from preservation" (p. 315). From the perspective that the environment is a public good, environmentally damaging acts therefore constitute irreversible withdrawals of cooperation. There are many instances of such acts. For one, capital accu-

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Table 1
A two-player, two-level public-goods game (with MPCR $m = 0.8$).

	$a_2 = 1$	$a_2 = 0$
$a_1 = 1$	$\begin{pmatrix} 0.6 \\ 0.6 \end{pmatrix}$	$\begin{pmatrix} -0.2 \\ 0.8 \end{pmatrix}$
$a_1 = 0$	$\begin{pmatrix} 0.8 \\ -0.2 \end{pmatrix}$	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$

mulation of environmentally unfriendly technologies are irreversible due to switching or exit costs. Irreversibility also holds for greenhouse gas releasing activities that permanently and negatively affect the climate and thus society in ways that are irreparable by subsequent behavioral changes. Amongst others, this applies to the global threat of deforestation identified by the World Wildlife Fund. Irreversible is the climate change that would have been mitigated by trees had they not been chopped—even if they may be replanted. Deforestation has also caused the irreversible extinction of species.

The problem of decumulation of public goods is analogous to an accumulation of so-called public "bads" in business and society. For example, consider the use or abuse of group reputation (Tirole, 1996). Members of renowned broker associations, restaurants with acknowledged quality, or holders of "eco-labels" (Hamilton and Zilberman, 2006) for green food or environmentally friendly production can comply to their group standard. Group reputation falls with individualistic opportunism (e.g. by decreasing costs through bad practice), and regaining reputation entails a costly process. Reputation losses are thus "as if" irreversible. Another example of the decumulation problem is the erosion of social norms and of morale (Kandori, 2003). Such erosion tends to be reversible only in the long term, e.g. by adapting legislation in societies or by mediation in small groups. Again, decisions may be reversible but only at substantial costs, implying the notion of irreversibility if these costs are prohibitive in the sense that they exceed the long term gains of reversing one's decision.

In this paper we provide a first theoretical and experimental analysis of cooperation in strategic problems of decumulation, which we call *dissent games*, contrasted against the more familiar problem of accumulation, which we call *consent games*. Across time periods, cooperation can be built gradually starting from zero cooperation in consent games, and cooperation can be withdrawn gradually starting from full cooperation in dissent games. The action space in each period may be binary choices of *yes* or *no* or multiple discrete levels of cooperation. The starting points may be extreme or intermediate levels, and we choose extreme levels to allow for the same range of possible outcomes in all games that we compare. Games end when players are either at the limits (i.e. maximum or minimum levels in consent and dissent games, respectively), or if all players simultaneously acquiesce in a round. Payoffs are based on the stock of cooperation standing at the end of the game.[1] We assume actions are perfectly irreversible in most of our analysis, but will also check for robustness to relaxing this assumption, by investigating dissent games where players can agree to restart the game at a cost (for example, as a result of roundtable agreements).

To fix ideas, let us use the game defined in Table 1 as a simple example. It is a two-player, two-level public goods game with linear payoffs as in Eq. (3) with $m = 0.8$. Action $a_i = 1$ indicates that i contributes to the public good, whereas $a_i = 0$ indicates that i does not contribute. If the game is played as a static game, with simultaneous moves, zero contributions $a_i = 0$ are strictly dominant and hence no player contributes in equilibrium. Similarly, in consent games, default contributions are zero, and no player has incentives to unilaterally push ahead. For, the other player will not follow suit under the maintained assumption of payoff maximization. Moreover, even if one anticipates the other player to contribute, one is best off not contributing in response. Since the opponent is contributing either way, one's payoff is maximized by not contributing. Contributions may be rational if they trigger further contributions of the opponents, but the last player "scheduled" to contribute lacks the incentive to actually follow through, and thus contributing is iteratively dominated even in non-binary consent games.

Now consider dissent games, with the default being full contributions $a_i = 1$. Here, sticking to full contributions is iteratively dominant. If one expects the opponent not to withdraw his contribution, one should not withdraw either and let the game terminate at the initial level of efficient contributions. If one expects the opponent to withdraw his contribution, one is indifferent: one might withdraw immediately, but one might as well wait and see if the opponent actually withdraws, responding only after it happened. Thus, immediate withdrawals are weakly dominated, and in turn, it is weakly dominant not to be the one withdrawing his contribution first. In general, withdrawals trigger further withdrawals until contribution levels are equalized again, and as a result, players tend to be best off sticking to their default of full contributions. The efficiency of the equilibrium outcome somewhat depends on the marginal per capita return of the public good, as shown below, but expected contributions are always positive in equilibrium.

Thus, we show that consent games are theoretically predicted to yield minimal contributions, assuming players maximize expected payoffs, while dissent games are predicted to yield positive contributions even if the irreversibility assumption is

[1] These assumptions characterize infinite horizon games if players are Markovian and patient. The assumption that the game ends when all players leave their contributions unchanged for a round is payoff equivalent to assuming players play Markov strategies in games with infinite horizon. The assumption that payoffs follow from the final contributions in our indefinite horizon games is payoff equivalent to assuming that players are patient (discount factors close to 1) in games with infinite horizon.