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Analysis

A common-pool resource experiment with postgraduate subjects from 41 countries

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ABSTRACT

This study reports results from a new series of experiments that examine the robustness of face-to-face communication as a cooperation-facilitating institution in common-pool resource settings. Results are reported from nine experiment sessions, initially designed for pedagogical purposes. The sessions were conducted between 1998 and 2007 as part of a series of summer institutes on institutional analysis and environmental change. Subjects were graduate students and professionals from diverse disciplines, representing 41 countries of residence. The participants in this study stand in sharp contrast to most previous studies, which used undergraduates who self-select into experiments by volunteering to participate. Results from these experiments substantiate earlier findings that non-binding communication can serve as an effective mechanism for solving social dilemma problems, with subjects achieving near socially efficient outcomes.

1. Introduction

This study provides evidence that sheds light on the robustness of previously conducted experimental results related to face-to-face communication in common-pool resource (CPR) games (Ostrom and Walker, 1991; Ostrom et al., 1992, 1994) and public-goods provision games (Isaac and Walker, 1988). Sally's (1995) meta-analysis of more than 100 social dilemma experiments reveals that face-to-face communication is among the most powerful facilitators of cooperation. Ledyard's (1995) review of public goods experiments and Kollock's (1998) general review of social dilemma research also indicate strong positive effects of communication on cooperation.

When subjects have preferences that are consistent with conditional cooperation but uncertainty exists as to the motivation and expected behavior of others, face-to-face communication may be more than "cheap talk" used to mislead others (Kollock, 1998; Messick and Brewer, 1983; Putterman, 2009). It appears that face-to-face communication allows conditional cooperators to exchange credible signals, which are not easy for those intending to be free riders to mimic (Poteete et al., 2010). Ahn et al. (2004) conjecture that facial expressions, body language, and eye movements observable during face-to-face communication have elements of biological signals that are beyond conscious manipulation for most people (see also Frank, 1988). Ahn et al.'s explanation of why face-to-face communication is successful in promoting cooperation is consistent with experimental evidence that exchanging numbers (Bochet et al., 2006) or prefabricated messages (Bochet and Putterman, 2009) instead of engaging in face-to-face communication does not raise the rate of cooperation among subjects.[1]

While the plausible mechanisms for explaining why communication may facilitate cooperation should apply to all humans, past experiments have mostly been conducted using undergraduates as subjects. This limited subject pool is one of the several methodological issues related to the "standard" way in which experimental economics research has been conducted (for example, see Cooper, 2006; Croson, 2005; Levitt and List, 2007a,b, 2008; Sears, 1986). Related to this methodological issue, Henrich et al. (2010) have recently asserted that the undergraduates used in most economics and psychology experiments are WEIRD (Western, educated, industrialized, rich, and democratic). They further assert that "American undergraduates are some of the most psychologically unusual people on Earth" (p. 29). If one of the goals of running an experiment is to enhance understanding of similar processes

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[1] But note that free-style written communication via chat room is as effective as face-to-face communication in public goods games (Bochet et al., 2006) and CPR games (Janssen et al., 2010). Communication using audio channels (Brosig et al., 2003) and e-mail communication (Frohlich and Oppenheimer, 1998) also raise the rates of cooperation, though not as effectively as face-to-face communication. Thus, biological signaling does not fully explain the power of communication.

in naturally occurring situations, using self-selected undergraduates as experimental subjects could pose a problem for understanding more naturally occurring processes. Given the diverse types of actors involved in CPR dilemmas (Ostrom, 1990), it is not clear which is the most natural and representative population for experiments on CPR dilemmas. One cannot presume that undergraduates' behavior would be replicated in experiments using different subject pools. Hannan et al. (2002), for example, find that MBAs put forth much more effort than undergraduate subjects in a gift-exchange game. Fréchette (in press) reviews more than a dozen experiments that compare behavior of undergraduates to that of professionals in diverse sets of games. Fréchette finds that undergraduates' and professionals' behaviors often differ from each other, although the evidence is not enough to argue that, in general, undergraduates are clearly different from professionals (see also Potters and van Winden, 2000).

The experiments reported here utilize approximately 200 subjects at various stages of their careers, ranging from studying for their doctorates to being a senior scholar in one field wishing to branch out to other fields related to the study of environmental change. The experiments were conducted at a summer institute each year for six years by colleagues associated with the Center for the Study of Institutions, Population, and Environmental Change (CIPEC) at Indiana University with participants from all over the world. Those experiment sessions are coded as SIxxxx, where "xxxx" is the year. The same experiment was conducted in a graduate seminar in 1999 (coded as GS1999) attended by PhD students and visiting scholars who participated as subjects. Finally, two sessions were conducted at the THEMES Summer School on Institutional Analyses of Sustainability Problems, organized by the Slovak Academy of Sciences in June of 2007 and coded as THEMES2007a and THEMES2007b. The primary purpose and design of the decision environment was pedagogical. From the beginning, however, one of the goals was to conduct the sessions in such a manner that the results could be used for research purposes. Since we planned to use the data eventually for research, the subjects were paid and we followed the standard procedures for running experimental subjects under review by the Human Subjects Committee at Indiana University. Designing the experimental setting for pedagogical purpose, with a time constraint, however, implied sacrifices from an experimental design perspective. In particular, some treatment sequencing effects that would have been accounted for in an experimental study designed purely for research purposes are not accounted for in our experiments.

It is not clear ex ante whether professionals, such as the subjects in the experiments reported here, would be as successful as undergraduate subjects in utilizing communication opportunties to achieve mutually beneficial outcomes. On one hand, undergraduates belong to the same college communities, which could make the face-to-face communication more effective. On the other hand, professionals may have stronger internalized norms of cooperation, making face-to-face communication an even more powerful tool for achieving cooperation.[2]

We do not argue that the experimental subjects whose behavior we report here are more representative of the decision makers in the naturally occurring CPR dilemmas. Instead, ours is a modest goal of taking advantage of the unique opportunity we had in terms of trying to replicate the results of communication experiments with an unusual subject pool. Our goal is similar to Cardenas's (2001) goal when he conducted a variation of the CPR experiments designed by Ostrom et al. (1994) in villages in Colombia. He found that face-to-face communication among campesinos led to the same general pattern of outcomes as observed in laboratory experiments using student subjects. An interesting result found in Cardenas's experiments, however, was that when a wealthy villager was among the group, cooperation was more limited compared to situations where most of the villagers shared the same economic status (see also Cardenas and Ostrom, 2004; Cardenas et al., 2000, 2004).

The experiments reported in this article provide an opportunity to investigate the extent to which the positive effects of face-to-face communication in solving CPR dilemmas go beyond those found in the settings from previous experiments. In particular, the study reported here allows one to examine how different cultural, educational, and career backgrounds might impact the role of face-to-face communication in resolving social dilemmas.

2. Experimental Design

The experiment was explained as a game involving "renewable common-pool resources" in which participants were asked to imagine themselves as "fishermen, fishing for fish or local villagers needing to find firewood" (see Appendix A). The game utilized a fixed match protocol, with seven subjects in a group. Each session started with 21 subjects, with participants assigned randomly to the three groups. Sessions consisted of six decision rounds. Except for rounds 5 and 6, discussed below, subjects did not know group composition.

In rounds 1 and 2, subjects were sitting in the same seminar room but they made their decisions in private on a paper form with no discussion. During rounds 3 and 4, subjects were allowed to communicate as a large group for 10 min. The communication opportunities in rounds 3 and 4 were among all 21 subjects, but subjects did not know the composition of their groups. Thus, subjects' comments could not be directed specifically to other subjects in their *own* decision-making group. As in past studies using face-to-face communication, subjects were explicitly told that they could not threaten others or make offers of side payments. Parallel to previous studies of face-to-face communication, rounds 5 and 6 were conducted with the same rules, except that each seven-member group was moved to a separate room.

Subjects made their decisions each round, in private, by writing down their token orders on a Token Order Form. "Ordering tokens" was explained orally by the experimenters, as well as in written instructions, as being synonymous with harvesting from a CPR.[3] After individual token orders were collected, subjects were informed of the aggregate token order in their group, as well as average token cost. Subjects then computed their earnings for the decision round. In addition, subjects were informed of the aggregate token order in all three groups.

The pay-off function for the game is the same as that used in Walker et al. (2000), in which the marginal cost of appropriation from the CPR increases with the aggregate level of token orders. Specifically, the per-round pay-off function for player i can be written as:

$$\pi_i = \left[0.761x_i - 0.007x_i^2\right] - [x_i(0.01(X+1)/2)],$$

where x_i denotes the number of tokens ordered by individual i and X denotes total number of tokens ordered by the group of seven.

Walker et al. (2000) derived the one-shot game Nash equilibrium and social optimum of this setting. Let Y be the sum of token orders by the six other players in player i's group. Then, player i's best response function is 32.5–0.208Y. Assuming the monetary pay-off function as the utility function of the game, the unique symmetric Nash equilibrium of the one-shot game involves each individual in a group ordering 14 tokens. This outcome gives a per-round monetary payoff of $2.35 to each player. The socially optimal outcome, on the other hand, involves each individual ordering nine tokens with a corresponding per-person payoff of $3.40. But if everyone else orders nine tokens, a player can maximize the monetary payoff by ordering 20 tokens.

[2] We thank a reviewer for suggesting these two possibilities.

[3] This is one example of how this decision setting differs from standard laboratory procedures where more neutral language is preferred. However, using language that explains the decision problem in the context of a naturally occurring field situation is standard practice in experiments conducted in the field.