



Hierarchical Bayesian analysis of outcome- and process-based social preferences and beliefs in Dictator Games and sequential Prisoner's Dilemmas



Ozan Aksoy^{a,*}, Jeroen Weesie^b

^a Department of Sociology & Nuffield Centre for Experimental Social Sciences, University of Oxford, Nuffield College, New Road, OX1 1NF Oxford, UK

^b ICS/Department of Sociology, Faculty of Social Sciences, Utrecht University, Padualaan 14, 3584 CH Utrecht, The Netherlands

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ABSTRACT

In this paper, using a within-subjects design, we estimate the utility weights that subjects attach to the outcome of their interaction partners in four decision situations: (1) binary Dictator Games (DG), second player's role in the sequential Prisoner's Dilemma (PD) after the first player (2) cooperated and (3) defected, and (4) first player's role in the sequential Prisoner's Dilemma game. We find that the average weights in these four decision situations have the following order: (1) > (2) > (4) > (3). Moreover, the average weight is positive in (1) but negative in (2), (3), and (4). Our findings indicate the existence of strong negative and small positive reciprocity for the average subject, but there is also high inter-personal variation in the weights in these four nodes. We conclude that the PD frame makes subjects more competitive than the DG frame. Using hierarchical Bayesian modeling, we simultaneously analyze beliefs of subjects about others' utility weights in the same four decision situations. We compare several alternative theoretical models on beliefs, e.g., rational beliefs (Bayesian-Nash equilibrium) and a consensus model. Our results on beliefs strongly support the consensus effect and refute rational beliefs: there is a strong relationship between own preferences and beliefs and this relationship is relatively stable across the four decision situations.

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1. Introduction

Social dilemmas are an important research area in sociology (e.g., Dawes, 1980; Kollock, 1998). Standard rational choice models explain the emergence and persistence of cooperation in *embedded* settings with several factors such as network embeddedness, conditional cooperation, rewards, sanctions, termination of the relation, and renegotiation of profits (e.g., Axelrod, 1984; Schuessler, 1989; Heckathorn, 1990; Weesie and Raub, 1996; Fudenberg and Maskin, 1986; Buskens and Raub, 2002). Yet, quite some social dilemma situations take place in *non-embedded settings* and among strangers where actors interact only once and will not see each other in the future. Such non-embedded settings lack the previously mentioned factors that could sustain cooperation. Thus, given classical models in the rational choice literature, one should not observe cooperation in non-embedded social dilemmas. However, we consistently observe otherwise (e.g., Sally, 1995; Camerer, 2003; Aksoy and Weesie, 2013b). Explaining cooperation in non-embedded settings, thus, has been a puzzle.

A rich body of literature, especially in social psychology and experimental economics but to a lesser extent in rational choice sociology, suggests that the emergence and persistence of cooperation in non-embedded settings are due to *social*

* Corresponding author.

E-mail addresses: ozan.aksoy@sociology.ox.ac.uk (O. Aksoy), j.weesie@uu.nl (J. Weesie).

preferences. That is, in non-embedded settings cooperation is observed because (some) people do not try to maximize only own outcomes but are interested also in others' outcomes or hold other non-monetary motivations such as reciprocity. Many models of social preferences have been proposed to capture such non-selfish social preferences (for an overview see Fehr and Schmidt, 2006). One can distinguish roughly two types of social preferences: *outcome-based* and *process-based* McCabe et al., 2003. Outcome-based social preferences are about how actors evaluate a certain outcome distribution between self and others. Social value orientations, e.g., individualism, cooperativeness, altruism, competitiveness (Schulz and May, 1989), and inequality aversion (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000) are examples of outcome-based preferences. In process-based social preferences, actors take the history of previous interactions into account. Responding kind intentions with more pro-social behavior (positive reciprocity) and unkind intentions with less pro-social behavior (negative reciprocity) are related to underlying process-based social preferences (Gautschi, 2000; Falk and Fischbacher, 2006; Vieth, 2009). In social dilemmas both outcome and process-based preferences could be at work. For example, in a sequential Trust Game when the trustor places trust, the trustee could be motivated by the objective outcomes that both actors would get in case she honors or abuses trust. But if trust is placed, the trustee may also want to reciprocate the kindness of the trustor irrespective of the monetary outcomes in the game. To understand cooperation in non-embedded settings, one should consider both outcome and process-based social preferences.

Social preferences are only part of the explanation. Social dilemmas are interdependent situations. In interdependent situations, behavior depends not only own (social) preferences but also on beliefs about others' choices. For example, one may not cooperate, however socially motivated, if one expects that others will free ride on one's cooperation. Thus, to predict the cooperative choice of people we should also deal with their *beliefs about the choices* of others. Although the economics and rational choice literatures on social preferences are vastly developed, the literature on beliefs is relatively scarce (see also Blanco et al., 2009; Aksoy and Weesie, 2013a,b).

In experimental economics and rational choice sociology, beliefs are often dealt with as an ingredient of the Bayesian-Nash equilibrium concept (Harsanyi, 1968). The Bayesian-Nash equilibrium is based on very strong assumptions about the beliefs that people have. For instance, people are assumed to know the distribution of social preferences in the population and that the interaction partner is a random draw from this distribution. Consequently, one's beliefs about others' social preferences are *independent* of one's own social preferences. These strong assumptions ensure that in the Bayesian-Nash equilibrium beliefs and choices are consistent. Throughout the paper we will use the term "rational beliefs" to denote beliefs that satisfy the aforementioned assumptions of Bayesian-Nash equilibrium (Bellemare et al., 2008). Although being mathematically elegant, in reality people's beliefs deviate from rational beliefs. There is a strong empirical relationship between preferences and beliefs which refute Bayesian-Nash beliefs (e.g., Blanco et al., 2009; Aksoy and Weesie, 2013a,b, 2012). Still, the behavioral consequences of ignoring this relationship between preferences and beliefs is yet to be studied. To be clear, if theoretical models which incorporate the rational beliefs assumption, thus ignore the relationship between preferences and beliefs, do not yield behavioral predictions that are far off from actual behavior, one might be content with the theoretical model despite the fact that the rational beliefs assumption is wrong.

We should note that there are studies in the experimental economics literature that elicit beliefs experimentally rather than relying on Bayesian-Nash equilibrium (e.g., Bellemare et al., 2008; Blanco et al., 2009). These studies restrict the focus exclusively on the *beliefs about the choices* of others (see for a brief overview Aksoy and Weesie, 2013a). In our view, as one explains choices through a micro-model of social preferences, one should also explain beliefs about others' choices through the same micro-model of social preferences. That is, beliefs about the choices of others should be explained by *beliefs about social preferences* of others given by the model of social preferences. Extending the use of a model of social preferences to explain beliefs about the choices of others will, firstly, facilitate the empirical test of the social preference model (Aksoy and Weesie, 2013b). Secondly, explaining choices and beliefs about others' choices using the same social preference model provides a more parsimonious account than taking beliefs about others' choices as exogenous variables measured empirically.

In this paper, we employ a within-subjects experimental design with a set of binary Dictator Games and a set of non-embedded sequential Prisoner's Dilemma (PD) games, see Fig. 1. Using a simple model with a single social value orientation parameter, our analysis focuses on the following three questions. First, how does the social value orientation parameter differ between situations with and without relationship history (*process*)? For example, is there a change in the social value orientation parameter of Ego after Alter's cooperative or defective behavior in line with positive or negative reciprocity? Second, how does the belief about the social value orientation parameters of others vary with own preferences, and does the

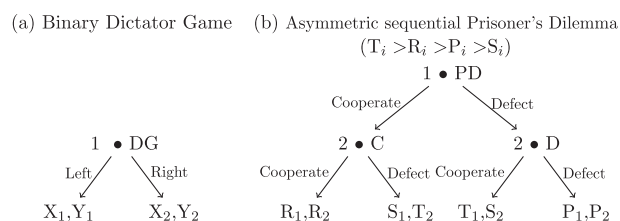


Fig. 1. Games used in the experiment. DG, PD, C, D are symbols that denote the decision nodes.

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