



Enforcement of contribution norms in public good games with heterogeneous populations ☆

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ABSTRACT

We investigate the emergence and enforcement of contribution norms to public goods in homogeneous and heterogeneous groups. With survey data we demonstrate that uninvolved individuals hold well defined yet conflicting normative views of fair contribution rules related to efficiency, equality, and equity. In the experiment, in the absence of punishment no positive contribution norm is observed and all groups converge towards free-riding. With punishment, strong and stable differences in contributions emerge across group types and individuals in different roles. In some cases these differences result from the emergence of an efficiency norm where all fully contribute. In the cases where full efficiency is not attained, these differences result from the enforcement of different relative contribution norms. Hence, our experimental data show that, even in heterogeneous groups, individuals can overcome the collective action problem inherent in public good games by agreeing on and enforcing a contribution norm.

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1. Introduction

The need for cooperation among people with heterogeneous characteristics is an undeniable fact of social and economic life. At the work place, teams are composed of workers who frequently differ in their productivity, ability, and motivation (Hamilton et al., 2003). Irrigation systems are often jointly used and maintained by farmers with different plot sizes and water needs.¹ Also, people can derive very different benefits from public goods. For example, the elevation of dams along the Mississippi River are of different value to individuals who live close to the river compared to those who live further away. In the international political and economic arena, countries that greatly differ in size and wealth are often confronted with situations that require them to find joint agreements in order to overcome social dilemmas. Sandler and Hartley

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¹ For instance, in the western states of the United States, family farms dependent on irrigation vary in annual farm sales from below \$100,000 to above \$500,000 (“Western Irrigated Agriculture Dataset”. United States Department of Agriculture, July 20, 2004. Retrieved from <http://www.ers.usda.gov/data/westernirrigation/methods.htm> on September 19, 2011).

(2001) discuss this problem in the framework of international military alliances. Other prominent examples of international cooperation include the Kyoto Protocol, which aims to reduce emissions of greenhouse gases, fishing quotas by European Union members to mitigate the overfishing of open waters, and the Global Disease Detection Program spearheaded by the United States that seeks early detection of infectious diseases.

As diverse as the above examples seem, they can all be viewed as special cases of a more general public good problem where the formal enforcement of cooperation by third parties is infeasible or very limited (e.g., due to high monitoring costs or the absence of a supranational institution with coercive power). For such situations scholars suggest that informal sanctions are used to enforce a social norm of cooperation (Elster, 1989; Coleman, 1990). Ostrom (1990) describes, among others, the case of fishermen in Alanya, Turkey, who overcame the commons problem through informal rules that are defended violently if necessary. The private lobster management in Maine provides another case where it is reported that free-riders of the informal self-regulatory system were “discouraged by surreptitious violence” (Berkes et al., 1989, p. 92).

The question of contribution norms supporting cooperation becomes especially interesting when taking into account that at least some of the involved parties are motivated by social preferences (Rabin, 1993; Fehr and Schmidt, 1999). Social preferences transform the social dilemma into a coordination problem with many Nash equilibria, where existing theoretical models give little guidance as to what outcomes to expect. However, if players can (tacitly) agree and, if necessary, punish deviations from specific contribution norms this could help solve the equilibrium selection problem. Indeed, for homogeneous groups, controlled laboratory experiments have shown that cooperative behavior in public good problems can be supported through punishment, and it has been suggested that cooperation is achieved through punishment of deviations from an equal contributions norm. Such evidence is lacking for heterogeneous groups.²

In this paper we study, for homogeneous and different heterogeneous groups, whether contribution norms are observed in public goods problems, whether and how they are enforced, and whether they help groups to overcome the coordination problem inherent in public goods problems with social preferences. To this end we define a norm as a rule of behavior that is only observed if people are aware that a normatively appealing behavioral rule exists and sufficiently many people follow that rule, either because it is internalized or because of the threat of sanctions (Bicchieri, 2006; Young, 2008). Specifically, we investigate (i) whether people hold specific normative views regarding rules of contribution behavior (e.g., equal and/or efficient contributions) that could serve as a basis for a contribution norm, and (ii) whether these normative views differ across different types of group heterogeneity. In addition, we examine (iii) whether individuals interacting in homogeneous and heterogeneous groups follow a *specific* rule of contribution behavior, (iv) whether sanctioning is needed for them to follow such a rule, and (v) whether the followed rule depends on the type of group heterogeneity.

For homogeneous groups it has been shown that high contributions to the public good can be sustained because some high contributors reliably sanction deviations from their own (or the group’s average) contribution. In such groups, such behavior is intuitively appealing and consistent with the enforcement of a contribution norm grounded in fairness principles such as efficiency, equality, and, given that individuals are symmetric, also equity.³

In heterogeneous groups, however, it is not clear what contribution norm may emerge, if one emerges at all. If people differ, fairness principles of equality, equity, and efficiency will often stipulate different normatively appealing rules of behavior. In such a case, even uninvolved individuals might find it hard to unambiguously answer questions such as: should high-income individuals contribute more to the public good even though they benefit equally from it? Such ambiguity in the normative appeal of fairness principles is also well known in the public finance literature where it is discussed as the benefit-received versus the ability-to-pay principles (see, e.g. Musgrave, 2008). In addition, even if individuals have a clear view about the rule of behavior they find normatively appealing, self-serving interpretations of fairness principles (Roth and Murnighan, 1982; Babcock and Loewenstein, 1997) may make it difficult for individuals in heterogeneous groups to agree on a specific rule that may constitute the basis of a contribution norm. For instance, if people have different tastes for the public good, a rule of equal contributions may be seen as normatively desirable by those who derive a higher benefit from the public good, whereas those who enjoy the public good less may think that such a rule is normatively unappealing.

² For recent reviews on homogeneous groups, see Fehr and Fischbacher (2004) and Gächter and Herrmann (2009). In contrast to homogeneous groups, the experimental evidence regarding contributions to public goods in heterogeneous groups is less conclusive. Experiments investigating endowment heterogeneity report mixed results. Ostrom et al. (1994), van Dijk et al. (2002), and Cherry et al. (2005) find that inequality leads to lower contributions, Chan et al. (1996) and Buckley and Croson (2006) report a positive effect, and Chan et al. (1999) and Sadrieh and Verbon (2006) no effect. With respect to heterogeneity in the marginal benefit from the public good, Fisher et al. (1995) find that individuals with a high marginal benefit contribute more than those with a low marginal benefit. Furthermore, evidence on the effect of sanctioning in heterogeneous groups is sparse. To our knowledge, the only experiment that combines endowment heterogeneity and punishment possibilities is Visser and Burns (2006). They report that punishment effectively promotes cooperation in both homogeneous and heterogeneous groups. Tan (2008) and Noussair and Tan (2011) study groups with heterogeneous productivities regarding the public good and find that punishment does not increase contributions as much in heterogeneous as in homogeneous groups. Nikiforakis et al. (2010) report that heterogeneity in punishment effectiveness, controlling for the average effectiveness, does not affect cooperation levels. Lastly, Reuben and Riedl (2009) and Nikiforakis et al. (2012) investigate groups with heterogeneous benefits from the public good. The former show that punishment is less effective in heterogeneous groups due to the reluctance of subjects with low benefits to increase their contribution after being punished. The latter report lower earnings in heterogeneous groups compared to homogeneous groups due to increased counter-punishment, which they attribute to conflicting normative expectations in heterogeneous groups.

³ The principles of efficiency, equality, and equity are commonly called upon in normative research and have been extensively discussed by philosophers (e.g., Aristotle, 1925; Rawls, 1971; Corlett, 2003). Equality is also commonly invoked in social choice theory as axioms of symmetry and anonymity (e.g., Moulin, 1991; Gaertner, 2006). Frohlich et al. (1987) and Frohlich and Oppenheimer (1990) are seminal experimental investigations into these justice principles. Konow (2003) provides an excellent survey on normative and positive views of justice.

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