Relative power: Material and contextual elements of efficacy in social dilemmas

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ABSTRACT

In Step-Level Public Good (SPG) situations, groups of individuals can produce a public good if a sufficient number of them contribute. In SPG situations it is thus only rational for any group member to contribute if according to the beliefs of that group member her contribution is essential to the production of the public good. An individual's estimate of the impact of their contribution on the likelihood of public good production is known as their *efficacy*. The classic *efficacy − cooperation hypothesis* holds that individuals will be more likely to contribute if they estimate their contributions to be more necessary. Based on a *game theoretical analysis* of the SPG game, we contribute to the literature by identifying two distinct components of efficacy, viz. *material efficacy* and *contextual efficacy*. The former is based on objective characteristics of group members (such as resources, power, or skill) and the latter on beliefs about the material efficacy of other group members and expectations concerning their behavior. We present evidence from three experimental studies, showing how information on the distribution of material efficacy in the group can break the monotone material efficacy − cooperation relation. In addition, contrary to what one would expect based on both the efficacy − cooperation hypothesis and game theory, our results show that the effects of material efficacy are not mediated by contextual efficacy, both forms of efficacy having significant effects on behavior.

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1. Introduction

A surprising trait of human societies is the prevalence of cooperation between unrelated individuals. Studies of cooperation have a long tradition at the forefront of social science. Cooperation problems are frequently conceptualized as social dilemmas (Kollock, 1998): situations in which individually rational behavior can lead to collectively suboptimal outcomes (Messick and Brewer, 1983). Social dilemmas are characterized by the existence of *deficient equilibria* (Kollock, 1998). These equilibria are such that (i) there is at least one alternative outcome in which everyone is better off (deficient), but (ii) no one has an incentive to unilaterally change their behavior (equilibrium). One reason why cooperation has received so much scholarly attention is that its prevalence appears fundamentally unlikely (e.g. Kollock, 1998; Olson, 1965). Despite grim predictions, experimental and observational research has shown significant levels of cooperation (Ostrom, 1990; Sally, 1995; Balliet et al., 2009). Prominent explanations of this phenomenon suggest that humans have *social preferences* (e.g., Fehr and Gintis, 2007), expressed variously as for example fairness (Rabin, 1993; Charness and Rabin, 2002) or inequality avoidance

(e.g. Engelmann and Strobel, 2004; Falk et al., 2008; Fehr et al., 2006), or may be motivated to cooperate by *incentives* or *disincentives* (e.g. Fehr and Gächter, 2000, 2002; Fehr et al., 2002; Olson, 1965). Sociologists and social-psychologists have specifically identified social incentives such as *status rewards* (Willer, 2009) and *moral judgments* (Simpson et al., 2013). While these are all examples of *proximate mechanisms* explaining why individuals cooperate, *evolutionary game theory* advances *ultimate mechanisms* explaining how the proximate mechanisms can be evolutionarily adaptive (Rand and Nowak, 2013).

Prominent models to test proximate explanations include the *Prisoners' Dilemma* (Axelrod, 1984), the *Ultimatum Game* (Thaler, 1988), the *Trust Game* (Snijders and Keren, 2001) and the *Public Good Game* (e.g. Fehr and Gächter, 2000). Most of these share the important property that free riding (i.e. not contributing) is a dominant strategy. That is, regardless of the decisions of others, not contributing is the most rewarding strategy.

However, cooperation is not always irrational for selfish individuals. An important model for which this is true is the Volunteer's Dilemma, studied by Diekmann (1985). A generalization of the Volunteer's Dilemma is the so-called *Step-Level Public Good games* (SPGs) in which a minimal level of cooperation is required to produce a collectively beneficial outcome (e.g. Van de Kragt et al., 1983; Marwell and Oliver, 1993). In SPGs payoffs from defection are not always greater than payoffs from cooperation. In particular, when one's contribution completes the minimum requirement for the collective good to be produced, one is better off contributing than defecting. Hence, cooperating is rational for individuals whose contributions are likely to be both *necessary* and *sufficient* for the collective good to be produced. Assuming that no actor can produce the SPG alone, this implies strategic uncertainty: whether cooperation is rational or irrational depends on the behavior of others. These traits describe a variety of real-life situations.

Consider an urban community situated in the approach path of an airport, such that landing aircraft cause much noise pollution. Households in this community would all benefit from a reduction in flight activity or a retracing of the approach path, yielding a reduction of noise pollution. Such a reduction would constitute a public good, as any decrease in noise pollution would benefit all community members regardless of whether they contributed to its production. In fact, the production of this public good frequently has the key characteristics of the SPG. Typically, community members have to set up some kind of community association that will negotiate with the airport authorities and (local) politics about reducing noise pollution. The cooperation problem then is *who* among the many community members is to become active in the community association, contributing time and effort to the production of the public good. Almost never can any single community member alone sway all necessary politicians, nor can any single person successfully negotiate with the airport authorities without the explicit backing by a large section of the community. Thus, multiple people have to combine their efforts for successful public good production. However, not every community member's efforts are needed, and once a sufficiently large portion of the community is active, additional contributions have little perceptible effects.

Previous research suggests that individuals deal with this strategic uncertainty by estimating their impact on the likelihood of collective good production (Kerr, 1989, 1992, 1996). An individual's estimated impact on the probability of collective good production is referred to as her *efficacy* (Kerr, 1992). Efficacy is a *subjective* construct, which can be based on but is not fully captured by a person's objective characteristics. The more likely it is in an individual's perception that her contribution is the deciding factor in whether or not the collective good is produced, the higher her efficacy, and thus the more likely that cooperating will be worth her while. As a result, the *efficacy-cooperation hypothesis* holds that individuals with high efficacy contribute more frequently than individuals with low efficacy (Kerr, 1992). Experimental research (e.g. Kerr, 1992, 1996) has corroborated this hypothesis.

Within a group individuals will differ in their power, wealth or skill, and an individual's estimation of her efficacy will be influenced by this intra-group heterogeneity. Much like how small political parties may be the deciding factor in the formation of coalition governments, individuals with low power, wealth or skill may be highly efficacious when complementing more powerful group members in the production of a collective good. Efficacy is thus not only subjective but also *context-dependent*, consisting of both *material* and *contextual* components. We propose to label *material efficacy* objective characteristics of a person relevant to the production of the collective good. In the context of our community example, the material efficacy of a community member would consist of her skill in letter writing, her knowledge of the physics of sound, her organizational abilities, the contacts she has in local politics, and the time she has available to devote to the community association, among other things. We propose to term *contextual efficacy* the individual's estimate of what her material efficacy is worth given her social environment. It is determined, first, by the individual's perception of material efficacies of other group members and, second, by the individual's expectations about the behavior of other group members as a function of these material efficacies. Thus, in our example any community member will assess the levels of relevant knowledge, skills, time, and social contacts possessed by fellow community members, and compare them to her own to decide about joining the association.

Social-psychological research on the efficacy-cooperation hypothesis (e.g. Kerr and Kaufman-Gilliland, 1994; Kerr, 1992, 1996) has commonly presented experimental subjects with information about their own material efficacy, giving only a general description of how material efficacy is distributed among their peers. Subjects are thus forced to form private beliefs about the distribution of material efficacy. Analyzing a game-theoretical model, Dijkstra and Oude Mulders (2014) show how different beliefs about the material efficacy distribution may result in vastly different behaviors of persons with the same material efficacy. This strongly suggests that anything that affects individuals' beliefs about the material efficacy distribution in the group (such as more detailed information on it) affects contribution behavior. *The purpose of this paper is therefore to investigate how contributions to SPGs depend on the degree of information about the distribution of material efficacy.*