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Original Article

Cooperative strategies outside the laboratory — evidence from a long-term large-N-study in five countries

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ABSTRACT

Research on human cooperation as an evolutionary adaptation is largely based on results from the laboratory, e.g. public goods games. However, it is debated whether these results of human cooperative behavior extend beyond such settings and whether they are valid in other contexts. Critical issues include the absence of context, the very short period of play and possible observer effects. This article presents data from an alternative controlled, but context-rich setting – a public goods game in an online browser game – with around 18,000 players from five countries over a period of ten months without observer effects. This article focuses on the robustness of previous findings about cooperative strategies and whether different types of cooperative behavior extend beyond the laboratory setting. Thus, the data presented provides external validity to existing laboratory experiments. The results suggest some important qualifications to previous work, since less high cooperators and a differing proportion of conditional cooperation are found. However, this data confirms the reported proportion of free riders at about 25% of the population. Cooperative strategies appear to be stable over time, individually fixed and rather independent of environmental parameters.

1. Introduction

In both evolutionary biology and economics, cooperative behavior presents many puzzles (Hammerstein, 2003). Multiple explanations have been advanced to explain the emergence and relative stability of human cooperation (Gintis, Bowles, Boyd, & Fehr, 2003; Guala, 2012; Hagen & Hammerstein, 2006; Hawkes & Bird, 2002; Voland, 2009; Wilson, 2013). It is still unclear which factors induce humans to cooperate.

Most arguments are based on public goods experiments in the laboratory. The more sophisticated the debate has become, the more the experimental setting has come into focus. The heavy reliance on laboratory-based and relatively protracted series interactions raises a fundamental question: How well do basic findings from these highly controlled and temporally limited settings extend to long-run, context-rich interactions that better reflect the bulk of human interaction past and present? Such criticism addresses the question of the *ecological validity* of experiments in the laboratory and therefore the specificity of evolutionary adaptations for cooperative behavior. Whether behavior in experimental situations accurately reflects real-world behavior is controversial, since some evidence points to markedly different cooperative behavior in natural field settings (e.g. Wiessner, 2009; Winking & Mizer, 2013).

Further evidence from evolutionary psychology confirms that the context-sensitivity of human heuristics applies to a broad range of problems (for examples for adapted decision-making, see Cosmides & Tooby, 1992; for examples of bounded rationality see Gigerenzer, 1991). For instance, it has been reported that the level of anonymity plays a major role for cooperation levels (Franzen & Pointner, 2012; Lamba & Mace, 2010). More specifically, it is well known for social dilemmas that framing (Frey & Meier, 2004; Gerkey, 2013), subtle cues of being in an observed environment (Bateson, Nettle, & Roberts, 2006) or just the wording of the instruction (Yamagishi, Terai, Kiyonari, Mifune, & Kanazawa, 2007; Zelmer, 2003) produce large effects regarding the level of cooperation. In addition, it has been shown that neither settings in public goods games that favor full cooperation nor conditions that favor no cooperation trigger the expected behavior fully. Other evolutionary heuristics (e.g. avoidance of extreme strategies) are important as well (Kümmerli, Burton-Chellew, Ross-Gillespie, & West, 2010). Therefore, the *context-dependency* of adaptive cooperative behavior is directly linked to the ecological validity of experimental results.

Recent research has reflected these facts insofar as there seems to be no general utility that could be maximized, but *several*, even potentially conflicting, context-dependent utility functions. These may account for the *different* preferences of individuals that have been found (Fischbacher, Gächter, & Fehr, 2001). Contrary to the assumption that all individuals optimize profit in a public goods game, there seem to be at least four distinguishable individual cooperative behaviors (free riding, conditional, hump-shaped and high cooperation). These

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differences have been forwarded as explanation for two key results: First, to explain variation in overall cooperation levels; second, to explain the decay of cooperation by conditional cooperators retaliating against free riders by not contributing themselves (Fischbacher et al., 2001).

Both individual differences and context-dependency have led to calls for conducting more “field-like experiments” (Rankin, 2011) to test for cooperative traits developed for specific problems in our evolutionary past as hunter and gatherer. This is especially important given evidence that participants in experiments behave rather differently in real life even if social dilemma structures are very similar (Levitt & List, 2007; List, 2006; Wiessner, 2009). It has also been suggested that people may behave more egoistically in more realistic settings (Rankin, 2011). In addition, the variability of cooperation in public goods games across cultures and subject pools is quite large (Buchan et al., 2009; Herrmann, Thöni, & Gächter, 2008).

However, laboratory experiments are very valuable, most notably for the experimenter's ability to control and manipulate specific parameters of interest that remain elusive in more complex environments. Furthermore, field experiments seldom allow for large subject pools and sometimes suffer from design compromises.

With the situation as of now, it seems impossible to decide some of the critical questions on the evolution of human cooperation raised above – e.g. whether cooperation levels depend on individual variability in preferences and context-dependent heuristics – within the traditional paradigm of the laboratory. Either the experimental settings are not suited to answer these questions at all, because our ancestral heuristics for cooperation are not triggered; or the “bare bones” settings of the laboratory do not allow conclusions about evolutionary hypotheses that have been forwarded to explain cooperative behavior (Rankin, 2011). Either way, it follows that conclusions about evolutionary pathways from laboratory evidence are limited, not least because the potentially involved heuristics have not been identified clearly (Kümmerli et al., 2010).

In order to shed more light on these questions, one solution may be to add richer empirical settings to the debate which would allow to estimate more precisely which results are specific to the laboratory and which may be more context-independent, hence more generalizable. One promising line of research is to couple field experiments with laboratory games (e.g. Rustagi, Engel, & Kosfeld, 2010; Winking & Mizer, 2013). This allows us to assess the respective results and complement laboratory and field findings.

Another way is to use still other contexts to qualify existing results in order to be able to assess context-specificity. Given substantial changes in cooperative behavior and punishment by just extending the usual 10 rounds in a public goods game to fifty (Gächter, Renner, & Sefton, 2008), such a setting would have to use data on behavior in *long-term* and *context-rich* environment since it should be more representative of our ancestral cooperative behavior (Hill, 2001). To avoid subject pool bias, participants would have to come from a *more diverse* pool of participants than western students in regard to age, education level and cultural background (Henrich, Heine, & Norenzayan, 2010) and participants should assume that they are *not being observed* — without compromising on the exact knowledge of parameters (Bateson et al., 2006).

This study uses such context-rich, long-term, cross-cultural data. Tapping into data from an online-browser based game with several built-in public goods games, the context-dependency of cooperative decisions in social dilemmas for more than 18,000 subjects across cultures in a controlled setting over a period of ten months can be tested.

With this data set, I focus on differences in cooperative strategies, because (a) they have been suggested to play a pivotal role in explaining cooperation levels, (b) previous results on differences are not consistent across studies and cultures and (c) the data structure allows us to decide whether strategies are dominantly shaped by the individual or by environmental parameters.

Three research questions on cooperative strategies will be addressed: First, do player types exist detached from the laboratory context? Second, are results from context-rich settings comparable to existing laboratory results? Third, how stable are player types across different contexts and countries? The setting analyzed provides new insights to the context-sensitivity of our cooperative adaptations as hunter and gatherers in regard to the laboratory settings discussed above.

Previous studies have pointed out that there are different *types of individuals* (Fischbacher et al., 2001; Rustagi et al., 2010). The interactions between these types may be responsible for the stability of cooperation (Gächter, 2007). However, it is unclear how the observed heterogeneity of preferences of players is affected by different contexts, including their dependence on socio-economic attributes, specific parameters of the environment or personality traits. The importance of classifying individuals as free riders, conditional and high cooperators is underscored by research on assortment mechanisms separating free riders from other player types, leading to large and significant differences in contributions to public goods (Page, Putterman, & Unel, 2005).

Concerning cross-cultural differences, evidence in public goods games (PGG) points to a high variance: Contributions to PGG range from only minor differences (Brandts, Saijo, & Schram, 2004) to notable and significant effects due to cultural variation (Ockenfels & Weimann, 1999) for Eastern versus Western Germany; see (Burlando & Hey, 1997) for Italian versus English subjects. The highest contributions to PGG have been found for salmon fishers and reindeer herders in small, isolated villages in Kamchatka, where 97% of the endowment was contributed to the public good (Gerkey, 2013). Large variation is also found in non-western, non-students pools (Buchan et al., 2009; Henrich et al., 2001).

Cross-cultural variation seems to hold for both reciprocal behavior (also termed conditional cooperation) and free riding behavior (Kocher, Cherry, Kroll, Netzer, & Sutter, 2008). In contrast, another study finds rather stable conditional cooperation but a varying percentage of free riders (Herrmann & Thöni, 2009).

Besides these cultural differences, two characteristics from the setting where human cooperative behavior emerged seem to be particularly important for the development of different cooperative strategies: First, the ancestral setting – with collective action problems like cooperative hunting, division of labor or the distribution of large animals – is skewed toward long-term interactions (Frey & Rusch, 2012; Gächter et al., 2008), where little could be gained by cheating a reciprocal partner, and cooperative partners were sought after; second, only a few hundred social relationships were available, setting the stage for a mixture of nepotist and reciprocal relationships (Hill, 2001). These characteristics should favor long-term conditional cooperation strategies adjusting own cooperation levels depending on the willingness to reciprocate of the respective partner.

Evolutionary adapted behavior is known to differ according to context even if the underlying cost–benefit decision remains the same (Winking & Mizer, 2013). The conclusion to be drawn from such field studies is to not rely on only one experimental paradigm (here: The laboratory public goods game) but to test these findings in other contexts. Therefore, this study validates findings on cooperative behavior by testing its hypotheses in another setting that – evolutionary speaking – is more representative of our past as hunter and gatherers.

Hence, this article argues that the online browser game used is more similar to our ancestral environment than laboratory experiments in many respects, since it consists in long-term repeated interactions with a small group of known partners where subjects interact in a natural way with an intrinsic motivation to play in a setting where the framing (here: Harvesting resources) resembles the real world. More importantly, game play happens in a context without subjects being aware they are observed, which is known to cause various biases resulting from this experimental situation.

Still, as a browser-game it may still lack ecological validity. However, patterns of communication, emotions, social interactions (Ducheneaut,