

# Is altruism evolutionarily stable?

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## Abstract

We develop an evolutionary approach to explain altruistic preferences. Given their preferences, individuals interact rationally with each other. By comparing the success of players with different preferences, we investigate whether evolution favors altruistic or selfish attitudes. The outcome depends on whether the individuals' interactions are strategic complements or substitutes. Altruism and self-interest are context dependent. © 1998 Elsevier Science B.V.

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## 1. Introduction

There is an abundance of observations showing that individuals do not always pursue self-interest: People risking their own life to rescue others, soldiers voluntarily going to war, the many forms of charity etc. These observations can be made consistent with standard economic theory by postulating utility functions that include the well-being of others in addition to one's own. Yet, this only rephrases the question of why individuals behave in this way. Instead of explaining altruistic behavior, one now has to explain why people sometimes have altruistic preferences. It is this question that we want to address.

We adopt an evolutionary approach to investigate whether altruism may have evolved in humans through a process of natural or cultural selection. Formally, the degree of altruism is expressed by a preference parameter describing how much an individual cares for the success of others. The range of possible parameters includes pure self-interest as

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the special case where an agent's objective is identical to his private success. In the interaction with others, each player rationally selects a strategy to maximize his preferences. As a result, in equilibrium each player's effective success depends on the altruistic attitudes of all the involved players. This allows us to compare the success of players with different preference parameters. In an evolutionary environment, players with higher expected success are less likely to be eliminated. Since success is related to preferences, we can study the question of whether evolution favors altruistic or selfish attitudes. Altruism is said to be evolutionarily stable if it survives evolutionary selection.

Instead of studying directly the evolution of behavior, which is the usual approach in evolutionary biology<sup>1</sup> and in evolutionary game theory (see, e.g. Hammerstein and Selten, 1994), we consider rational behavior for given preferences. These preferences determine the players' behavior and their effective success via their effect on the outcome of strategic interactions. By assuming rational behavior and applying the concept of evolutionary stability (see Maynard Smith, 1982) to preferences rather than to strategies, we endogenously determine preferences. Our approach thus offers a way of endogenizing individual objective functions, which neoclassical theory usually treats as exogenous.<sup>2</sup>

Our analysis of individual interactions yields two insights: First, a comparison of the interaction between altruists and the interaction between egoists reveals that the altruists achieve a higher material payoff than the egoists. This is so because altruistic preferences internalize some externalities in the game between the players. Second, when an altruist interacts with an egoist, the altruist's material payoff is lower than the egoist's payoff. This finding is in line with the conventional view that altruistic preferences reduce the individual's success, while at the same time increasing the opponent's success.

The second result is often used as an argument that altruism cannot possibly evolve by natural selection. Yet, this argument does not directly address evolutionary considerations. For the process of natural selection, the relevant question is whether an egoistic mutant facing a population of altruists is more successful than the altruists among themselves. Altruism will be evolutionarily stable if an egoist in the interaction with an altruist receives a lower material payoff than an altruist. In our model, this depends on the strategic dependence between the players. Altruism turns out to be evolutionarily stable only if the game exhibits strategic complementarities in the sense of Bulow et al. (1985). If there is strategic substitutability, then the only evolutionarily stable equilibrium is one in which everybody is selfish. If there is strategic complementarity, one's partner, even if he is perfectly selfish, will treat one better if one is nice than if one is nasty. So it turns out that altruists may perform less well than their selfish partners, but still better than selfish individuals who have selfish partners. As a result, strategic complementarity supports altruism as an evolutionarily stable outcome. Our study thus suggests that preferences may be context-dependent. Situational factors may decide whether individuals are motivated by altruism or self-interest.

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<sup>1</sup> Note that also in evolutionary biology one often considers the assumption of genetically determined behavior as questionable (see van Lawick-Goodall, 1974). Higher developed species like mammals live in such a complex and stochastic environment that a genetically determined reaction behavior to all circumstances appears to be impossible.

<sup>2</sup> The exceptions include Becker (1976), Frank (1987) and, more recently, Güth and Yaari (1992), Hanson and Stuart (1990), Rabin (1993), Rogers (1994), and Waldman (1994).

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