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**The co-operative and the selfish are equally successful at getting what they want**

MANY people, it is said, regard life as a game. Increasingly, both biologists and economists are tending to agree with them. Game theory, a branch of mathematics developed in the 1940s and 1950s by John von Neumann and John Nash, has proved a useful theoretical tool in the study of the behaviour of animals, both human and non-human.

An important part of game theory is to look for competitive strategies that are unbeatable in the context of the fact that everyone else is also looking for them. Sometimes these strategies involve co-operation, sometimes not. Sometimes the "game" will result in everybody playing the same way. Sometimes they will need to behave differently from one another.

But there has been a crucial difference in the approach taken by the two schools of researchers. When discussing the outcomes of these games, animal behaviourists speak of "evolutionarily stable strategies", with the implication that the way they are played has been hard-wired into the participants by the processes of natural selection. Economists prefer to talk of Nash equilibria and, since economics is founded on the idea of rational human choice, the implication is that people will adjust their behaviour (whether consciously or unconsciously is slightly ambiguous) in order to maximise their gains. But a study just published in the *Proceedings of the National Academy of Sciences*, by Robert Kurzban of the University of Pennsylvania and Daniel Houser of George Mason University in Fairfax, Virginia, calls the economists' underlying assumption into question. This study suggests that it may be fruitful to work with the idea that human behaviour, too, can sometimes be governed by evolutionarily stable strategies.

Double or quits?

Dr Kurzban and Dr Houser were interested in the outcomes of what are known as public-goods games.

In their particular case they chose a game that involved four people who had never met (and who interacted via a computer) making decisions about their own self-interest that involved assessing the behaviour of others. Each player was given a number of virtual tokens, redeemable for money at the end of the game. A player could keep some or all of these tokens. Any not kept were put into a pool, to be shared among group members. After the initial contributions had been made, the game continued for a random number of turns, with each player, in turn, being able to add to or subtract from his contribution to the pool. When the game ended, the value of the pool was doubled, and the new, doubled value was divided into four equal parts and given to the players, along with the value of any tokens they had held on to. If everybody trusts each other, therefore, they will all be able to double their money. But a sucker who puts all his money into the pool when no one else has contributed at all will end up with only half what he started with.

This is a typical example of the sort of game that economists investigating game theory revel in, and both theory and practice suggests that a player can take one of three approaches in such a game: co-operate with his opponents to maximise group benefits (but at the risk of being suckered), free-ride (ie, try to sucker co-operators) or reciprocate (ie, co-operate with those who show signs of being co-operative, but not with free-riders). Previous investigations of such strategies, though, have focused mainly on two-player games, in which strategy need be developed only in a quite simple context. The situation Dr Kurzban and Dr Houser created was a little more like real life. They wanted to see whether the behavioural types were clear-cut in the face of multiple opponents who might be playing different strategies, whether those types were stable, and whether they had the same average pay-off.

The last point is crucial to the theory of evolutionarily stable strategies. Individual strategies are not expected to be equally represented in a population. Instead, they should appear in proportions that equalise their pay-offs to those who play them. A strategy can be advantageous when rare and disadvantageous when common. The proportions in the population when all strategies are equally advantageous represent the equilibrium.

And that was what happened. The researchers were able to divide their subjects very cleanly into co-operators, free-riders and reciprocators, based on how many tokens they contributed to the pool, and how they reacted to the collective contributions of others. Of 84 participants, 81 fell unambiguously into one of the three categories. Having established who was who, they then created "bespoke" games, to test whether people changed strategy. They did not. Dr Kurban and Dr Houser were thus able to predict the outcomes of these games quite reliably. And the three strategies did, indeed, have the same average pay-offs to the individuals who played them—though only 13% were co-operators, 20% free-riders and 63% reciprocators.

This is only a preliminary result, but it is intriguing. It suggests that people's approaches to co-operation with their fellows are, indeed, evolutionarily stable. Of course, it is a long stretch from showing equal success in a laboratory game to showing it in the mating game that determines evolutionary outcomes. But it is good to know that in this context at least, nice guys do not come last. They do just as well as the nasty guys and, indeed, as the wary majority.

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