

# Egoism May Facilitate Cooperation

People are a very special phenomenon for evolutionary biologists. No other animal is as helpful and uses mutual support to such an extent as *Homo sapiens*. What is so unusual is that we also help people who are not related to us, as well as those we don't even know – who we've never met before and never will meet. The result of this pronounced sense of community is that people live relatively peacefully in large, anonymous societies, pay premiums into a health insurance system, use a public transportation system and support other people somewhere in the world with a donation. Such a concept would be utterly absurd for a chimpanzee or an ant.

Biologists, who assume that everything must ultimately pay off for the individual, long had difficulties explaining this pronounced form of cooperation. In most cases, sociobiologists refer to kin selection and reciprocity to explain why essentially selfish beings that are driven by selfish genes cooperate. We help our relatives, for example, because they possess some of our genes – a mechanism that is also very common in the animal kingdom. It explains how ants, bees and bumblebees manage to live together in huge colonies.

As a result of reciprocity, we help those who have helped us before, in line with the old rule: "You scratch my back and I'll scratch yours." However, this works only when those involved see each other repeatedly, which is typical for friends and ac-

quaintances, or for the original small communities of hunters and gatherers in which people once lived.

But mankind has long since moved past this stage. How can cooperation be explained when mechanisms such as kin selection and direct reciprocity don't apply? "Through the mechanism of indirect reciprocity," says Manfred Milinski, Director at the Max Planck Institute for Evolutionary Biology in Plön. Reputation promotes cooperation: people don't just help those who have helped them, but usually also readily support anyone who has helped others. "We gain the support of others through our good reputation," says the biologist.

## THE REWARDS OF A GOOD REPUTATION

In his 1987 book *The Biology of Moral Systems*, insect researcher and evolutionary biologist Richard Alexander conjectured that human moral systems are based on what he calls indirect reciprocity, much like it is written in the Bible: "Give and you shall receive ...." As plausible as this proposition was, it was nevertheless long contested among evolutionary biologists that this mechanism would actually have fostered cooperation.

"It certainly sounded good, but no one wanted to believe that it could work on Earth," says Manfred Milinski, "perhaps in Heaven." But the Israeli behavioral biologist Amos Zahavi had previously contributed a concept that brought the religious

*Donating money for the victims of an earthquake or famine does not pay off for the benefactor – a chimpanzee might think, and thus not do it. But that is not true, as scientists working with **MANFRED MILINSKI** at the **MAX PLANCK INSTITUTE FOR EVOLUTIONARY BIOLOGY** in Plön have found. It seems that a good reputation always creates advantages.*



PHOTOS: CORBIS/DPA

Even stone-age hunters cooperated in the hunt – this increased their success rate. But we benefit from mutual support even in modern societies – as with the dike reinforcement shown here.







It is the tragedy of the commons: Because it is free for everyone, hardly anyone takes particularly good care of it. This applies to the use of transportation routes, leading to congested roads in urban centers, but it also applies to the climate. More and more, we are polluting the air with greenhouse gases.



PHOTOS: CORBIS/DPA

ideal back to the earthly realm. Experience shows, says Zahavi, that helpfulness rarely occurs behind closed doors: “If someone behaves altruistically, it is because others are watching. This is due to the fact that this then improves his image, and he can benefit from that,” says Milinski. That, too, sounds plausible, but there was no scientific proof.

In the late 1990s, Martin Nowak, now at Harvard University, and his colleague Karl Sigmund provided theoretical proof. In the journal *NATURE*, they described how, in a computer simulation, cooperation can indeed evolve among egoists through indirect reciprocity. “What was important was that every participant be given a so-called image score that showed the others how well he or she has cooperated,” says Manfred Milinski. Those who had a poor image failed. So, through indirect reciprocity, a good reputation stimulated cooperation – at least in theory.

The article fell on fertile ground with Milinski. He had already in-

vestigated the evolution of cooperation in a practical manner that is otherwise used primarily by economists. They boil the world down to a game situation in which they can control the conditions very precisely – and which involves real money. “We copied that from them,” says Milinski.

THE TRAGEDY OF THE COMMONS

The amounts are charged to the department’s budget, but if it was Monopoly money, the participants would not take the matter as seriously as they should, and would quickly lose motivation. In order to limit the strain on the institute’s budget, Milinski and other researchers tend to focus on the perpetually “hard-up” first-semester students: “They can win so much money here that they can go out for a really nice dinner.” But first-semester students also offer other advantages. They aren’t yet familiar with the science, so don’t usually know the background of the

study, and they are very familiar with computers.

The question was: Would students support someone they know cannot repay them in kind? Everyone was given five euros starting capital and could increase the amount through cooperation or egoism. Milinski was astonished: what Nowak and Sigmund had previously calculated theoretically and played out virtually – and what the Bible quote suggests – actually occurred: give and you shall receive. It even turned out that those who gave a lot also received a lot. The key was that everyone could see whether the person across the table was cooperative or not. They only needed to know whether the other person was a good guy or a bad guy.

Facilitating cooperation in anonymous groups is not the only thing a good reputation can do: it can solve the tragedy of the commons. Economists are very familiar with the phenomenon that bears this dramatic name, which was coined by ecologist Garret Hardin in 1968. It says that a

public resource will collapse within just a few rounds because the players will ruthlessly exploit it. Even if the players cooperate in the beginning, they eventually assert their own interests against the interests of the group. This game explains real-world situations that everyone is familiar with, from overfishing to the global climate crisis.

Using so-called public goods games, the researchers aim to find a solution to the conflict between individual and group interests. For instance, four players are asked to contribute one euro each to a public pool. The investigator then doubles the amount in the pool and divides it evenly among all four players, regardless of whether they actually contributed anything.

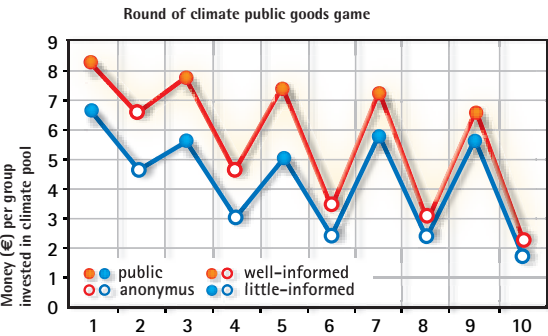
If everyone paid in, each one will receive two euros back, making a profit of one euro. However, if even one player doesn’t contribute, everyone will get just 1.50 euros back. That’s a net profit of 1.50 euros for the uncooperative player, the freeloader, and just 50 cents for each cooperative player. At the end, everyone is paid out the total funds in their account. Such experiments normally start out very cooperatively, but the cooperation collapses within a few rounds and no one invests in the common good anymore. “And that happens every time this game is played,” says Milinski.

Economists like Ernst Fehr from the University of Zurich have discovered that punishing those who don’t cooperate can solve the problem. This is a concept we are only too familiar with – just think of the ticket inspectors in the public transportation system, for example. But punishment has one major disadvantage: it isn’t free. “Punishment is hardly worthwhile in these games,” says Milinski. “The cost to the punisher and the punishee together is approximately so high that it largely destroys any gain from greater cooperation.”

PUNISHMENT OF FREELOADERS

Reputation is a very different matter. It doesn’t cost anything. In fact, anyone who doesn’t cooperate with a freeloader actually saves money. So it was only logical to test whether a good reputation could also solve the tragedy of the commons. To do this, Milinski and his colleagues Dirk Semmann and Hans-Jürgen Krambeck chose an unusual approach: they combined the game type they had chosen for indirect reciprocity and reputation with a public goods game.

“The participants played one game in one round and the other game in the next, and so forth,” says Milinski. The result: when the players were able to carry over the good reputation they acquired in the in-



Willingness to contribute money for an ad about climate change grew when players were well informed about climate change, and especially when they could make public contributions to the ad pool. Much less was paid anonymously, which brings no gains in reputation.

direct reciprocity game into the public goods game, the public good was saved and everyone earned a lot of money for dinner. When they had to leave their positive image from the previous round behind them and continue playing with a new, neutral name, then the altruists immediately went back to being egoists when asked to contribute to the public good.

Reputation saves the public good, and anonymity destroys it. “People look after their good reputation. And they pay just as much attention to whether others can see what they do. Altruists who act in such a way that others notice it come out winners,” says Milinski. He and his colleagues have quite a bit of faith in reputation – even that it could help curb climate change. “With more than six billion

THE POWER OF RUMORS

In a recent study, Manfred Milinski and Ralf Sommerfeld, together with their colleagues Hans-Jürgen Krambeck and Dirk Semmann, proved that we base our judgments of others not only on facts, but even more so on rumors. Before deciding whether to support someone with a certain amount of money, players were given some information about the generosity of the recipient. This was done either through hard facts gained in the course of the game, through the gossip of other players, or through rumors spread by the investigators, in which a player was classified as a “generous benefactor” or a “nasty miser”, all the while showing the hard facts.

The gossip developed unimagined power – both positively and negatively. On average, cooperation dropped 20 percent for players who were slandered, while it grew 20 percent as a result of positive rumors, regardless of what the facts showed about that person. But what happens when a reputation is based on false rumors? “Gossip becomes all the more reliable the more people spread the same statements,” adds Manfred Milinski. And the gossip did, in fact, describe the player’s true generosity very reliably. So, the scientists concluded, gossip can to some extent replace direct observation. As the saying goes: There’s a bit of truth to every rumor.



The “Old Wives” fountain in Sindelfingen’s old town.

GRAPH: CHRISTOPH SCHNEIDER, BASED ON MATERIAL FROM THE MPI FOR EVOLUTIONARY BIOLOGY / PHOTO: SINDLEFINGEN CULTURAL OFFICE





PHOTO: MPI FOR EVOLUTIONARY BIOLOGY

Playing in the service of research: Manfred Milinski during a public goods game with students.

players, protecting the Earth's climate is probably the largest public goods game we know," says Milinski.

### MAKING DONATIONS PUBLIC

Together with Jochem Marotzke, Director at the Max Planck Institute for Meteorology in Hamburg, using the same game combination as before, Milinski's team managed to get students to donate their money for a newspaper ad. This was to explain to readers the consequences of climate-damaging behavior and present some simple rules for climate protection. All players donated at least a little money for the ad; participants who were well informed about climate change before the game demonstrated a greater willingness to donate.

However, the contributions toward saving the climate were far higher when the players knew that everyone would find out who had donated what. Surprisingly, the public donors received more money from their teammates in the other rounds and were thus actually rewarded for their commitment. The power of a good reputation has an impact in this game, too, and may help save the climate.

So if reputation is so successful in promoting a sense of community among people, and also incurs no cost, then it really should render

punishment unnecessary. This idea immediately sounds very appealing. To test this, Milinski himself engaged in a cooperation: with economist Bettina Rockenbach from the University of Erfurt, who had already done some work on punishment and cooperation.

In a comparison of the two strategies, Rockenbach's students were to rely on a positive image rather than punishing freeloaders. The scientists predicted that punishment would die out after several rounds of play. Milinski and Rockenbach gave the participants the option to choose which variant of the game to play. Before beginning each round of the public goods game, the participants could join a group in which it was possible to cooperate based on punishment by means of penalty points and on building up a reputation. Alternatively, they could choose a group that relied solely on reputation. In a second experiment, they chose between a game that allowed only punishment, or the simple public goods game with no further options.

In the beginning, most chose the game that involved no punishment. "Perhaps simply because they wanted to avoid punishment," guessed Milinski. To the researchers' surprise, though, as time went on, more and more players joined the penal camp, where cooperation was built up through punishment and reputation. And contrary to what one would expect based on pure calculations, the costly punishment also did not disappear. "Nevertheless, the share of sanctions did drop to a third," says Milinski. The participants used punishment only for the most persistent defectors, but then did so all the more rigorously. So punishment does seem to be an accepted mechanism

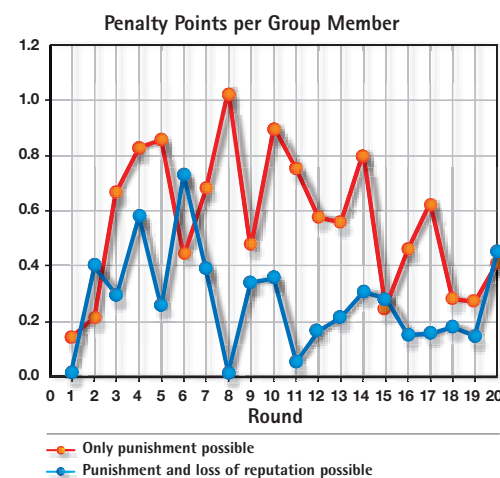
Cooperation can be maintained almost entirely without punishment when one's personal reputation is at stake. Then costly punishment (orange curve) decreases and the public goods game becomes extremely efficient.

to induce cooperation despite the associated costs, however unpleasant this thought may be.

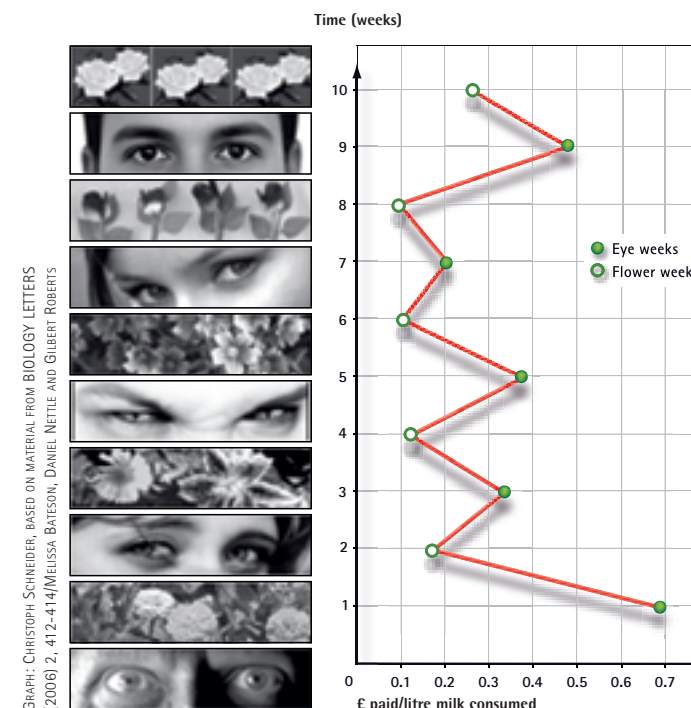
### THE BATTLE FOR SUPPORT FROM OTHERS

But because a good reputation is of such great value for receiving support from others, a competition arose over the course of human evolution – between those who want support and those who are to give it. After all, supporters are not naturally inclined to offer assistance to a dazzler who merely pretends to be noble. According to the logic of evolutionary biology, egoism pays off for altruists when they think no one is watching. Milinski explains the evolutionary rivalry between givers and takers thus: "Some are always on the lookout to see whether they're being watched, while others try to determine how honest everyone else is while making sure that they themselves are not seen."

Manfred Milinski is firmly convinced that this has left its mark in our brains. We feel it every time we see a pair of eyes. "Just noticing a pair of eyes triggers stronger reactions in the basal forebrain than seeing a face," he says. Noticing and reacting to pairs of eyes is hard wired, as Milinski calls it – it is firmly anchored in our cognition. Just how firmly is demonstrated by an impressive experiment conducted by British behavioral biologist Melissa Bateson and co-workers, as



GRAPH: CHRISTOPH SCHNEIDER, BASED ON MATERIAL FROM THE MPI FOR EVOLUTIONARY BIOLOGY



GRAPH: CHRISTOPH SCHNEIDER, BASED ON MATERIAL FROM BIOLOGY LETTERS (2006) 2, 412-414/MELISSA BATESON, DANIEL NETTLE AND GILBERT ROBERTS

Willingness to pay at a beverage vending machine increases when it is adorned with a pair of eyes rather than a flowery banner. The more piercingly the pair of eyes gazes at the person (bottom example), the more money is given. We also see such pairs of eyes on Indian totem poles (right in a park in Vancouver). That may also be a way to get people to cooperate.

the evolutionary biologist relates with obvious delight.

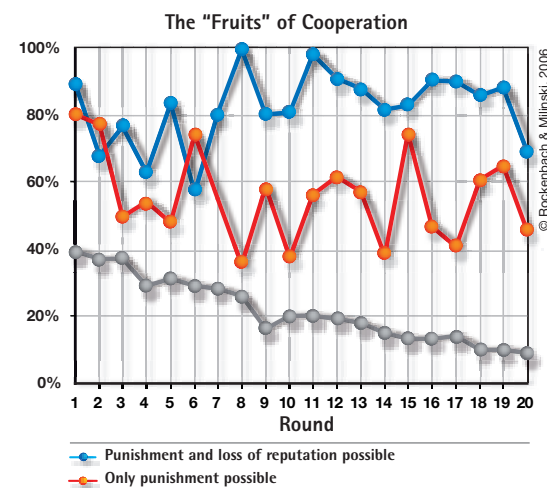
### KEEPING AN EYE ON BEHAVIOR

Bateson let her subjects decide how much they wanted to pay for a beverage from a tea vending machine. There was no one present to check the payment; Bateson merely "decorated" the vending machine: one week with a flowery banner, the next week with a pair of eyes aimed directly at the person taking a product from the machine. Although it was

obviously only an image of eyes, the subjects paid more than they did when they saw the flowery banner. "The only way to explain this different behavior is that we have this subconscious neuronal mechanism that makes us pay attention to whether we feel we are being watched or not," says Milinski.

And thus does cooperation research lead to the question of why humans, of all creatures, possess pairs of eyes from which it is immediately evident where they are looking: "We are probably the only creatures

in which the whites of the eyes are visible to others," says Milinski. Perhaps this is to enable us to force our fellow humans to cooperate because this tells them that we are watching them?



The gain from cooperating in the public goods game is highest (blue curve) when both punishment and loss of reputation are possible. It is lower (orange) when only punishment is possible. When there is no punishment and no loss of reputation, cooperation collapses (gray).



PHOTO: TONY PITCHER

In his research, Milinski noticed images of totem poles of old Indian tribes: "They always have visible pairs of eyes that look directly at the people and that show a white sclera, even for stylized crows and goats," says the biologist. For him, the case is clear: since a pair of eyes triggers an automatic response, the villagers must have subconsciously felt like they were always being watched when they left their homes. "It was certainly an easy way to get people in a village community to cooperate," believes Milinski.

Does that still work today? The tea vending machine would suggest that it does. In the end, all of this shows, says Milinski, "that the reason we are always concerned about our good reputation may be because it is what gets us the support of others." Nevertheless – as soon as we think no one is watching, cooperation decreases drastically. Maybe good people exist only when someone is looking.

MARCUS ANHÄUSER