

## What's Your Real Motive for Being Altruistic?

The interaction between brain areas during a generous act may reveal the reasons underlying such behavior

By [Jordana Cepelewicz](#) on March 3, 2016

Last December Facebook CEO Mark Zuckerberg and his wife, Priscilla Chan, announced the birth of their daughter—and made a pledge to donate 99 percent of their Facebook shares over the course of their lives to charitable causes. The decision was met with both praise for its altruism and criticism, as people called into question Zuckerberg's true motives and whether this was a move to save millions of dollars in taxes. Of course, the world may never know whether or not the intent of the new parents was truly philanthropic.

Until now, that is. New research published this week in [Science](#) shows that by looking at how different brain regions interact, it is possible to predict whether an altruistic act is motivated by empathy or by reciprocity—a “you scratched my back, now I'll scratch yours” situation. “Motives have a neurophysiological fingerprint,” says Ernst Fehr, a behavioral economist at the University of Zurich (U.Z.H.) and the study's principal investigator. “The whole notion of a motive is that it's a mental concept you cannot observe directly. And we were able to show that we could make this visible.”

The researchers found that simply looking at a person's behavior or the activity of specific brain areas revealed nothing about the motive underlying his or her altruistic decisions. The way those regions of the brain communicate, however, differed significantly, depending on whether someone's decision was empathy- or reciprocity-driven. Furthermore, selfish and altruistic, or prosocial, people processed these motives differently: Selfish people made more altruistic decisions when motivated by empathy but not reciprocity, and prosocial people made more altruistic decisions when motivated by reciprocity but not empathy.

The research team first randomly assigned participants to one of two groups: the empathy-induction group or the reciprocity-induction group. In the first group each subject observed as a partner (who was cooperating with the researchers) received pain shocks, thus inducing empathy. In the second group the subject watched as a partner gave up money to spare him or her from receiving pain shocks, inducing reciprocity by making the subject feel obligated toward the partner. In both cases each subject also had a second, neutral partner who acted as a control.

The team then measured the volunteers' behavior and brain responses. They took functional magnetic resonance imaging scans while the participants engaged in a money-allocation task between themselves and one of the partners—the empathy partner, reciprocity partner or control partner. The participants could choose to either maximize the partner's monetary payoff to their own detriment (prosocial behavior) or maximize their own monetary payoff to the partner's detriment (selfish behavior). The decision they made when facing the control partner served as a measure of their “baseline,” or unconditional, level of altruism, because no motives were induced in that scenario.

The researchers found the participants, no matter which group they were in, exhibited the same altruistic behavior: They made altruistic decisions about the empathy or reciprocity partners far more frequently than they did about the control partner, and this increase in altruism relative to the control did not differ significantly between the two groups. Moreover, the fMRI scans revealed a brain-activation network in the anterior insula, anterior cingulate cortex and ventral striatum—regions previously found to be associated with empathy and reciprocity—that was consistent across motives.

But the researchers did find significant differences when they analyzed the interactions and connectivity between these three brain regions using dynamic causal modeling, a probabilistic framework for inferring the hidden neural architecture underlying brain activity. The networks for empathy-driven altruism and baseline altruism were similar: both were marked by a positive connectivity from the anterior cingulate cortex to the anterior insula (with connectivity more enhanced for the empathy-induced brain). The neural model for reciprocity-driven altruism, in contrast, was characterized instead by positive connectivity from the anterior insula to the ventral striatum. So although the two motives resulted in the same behavior, each activated very different patterns of

neural communication. “These differences are robust enough that you can use them to classify the motive,” adds Grit Hein, a psychologist at U.Z.H. and the study’s lead author. In fact, Hein and her team were able to use the participants’ brain data to determine their motives with an accuracy of nearly 80 percent.

Finally, the researchers wanted to examine whether people classified as “selfish” or “prosocial” during the money-allocation task responded differently to the induction of empathy or reciprocity. They reorganized the subjects into two new groups, based on how frequently they had made selfish or altruistic decisions when giving money to the control partner, and then studied the effects of both motives on each group. They found that inducing empathy increased altruism in selfish people but not in prosocial people. Meanwhile inducing reciprocity increased altruism in prosocial people but had no effect on selfish people. “It’s a nice result,” says Cendri Hutcherson, a psychologist at the University of Toronto who was not part of the study. “It suggests that if you’re trying to think about how to increase generosity across the board—either because you’re a charitable organization trying to raise money or you just think generosity in general is a good thing—you really need to know your audience and what motives they habitually rely on, because that’ll tell you what the most successful strategy is likely to be.”

Sebastian Gluth, a psychologist at the University of Basel who also did not participate in the study, found this to be a particularly powerful application of fMRI data. Whereas fMRI provides information about activity in different brain regions, the researchers went further by combining sophisticated probabilistic modeling with a classification algorithm to evaluate how these regions communicate. “This is a particularly nice way to show that fMRI is more than just looking for activated versus nonactivated regions,” Gluth says. “It is, and will be in the future, more about how these activated regions interact with each other. There’s huge potential in extracting insights, knowledge and information out of this connectivity and out of this fMRI.”

Hutcherson agrees about the future potential for this type of research, noting this study, by analyzing connectivity in the brain while someone is making altruistic decisions, tells only half the story. Measuring connectivity during selfish decisions could be equally revealing. One person, after all, often makes both generous and selfish decisions based on various factors, including how much it costs the subject to be generous or how much the partner ultimately receives from that generosity.

The researchers now plan to take steps toward generalizing their findings by studying other motives for altruistic behavior, such as the desire to act morally, benefit from future reciprocity or protect one’s reputation. Hein also expresses interest in what might happen if several motives are induced at once—a condition that would more closely resemble real life.

And these measures of connectivity do not tell us anything about a person’s baseline proclivity toward altruism or selfishness, either. “One huge question, given the range of benefits associated with prosocial behavior, is how people who are already generous or selfish in that baseline condition get to that point,” Hutcherson says. “Is this about genetic differences? Is this about training or education?”

To pursue answers to all these questions, she suggests also examining other parts of the brain, such as the temporoparietal junction, an area associated with self-awareness and empathy. “We’re at the beginning of this puzzle, and this [study] has added one piece, but it also highlights how big that puzzle is,” she says. “It’s not a puzzle for five-year-olds, it’s a thousand-piece puzzle that has no edge pieces. There are so many mysteries here, and they’re such important ones to the human condition.”