

Exploring the neurochemistry of fairness

By [John Timmer](#) | Published: June 08, 2008 - 06:56PM CT

For many humans, interactions with their fellows are driven in part by an innate sense of fairness. People often base their own actions on what they perceive as being fair, and will frequently attempt to punish those who violate that sense. The complex behavior associated with the sense of fairness can be studied through a simplified test called the "Ultimatum Game." New results published in *Science* suggest that behavior in these studies can be easily manipulated by treatments that subtly alter the chemistry of the brain.

For a relatively simple test, the Ultimatum Game (UG) has a large number of implications for a number of fields, from ethics to economics. The UG starts with a set amount of money; one participant gets to decide the percentage of that money that's shared with a second. If the second accepts that offer, they keep the money; if the offer is rejected, neither participant gets any money. Each participant only takes part in the UG once, to avoid issues with retribution or cumulative anger.

At its heart, the UG represents a peek into notions of fairness and how we police them. In purely economic terms, any offer should be accepted, since some money is better than none. But humans don't display rational economic behavior here. They're generally happy to accept a deal that's within 10 percent of an even split of the money. But their actions appear dominated by a sense of fairness, as rejection rates climb to over 50 percent by the time an offer drops to 30 percent of the total cash. The response also suggests a social dimension, as people are willing to punish the perceived unfairness in others, despite the personal cost.

An innate sense of fairness

The fact that the UG works similarly across cultures has suggested that humans have an innate sense of fairness, which is consistent with the fact that many groups operate under something similar to the "golden rule," despite significant religious and cultural differences. These findings have been used to argue that there has been a selective advantage for those humans who have evolved behaviors that help them operate as part of social groups.

The new research shows that, despite the apparent significance of this behavior, it's remarkably easy to manipulate responses to the UG by tweaking brain chemistry. The authors of this study recruited volunteers that ingested a drink that was either a placebo, or one that would produce a short-term drop in the neurotransmitter serotonin. Five hours later, when serotonin levels should be stably depleted, the subjects with reduced serotonin rejected unfair offers at significantly higher rates than the placebo population. No difference in behavior was detected in offers that are typically viewed as fair.

This follows [results from last year](#), published in the open access journal *PLoS one*. In that study, researchers were able to manipulate the generosity of offers by altering levels of the neural hormone oxytocin, which is implicated in forming trusting familial bonds. Those with elevated oxytocin made offers that were 80 percent more generous than the placebo



controls.

These studies suggest that a basic aspect of human behavior, one that may be a critical contributor to our ability to function in social contexts, is quite sensitive to basic brain chemistry. At a time when there is a great deal of interest in the use and developments of drugs that manipulate this chemistry, they serve as excellent reminders that these drugs will necessarily have side effects and unintended consequences.

Science, 2008. DOI: [10.1126/science.1155577](https://doi.org/10.1126/science.1155577)

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