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## FEATURES: In search of the inside story of economics

By Tim Harford

Financial Times; Sep 30, 2003

Let's play a game of trust. I give you £10. The rules of the game are that you can keep it, or give it away to an anonymous person whom you will never meet. If you decide to do that, the money will be quadrupled to £40. Then your anonymous beneficiary may either send £15 back, or keep the lot.

What should you do? First, reflect that since you will never meet the other player, he or she has no reason to send back any money. The answer then is obvious: you should hold on to your £10, since if you send money you will never see it again.

This strategy is the "Nash equilibrium" of the game, named after John Nash, a Nobel prize winner and inspiration for the film *A Beautiful Mind*. But the solution that Nash, an inspired mathematician, proposed to the game does not reflect what people actually do.

When experimental economists run the game in the laboratory, half their subjects decide to send the £10 over, and three quarters of beneficiaries send money back again.

The puzzle for economists is to discover why, and that is why one of Nash's successors is now looking inside the brain itself.

Vernon Smith of George Mason University shared the Nobel prize in 2002 for pioneering work in experimental economics. His latest interest, neuroeconomics, adds a new dimension to research in this field by carrying out brain scans of experimental subjects playing economic games.

"We didn't know whether it would work. But we have opened up a more aggressive and daring set of experiments in neuroscience," Prof Smith says.

Neuroeconomics is attracting a growing number of researchers. Economists and neuroscientists gathered in mid-September in Martha's Vineyard, off Massachusetts, at Neuroeconomics 2003, one of the first conferences devoted to the new subject.

One of the speakers, Paul Zak of Claremont Graduate University, explains the motivation behind the new research: "We have run experiments, found out that people systematically deviate from the game theoretic equilibrium, so then we start telling stories about why that might have happened.

"I can tell lots of stories but it might take five lifetimes before I figure out the truth. So, given the availability of neuroscience techniques, we just take out the middleman and go directly to neurological processes."

Prof Smith and his colleagues have done just that with the "trust game". One possible explanation of people's behaviour is that they have not understood the game correctly and are making mistakes. Another is that they understand very well, but some other mental process, stronger than rationality, is at play.

Prof Smith suggests that many people have formed a habit of making reciprocal exchanges: "People come in off the street and they are accustomed to trading favours. If they unconsciously pick up on the fact that they've been done a favour, the implicit question is: Are you going to return the favour or screw me over?"

The idea is plausible, but it is not easy to test. So during the games, Prof Smith's team scanned players' brains using functional magnetic resonance imaging. The fMRI scan showed that players who co-operated were using parts of their brain called Brodman's areas 8 and 10. These areas had previously been associated with thinking about the mental activities and the motivations of others, and of delaying gratification to receive higher rewards later. Non-cooperative players did not use these parts of the brain, and neither did those who knew they were playing against computers instead of human opponents.

This, argues Prof Smith, is consistent with the reciprocity explanation: players are thinking about the likely responses of other players and deciding to trust them.

Brain scans are not the only tool of neuro-economists. Other approaches include measuring pulse rates, skin conductivity and hormone levels. And as a result of such experiments, neuroeconomics boasts an eclectic collection of findings - one of them being that ovulating women are less trustworthy than the rest of us (see box).

But not everybody is convinced that the new field is telling us anything new. One economist noted for championing alternative ways of modelling economic behaviour is sceptical: "There are a lot of silly papers out there. I am just not sure what we are learning.

"We already knew that people played differently against computers, so the value-added of seeing that different things happen in the brain is small at this point."

Greg Berns of Emory University, who organised the Neuroeconomics 2003 conference, recognises the criticism: "I'm not making claims that it will yield any great insight: I don't know myself. It's too early to say."

Early it may be, but entrepreneurs have not been slow to see the commercial possibilities of the technology. Brighthouse, a consultancy based in Atlanta, Georgia, has set up a "neuro-marketing" division.

Justine Meaux, research scientist at Bright-house, offers a patter that sounds much like that of any other marketing consultancy. The difference is that Brighthouse is using fMRI scans as part of its marketing toolkit. One recent project scanned brain activity while showing subjects pictures of products, people or activities about which they had previously expressed preferences.

"What we observed is that there are qualitative differences in patterns of brain activity for strong preferences versus weak or negative preferences," says Ms Meaux.

Brighthouse is unwilling to reveal either clients or specific research findings. But Ms Meaux claims that "neuromarketing is in a unique position to give companies a new perspective about what it means to bond with customers". She also hopes for an end to "advertising clutter".

The prospect of marketers and advertisers looking into our brains to work out how to "bond" with us sounds sinister. "Marketing is always frightening," laughs George Loewenstein, a neuroeconomist at Carnegie Mellon university. None of the neuroeconomists feels that free will is under any immediate threat.

There is even a chance unscrupulous marketers may have the tables turned on them. John Dickhaut, of the University of Minnesota, believes that neuroeconomics will provide a theory of when and why people behave irrationally. This could be used to design better statutory information requirements for complex products such as credit cards or pensions, so customers can make more informed choices.

Other researchers in the field hope for similarly benign applications. Prof Dickhaut and Prof Smith both hope to design better markets and market institutions: auctions, exchanges and markets for sensitive commodities such as water.

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Prof Smith elaborates: "We're trying to understand what's involved in the transition from personal exchange to impersonal exchange. In personal exchange, trust is important. In impersonal exchange, somehow that trust needs to be replaced by an institutional framework."

The absence of such a framework is widely recognised to be one explanation for why some countries have failed to achieve strong economic growth, so if neuroeconomics can improve our understanding the results could be profound.

Prof Berns wants to venture into yet deeper waters: "My hope is that by studying the brain, we will get a better understanding of 'well-being', of why it is so hard for people to be satisfied with what they have."

If he succeeds in this endeavour, neuroeconomics really will have turned economics upside-down.

IS OXYTOCIN THE BRAIN'S TELLTALE 'TRUST HORMONE'? Professor Paul Zak of Claremont University has run trust games similar to those used by Vernon Smith. But Prof Zak has been testing hormone levels, looking for evidence of a "trust hormone", levels of which vary according to how far the experimental subjects decide to co-operate with their counterparties. He has found one candidate: levels of the hormone oxytocin rise in players who receive and return money. Oxytocin is primarily a reproductive hormone responsible for, among other things, lactation. But it can be stimulated by eating, massage, sex and, says Prof Zak, by social signals such as being trusted. Prof Zak has also found that women who take part in the trust game while they are ovulating send back substantially less money to their fellow player than other women or than men - crudely, they are less trustworthy. He explains: "The physiological reason is that progesterone suppresses the effect of oxytocin. The evolutionary biological reason is that is that if you're about to get pregnant, you should be very careful about overreacting to the social signals you receive. In addition, you don't want to be giving away resources." Prof Zak points out that since trust is fundamental to economic development, a better understanding of the oxytocin and the physiology of trust could be fundamental for promoting development. The Bangkok Post has already picked up on his work: the newspaper says that since the oxytocin stimulants massage, food and sex are much beloved of Thais, Thailand's economic development is assured.



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