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## After the crash, can biologists fix economics?

Orthodox economics is broken. Applying what we know about evolution, ecology and collective behaviour might help us avoid another catastrophe



Moulding the future of economics (Image: Matt Murphy/Handsome Frank)

THE GLOBAL financial crisis of 2008 took the world by surprise. Few mainstream economists saw it coming. Most were blind even to the possibility of such a catastrophic collapse. Since then, they have failed to agree on the interventions required to fix it. But it's not just the crash: there is a growing feeling that orthodox economics can't provide the answers to our most pressing problems, such as why inequality is spiralling. No wonder there's talk of revolution.

Earlier this year, several dozen quiet radicals met in a boxy red building on the outskirts of Frankfurt, Germany, to plot just that. The stated aim of [this Ernst Strüngmann Forum](#) at the Frankfurt Institute for Advanced Studies was to create "a new synthesis for economics". But the most zealous of the participants – an unlikely alliance of economists, anthropologists, ecologists and evolutionary biologists – really do want to overthrow the old regime. They hope their ideas will mark the beginning of a new movement to rework economics using tools from more successful scientific disciplines.

Drill down, and it's not difficult to see where mainstream "neoclassical" economics has gone wrong. Since the 19th century, economies have essentially been described with mathematical formulae. This elevated economics above most social sciences and allowed forecasting. But it comes at the price of ignoring the complexities of human beings and their interactions – the things that actually make economic systems tick.

The problems start with *Homo economicus*, a species of fantasy beings who stand at the centre of orthodox economics. All members of *H. economicus* think rationally and act in their own self-interest at all times, never learning from or considering others.

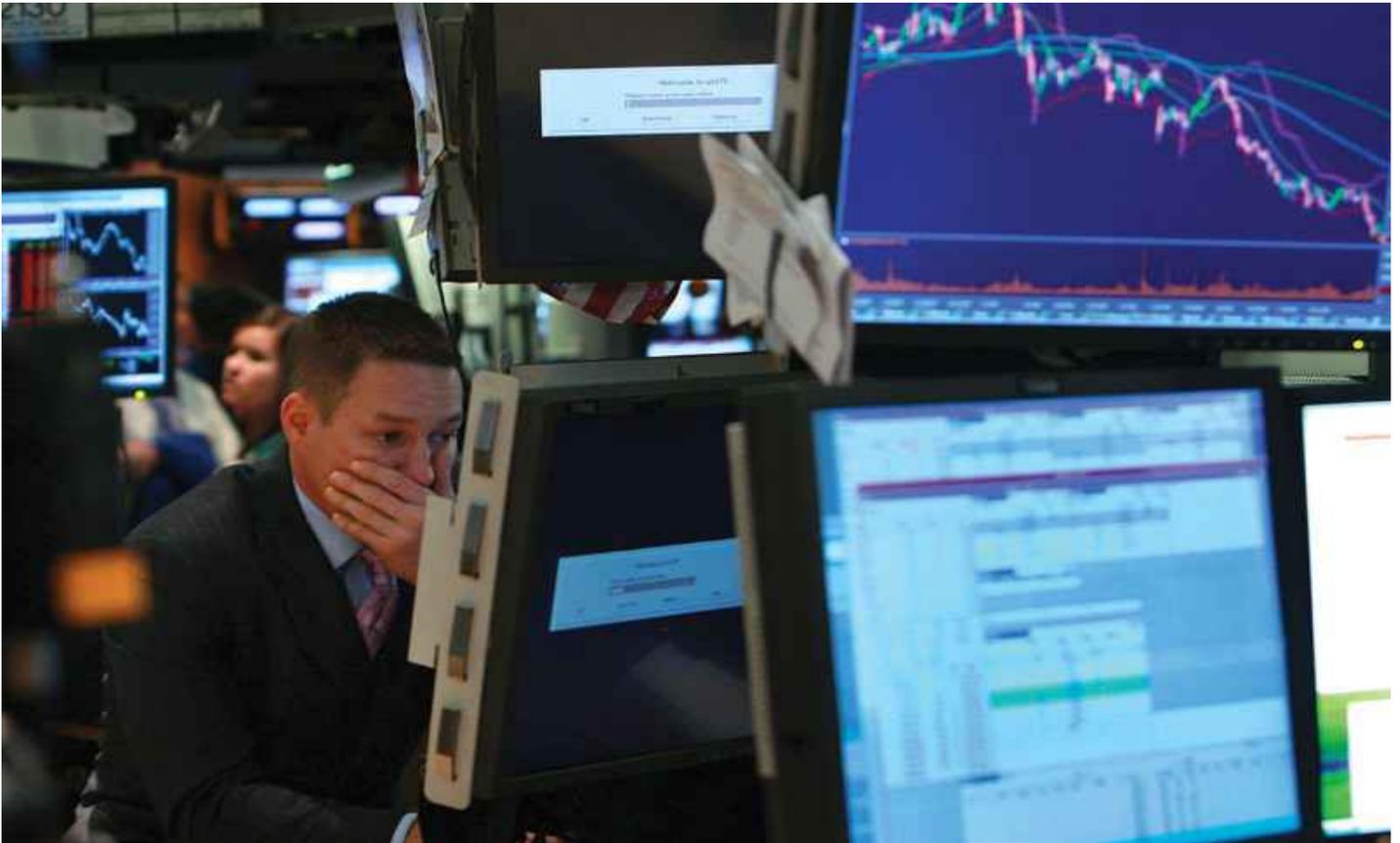
We've known for a while now that *Homo sapiens* is not like that (see "[Team humanity](#)"). Over the years, there have been various attempts to inject more realism into the field by incorporating insights into [how humans actually behave](#). Known as behavioural economics, this approach has met with some success in microeconomics – the study of how individuals and small groups make economic decisions. It has persuaded governments to "nudge" people into doing what's best for the economy, influencing behaviour by more subtle forms of persuasion than financial inducements. In 2010, the UK government set up the Behavioural Insights Team (known as the Nudge Unit) and the White House established something similar in the US in February last year.

## Pass the risk

But the complexities introduced by behavioural economics make it too unwieldy to be applied across the board. And it has had little to say about macroeconomics – the workings of financial markets and national and global economies, which have been so troubled in recent years. In the run-up to the recent crash, for example, economists seemed blind to the perils associated with selling sub-prime mortgages and bundling them up as derivatives, where the financial risk is transferred from party to party over and over again. "It's macroeconomics where the problem lies," says Alan Kirman, an economist at the School for Advanced Studies in the Social Sciences in Paris, France, who co-chaired the Frankfurt forum.

Its aim was to try to address the macroeconomic problem by looking to psychology, anthropology, evolutionary biology and our growing understanding of the dynamics of collective behaviour. That way we might better understand the deficiencies of current economic models and how they can be improved.

Prime among those is their indifference to how individual humans really interact, and the wider effects of those interactions. For simplicity's sake, orthodox economics assumes that *H. economicus*, when making a fundamental decision such as whether to buy or sell something, has access to all relevant information. And because our made-up economic cousins are so rational and self-interested, when the price of an asset is too high, say, they wouldn't buy – so the price falls. This leads to the notion that economies self-organise into an equilibrium state, where supply and demand are equal.



How different is a stock price crash from a wildlife population crash? (Image: Spencer Platt/Getty Images)

Real humans – be they Wall Street traders or customers in Walmart – don't always have accurate information to hand, nor do they act rationally. And they certainly don't act in isolation. We learn from each other, and what we value, buy and invest in is strongly influenced by our beliefs and cultural norms, which themselves change over time and space.

“Many preferences are dynamic, especially as individuals move between groups, and completely new preferences may arise through the mixing of peoples as they create new identities,” says anthropologist Adrian Bell at the University of Utah in Salt Lake City. “Economists need to take cultural evolution more seriously,” he says, because it would help them understand who or what drives shifts in behaviour.

Using a mathematical model of price fluctuations, for example, Bell has shown that [prestige bias – our tendency to copy successful or prestigious individuals – influences pricing and investor behaviour in a way that creates or exacerbates market bubbles.](#)

We also adapt our decisions according to the situation, which in turn changes the situations faced by others, and so on. The stability or otherwise of financial markets, for instance, depends to a great extent on traders, whose strategies vary according to what they expect to be most profitable at any one time. “The economy should be considered as a complex adaptive system in which the agents constantly react to, influence and are influenced by the other individuals in the economy,” says Kirman.

This is where biologists might help. Some researchers are used to exploring the nature and functions of complex interactions between networks of individuals as part of their attempts to understand swarms of locusts, termite colonies or entire

ecosystems. Their work has provided insights into how information spreads within groups and how that influences consensus decision-making, says [Iain Couzin](#) from the Max Planck Institute for Ornithology in Konstanz, Germany – insights that could potentially improve our understanding of financial markets.

## Collective stupidity

Take the popular notion of the “wisdom of the crowd” – the belief that large groups of people can make smart decisions even when poorly informed, because individual errors of judgement based on imperfect information tend to cancel out. In orthodox economics, the wisdom of the crowd helps to determine the prices of assets and ensure that markets function efficiently. “This is often misplaced,” says Couzin, who studies collective behaviour in animals from locusts to fish and baboons.

By creating a computer model based on how these animals make consensus decisions, Couzin and his colleagues showed last year that the wisdom of the crowd works only under certain conditions – and that [contrary to popular belief, small groups with access to many sources of information tend to make the best decisions.](#)

That’s because the individual decisions that make up the consensus are based on two types of environmental cue: those to which the entire group are exposed – known as high-correlation cues – and those that only some individuals see, or low-correlation cues. Couzin found that in larger groups, the information known by all members drowns out that which only a few individuals noticed. So if the widely known information is unreliable, larger groups make poor decisions. Smaller groups, on the other hand, still make good decisions because they rely on a greater diversity of information (*Proceedings of the Royal Society B*, [doi.org/565](https://doi.org/565)).

So when it comes to organising large businesses or financial institutions, “we need to think about leaders, hierarchies and who has what information”, says Couzin. Decision-making structures based on groups of between eight and 12 individuals, rather than larger boards of directors, might prevent over-reliance on highly correlated information, which can compromise collective intelligence. Operating in a series of smaller groups may help prevent decision-makers from indulging their natural tendency to follow the pack, says Kirman.

Taking into account such effects requires economists to abandon one-size-fits-all mathematical formulae in favour of “agent-based” modelling – computer programs that give virtual economic agents differing characteristics that in turn determine interactions. That’s easier said than done: just like economists, biologists usually model relatively simple agents with simple rules of interaction. How do you model a human?

It’s a nut we’re beginning to crack. One attendee at the forum was Joshua Epstein, director of the Center for Advanced Modelling at Johns Hopkins University in Baltimore, Maryland. He and his colleagues have come up with [Agent Zero](#), an open-source software template for a more human-like actor influenced by emotion, reason and social pressures. Collections of Agent\_Zeros think, feel and deliberate. They have more human-like relationships with other agents and groups, and their interactions lead to social conflict, violence and financial panic. Agent\_Zero offers economists a way to explore a range of scenarios and see which best matches what

is going on in the real world. This kind of sophistication means they could potentially create scenarios approaching the complexity of real life.

Orthodox economics likes to portray economies as stately ships proceeding forwards on an even keel, occasionally buffeted by unforeseen storms. Kirman prefers a different metaphor, one borrowed from biology: economies are like slime moulds, collections of single-celled organisms that move as a single body, constantly reorganising themselves to slide in directions that are neither understood nor necessarily desired by their component parts.

“Economies are like collections of organisms moving as a single body”

For Kirman, viewing economies as complex adaptive systems might help us understand how they evolve over time – and perhaps even suggest ways to make them more robust and adaptable. He’s not alone. Drawing analogies between financial and biological networks, the Bank of England’s research chief Andrew Haldane and University of Oxford ecologist Robert May have together argued that [we should be less concerned with the robustness of individual banks than the contagious effects of one bank’s problems on others to which it is connected](#) (*Nature*, vol 469, p 351). Approaches like this might help markets to avoid failures that come from within the system itself, Kirman says.

To put this view of macroeconomics into practice, however, might mean making it more like weather forecasting, which has improved its accuracy by feeding enormous amounts of real-time data into computer simulation models that are tested against each other. That’s not going to be easy.

So will the ideas that came out of the Strüngmann Forum have any practical influence? Economist Scott Page from the University of Michigan, Ann Arbor, is sceptical. He doubts that “evo-complex economics”, as he calls it, will ever be mainstream. “Most economists are already smart to the alternatives,” he says. And although the biological perspective offers a more realistic view of human behaviour, incorporating this disorder into workable economic models is a massive challenge. What’s more, Page points out, economists are not alone in resisting complexity. “Politicians want simplicity, hence the appeal of the neoclassical approach.”

Biologist Peter Turchin of the University of Connecticut in Storrs, another attendee in Frankfurt, thinks it is more to do with an attitude problem. Although some economists are open to new ideas, he says, the field as a whole is resistant to outside incursions. “I doubt that our forum will make any impact on this proud and superior profession,” Turchin wrote in the aftermath of the gathering.

It’s a point echoed by David Sloan Wilson, an evolutionary biologist at Binghamton University in New York who co-chaired the meeting and in 2008 set up [the Evolution Institute](#), a think-tank that aims to bring evolutionary thinking into policy formation. “The reluctance of the economics profession to change and the fact that the people most in need of change are also in a position of power is a big part of the problem,” says Wilson. “At what point does one stop trying to be diplomatic and adopt a rebellious stance?”

Yet the calls are not going entirely unheard. Haldane, for one, sees the [need for a change in attitude](#) (*New Scientist*, 28 March, p 28). “We require a great leap forward if we are to do a better job of reading the bumps in the economy in future,” he says.

“That calls for new data, new models and a new humility across the profession.”

For would-be revolutionaries, it's not just a question of whether economists should do biology. It's about viewing the world through a different lens. It's about basing economic modelling on what biology tells us about human behaviour – and how we can channel that into creating the outcomes we desire. What is the right balance between competition and cooperation? How should we value welfare? Can we pull together to solve global problems? How do we create a more equitable form of capitalism? These are daunting questions – but all revolutions have to start somewhere.

**Leader:** [“Is it time to accept that economic crashes are inevitable?”](#)

## Team humanity



(Image: Jeff Jacobson/Aurora Photos)

The selfishness of humans is a central assumption of orthodox economics, where it is thought to lead to benefits for the economy as a whole. It is what the 18th-century Scottish economist Adam Smith described as the “invisible hand”.

But [evolutionary biologists have come to see cooperation and selflessness as a big part our success as a species.](#) During the course of our evolution, they point out, cooperative groups consistently outcompeted groups of cheats.

So we are inherently cooperative when operating within our own groups. We have also developed social mechanisms to reinforce actions that benefit the group. “You could say teamwork at the scale of small groups is the signature adaptation of our species,” says evolutionary biologist David Sloan Wilson from Binghamton University in New York.

But effective teamwork can include competition, and mechanisms to promote actions that benefit the group can break down, particularly in larger groups. It’s also important to remember that in-group cooperation evolved partly in response to competition between groups.

This evolutionary perspective is radically new to economics, and it could be relevant to grand-scale economic problems that require solutions involving cooperation between nations. Take the challenge of getting nations to work together over

economic solutions to climate change – a particular focus in the run-up to climate negotiations in Paris, France, later this year. This is a gargantuan problem from any perspective, but it is essentially an issue of coordination for the sake of the common good at a massive scale, says Wilson. “The challenge is therefore to implement at larger scales the coordination and control that takes place more spontaneously at smaller scales,” he says – from multicellular organisms to village-sized groups of humans.

“Morality evolved out of cooperation within and competition between groups, so when acting as a single group to tackle global problems we will have to assume the role of natural selection ourselves,” Wilson says. This might involve pursuing a wide variety of strategies, identifying those that work best, and then creating incentives to cooperate on implementation. “In some ways it’s the opposite of the invisible hand.”

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