Economic Explanations

Paul Thagard, University of Waterloo

Thagard, P. (forthcoming). Economic explanations. In M. Lissack & A. Graber (Eds.), *Modes of explanation*. London: Palgrave Macmillan.

[Note: This is a transcript of a talk given at a conference on Modes of Explanation in Paris, May, 2013. In order to preserve the character of the oral presentation, only very light editing has been done. A list of sources is provided at the end.]

I'm going to talk about explanation in a particular field, economics, and I'm going to say some things about reflexivity. The way I'm going to approach reflexivity is to try to understand it in terms of psychological mechanisms, and once you do that you can say some interesting things about economic change. I'll try to draw out some of the implications for economics and also for more general questions about explaining social complexity.

Let me start by telling you my favorite story about decision making. This is a story about Howard Raiffa, who is a famous decision theorist, and Ernest Nagel, who was a famous philosopher of science. The story takes place when they were both teaching at Columbia. I've been telling this story for years and I didn't have any reason to believe it was true until I told it about ten years ago at the University of Tel Aviv and one of the people in the audience said, "Oh, I was a student of Ernest Nagel. I heard this story from him."

Nagel encountered Raiffa in the hallway. Raiffa was pacing up and down muttering to himself, “What should I do? What should I do?” and Nagel said, “Howard, what’s the problem?” and Raiffa said, “Oh, it’s really difficult. I got a job offer and I just can’t decide whether to accept it or not.” Nagel, who did a lot of work on probability theory, said, “Well, Howard, you’re one of the world’s greatest experts on decision theory, so why don’t you draw out the decision tree? Why don’t you plug in the probabilities and utilities, calculate how to maximize your expected utility and decide?” and Raiffa looked back at him and said, “Ernest, this is serious.”

All of us have encountered serious problems in our lives - what job to take, whether to go to graduate school, whether to get married, whether to get divorced, whether to have a baby. If you’ve ever tried to use some mathematical methods, you’ve encountered the same problem that Raiffa did in this situation. How is this relevant to economics? Well, it’s relevant to economics generally because most of economics for decades now, at least since the ‘40s when von Neumann and Morgenstern had a huge influence, has assumed something like rational choice theory. It’s assumed that what individual consumers do and should do is to maximize their expected utility. This operates at the microeconomic level of individuals, but also it’s assumed that what happens at the level of whole societies in macroeconomics is somehow an aggregate of that, so if you work out the microeconomics, everything else will follow. The problem with this theory is that it’s not true. Some philosophers have worried about

economics being unfalsifiable. Well, it is clearly falsifiable because it's been falsified.

I would say the same thing about creationism. It's not unfalsifiable. It's false. In the case of creationism, you know it's false because there are alternative theories that provide much better explanations of the evidence. That is unfortunately one of the big lacks in economics. Nevertheless, empirically, economic theory has been shown to be false. It's been shown to be false at the microeconomic level by a whole series of experiments in behavioral economics and behavioral game theory. People have taken the central assumptions of microeconomic theory, assumptions about independence of choices, assumptions about transitivity, and they've all been knocked down by behavioral experiments. So that's clearly false.

At the macroeconomic level, the standard economic theory is also clearly false, and it's not just that the economists failed to predict collapses such as in 1999 and 2008. It's that they predicted the opposite assumption. If people are being rational, and if there's perfect information in the society, then you just can't have a collapse. Well, of course you did have a collapse. So I take that as a falsification. Given that this has happened, it's a really interesting sociological question why economic theory of this brand is still dominant. It's still taught in the leading schools and I think there are two reasons for that. One is ideology, that the theory fits with the goals of people who've got certain interests in the way the economy

should work. Part of it is also logical. In the philosophy of science, Karl Popper is famous for saying that the mark of science is falsifiability, but it's been pointed out by a number of people, including Imre Lakatos who was a student of Popper's, that that's not how science works. You rarely find in science that there's a theory that gets falsified because it doesn't succeed in its predictions. What happens instead is that, when you have a theory that isn't doing well in its predictions, people start to look for alternative theories. It's when there is an alternative theory that the theory gets rejected. That's what happened with creationism when evolution by natural selection came along.

So the problem in economics is that even though we've got a theory that's hanging on only by an ideological thread, it hasn't been replaced because there's no good alternative. I'm going to suggest that the way that you can look for an alternative is to try for more detailed explanations using psychological and social mechanisms . Lots of people in economics have been aware of this problem, but often they haven't really developed alternative theories. What they've only been able to work with is metaphors or slogans. If you go back to Keynes's theory, he talked about animal spirits; he was certainly no rational choice theorist. He gave explanations of how the crash of 1929 took place in terms of an old 17th century term, animal spirits, by which he meant emotions. People aren't being rational - they're responding to their emotions. So that was pretty good for 1933 when he wrote the general theory, but oddly enough there

are leading economists today like Akerlof and Shiller that aren't any more psychologically sophisticated than Keynes was. I think that's pretty weird because lots more is known about cognition and emotion than was known in those days.

Another kind of explanation has been produced by George Soros, the famous financier, who has written books where he says the problem is that the economists aren't taking into account reflexivity, which he thinks requires a different way of doing social science. My own preferred way to approach economics is to look at the emotional mechanisms that underlie human decision making. Why was Howard Raiffa having such a problem? Well, if you have to make an important decision about whether to take a new job, clearly it's emotional. He's got different sorts of goals. He's got his career goals. Perhaps there were family issues. Perhaps there were cultural issues. And these are all things that are highly emotional to us and we have to figure out how to put them together. So I think if you've got an understanding of the cognitive and emotional mechanisms, you might be able to start to answer these questions. Now using the word mechanism makes me nervous at this conference because mechanism here seems to have roughly the same emotional value as child molester.

But I'm going to try to convince you that if that's the emotional valence you attach to mechanisms, you're just not thinking about the right kinds of mechanisms. Let's talk about what mechanisms are. When people

disparage mechanisms, they're attacking very simple kinds of mechanisms, just simple pushes and pulls or straightforward linear cases where A causes B causes C causes D. I'm not talking about that sort of mechanism at all. Drawing on a lot of recent philosophy of science, I will consider a mechanism to be a system of parts whose interactions explain regular changes and also critical transitions. All the mechanisms I'm going to be talking about today fit perfectly well with some of the favorite categories of complexity theory. The mechanisms are nonlinear systems that are capable of generating multiple attractors with movement from one attractor to another constituting a critical transition or a tipping point with lots of emergent properties.

All the kinds of biological systems I'm aware of, things like the heart and the lungs and certainly the brain which is often cited as one of the most complex systems in the world, have all of these kinds of properties. They're also open to chaos in the technical sense that small inputs can produce large outputs, with lots of feedback loops. So I'm dealing with very complex systems, but nevertheless I think they're perfectly well describable in terms of mechanisms in the sense that I give here. We're most familiar with mechanisms from things like bicycles where you've got the different parts, but of course that's a simple sort of mechanism where you don't have the kinds of feedback loops and nonlinearities that give rise to critical transitions and emergence.

What's a psychological mechanism? Can we talk about the way the mind works in terms of parts and interactions? The answer is clearly yes. If you look at all the leading theories in cognitive science, then you can think of the parts as being mental representations. These are representations in the mind that stand for things in the world that interact with each other. They can be concepts. They can be beliefs. They can be analogies. They can be visual images. They can be auditory. I'm going to show very quickly that these are both cognitive and emotional, so there's not a sharp division in the mind between what's cognitive and what's emotional. In fact, looking at the brain you can see lots of interconnections. The psychological mechanisms can be described in terms of computational procedures.

The same is true about the brain. The brain is a mechanism because the parts are neurons and they have connections with each other and interactions between the neurons that lead to very complicated properties.

I think it's perfectly legitimate also to talk about the social in terms of mechanisms. This is a little strange, but I think it works perfectly well. In social mechanisms the parts are people. The people interact with each other, and lots of complex phenomena come out of this. The regular interactions between people include communication, such as coming to a conference and talking to each other and exchanging not only ideas, but also analogies and sometimes visual representations when people put up

pictures, and also emotions. These are all things that are going on in social interactions and are part of what I'm calling a social mechanism. It's not just verbal, but can be highly nonverbal as well. From this point of view, mechanism isn't like child molesting, but fits perfectly well with complexity ideas.

How do we get reflexivity into it? Soros not only makes lots of money, he spends lots of money, and he set up an institute for new economic thinking at Oxford and put $100 million into it. He thinks, and he's quite right about this, that there's really a need for a new way of thinking about the economy. His best guess-- he's put this in a couple of books-- is it needs to incorporate reflexivity. Of course, this has been a common topic in the social sciences. Sociologists like Giddens, Bourdieu, and Woolgar have all talked about it. In philosophy, Ian Hacking doesn't talk about reflexivity as such, but he's got very interesting ideas about what he calls the looping effect of human kinds. What this means is that when you introduce a new human category into thinking about the world, you can actually change the world. That's a kind of reflexivity. Soros says that the role that intentions and future expectations play in social situations sets up a two-way connection between the participants' thinking and the situation in which they participate. So you get kind of feedback where people are starting to think that, "Oh, the economy's going up. This is a new situation. We can just make more and more money." So people are optimistic, but then of course it feeds back and creates that whole

situation, because people's optimism turns into a bubble. Of course, once the bubble bursts, it goes the opposite way. Soros is right in identifying this kind of reflexivity in economic change, and this is very difficult to handle within the conventional approach assuming perfect rationality and perfect information.

I think that reflexivity can be explained at a deeper level in just the same way that Keynes's ideas about animal spirits can be fleshed out in terms of psychological and neural processes. We can do the same thing with reflexivity with the central idea of cognitive science -- mental representation. You can represent the world, but you can also represent yourself in the world. You've got various concepts of yourself and the markets you're participating in, buying and selling, various things that you believe or don't believe about stocks going up or stocks going down. You've got loads of emotions because you're happy when the stocks you buy are going up, and you're fearful that they're going to stop going up or they might go down. These are all different kinds of mental representations, not just words, but various kinds of images and emotions as well.

What are the mental processes? That is, what are the interactions between the parts? They can include different kinds of inferences, different kinds of calculations, different kinds of emotional feedbacks that operate. All of these make reflexivity happen with effects on the economy

that can be understood as mental processes. So my main goal today is to describe the mental representations and processes that are most responsible for economic booms and economic busts. There are lots of other economic phenomena that they might be applied to, but booms and busts are the most salient ones. This isn't just metaphorical; it's a theory about how emotions and cognitions operate in our minds - my theory of emotional coherence.

The standard view of inference from philosophy and artificial intelligence is a kind of sequential one that you start off with some beliefs and you apply rules and inference and you acquire more beliefs. The coherence approach to this is different. It's inspired by neural network models and it says that what happens when people reach conclusions is in fact much more holistic, but not in a mystical way. You've got a bunch of different beliefs that are connected to each other in different ways and what you do is come up with a coherent account of how they should operate. This can be developed quite precisely mathematically and modeled on a computer, but I'm not going to go into the details on that. So coherence is basically the normative theory of how you ought to make inferences.

Of course people don't always behave normatively. Sometimes they do lots of crazy things. To explain that we have to bring in emotional characteristics where every element in our network of coherent or incoherent elements is going to have, not just a degree of acceptance

which is kind of analogous to a probability, but also an emotional valence which you could think of as being desirability. When you're thinking about something like whether stocks are going to keep going up, it's not just that you think it's probable or improbable. You're also thinking about whether it's desirable or undesirable, and that goes into the conclusion. The general view which I've defended in a couple of books is that, when people make decisions, they're doing it on the basis of emotional coherence. To some extent that's actually perfectly appropriate. Once you're doing decision making, you need to have some way of getting utility into the picture, not just probabilities. How are we going to calculate utility?

Well, just like Howard Raiffa, that's really hard because we often can't be very precise and so we have to go with our emotional judgments. What you get out of this is something that may not look like linear inference. It's more like an emotional gestalt. You get an overall picture taking into account the emotions of what you should do. Once you've got that picture, you can give an account of how inferences go well, but you can also use it to figure out what are the reasons why it sometimes goes quite badly. Where does it break down? I've developed accounts of a whole bunch of different kinds of emotional mechanisms that can get in the way of thinking well.

Often I think emotional coherence does perfectly well. Any important decision is going to be emotional and often we do it well, but sometimes we really screw it up. In economics I think people often screw it up, and I'm going to try to give you an idea of some of the major ways. You're trying to figure out what to do -- buy stocks, sell stocks -- based on your goals, but you can get misled by a number of kinds of inference. The one that's most familiar, because it's been discussed by psychologists for 20 years, is motivated inference. This is where you let your desires get in the way of your beliefs. Everybody here is guilty of it. I'll give you some examples to make it plausible for you that you engage in motivated inference.

Another kind of error pattern that I've only learned about fairly recently, I'm going to call *fear-driven inference.* In this case you don't believe something because it makes you feel good as in motivated inference. You believe something because it makes you feel bad. You might be wondering: how could anybody be that stupid? I'm going to provide examples to convince you that you're often that stupid. I know that you're that stupid because I'm that stupid. The last error I won't talk about much - rage-driven inference. This is where the actions that you do come about because you're really angry about something. I think this governs a lot of political movements, but I won't talk about that very much because it's not so relevant to the economic case.

Motivated inference is the idea that when you form your beliefs you do it, not just on the basis of the evidence, but also on the basis of goals and desires that you have that distort the evidence. In philosophy, this is sometimes called wishful thinking, though motivated inference is psychologically more complicated than wishful thinking. Psychologists have other names for it. They sometimes talk about positive illusions. Sometimes they talk about the optimism bias, but these are all ways in which your beliefs are affected, not just by the evidence coming in, but what you want to believe. My favorite example is Muammar Gaddafi just before he was brought down. He said, "I have millions of supporters including God." This is a motivated inference - he didn't have a lot of evidence that God was on his side, but he really wanted to believe that.

But motivated inference isn't just for crazy people like Kaddafi. All of us do this all the time. I've heard it said that the difference between men and women when they get married is that the women believe that their husbands will change and the husbands believe that their wives won't change, and they're both wrong. Either case is clearly a motivated inference because people have a rosy view of the relationship that (given that in the United States 50 percent of marriages end in divorce) is usually not directly based on reality. So motivated inferences happens in relationships all the time.

Medicine. People have problems and they think, “Oh, it’s going to go away.” I know somebody who walked around with a lump under his arm for a year before he got it checked out. It turned out to be melanoma. There’s clearly motivated inference in medical cases.

Politics. We think a leader can bring us hope and change. Motivated inference is rampant concerning climate change. There’s a paper you can find on my website called “Changing Minds About Climate Change.” I’ve got models of leaders and other people who are opposed to ideas about climate change, where the evidence is strongly in favor that global warming is being caused by human actions. The evidence, I would say, is overwhelming. How do people reject it? It’s because they don’t *want* it to be true that there should be any restrictions on oil companies or that there should be more government involved in the economy. I think both these motivations affect the Prime Minister of Canada. He’s very slow to do anything about climate change.

Economic bubbles are cases of motivated inference. Part of what happens in economic bubbles is the motivation to believe it can only keep on going up or that this time is not like all the others. You’d think that people in business would learn from the past that there’s a bubble and a crash about every 10 or 20 years. No, because this time it’s different. During the ‘90s when there was the dot-com bubble, people said this time it’s different. So that goes on over and over again.

Sports. People get themselves pumped up to think we're going to play well today. This is a case where a positive illusion might be helpful. If you think that you're going to play well, maybe you will play well, but it's obviously not based on much in the way of evidence.

Research. When I start a new project, I often start thinking, "This is one of the best papers I ever wrote. It's going to end up in a top journal," and only later when it appears in the Albanian Journal of Irreproducible Speculations do I realize that it wasn't as good as some of the others I've done.

Religion. You may have a motivated inference to think that there's a God who's going to look after you, which is very reassuring, but not always based on much evidence. So I'm sure everyone here could write down a case where you have motivated inference. This is universal to humans.

Now I'm going to tell you something that I don't think you know about because I didn't know about it until a social psychologist, Dave Nussbaum, told me about it a few years ago. Fear-driven inference is where you believe something, not because it makes you feel good, but because it makes you feel bad. Who could be that crazy? Well, one classic case is Othello. If you know Shakespeare's play, *Othello*, what happens there is that Othello is in love with his wife Desdemona and he certainly wants her to continue to be his wife. But the sneaky Iago plants little bits of evidence

that suggest that Desdemona is unfaithful to him. Clearly Othello is motivated to think that his wife is faithful to him, but there's a little bit of evidence and he starts to worry about it ; and he worries about it and he worries about it until he becomes convinced that Iago was right. So he ends up believing something that he's motivated not to believe, but he can't help from believing it because it worries him so much.

John Elster is one of the few people who've written about this. He calls it "countermotivated inference", an opposite to motivated inference, but I don't think that's a very good term because it doesn't indicate what drives it. When there's no such thing as countermotivation that's driving it, what's going on there? John Stuart Mill talked about this in *System of Logic*. He didn't give it a name, but he clearly describes it. There's a philosopher Alfred Mele who calls it "twisted self-deception". In self-deception you're using motivated inference to trick yourself into believing something. In this case he calls it twisted because it makes you less happy. The originator of the idea as far as I've been able to find-- this was cited by Elster-- is a French fable writer, Jean de la Fontaine, who says that people naturally believe both what they want and what they fear.

When Dave Nussbaum first told me about this, my sons were teenagers. One kind of fear-driven inference happens naturally to parents, not when your kids are little so much because there you've got some control over their lives, but once they're teenagers they're off in the world and you don't

know what they're doing. If you haven't heard from them in a while or if they're late one day, it's natural to start thinking, "Uh-oh, something bad has happened." Now of course you don't have any evidence that something bad has happened, but you can't help but thinking about it. So that's a case of fear-driven inference.

In medicine, I described how motivated inference can produce people not being as concerned as they should be, but there are people, hypochondriacs, who became much more concerned than they should be when they think: "This is one of those diseases that you read about only in medical textbooks and I've surely got it." In politics, fear-driven inference comes along in conspiracy theories where people think they're sure that something really horrible is happening because they are afraid that it's happening.

In business I think that panics are the flipside of bubbles. In a bubble you think that things are much better than they really are, but in a panic you can move to the other extreme where you think, "This is the end of the economy." Remember back in 2008 some people were like that, saying this is the complete collapse of the capitalist system. They made a fear-driven inference. They certainly didn't want to believe that, but they couldn't help but look at the little bit of evidence that was around and obsess and infer the worst.

Sports: my team is hopeless, which actually is usually true with the Toronto sports teams. Research. Around the time that Dave Nussbaum told me about this, I had submitted a book proposal to MIT Press and it had been a few weeks and I hadn't heard back from the editor. I've actually done seven books with MIT Press, so I should have had some reason for confidence, but I kept thinking, "Oh, the editor hates it. He's not going to want to publish it." I had no evidence for that, but fear-driven inference got me thinking that way until finally the encouraging email response came.

Religion. I wrote an article a long time ago about religion being the result of motivated inference, but only after Nussbaum told me about fear-driven inference did I realize that that actually only works with some religions. It only works with the religions that paint a nice picture for you, that tell you that you're going to have eternity in heaven with a benign God. But lots of religions don't have benign Gods. Think about the Old Testament or Calvinism where God really isn't very nice. This is not motivated inference, but if you're afraid of death and if you're afraid of a vengeful God, then the sheer fear can make it seem more plausible to you that there is such a God.

How does fear-driven inference work? What's the psychological mechanism? Here some complexity thinking is useful in terms of feedback loops rather than some linear inference. What's going on in

fear-driven inference is a kind of feedback loop where what you take to be the evidence for the negative belief is that you feel bad. What reason does Othello have to believe that Desdemona is unfaithful? Thinking that she might be unfaithful makes him feel bad, but then feeling bad provides an illegitimate basis for thinking that she really is unfaithful. You can think to yourself, “Would I really be this worried if it weren’t true?” and what’s happening is not getting evidence from the outside world. It’s rather an internal feedback loop where your thinking that things are bad makes you feel bad, but feeling bad makes you more convinced that things are bad.

I call that a “gut overreaction”. Everyone knows what a gut reaction is. In this case it’s a gut overreaction because you’re overreacting to the gut feeling that you get. The same thing happens in motivated inference when you have a sort of positive gut overreaction. In a new romance, you think that your lover is wonderful and that generates feeling good, but feeling good generates more evidence that your lover is wonderful. In the infatuation stage of romance, you get this kind of feedback loop that can make you think things are better than they are. In general, you’re feeling that things are good because you feel good, and you are relying on that rather than external evidence.

The same sort of feeling goes on in economic cases. The difference between somebody being excessively positive about the stock market and somebody being excessively negative about the stock market is the

difference between motivated and fear-driven inference. Of course this is happening not just at the individual level, but also at the social level, with people sharing information and emotions to produce shared illusions.

Now we have to ask the question: how can people be this dumb? Why do people engage in motivated inference? Why hasn't natural selection led people to be more rational than they are? I think there's actually a very good neurological reasoning for this. It's because the brain didn't evolve to do probability and utility very well. These are cultural developments. Probability theory was only developed in the 17th century, and utility theory was much later. These can often be useful tools, but I don't think they're tools that are built into our brains. There's lots of empirical evidence that in the brain there's no division between cognition and emotion, between probabilities and utilities.

Here are just three of the kinds of evidence that people have talked about. George Lowenstein and others wrote a great paper called "Risk as Feeling" where they summarized the evidence that the way people estimate risk is in terms of emotions. Another social psychologist, Norbert Schwartz, wrote a paper called "Feelings as Information" where he says the way in which we assess probabilities and utilities is through our emotions. There's also some related work in neuroscience by Sam Harris, who's more famous for his critiques of religion. He's a neuroscientist who has found that the neural correlates of belief and

disbelief are tied in with different brain areas. When people agree with something, it's tied in with positive emotion parts of the brain; whereas when people find something false, it's tied in with negative emotion parts of the brain. So the way the brain works is not with a kind of optimal assessment of probabilities and utilities. It's using emotions for all these purposes and that's the sort of thing that can get us in trouble in lots of contexts.

I think the same thing goes on in fear-driven inference. There are many psychological experiments that document the occurrence of motivated inference. Unfortunately for fear-driven inference, we've only got anecdotes at this point. Dave Nussbaum, my collaborator on this, tried to do some experiments, but the problem is that in order to do tests of fear-driven inference, you have to make people really afraid, and he tried to do it by making people just a little afraid because of obviously ethical concerns. What I think is happening with fear is that rumination (thinking about things over and over again) generates a kind of amplified feedback loop in which the representations feed on each other. They become an internally reinforcing system that makes you convinced that what you fear is actually true.

Fear-driven inference can produce a critical transition in a complex system where you've got a bubble based on motivated inference. The economy's great. It's going to keep going up, but then the evidence gets

overwhelming when something really big happens, like the collapse of Lehman Brothers in 2008. An emotional transition takes place toward fear-driven inference. This sort of thing happens to people every day, when you go from being in a good mood and then you get some bad news and that puts you into a bad mood or vice-versa. You get an emotional transition and you end up being engaged in fear-driven inference. So this is my attempt to explain economic booms and busts, as an emotional transition from motivated inference to fear-driven inference.

Of course sometimes it turns around. I think that political revolutions often go the other way. I'm thinking of the Arab spring where people were driven by fear-driven inference. They think, "Oh, there's nothing we can do. The oppressive regime is just too strong," but then there's an emotional transition sparked by some particular event like the guy in Tunisia who set himself on fire. People then go over to the other extreme and think, "Oh, we really can do something," and so motivated inference makes them think that revolution can take place.

So far I've only been talking about psychological mechanisms, but that's only part of the story because people don't do these things on their own. If people are part of a firm or they're part of the stock market or if they're even just hanging out with friends in a coffee shop, then they aren't making decisions on their own. They aren't just developing emotions on their own or cognitions on their own. They're doing it through interaction

with other people. To understand those interactions we need social mechanisms with the modes of interaction that can lead to the transmission of cognitions and emotions from one person to another.

Here's my current list of some of the ways in which people transmit verbal information by talking and writing, and also nonverbal information about emotions. One of the most basic neurologically is mirror neurons, where you see something happening in someone else and you end up with the same kind of neural firings in your brain that would be going on if you were doing it yourself. So there's a kind of direct transmission of emotional information through mirror neurons. There can be molecular communication. You might've heard the metaphor "the smell of fear." It turns out it's not just a metaphor. People who are afraid do produce different kinds of molecules in their sweat, and when other people perceive that, they're more likely to be afraid.

Moving up to things that are more psychological, there's emotional contagion. Emotional contagion is where you pick up on the emotions of others. One way that can happen is through mimicry when you see someone expressing an emotion with a big smile or a frown. People have a natural tendency to mimic each other and one of the ways in which your brain develops the emotions that it does is by taking in signals from your face. So if your mother said, "Put on a happy face," she was right that it

can actually lead you to be happier. People are doing this not just individually, but also socially.

Interaction rituals are really important for that. Interaction rituals are important in religion or in the army. People march together or they sing together -- stand up, sit down. People become attuned to each other emotionally as a result of interaction rituals which is another kind of emotional contagion. Attachment-based learning is the idea of Marvin Minsky that we tend to acquire the emotions of people who teach us and to whom we're attached. They may be parents or religious leaders, and if you're attached to these people then you're going tend to acquire their emotions.

Empathy and emotional analogy also contribute to emotional transmission. There are two kinds of empathy. One is where you have something really fundamentally physiological as in mirror neurons. The other is more cognitive where you can think your way into the position of somebody else because you think, "Well, how would I feel if I were in their shoes?" So that's a kind of emotional analogy, which is the more high-level kind of empathy that can also lead you to acquire new emotions.

Altruism and sympathy also transfer emotions. With people you care about, you can adopt some of their emotions as a result of the fact that you care about them. Emotional cuing is a more complicated social

process where what someone else is doing can actually put you in a different emotional state. If somebody is really angry at you, you may feel guilty because you're sensitive to social situations. So anger can cue guilt.

Power is often used to transmit emotions, and there are two main ways that people get power over other people from an emotional point of view. One way is by having rewards you can offer them so you make them feel good. You make them think, "If I affiliate with this person then I'm going to get rewards." The other way is fear, where you make people think that if they don't do what they want, you're going to make something awful happen to them. Other methods like propaganda and advertising also manipulate people's emotions.

These social mechanisms are probably only a subset of the total, but they show that communication operates at the level of high-level inference as in verbal empathy, but also at very fundamental biological levels like mirror neurons and molecular communication. These mechanisms explain how it is that emotions can spread through a community, sometimes rationally when everybody is feeling good because the situation really is good, but sometimes in ways that are driven by collective motivated inference or collective fear-driven inference that can operate through emotional communication.

Let me say more about the kinds of feedback loops that operate here, because one thing that happens in any complex system is you can have both stability and transitions. In the cases we're talking about here, you can have stability that comes from dampening feedback. It's sometimes called negative feedback, but since I use "negative" for emotions, I'm not using it here. So dampening feedback enables stability. In psychological terms you've got inhibition between elements. If you're feeling good about the stock market, you won't be feeling bad about the stock market. At the social level you can have different kinds of intimidating communication that can promote stability. If somebody's saying something you don't like, then you glare at them, you inhibit their communication. At the individual level, you can have feedback loops that can either flip you into a mode where you're doing motivated inference or into a mode where you're doing fear-driven inference.

What's interesting is not just what happens to individuals, but what happens to whole social groups, where you can have both stability and instability. How do you get transitions? If you've got a dampening feedback loop, why would you ever change? if you're individually in a group, the transitions can happen as a result of amplifying feedback where one thing excites another which excites another and everything gets heated up even more. In the case of the psychological models, there is excitation between different elements, just as among neurons, resulting in a whole circle of excitation going on. At the social level, with amplifying

feedback we have a kind of collective energy where people go to a meeting or join a party. In these cases, at both the social and psychological level, using the kinds of psychological and social mechanisms that I've described, you can have both situations where you get stability and others where you get dramatic change.

So what can we say about animal spirits? I suggested to you that if we look at rich models of how emotions work, we don't have to stay with the Keynes or Akerlof & Shiller metaphor of animal spirits. We can say why people go through these economic changes because of the kinds of minds and brains that we all have. Pessimism and irrational despair come from fear-driven inference, whereas excessive optimism and irrational exuberance come from motivated inference. Emotional transitions take place because sometimes small inputs into the system can reverberate through the minds of individuals, but also through the whole societies to produce quite dramatic changes.

What about reflexivity? This derives from representations that include the representations of yourself and your own social situation and the whole economy. In a paper called "Mapping Minds Across Cultures," I gave a principle which I think covers this fairly well, a principle of social recursion. It's the idea that the actions of groups depend on the actions of individuals who think of themselves as members of groups. I'm not trying to be methodologically individualist and reduce the groups to the individual.

Nevertheless, I think that to understand the actions of groups you have to realize that groups are constituted by individuals, but the individuals are capable of representing themselves as members of groups, and that has a crucial effect on the behavior of the individuals and on the behaviors of the groups.

What are the general methodological implications of this approach? I think it does have implications for the idea that there have to be two different ways of doing science, as Soros suggests. If you don't appreciate the mechanisms that are operating in minds, then you probably have to do social science differently. But if you do social science in a way that integrates neural mechanisms, psychological mechanisms, and social mechanisms, then you can get a sufficiently complex account that is similar in its methods and results to what happens in natural sciences such as physics and biology. Prediction is difficulty because these systems are highly nonlinear. They're chaotic in the sense that they're easily perturbed. So prediction is still going to be hard, but as far as giving a mechanistic explanation of what goes on in complex social phenomena like economic booms and busts, this is a perfectly reasonable way to go.

I've made the case, I hope, that economic explanations are in fact mechanistic in that they're based on complex psychological and social mechanisms that I've described. Explanations are not mechanistic at the

level of the abstract economy, but if you get down to what's going on in the minds of individuals and pay attention to how cognition and emotion operate, then you can get some fairly reasonable explanations of economic changes. The ideas of animal spirits and reflexivity that economists have used in order to get beyond the empirical inadequacy of mainstream economics can be spelled out by looking at the mechanisms of emotional coherence and social communication.

Man 1: I was wondering, so one thesis here is that credence is actually in a feedback loop with emotions so that credence increases fear and fear increases credence, say in the negative case. I guess another alternative account would be attention which we know has cognitive functions also. It's hard to keep cases separate so part of our culture is to do arguments and logic in order to not run things together, and so when contemplating a decision where you don't have dominance, you should keep all the cases separate. But maybe the really scary things attract attention and so what's really going on in the overall decision is the attention effect that's raising the influence of the utilities under the scary columns in the table rather than that the credence is going up on that column in the table.

Paul Thagard: Well, I think that attention is part of that, but attention by itself won't do it all on its own and so you certainly are going to be paying more attention to scary stuff, but why would that lead you to think it's more likely that it's true? So there has to be some sort of connection between

attention and credibility and I don't think that just attention can explain it. You have to have the fact that you are dwelling on it leading to making it seem more plausible. So attention is clearly part of the story, but it's not really an alternative account to the one that I gave.

Woman 1: I wanted to ask you two things. One is that you're looking at economic decisions, but in general if you look at a theory of economics, well a sort of standard textbook account, it says that the task of any economist to sort of look at a situation where there are infinite desires, but there are only limited resources. So in a situation where there are infinite desires, but limited resources, you would always have to make the decision one way or the other and so it's really about resource allocation. If you transfer that sort of understanding of economics which is a standard kind to emotion-based economy, which is what you're talking about, desires are kind of created by some kind of psychological investment in terms of emotions, then I would want to ask why you're thinking of fear and what you call motivated emotions, what I think of as whole emotions, hope-driven inferences versus fear-driven inferences. Why would you not have a slightly enriched economy of inference making which would include things like surprise, disgust, and so on, which would all be part of an emotional economy? So if we were looking at the notion of desire in terms of decision making, would you not want to include at least the basic emotions as part of economy of desire?

Paul Thagard: Yeah, I think that human actions aren't just driven by the hope and fear that I've talked about here. There are lots of other ones. The one thing that I mentioned earlier that is relevant is what I call anger-driven inference. I think this is something that really tends to galvanize people in political activities that could make them go out in the streets or risk their lives in a revolution. So that's a case where there's an emotion that is particularly good at getting people to act, namely anger, one of the basic emotions that would be part of a bigger picture. I hadn't thought about how other basic emotions like disgust or surprise would perhaps distort people's inferences, so that's probably the case. I read a book by the leading theorist on marriage counseling named Gottman who said that he can watch a videotape of a couple for 20 minutes and predict with a high probability whether they're going to break up or not. The main predictive factor he identified was the frequency with which the wife looks at the husband with contempt. That's a case where contempt is clearly driving the process as well. Contempt and disgust I think are pretty linked to each other. So yeah, there's room for lots of other emotions to operate within the general case.

Man 3: Regarding the characterization of the folks who deny manmade global warming, obviously they're going to resist your characterization and they're going to actually hear some evidence that we think the global warming theory doesn't take into account and I guess my point is to maybe make a general point about this case in which data vastly

underdetermine theory and if you want to come up with a coherent theory that handles-- or if you want to hang onto your theory come what may, you can find ways of doing it and of course also there's confirmation bias when you look at the data that supports your theory and there's also a certain amount of value judgment that influences I suspect their thinking. We want to put human thriving above a scientific theory about a super-complicated process for which we find our evidence that it's not bringing on sun spots or whatever. But the more general point is that it's best to give these folks a healthy respect as part of the rubric of letting a thousand flowers bloom, which allows you multiple trajectories through the search space where if we all came to the same conclusions based on the data, there would be no real diversity and it would be very easy for us all to get stuck in local minima. But if we have as healthy a respect for opposing views as possible and allow that it does underdetermine theory and so on, we don't suppress vigorously and so I wondered what you'd say about any of that.

Paul Thagard: Yeah, I haven't said anything about suppressing diversity. There certainly is room for different views, but remember, this isn't just a question of belief. It's a question of action and I think there's good reason to believe that if there aren't major changes made in industrial and economic policies, 20 or 30 years from now millions of people are going to be dying as a result because of rises in sea level and because of major storms. Now it's an important practical question. Does that mean you

should stifle alternative ideas? Well, no, but you can also look for why it is that people like the Prime Minister of Canada and the Bush administration and lots of other people are so vehemently opposed to this set of ideas. Is it because they've got alternative evidence? Well, of course they can always seek out alternative evidence. This is where motivated inference is different from wishful thinking. People don't just believe whatever they want. What they do is they seek out sources. My brother works for the government of Alberta and he's convinced that climate change is a hoax and what does he use for evidence? Well, he sends me to websites for these guys living in Idaho funded by Exxon. So he can find the evidence to support it; but I think in this case, with the evidence according to 99 percent of the world's scientists and 100 percent of the world's learned societies supporting the view, you have to look for a non-epistemic explanation of why people are holding onto these views. In the case of the Prime Minister of Canada or George W. Bush, they're closely aligned with the oil companies. They're closely aligned with anti-government intervention. They're closely aligned with fundamentalist religious societies.

Man 3: But their side could say the same thing about our side and say well, they're closely aligned with the folks who were antecedently committed to this view. I mean how many people go into climate change research who aren't already on board with the theory and then of course you've got the green lobby and the folks who are making money off of

selling carbon credits and so on and they say, “Well, you’re aligned with those folks and they’re funding you.” Why not say, “Well, you know what? It’s possible that they are not irrational and we are rational.” So you’re saying you’re not sort of demeaning the one side, but it sounds like you are. It sounds like you want to say those folks don’t have a rational basis for their views, but we do, and that’s what I’m trying to resist.

Paul Thagard: Well, it just depends on what the landscape of evidence is and the motivation is on both sides. As I said, everybody, no matter how rational you are, is susceptible to motivated inference, but on the other hand in a social context or a scientific context, you are socialized to look at the overall weight of the evidence and in this case I think it’s pretty clear how that goes.

Man 5: I don’t agree with your interpretation of “Othello.” I think it’s wrong and I’ll link back to this to where I started. My interpretation of “Othello” is it’s fundamentally a brilliant play about race and about what it meant to be black in England and about how that particular social identity led to his insane jealousy and a totally destructive situation. As I have a very different way of talking about “Othello” than you do, again about the current economy, a very different way of talking about the economy than you do. I want to talk about self interest, conflicts of interest. I’d like to talk about power. I’d want to talk about efforts of service industries and especially banks and insurance companies to imprison the rest of society.

Within its own boundaries your own story is perfectly rational, but why would I choose those boundaries and what's the principle of choosing the boundaries because I would say in our current situation the boundaries you've chosen are politically undesirable because they seem to exclude the enormous conflicts of power and relationships in social groups that are playing themselves out.

Paul Thagard: I haven't excluded power from the picture at all. Remember, that was one of the social mechanisms that I talked about and there's no question that power is an important part of what's going on here. I think you have to understand how power works. It's not just a matter of social relations, though it's certainly that. It's something that works because of the way it can affect human psychology, of the way it can either give people positive expectations, hopes that things will get better, or also because of the way that fear can motivate you to do things. So I think what you need is to think seriously of all the things you've talked about, the power, the relations, but see how they interact with psychological processes. You need to have a cognitive and a social account of what's going on. Now there's lots of other cases that I think this can apply to. Austerity is a case where I think you get motivated inference, heavily affecting the extent to which people like austerity economic practices. So if you believe in minimum government intervention, if you think that people should be frugal, then the austerity policies sound really good to you. If on the other hand, if you've got a

more Keynesian view of how the society works and you think that stimulation is better, then you're going to look at different kinds of studies. An extreme example of this just happened in the US where it was revealed that one of the main studies that's been used to justify austerity policies in Europe was essentially a fabrication: a couple of leading economists advertently or inadvertently made up some data to support the idea that if you have too much spending you end up poor. I think motivated inference is operating there. Power is certainly operating because there are interests in society that want government to be smaller and economic freedom to be greater. So power and motivation are interacting.

SOURCES

Akerlof, G. A., & Shiller, R. J. (2009). *Animal spirits: How human psychology drives the economy, and why it matters for global capitalism*. Princeton, NJ: Princeton University Press.

Bechtel, W. (2008). *Mental mechanisms: Philosophical perspectives on cognitive neuroscience*. New York: Routledge.

Collins, R. (2004). *Interaction ritutal chains*. Princeton: Princeton University Press.

Elster, J. (2007). *Explaining social behavior*. Cambridge: Cambridge University Press.

Giddens, A. (1984). *The constitution of society*. Berkeley: University of California Press.

Gottman, J. M., Tyson, R., Swanson, K. R., Swanson, C. C., & Murray, J. D. (2003). *The mathematics of marriage: Dynamic nonlinear models*. Cambridge, MA: MIT Press.

Hacking, I. (1999). *The social construction of what?* Cambridge, MA: Harvard University Press.

Harris, S., Kaplan, J. T., Curiel, A., Bookheimer, S. Y., Iacoboni, M., & Cohen, M. S. (2009). The neural correlates of religious and nonreligious belief. *PLOS One, 4*(10), e7272. doi:7210.1371/journal.pone.0007272.

Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1994). *Emotional contagion*. Cambridge: Cambridge University Press.

Keynes, J. M. (1936). *The general theory of employment, interest and money*. London: Macmillan.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108*, 480-498.

Lakatos, I. (1970). Falsification and the methodology of scientific research programs. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 91-195). Cambridge: Cambridge University Press.

Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin, 127*, 267-286.

Mele, A. R. (2001). *Self-deception unmasked*. Princeton: Princeton University Press.

Mill, J. S. (1970). *A system of logic* (8 ed.). London: Longman.

Minsky, M. (2006). *The emotion machine: Commonsense thinking, artificial intelligence, and the future of the human mind*. New York: Simon & Schuster.

Popper, K. (1959). *The logic of scientific discovery*. London: Hutchinson.

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: Eight centuries of financial folly*. Princeton, NJ: Princeton University Press.

Rizzolatti, G. (2005). The mirror neuron system and its function in humans. *Anatomy and Embryology, 210*, 419-421.

Schwarz, N. (1990). Feelings as information: Informational and motivational functions of affective states. In E. T. Higgins & R. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (pp. 527-561). New York: Guilford Press.

Soros, G. (2008). *The new paradigm for financial markets: The credit crisis of 2008 and what it means*. New York: Public Affairs.

Thagard, P. (2000). *Coherence in thought and action*. Cambridge, MA: MIT Press.

Thagard, P. (2005). *Mind: Introduction to cognitive science* (2nd ed.). Cambridge, Mass.: MIT Press.

Thagard, P. (2006). *Hot thought: Mechanisms and applications of emotional cognition*. Cambridge, MA: MIT Press.

Thagard, P. (2010a). Explaining economic crises: Are there collective representations? *Episteme, 7*, 266-283.

Thagard, P. (2010b). *The brain and the meaning of life*. Princeton, NJ: Princeton University Press.

Thagard, P. (2012a). Mapping minds across cultures. In R. Sun (Ed.), *Grounding social sciences in cognitive sciences* (pp. 35-62). Cambridge, MA: MIT Press.

Thagard, P. (2012b). *The cognitive science of science: Explanation, discovery, and conceptual change*. Cambridge, MA: MIT Press.

Thagard, P. (forthcoming). The cognitive-affective structure of political ideologies. In B. Martinovski (Ed.), *Emotion in group decision and negotiation*. Berlin: Springer.

Thagard, P., & Findlay, S. D. (2011). Changing minds about climate change: Belief revision, coherence, and emotion. In E. J. Olsson & S. Enqvist

(Eds.), *Belief revision meets philosophy of science* (pp. 329-345). Berlin: Springer.

Thagard, P., & Nussbaum, A. D. (forthcoming). Fear-driven inference: Mechanisms of gut overreaction. In L. Magnani (Ed.), *Model-based reasoning in science and technology*. Berlin: Springer.

Von Neumann, J., & Morgenstern, O. (1947). *Theory of games and economic behavior* ([2d ed.). Princeton: Princeton University Press.