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Sandra Mitchell and Wolfgang Streeck

# Complex, Historical, Self-reflexive: Expect the Unexpected!

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## Abstract

The object world of the social sciences is complex, historical and self-reflexive. It generates nonlinear effects, it is unique, and it is able to understand the theories developed about it and respond to them intentionally. Recognizing the emergent, historically contingent and self-organizing nature of the social world, and developing responsive policy vehicles for managing its complexity, requires a shift in our conception of science in general and of economics in particular.

## Zusammenfassung

Die Gegenstandswelt der Sozialwissenschaften ist komplex, historisch und reflexiv. Sie unterliegt nicht-linearen Effekten, es gibt sie immer nur einmal, sie versteht die über sie entwickelten Theorien und reagiert auf sie mit eigenem Willen. Den emergenten, historisch kontingenten und selbstorganisierenden Charakter der sozialen Welt zu erkennen und Politikinstrumente zu finden, die ihrer Komplexität gerecht werden, erfordert ein verändertes Konzept von Wissenschaft im Allgemeinen und von Wirtschaftstheorie im Besonderen.

Much has been written lately about the causes of the global economic crisis. It clearly caught world leaders and economists by surprise. How did we get here? Economics is, after all, a science, and science is supposed to discover the laws that govern the behaviors of objects in their domain (physics discovered that $E = mc^2$, biology has the principle of natural selection, and so on). As Richard Posner observed:

> Economists pride themselves on being engaged in a scientific endeavor. From the basic premise that people are rational maximizers of their satisfactions the economist deduces a variety of hypotheses, of which the best known is the "law of demand" – a rise in the relative price of a product will, other things held constant, cause a reduction in the quantity of the product demanded. These hypotheses are confirmed or refuted by studies of actual economic behavior. (Posner 1993: 362–363)

Thus the science of economics should have put us in a position to predict what would happen under the circumstances that occurred and given us the knowledge to prevent such undesirable outcomes. But that didn't happen. The problem, we think, does not lie in particular faulty hypotheses, or mismeasured variables, but rather at a more fundamental level. The problem is an overly narrow understanding of the nature of science as a solely deductive enterprise, deriving explanations and predictions from universal, exceptionless laws based on axiomatic assumptions about individual behavior. Some science fits this model; scientific study of social beings like ourselves does not. The social world, like most of the biological world and a good part of even the physical world, is populated by highly contingent, context-sensitive, emergent complex systems. Understanding these features of complexity requires an expansion of our paradigm of science itself.

It makes no sense to expect the economy, or the biosphere, or the global climate to be reducible to simple laws which apply to all times and places. Complex systems exhibit emergent phenomena, surprising by definition, which arise from the interactions of simpler components. These phenomena take on a life of their own, often affecting the behavior even of the very components that initially gave rise to them. Feedback and chaotic dynamics sensitive to destabilizing conditions, not the step-by-step inevitable progress to a predetermined end, is what we should expect of economic behavior. But we did not.

> Few economists saw our current crisis coming, but this predictive failure was the least of the field's problems. More important was the profession's blindness to the very possibility of catastrophic failures in a market economy … The economics profession went astray because economists, as a group, mistook beauty, clad in impressive-looking mathematics, for truth … Economists fell back in love with the old, idealized vision of an economy in which rational individuals interact in perfect markets, this time gussied up with fancy equations … (Krugman 2009)

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A shorter German version of this paper was published in the German business newspaper *Handelsblatt* on November 20, 2009.

The world is complex; so, too, should be our representations and analyses of it. Economics is not alone in searching for beautiful mathematical simplifications as the goal of science. Science has traditionally sought to reduce the "blooming, buzzing confusion" (James 1981 [1890]: 462) of our experience to simple, universal, and timeless underlying laws to explain what there is and how it behaves. The successes of the Scientific Revolution of the seventeenth century in providing simplifying, unifying representations, in particular Newton's laws of motion and his law of universal gravitation, led philosophers to define what they would admit as reliable knowledge in like terms. But much of what we know now of the complexity found in the world does not conform to the simplifying, reductive and universalizing strategies of a Newtonian paradigm. Social, economic behavior is a case in point.

This does not make the complexity of the economic world beyond scientific understanding; it requires a recognition that good scientific practice reaches beyond the Newtonian paradigm. It requires, in many cases, a more explicit and detailed analysis of the many roles specific context plays in shaping natural and social phenomena. It means that conditions often relegated to the status of "accidents" or "boundary conditions" on the old paradigm must be elevated to the subject of scientific study in their own right. Historical contingency conspires with episodes of randomness to create the actual forms and behaviors that populate the social world.

To know what will happen, it does not suffice to deduce economic behavior from universal laws governing rational choice. One must keep track of local and idiosyncratic conditions, and especially of the interactions and their feedback on the components, which may generate novel, emergent phenomena that change the very rules of the game. As Brian Arthur notes, "small events (the mutations of history) are often averaged away, but once in a while they become all-important in tilting parts of the economy into new structures and patterns that are then preserved" (Arthur 1994: 11–12).

A simple example that shows some of the features of complexity is that of flocking birds. Each individual acts in coordination with the other birds – keeping from colliding, moving in the same direction, and staying with the flock. What each bird does depends on the others. In addition the rules guiding their individual behavior can themselves evolve, for example, to better adapt to predators who themselves are adapting to be better at catching the prey. Explaining the emergent behavior requires integrating multiple causes, including the internal rules, the local circumstances, and the adaptive environment, which are all changing in relation to each other. Multiple causes at multiple levels of organization operating at multiple time scales work together to generate the behavior we see.

This is very different from some simple cases of physical causation. A billiard ball moves in the direction and with the velocity it does because of the impact on it from the cue ball. Of course there are slight perturbations in the trajectory, due to spin and friction, that would be expected, but for the most part, such behavior is explained by a single

dominant cause. Not so in the world of the complex. Certainly there are multiple degrees and kinds of complexity. Some systems are closer to the billiard ball, just with a greater number of causal influences. The multiplicity of factors is not particularly problematic, especially if there are simple rules of interaction, such as additivity. However, complex systems often involve feedback mechanisms resulting in the amplification or dampening of the results or of nonlinear chaotic behavior, and under these conditions, causal explanations by additivity will fail. This is what Nobel laureate Robert Solow alludes to when he speaks of "currently fashionable macroeconomics" liking

> to formulate things in a way that inevitably endows the economy with more coherence and purpose than we have any right to assume … I expect that there will be a revival of doing macroeconomics that does not push this kind of coherence on aggregate economic behavior. Which is not to say that some individuals don't behave in a coherent way, but the system does not translate that behavior into something like a super-individual.[1]

Moreover, the social world is not just complex; it is also historical. Of each society, and certainly of human society as a whole, there is only one case, not a universe of cases for which one could calculate a normal distribution. We observe only one world, not the universe of all possible worlds. There is no way, therefore, to imagine a future cleansed of chance, or accidents. History unfolds through events that might just as well not have taken place, and would by not materializing have made space for a different history. Without the First World War and the Russian Revolution, neither of which *had* to happen, the twentieth century would have run a different course and modern capitalism would not be what it is today; what it would be, however, nobody can know.

There are obvious parallels here to natural history and the evolution of life. Without the extinction of the dinosaurs by a meteorite the advance of the mammals would not have taken place and consequently there would be no humans. While we can be sure of this, however, we will never be able to say what would have become of the dinosaurs had they been allowed to continue their march through time (whether their current descendents, for example, would eat with a knife and fork or have more specialized teeth). Historical events like the breakdown of Communism in 1989, German unification or the current financial crisis may ex post facto be construed as probable or even inevitable; but as long as they have not yet happened, other events can happen and prevent, postpone or modify them, without anybody ever knowing that they had been about to occur.

Complexity and historicity mean above all that human action inevitably takes place in the face of an uncertain future. Uncertainty, as Keynes knew, is not the same as risk, or probability: risks can be calculated, uncertainty escapes calculation. "The game of roulette," Keynes wrote in 1937,

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1 Interview with MIT News Office, October 7, 2009, <http://web.mit.edu/newsoffice/2009/3q-solow.html>.

> is not subject to uncertainty … The expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. The sense in which we are using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention, or the position of private wealth owners in the social system, in 1970. About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know. Nevertheless, the necessity for action and for decision compels us as practical men to do our best to overlook this awkward fact. (Keynes 1937: 213–214)

How can "practical men," and women, responsibly deal with a world so complex and unique that its future will always remain veiled in uncertainty? To begin with, they must divest themselves of technocratic illusions of precise predictability and assured control. After the crisis caused in 1998 by the crash of the Long Term Capital Management fund, it became received wisdom on Wall Street and among American regulators that between them they had all the tools needed to handle any crisis that might occur in the future. When the former chief of the Federal Reserve, Alan Greenspan, testified before the House Government Oversight Committee on October 24, 2008 – in his own words: "in a state of shocked disbelief" – he looked back at

> a vast risk management and pricing system … combining the best insights of mathematicians and finance experts supported by major advances in computer and communications technology. [Even] a Nobel Prize was awarded for the discovery of the pricing model that underpins much of the advance in derivatives markets.

Based on this "intellectual edifice," which, in Greenspan's words, "collapsed in the summer of 2007," regulators had allowed financial engineers, in the name of innovation and efficiency, to introduce more and more new "products," under what was euphemistically called "light touch regulation." Nobody imagined, or perhaps cared, how costly it would turn out to be for society to clean up the mess caused by the next crisis that was about to come in 2007.

What someone like Greenspan, committed to the mechanistic machine model of standard economics, did not take into account was that, as technical capacities increase and the range of the possible expands, complexity and uncertainty increase as well. The more we calculate, the less calculable the future may become. Growing complexity in a historical world means that policy must be prepared to expect the unexpected, and develop routines of action that are ready for it. This is how nuclear reactors are run – which are of course much less complex than a globalized world economy. The breeding of money in an investment bank is no less unpredictable, and certainly no less dangerous in a global economy, than the breeding of plutonium in a nuclear power plant. Nobody in their right mind would, in order not to stifle innovation, allow the operators of nuclear reactors to try out whatever new tricks come to their mind to increase the efficiency of their plant, on the assumption that the accidents that will perhaps ensue can be expertly handled by the firefighters.

New frameworks for policy may be better able to handle the kind of deep uncertainty that social complexity entails. Adaptive management in place of "predict-and-act" models introduces flexibility to respond to both new situations and new knowledge of the situation. Where we cannot predict, we should not pretend to know what the future will hold. As noted, we cannot even reliably assign probabilities to future conditions. Our understanding of what will happen next needs to be updated regularly. Monitoring and adjusting regulations in light of dynamically changing conditions is a better match to the kind of complexity found in the social world than expectations based on a time-honored paradigm of simple, linear, deterministic models. Surprises, ironically, should be expected.

Finally, there is one more reason why human societies cannot be explained or controlled by deterministic theories. In addition to being subject to emergence and shaped by historical events, societies are self-referential: they learn about and can take into account the theories developed and deployed to govern them. Human beings are capable of agency: they do not just behave, i.e. respond automatically to whatever stimuli they are exposed to, but they act intentionally. Man, according to none other than Charles Darwin, is a "moral being" who "is capable of comparing his past and future actions or motives, and of approving or disapproving of them" (Darwin 1871: 482–483). This is why machine-model theories of social or economic processes tend to have only a limited shelf life if any: they cannot be kept secret, and their use gets noticed, investigated for its intentions, and responded to intentionally. A well-known example is the famous Hawthorne experiments (1924–1932), where the researchers thought they had found that workers work faster and better, even without a wage increase, if the walls of their workshop are painted yellow and managers are nicer to them. But once the workers discovered that the fresh color and the new kindness were "only" to save money, they went on strike for better pay. Something similar happened posthumously to none other than Keynes who, of course, was as much as any economist aware of the importance of expectations. When in the 1970s Keynesian demand management had become an established practice in Western countries, firms and consumers reacted ever more slowly to lowered interest rates, believing that as stagnation continued, interest rates would be lowered even further. In the end the theory ceased to work because it had become common knowledge and a point of departure for strategic action of its subjects.

Another, and perhaps the most important, aspect of self-reflexivity is that, while societies may not be governed by unchanging natural laws, they can govern themselves through laws of their own, in the form of institutions. Again, we can turn to Keynes for elaboration. In 1937, in an essay that reads as though it had been written to explain the current crisis, Keynes argued against the belief of "classical economic theory" that free markets are subject to law-like regularities that can be discovered by theory and used by policy to control the future. To the contrary, Keynes wrote, since in a free market uncertainty exists not just for the observer but also, and most importantly, for the participants, the latter are bound to behave in a way that will continuously produce random

disturbances, by following the behavior and adopting the expectations of others who, in turn, do the same:

> Knowing that our own individual judgment is worthless, we endeavor to fall back on the judgment of the rest of the world which is perhaps better informed. That is, we endeavor to conform with the behavior of the majority or the average … A practical theory of the future … being based on such a flimsy foundation … is subject to sudden and violent changes … New fears and hopes will, without warning, take charge of human conduct. The forces of disillusion may suddenly impose a new basis of valuation … (Keynes 1937: 214)

Markets, Keynes continues, become predictable, not through the refined mathematics of positivistic theories, but only through regulation: through human intervention imposing order on them by subjecting them to man-made laws as distinguished from natural laws – through instituted laws created by legislation, instead of natural laws identified by science. According to Keynes, it is only in what he called "a nicely regulated market" that "pretty, polite techniques" like those of "classical economic theory" can work at all (Keynes 1937: 215).

It is at this point at the latest that economics must turn into political economy. Societies cannot wait for their order to be discovered for them by scientists: they have to produce their order themselves. If they fail to use human agency collectively to get organized, it will permanently give rise to disorganization through the unpredictable emergent effects of individually rational strategic action. There is, in other words, no way of replacing politics by science. Of course, unlike the world of standard economics, politics is messy and by definition contested, but so is life. Adam Smith's favorite academic discipline was astronomy – indeed, its Newtonian version, in which stars and planets move majestically around each other, on precisely predictable orbits, in eternal self-reproducing equilibrium. It was not Smith's fault that he knew nothing of the chaotic dynamics of an expanding universe.

When economic science is based on an out-of-date paradigm of what science looks like, i.e. deterministic, linear, simple and reductive, it will fail to comprehend the complexity that will continue to shape our future. Recognizing the emergent, historically contingent, self-organizing and self-reflective character of the social world, and developing responsive policy vehicles for managing that complexity, requires a shift in our conception of science in general and of economic science in particular. To pretend otherwise in order to satisfy a preconceived notion of order in the world or of elegance and simplicity in its theoretical representation is to miss out entirely on what is in front of us: a dynamically changing, complicated, complex, and chaotic but understandable universe. We need to embrace more than the simple, and expect less than the fully predictable.

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