Interface Focus, Theme Issue on "Top-down causation", February 6, 2012, 2 (1)

Ellis, George F. R., Noble, Denis, and O'Connor, Timothy (Eds.)
Royal Society Publishing: London, 2012
ISBN 9780854039340 (pb)

Reviewed by Flaminio Squazzoni
GECS Research Group, Department of Economics and Management, University of Brescia, Italy

This is an interesting multi-disciplinary journal issue that zeroes in on the idea of emergence and top-down causation. Originated from a meeting at the Royal Society and organised by George F. R. Ellis, Denis Noble and Timothy O'Connor, it includes fourteen articles that take stock of the situation in various fields, such as physics, chemistry, biology, neurosciences, sociology and philosophy. Although these articles doe not put an end to the dispute between supporters and opponents of the causal power of macro structures - and by the way this was not the original aim of the Royal Society meeting, nor that of this issue -, I believe that JASSS readers could find food for thought in this collection. Indeed, these articles allow us to realise that concepts we are familiar with, such as emergence, complexity, bottom up vs. top-down levels, are deeply discussed also in physics, biochemistry, molecular biology and neuroscience. This issue gives us a chance to confront and learn from other approaches.

Among other things, I found interesting the brief overview by the three issue editors, where there is a useful glossary of terms that are often used also in social simulation ("aggregate", "emergence", "system", "self-organised systems"). This glossary may help us to clarify our own foundations. Moreover, they argued that complexity cannot be fully understood looking only at bottom-up emergent properties but also that a roadmap for research should be set up in which the need for empirical test on top-down causation is crucial. Without some clear empirical test, reasoning about top-down causation is only a matter for philosophical debate and in my opinion, this should be avoided, especially in the social sciences.

The issue confronts different positions and testifies to the fact that there are certain fields where the existence of top-down causation could be even defended, such as molecular and evolutionary biology, whereas this is really problematic, if not impossible in other areas, among which I would include social sciences. On the other hand, interestingly for us, some articles allow us to realise that determinism and reductionism complement with interpretation and idealisation even in 'hard' sciences.

I have found especially interesting the first article by Robert C. Bishop (background in physics, influential work on reductionism, complexity and the philosophy of social sciences). The author examined the problem of complexity in terms of system/environment boundaries by illustrating the example of a well-known convection

phenomenon, namely Rayleigh-Bénard convection, i.e., a nice example of self-organised complex pattern. He showed that a certain amount of idealisation and choice is always present in defining system/environment boundaries, independently of the nature and features of the system under investigation. Bishop insisted on the idea that the presence of nonlinear dynamics imposes that interpretation is needed to allow fundamental laws to achieve a "necessitarian" status. It is interesting to learn that social systems and social sciences have no a special status on this. On the other hand, Bishop correctly argued that any transposition of emergence, top-down causation and alike from physics to social sciences is problematic as in physics "the whole can be observed" while this is not always the truth for social systems.

The subsequent contributions alternate arguments against the existence of top-down causations (e.g., articles by Barry Loewer, philosopher, also interested in mental causation, and Eric R. Scerri expert in the history and philosophy of chemistry) with cases where some proofs could be even found (e.g., articles by George F. R. Ellis, applied mathematician, who provided a description of various types of top-down causation mechanisms with examples in various fields and Alan C. Love, philosopher of biology).

As regards to the second position, I have found interested the article by Luc Jaeger and Erin R. Calkins (two bio-chemists) who suggested an information control viewpoint. In a well-documented and comprehensive excursus on emergence, they found evidence on the existence of top-down causation looking at feedback information control in synthetic biology, arguing that this type of causation is even necessary for life. While considering classes of functional equivalence from the bacterial operating system that regulate information encoded in the genome, they showed that information control and adaptive selection can act as severe constraints upon the emergence of molecular complexity during the evolution of the modern DNA/RNA/protein world. The same position is expressed by Paul Davies (famous physicist, with an interest also in astrobiology), who discussed the role of epigenomic control and Samir Okasha (influential philosopher of evolutionary biology), who examined the role of multi-levels of selection. Along the same lines, Denis Noble (expert in cardiovascular physiology, the first to model cardiac cells in 1960, one of the issue editors) suggested that the modelling of the heart and its experimentation allow us even to question the presence of a privileged level of causation and so the priority given to bottom-up emergence. He showed that there is a causal influence of certain initial and boundary conditions on the solutions of differential equations used to represent lower level processes of heart cells. He also discussed the role of organism, organs and tissues in triggering cell signaling that induce protein machinery to select, read and correct genes at the lower level.

I have found of great interest the article on neuroarchitecture and nervous system evolution by Gary G. Berntson and colleagues as it presents a pragmatic approach to complex systems, with important implications even for social simulation. They showed that properties of higher level neural networks can be understood only by looking at aggregate phenomena and proposed the notion of "calibrative reductionism" as a pragmatic strategy to deal with the relation between psychological and neurological processes far from any "eliminativistic" and reductionist point of view. A similar stance is shared also by Harald Atmanspacher (physicist with an interest on mind-matter issues), who suggested to approach top-down causation in the relation between neural and mental states in terms of "downward confinement".

Gary G. Berntson and colleagues showed that understanding complex system behaviour could be really problematic if we look only at foundational levels. For instance, examining the role of the social dimension on brain activities, they suggested that "many interesting problems, with considerable personal and societal implications, revolve around psychological processes. To 'reduce' these to the language and concepts of neuroscience

many not adequately capture the essence of the phenomena in question. A category error is likely, as there may not be a simple one-to-one mapping across domains [...] Consequently, integration of information across levels of analysis may be challenging in view of potential category errors and misalignment of concepts" (70). By presenting an interesting social neuroscience perspective, very close to the socio-cognitive approach of some work in social simulation, they tried to link neuroprocesses, cognition and social environment around the idea of "social brain", insisting on the argument that "interacting human brains cannot be simply reduced to the operation of a solitary brain that simulates the brain of others". This article showed that very important links potentially exist between social simulation and social neuroscience about the need for examining the influence of social interaction, norms and institutions on individual perceptions and behaviour.

I must say that I did not find convincing the only article by a social scientist included in the issue. Dave Elder-Vass (well-known constructivist sociologist) presented an excursus on emergentism in sociology to support the idea of the causal power of social structures. Although well-written and full of references in the literature, this article provides no empirical or experimental proof of top-down causation, if not a reference to the theory of norm circles and an interesting discussion on certain multiple possible normative causes on individual behaviour. The author correctly argued that there is a fundamental difference between possible top-down causation mechanisms in social and non-social systems, but failed to draw what is, in my opinion, the natural conclusion: this difference lies in the true 'causal force' of human cognition and decision, i.e., the genuine, foundational (micro) level component of any social system.

In this respect, even the classical sociological examples on the causal power of roles, expectations and values provided by Ellis G. F. R. in the article mentioned above are not proofs for the existence of a causal ontology of social structures, as they naively conflate constraints and causes on individual behaviour. Again – I insist – these approaches lay themselves open to criticism about the impossibility of explaining the foundations of change and innovation in social systems, which derive from individual choice in the first place (surely constrained in various ways, but choice and decision).

To conclude, although I continue to be sceptic on this idea of top-down causation and emergence in the social sciences and a bit frustrated by the 'mere' speculative plane in which the debate is often conducted, this reading challenged my view and helped me to confront with other approaches and studies. I believe that, in this important debate, there is room for social simulation to try to bring this debate back to a more pragmatic, experimental level also in the social sciences.
