



Guest editors' Introduction. Philosophical lessons from complexity: Sandra Mitchell's contribution to philosophy of science

*(Introducción. Lecciones filosóficas desde la complejidad:
la contribución de Sandra Mitchell a la filosofía de la ciencia)*

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ABSTRACT: This monographic issue contains a long article bringing together the Lullius Lectures delivered by Professor Sandra Mitchell during the Xth Conference of the Society of Logic, Methodology, and Philosophy of Science in Spain, that took place in Salamanca (16-19 November, 2021). The publication of her Lectures is complemented by six original articles that address and examine different aspects of Sandra Mitchell's contributions to the philosophy of science. In this introduction to the monograph, the editors present the broad outlines of the Lullius Lectures given by Mitchell on the landscape of integrative pluralism. We accompany this overview with a review of some of the fundamental concepts of her philosophy as reviewed and discussed by the original articles included in the monograph on integrative pluralism (Deulofeu & Suárez, 2023; and Van Der Merwe, 2023), emergence (Onnis, 2023), scientific laws (Andersen, 2023; and Plutynski, 2023), and realism (Bertolaso & Sterpetti, 2023).

KEYWORDS: Sandra Mitchell, Lullius Lectures; SLMFCE; integrative pluralism, emergence, scientific laws, realism.

RESUMEN: *Este monográfico recoge un extenso artículo que reúne las ponencias de las Conferencias Lullius pronunciadas por la Profesora Sandra Mitchell durante el X Congreso de la Sociedad de Lógica, Metodología y Filosofía de la Ciencia en España, que tuvo lugar en Salamanca (16-19 de noviembre de 2021). La publicación de sus Conferencias se complementa con seis artículos originales que abordan y examinan diferentes aspectos de las aportaciones de Mitchell a la filosofía de la ciencia. En esta introducción a la monografía, las editoras presentamos las líneas generales de las Lullius Lectures de Mitchell sobre el panorama del pluralismo integrador. Acompañamos esta visión general con una revisión de algunos de los conceptos fundamentales de su filosofía, tal y como se revisan y discuten en los artículos originales incluidos en la monografía sobre pluralismo integrador (Deulofeu & Suárez, 2023; y Van der Merwe, 2023), emergencia (Onnis, 2023), leyes científicas (Andersen, 2023; y Plutynski, 2023) y realismo (Bertolaso & Sterpetti, 2023).*

PALABRAS CLAVE: *Sandra Mitchell, Conferencias Lullius; SLMFCE; pluralismo integrativo, emergencia, leyes científicas, realismo.*

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In November 2021 Prof. Sandra D. Mitchell (Pittsburgh University) delivered the *Fourth Lullius Lectures* during the Xth General Conference of the SLMFCE (*Society for Logic, Methodology, and Philosophy of Science in Spain*) held in Salamanca. The Raimundus Lullius Lectures were initiated by the SLMFCE in 2012 with the aim of recognizing the contributions of leading philosophers working in the areas of interest of the Society. They take their name from Ramon Llull, a 13th century Catalan philosopher, theologian and writer who advocated the open debate of ideas, the unity of religions and tolerance. The SLMFCE Society chose this name of the Conferences to represent its own commitment to the open search for truth. Previous speakers have been: Philip Kitcher in 2012 in Santiago de Compostela; Hartry Field in 2015 in Barcelona, and Nancy Cartwright in 2018 in Madrid.

Philosopher Mitchell was elected by vote to deliver *The Lullius* by the members of the SLMFCE. She is a distinguished professor of History and Philosophy of Science at the University of Pittsburgh. As a philosopher of science, she has worked on a wide range of topics throughout her life, with a particular focus on complexity in biology and the nature of scientific explanation. Her research has been concerned with understanding the assumptions and structure of scientific explanations of complex systems and their behavior. Mitchell's work and perspective in philosophy of science has been influenced by the fields she chose to study (biology, complex systems) and by working collaboratively with scientists in these fields.

Sandra Mitchell delivered two Lectures in Salamanca; the topic of the first one was "From scientific complexity to epistemic pluralism", and the second was on "From representational perspectivism to pragmatic realism". The two of them come now reunited in a single long article with the title "The landscape of integrative complexity" (Mitchell, 2023a). The first part of her article deals with her earlier work on complexity and emergence, including her pragmatic approach to scientific laws, whereas the second part addresses her more recent work on perspectivism and realism, which also incorporates her insights into how Gibsonian affordances may illuminate metaphysical ontology, epistemology, and scientific practices.

In her book *Biological complexity and integrative pluralism*, Mitchell (2003) shows two kinds of contributions to philosophy of science from a biological perspective. One is the philosophical investigation of specific questions raised in biology, while the other is the discussion of general problems of philosophy of science from the perspective of biological complexity. This second line allows us to consider problems that go beyond the scope of physics, the "model science" of the classical approach. The book presents developments in both of these lines, by considering the notion of complexity and defending pluralism on its behalf. The main thesis is that the complexity of biological systems shapes the form of the scientific explanations adequate for them and justifies pluralism. This is a defense of pluralism that does not celebrate diversity just for the sake of it. In fact the author does her best to separate her position from other "anything-goes" appeals of pluralism. Instead, it develops arguments for pluralism from the metaphysical and epistemological grounds of complexity, i.e. the nature and processes of complex systems, as well as from thoughts about how limited our explanations of them are. Thus, her theory of *Integrative Pluralism* aims to describe and explain the relationships among multiple models, explanations and entire disciplines. Her 2009 book *Unsimple Truths: Science, Complexity and Policy* offers detailed arguments for how and why understanding the science of complexity changes our views of

knowledge of nature, how we obtain such knowledge, and how we use it to pursue our human interests. She has written about different types of explanations in biology, the role of social values in science, emergence and robustness and how standards for reliability of scientific instruments might help us understand why we should or shouldn't trust new artificial intelligence learning algorithms.

The concept of “**integrative pluralism**” appears in the title of Mitchell's article and was a major theme of her work from the beginning. Her version of pluralism confronts the challenge of explaining “how can a diverse, well confirmed, but irreducible set of theories be used collectively to achieve a more complete understanding than any of the theories taken in isolation?” (Mitchell, 2003, p. 115). Mitchell considers whether there is a case for reductionism in the study of complex systems, arguing instead for an alternative approach based on the integration of compatible, rather than competing, explanations. The enormous *diversity and complexity* of the phenomena under investigation requires a view of science that is *partial* and therefore necessarily *perspectival*. The first two articles of the monograph discuss various aspects of integrative pluralism.

In their contribution to the monograph, Roger Deulofeu and Javier Suárez question whether integration is the best strategy envisaged to deal with pluralism (Deulofeu and Suarez, 2023). These authors acknowledge the importance of integrative pluralism for recent philosophy of science, and refer to the special pragmatist version that underlies Mitchell's work. However, they believe that there may be limits to the capacity for integration, as certain models may not be compatible with each other. In particular, they argue that the integrative project may not be epistemically the best option nor ontologically possible for some lines of research. For example, a complex case such as major depressive disorders can be analyzed in the three terms of the complexity: integrative pluralism of compositional dynamic and evolutionary. However, the authors argue that in other examples discussed in their paper, integration is not desirable in the sense that it does not provide the best science for the problem at hand. They analyze examples of different types considered by Mitchell; that is, aggregative, composite component and composite integrative. Integration difficulties arise when models at different levels are incompatible or there are preferences about the level at which explanations should run, and also when only higher-level causality is relevant and the lower level can be disregarded.

On the other hand, Ragnar Van Der Merwe discusses in his article how to understand the pluralism of Mitchell's integrative pluralism (Van Der Merwe, 2023). This author considers that Mitchell adopts an epistemological pluralism that conflicts with the unitary goals required for epistemology beyond the fact that there are plural epistemic practices. The author distinguishes between integrative pluralism in science, which says that there is a plurality of epistemic ends, and integrative pluralism in philosophy, which would speak of a plurality of different ways of understanding epistemology itself. Here he considers that although Mitchell presents her position as an epistemological pluralist in this second sense as well, her aim is certainly a unitary one pursuing objectual understanding. This is why Van Der Merwe's proposal appeals to Feyerabend to say that pluralism would be no more than an opportunistic strategy to pursue a unitary goal linked to this understanding.

If complexity is a key-word in biology, **emergence** readily comes with it: Emergence will make scientifically coherent the recognition of the self-organizing dynamic behavior of complex systems as having implications for the ontology of our world. So Mitchell (2012) proposes taking emergence seriously. Where there is novelty, where there are

properties that cannot be predicted or explained by lower-level properties, and where there is self-organization and downwards causation, there is emergence in its strong form. It is commonplace in science to appeal to emergence. However, philosophers look more reluctant. In the first part of her contribution to this volume, Mitchell will pay special attention to Kim's arguments against downward causation and, consequently, against emergent phenomena. In a shell, Kim (1999, 2006) has claimed that there is downward causation only where there is reduction; so there is no true emergence. Mitchell complains that not only micro structural descriptions do not explain how new properties are maintained in time, but Kim's approach makes the unwarranted assumption that every material object has a unique, complete micro structural description. The fact of general partiality, so many times underlined by Mitchell, shows the assumption is unjustified. There is no unique description of any object into a language, and descriptions at the micro-level are not to be privileged. Emergence is thus more than welcome as a natural form of understanding and modeling reality.

However, Mitchell's account of emergence, mainly in terms of unpredictability, novelty and downward causation, is not the only one. In her paper for this volume, Erica Onnis compares it with other two important views on emergence in the literature, Humphrey's transformational emergence in fundamental physics, and Wilson's metaphysical emergence concerning free will (Onnis, 2023). Onnis claims that the three analyses only partially overlap. So, even when the three use similar terms in pointing to salient characteristics of emergence, the terms are intended in different ways. For instance, unpredictability can mean incompressibility, surprise, computational novelty, etc. Now, according to Onnis, and very much into the spirit of Mitchell's integrative pluralism, so much diversity is positive and significant: It might be a sign of the complexity of nature and the possibility of approaching it from different perspectives. Emergence, she concludes, is better understood as an open cluster concept, rather than one signaling a natural kind.

Mitchell's work on **scientific laws** is an important contribution to the philosophy of laws from the perspective of whether there are or not laws in biology. According to the evolutionary contingency thesis, the laws that apply to living systems are either physical, chemical and mathematical, or distinctively biological in that they describe a contingent outcome of evolution (Beatty, 1995). Although Mitchell accepts this contingency, its consequences must be tempered with a careful attention to the necessity shown by other kinds of laws that are not biological. The standard approach to the notion of scientific law admits that the necessity of natural laws is not logical, but they are understood according to a notion of necessity that mirrors logical necessity too closely. Sandra Mitchell's analysis of the different conditions of the universe that account for the different levels of necessity that support different kinds of laws is truly original, resolving in an epistemological approach to laws where these satisfy the pragmatic goals of science. Laws are defined by their functional role in science: they let us explain, intervene and predict phenomena. And for this to be possible, it is not required that laws are necessary. In biology, functional laws depend on contingent and contextual features that confer variations in their stability. But there is stability. Thus, stability, and characteristics such as robustness, resilience, dependence and invariance account for the explanatory roles of laws. However, as H. K. Andersen argues in her paper in this volume, Mitchell's pragmatist account is not just one among other recent pragmatic versions of regularity theories (Andersen, 2023). According to Mitchell, and Andersen, it is precisely the perspectival character of laws that allows for the recognition of an

objective gradation of their stability. Perhaps we could state their view as the claim that, when Humeanism becomes human, thus allowing the scientific subject and the philosopher a proper location and movement within the map of the world, it can show why and how not everything is possible. In this way Andersen's paper continues the discussion over pragmatism that is salient in their jointly edited *The pragmatic challenge: Pragmatic metaphysics for philosophy of science* (Andersen & Mitchell, 2023).

Mitchell's epistemological account on laws can *also* leave room for necessary laws in biology, so that theorems, e.g., Fisher's fundamental theorem of natural selection or Malthus's law, could be integrated in the picture. This is the question to which Anya Plutynski aims to give a positive answer in this volume (Plutynski, 2023). Contextualizing Mitchell's account within the history of evolutionary theory, from the role that Malthus's law played in the philosophy of biology of Darwin, to Elliott Sober's work about mathematical results in biological theory (Sober, 1993), Plutynski argues that certain theorems function in biology as organizing principles that frame future research in the field. Biology needs generalizations that function for prediction and intervention. But there are also theorems in biology that can be thought as naturally necessary and having a greater stability than other laws.

Mitchell's liberal and pluralistic philosophical approach to science also intends to be **realist**. In the second part of her contribution to this issue, she addresses the question of how a pluralist, perspectival, pragmatic approach to science in fact contributes to realism. She distinguishes two general positions on realism, one of them bottom-up, for which unobservable phenomena are linked to causation and intervention, and defended by figures such as Ian Hacking and Nancy Cartwright, while the other is top-down and understands that unobservable phenomena are the referents of abstract explanatory theories as defended by a structural realism in the line of John Worrall. However, Mitchell contends that neither entity realism nor structural realism are sufficient; they need to be integrated. As a way out of the dichotomous choices, Mitchell develops a particular form of pragmatic realism which is inspired by J.J. Gibson's theory of affordances (Mitchell, 2023a, 2023b).

In the final paper of the monograph, Marta Bertolaso and Fabio Sterpetti address problems related to this particular form of pragmatic realism developed by Mitchell. According to them, she aims to deprive the two received views on realism of their foundationalist ambitions, and to combine them in a pragmatist framework which involves an integration of human interventions and conceptualizations (Bertolaso & Sterpetti, 2023). They claim that, by appealing to affordances, Mitchell brings together epistemic subjects and objective reality in science in the same way as in Gibsonian psychology the environment does not only convey perceptions but also possible actions. The rest of the article is concerned with various questions about the type of realism Mitchell proposes, and with the extent to which her positions might be acceptable to realists and anti-realists, since she appeals both to the non-miracle argument and to abduction and inference to the best explanation. They conclude, then, that the realism she defends has mainly a metaphysical character, while remaining anti-realist in other respects.

In sum, this monograph presents a rich approach to various topics of the philosophy of science from the perspective of Sandra Mitchell's work. The collection provides a comprehensive understanding of her contributions because of the combination of an original text by the targeted author together with six different papers which elaborate on different crucial features such as pluralism, pragmatism, realism, emergence and scientific laws.

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