

## Foreword: Culture(s) of Modelling in Science(s)

This volume of *Studia Metodologiczne (Dissertationes Methodologicae)* addresses the question of culture(s) of modelling in science(s), bringing together two issues significant for contemporary methodology of sciences, namely scientific modelling and scientific culture. For a long time these two issues used to be treated separately in philosophical discussions and with discernable priority given to scientific modelling. Thus, once natural, computer, cognitive and social sciences became broadly populated by models, the ontological nature, cognitive status and practical types of scientific models and modelling were taken as primary objects of numerous philosophical investigations. Recognizing that many scientific disciplines are populated by models of different nature, status and type does not preclude, however, that scientific modelling is still immersed in symbolic and material culture. This is where the idea of scientific culture comes into play.

Since the very term “scientific culture” has been systematically equipped with many different meanings, there are numerous conceptual tools at hand for philosophical reconstructions and analyses of various manifestations of symbolic and material culture in daily scientific research practice. Let us recall here only a few of them: ‘material and theoretical cultures’ (Peter Galison), ‘thought styles’ (Ludwik Fleck), ‘epistemic cultures’ (Karin Knorr-Cetina), ‘styles of reasoning’ (Ian Hacking), ‘epistemological cultures’ (Evelyn Fox Keller), ‘experimental cultures’ (Hans-Jorg Rheinberger), ‘local scientific cultures’ (Barry Barnes, David Bloor, John Henry), ‘evaluation cultures’ (Donald MacKenzie), ‘scientific imagination’ (Fiora Salis, Roman Frigg) or ‘norms of science’ (Robert Merton).

Regardless of the multiplicity of available conceptual tools that help theoretically grasp the symbolic and material culture in daily scientific research

practice, the question how to discuss culture(s) of modelling in science(s) remains open. With this volume the editors aim to contribute to this discussion. Our idea is to equip the reader with a conceptual framework that may help him or her in a two-fold way: better orientate in heterogeneity of conceptualizations of cultural dimensions of scientific research in general and scientific modelling in particular, as well as increase awareness of interconnections between these various conceptualizations. For this purpose, we distinguish three subproblems within the leading problem of culture(s) of modelling in science(s):

- culture(s) of science – which relates to the question of a multitude of cultures with the spectrum of possibilities from monism (monoculturalism), via dualism (biculturalism) to pluralism (multiculturalism or polyculturalism);
- culture in science(s) – which relates to the question of a range of culture with the spectrum of possibilities from global culture, via regional culture to local culture;
- culture(s) of modelling – which relates to the question of a function of modelling with the spectrum of possibilities from the culture of representing, via the culture of intervening to the culture of exploring.

This volume consists of contributions by scholars with different disciplinary background who either investigate the culture(s) of modelling in science(s) or reflect on cultural dimension of their own modelling practice. The first article offers an analysis of the very term of ‘model’ by exploring different meanings attached to this terms in different domains (logic, mathematics, science, everyday life), as well as different uses that model may serve; the author further presents his account of the general theory of models (Bernhard Thalheim). The second paper deals with the view on scientific modelling by the physicist Sir Rudolf Peierls whose taxonomy of scientific models exhibits points of convergence with contemporary philosophical accounts of how scientific models function; the author argues that Peierls’ view warrants the recent philosophical shift from a focus on model-based representation to non-representational (e.g., exploratory) uses and functions of models (Axel Gelfert). In the third article the authors present their account on the past and future of modelling in biology and invite philosophers of biology to provide normative research guidance for biologists; such a call comes amid

unprecedented availability of ecological, evolutionary, and molecular data, of computational resources, and of mathematical and statistical tools (Steven Hecht Orzack, Brian McLoone).

The fourth paper focuses mainly on the proper uses and difficulties of formal theory (e.g., rational choice theory, game theory) in political science; according to the author, the roots of the formal approach can be traced to Thomas Hobbes and William Riker's second launch of 'Hobbesian advice' who put the field of formal theory on the map of political science; the author supports his historical analyses by both offering an example that explains the necessity of formal political science and discussing a trap for a barefoot empiricism (Piotr Świstak). In the fifth article the authors concentrate on the social sciences and present the variety of computational methodologies from both data-driven (such as 'black box') and rule-based (such as 'per analogy') approaches; what is more, they show how to build simple models and discuss both the greatest successes and the major limitations of modelling societies and populations (Andrzej Jarynowski, Michał B. Paradowski, Andrzej Buda). The sixth paper focuses on the nature of knowledge about the world that models and modelling give us; it puts forward the thesis that models are producers of beliefs about their targets and concludes that these beliefs should not be interpreted in terms of probabilities but rather as claims about prototypical characteristics of entities being under investigation (Łukasz Hardt). In the seventh article the author discusses how the developments in game theory and social choice theory transformed our understanding and modeling of social rationality in the social sciences due to the erosion of the concept of social optimum (Marek M. Kamiński).

The eighth contribution to the volume shows idealizations and limiting cases in models as playing an exploratory role in science; the authors distinguish four senses of explorations and illustrate their claims with three case studies from physics; finally they compare their account of idealization with Michael Weinsberg's three-fold taxonomy (Elay Shech, Axel Gelfert). The ninth paper calls for the need to introduce analysis of value judgements into literature on economic modelling; the author uses the prescription formulated by Max Weber that social scientists should openly state values and policy ends they accept while doing research and he adds this requirement to Uskali Mäki's

‘model of a model’ (Robert Mróz). In the final article the authors explicate the very term of ‘integration of sciences’ in order to disentangle it from the concepts of unification and interdisciplinarity; they support their account on integration with a case study and argue that the methodology of humanities may play an important function in integration trials (Jarosław Boruszewski, Krzysztof Nowak-Posadzy).

The editors of this volume of *Studia Metodologiczne (Dissertationes Methodologicae)* believe that this issue will foster more systematic and deepened insights into the culture(s) of modelling in science(s). Still, there are other research practices in science to be explored through the cultural lens, namely theorizing, measurement, experimentation or simulation.

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