BOOK REVIEW

Rasmus Grønfeldt Winther, *When Maps become the World*, Chicago: The University of Chicago Press, 2020

Hernán Bobadilla[1]

Rasmus Grønfeldt Winther's latest book, *When Maps Become the World*, is a valuable contribution to the philosophy of scientific representation. Its central premise is that a philosophical investigation concerning the making and employment of maps may enlighten scientific practices of representation in fields other than cartography. The book is structured around this premise in two main parts. In Part 1 (the 'philosophy' part), Winther engages in what he calls 'map thinking': a philosophical reflection on what standard geographic maps are and how they are made and used (p. 4). In Part 2 (the 'science' part), Winther assesses how the results of his philosophical reflection on maps bear on different cases of scientific representation.

In the book's introduction (Chapter 1), Winther tackles the obvious question: 'Why maps?'. Maps are presented as an expedient context to learn about representational practices, mainly due to the pervasiveness and variety of 'mapping' endeavours in human history. As Winther claims, the impulse of representing space visually and communicating such representations to others is arguably as old as *Homo sapiens*, if not older (pp. 5–7). Furthermore, there has been a prolific, diverse, and well-documented modern tradition of mapmaking in the 'West' for at least five centuries (pp. 7–8). Consequently, maps are familiar objects whose features and related practices—although dissimilar—are reasonably understood or, at least, more readily accessible to examination. Winther's methodology is straightforward: to explore the vast and complicated (i.e. representational practices in science and beyond) by analogy with the more specific and familiar (i.e. mapping practices).

Winther explores the scope of the analogy between maps and scientific representations, together with its limitations, in the first chapter of Part 1 (Chapter 2). At its core, the so-called 'map analogy' posits that the relation of scientific theories and models to the world is analogue to the relation of maps to territory. In this

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✉ Hernán Bobadilla
hernan.bobadilla@univie.ac.at

1   Department of Philosophy, University of Vienna, Universitätsstraße 7, 1010 Vienna, Austria

⌂ Springer

sense, theories and models can be characterized as "maps" of the world (p. 29, 46). Winther shows that the map analogy has a significant bearing not only on scientific endeavours but also on humanistic inquiry (pp. 40–52). Given its ubiquity, it is crucial to conduct an 'assumption archaeology' of the map analogy. This way, the assumptions embedded in the representational practices of users of the map analogy can be unearthed and properly assessed. Winther suggests that three main assumptions are embedded in the employment of the map analogy to understanding knowledge building across the sciences. The first assumption is that the insights that scientists produce are some kind of 'spatialized knowledge', with 'space' broadly conceived. The second assumption is that scientific representation involves representational practices, such as selecting and simplifying, which are also present in cartographic mapmaking. The third assumption is that scientific and cartographic representations are influenced by their political and social contexts (pp. 54–55).

In Chapter 3, Winther introduces two central and complementary representational practices, namely 'abstraction' and 'ontologizing'. In abstraction, the world is represented via measurements and conceptualization (as in 'mapmaking'). Winther argues that abstraction is conducted in three stages. In the first stage, units and coordinates are calibrated. In the second stage, data is collected and managed. And in the third stage, the data is generalized through different protocols for selection, simplification, classification, symbolization, and exaggeration. In ontologizing, a representation is deployed to function in the world (as in 'map use'). Winther proceeds to explore four forms of ontologizing practices: representation testing, changing the world, understanding the world, and pedagogical uses.

Chapter 4 discusses two scenarios that result from ontologizing, namely 'pernicious reification' and its benign counterpart 'contextual objectivity'. Pernicious reification results from overestimating the representational capacities of certain representations ('universalizing') and/or overly constraining their nuances and diversity ('narrowing'). To avoid pernicious reification, Winther promotes the practice of contextual objectivity. According to this practice, the relation between representations and the world is one of 'conformation' in some regards to a certain degree, where 'conformation' comprises several notions for epistemic success (e.g. truth, similarity, isomorphism, fit, alignment, and homomorphism). A special feature of conformation is that it can only be assessed from a particular standpoint or context, i.e. it is 'essentially indexical'. Because of this, contextual objectivity calls for an assessment of conformation of multiple representations in different contexts. This assessment is conducted in what Winther calls 'integration platforms', which are data management devices that allow for a compared evaluation of representations in context. Winther explores these practices in a detailed discussion concerning the ontologizing of cartographic projections in modern maps.

In Chapter 5, Winther develops his ideas on conformation and contextual objectivity further by exploring the representational relation between map and world. He spends some time discussing canonical accounts of representation, namely the 'isomorphism' and 'similarity' accounts. These accounts are relevant to understand how the 'metric' and 'symbolic layers' of maps conform to the world. However, to grasp how maps *become* the world (or worlds), a third account of representation is required to take care of the 'ontological layer' of maps, namely the 'multiple representation'

account. According to this account, there are three progressive stages in which users of maps implement them in the world. The first stage is 'ontologizing', in which the user of a representation takes the representation to be the world. In the second stage, referred to as 'merely-seeing-as', the user of the representation realizes that the content of the representation is merely one way to depict the world. This realization is typically achieved by conducting assumption archaeology. The third stage is 'pluralistic ontologizing', in which different representations are ontologized through a comparative analysis in integration platforms. This third stage is the peak of contextual objectivity: The representation is one among many and the world is one among many mapped (p. 128).

In Part 2, Winther conducts three case studies to assess the impact of map thinking and the map analogy in understanding representational practices across the sciences. In particular, these case studies involve a great component of assumption archaeology, which Winther conducts at length and in great detail. In Chapter 6, Winther examines practices of mapping space. He focuses on four kinds of maps being used in four distinct disciplines: extreme-scale maps in cosmology, literal cartographic maps in geology, state-space maps in physics and physical chemistry, and analogous maps in mathematics. In Chapter 7, Winther discusses three cases of pernicious reification of causal maps and their overcoming via 'countermaps' in three domains: migration studies, brain sciences, and statistical causal analysis. And in Chapter 8, Winther shows how seven distinct maps in the field of genetics can be used as part of an integration platform to advance contextual objectivity.

The closing chapter in Part 2 provides insights on three further applications for map thinking and the map analogy. First, Winther suggests that map thinking plays a role in deciding matters of existence. More explicitly, he suggests that three canonical philosophical approaches to existence—constructivism, empiricism, and realism—should be taken as components of an integration platform. This way, these approaches may inform what exists in a contextually objective fashion. Second, a similar situation obtains in discussing scientific methodology. The different forms of inference or styles of reasoning practiced in science can be imagined as philosophical maps of how science is conducted in a way that aligns with Winther's multiple representation account. Third, a similar case is made in the context of philosophical methodology with a focus on three practices: assumption archaeology, tracking ethics and power tracing, and imagining 'what-if'.

Winther's writing and reasoning is clear and engaging. For the most part, this book is widely accessible to non-expert readers. And for those readers who might be intimidated by slightly more technical philosophical topics, Winther provides a 'symbology' that indicates the level of philosophical depth reached in sections across Part 1. The book counts with several reproductions of maps and other illustrations—some of them in full colour—which improve the presentation of the overall argument and illustrate the case studies. The book also counts with proposed activities designed to make the reader reflect upon her or his implicit assumptions and representational biases.

If I was pushed to criticize something about Winther's excellent book, it would be the extremely wide-ranging scope of the map analogy and the far-reaching impact of map thinking. My concern is that Winther's thesis may itself fall prey to pernicious

reification given its seemingly unconstrained scope of application. This is a particularly sensitive issue given the thesis' normative elements. I suspect that Winther would not wish his thesis to suffer this fate, but he does not do much to dispel it. In fact, one could argue that Winther overstates the power of map thinking and the map analogy by focusing almost exclusively on the positive analogies between mapping practices and scientific representational practices. To avoid a potential pernicious reification of his own thesis, Winther might have benefitted from spending more time spelling out the disanalogies between maps and scientific representations. To be clear, the risk of pernicious reification does not come via 'universalizing': Winther does not claim that his model is intended to be the one and only model suitable to understand representational practices. However, the scarcity of nuance in the map analogy—embodied in a lack of attention to disanalogies—may be interpreted as an opportunity for pernicious reification in the form of 'narrowing'.