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Nominalism and constructivism in seventeenth-century mathematical philosophy

David Sepkoski

Department of History, Oberlin College, Oberlin, OH 44074, USA

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Abstract

This paper argues that the philosophical tradition of nominalism, as evident in the works of Pierre Gassendi, Thomas Hobbes, Isaac Barrow, and Isaac Newton, played an important role in the history of mathematics during the 17th century. I will argue that nominalist philosophy of mathematics offers new clarification of the development of a "constructivist" tradition in mathematical philosophy. This nominalist and constructivist tradition offered a way for contemporary mathematicians to discuss mathematical objects and magnitudes that did not assume these entities were real in a Platonic sense, and helped lay the groundwork for formalist and instrumentalist approaches in modern mathematics.
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Résumé

Cet article soutient que la tradition philosophique du nominalisme, évidente dans les travaux de Pierre Gassendi, Thomas Hobbes, Isaac Barrow et Isaac Newton, a joué un rôle important dans l'histoire des mathématiques pendant le dix-septième siècle. L'argument principal est que la philosophie nominaliste des mathématiques est à la base du développement d'une tradition « constructiviste » en philosophie mathématique. Cette tradition nominaliste et constructiviste a permis aux mathématiciens contemporains de pouvoir discuter d'objets et quantités mathématiques sans présupposer leur réalité au sens Platonique du terme, et a contribué au developpement desétudes formalistes et instrumentalistes des mathématiques modernes.
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In the middle decades of the 20th century, historians of 16th- and 17th-century mathematical sciences tended to focus on the conceptual or metaphysical foundations of mathematical natural philosophy. This

E-mail address: dsepkosk@oberlin.edu.

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approach, exemplified in the work of scholars such as E.A. Burtt [1952], Alexandre Koyré [1978], and E.J. Dijksterhuis [1961], had a major role in defining the period of time now traditionally known as the "scientific revolution." While this conceptualist program has been eclipsed in more recent decades by studies of the social, institutional, and technical context of early modern mathematical practice, there remains a strong tradition in intellectual history of mathematics. Recent scholarship by Paolo Mancosu [1996], Douglas Jesseph [1999], Niccolo Guicciardini [1999], Michael Mahoney [1998], and Peter Dear [1995] has analyzed intellectual traditions in mathematical practice and shown that 17th-century mathematical philosophy developed out of a more complex and heterogeneous web of influences than was envisioned by what H. Floris Cohen calls the "Great Tradition" in 20th-century historiography [Cohen, 1994, Ch. 2].[1]

One liability, however, in the greater degree of specialization with which historians have approached the history of early science has been a fragmentation of the older, more unified narratives. This is particularly the case in the history of mathematics. While we now have a better understanding of the diversity of mathematical practices, methods, and traditions in the 16th through 18th centuries, there is a need to connect the history of mathematics with a broader view and with attention to its general philosophical context. This need is more than simply historiographical: early modern natural philosophers themselves did not separate mathematical and scientific pursuits from more general questions in philosophy, so understanding the philosophical basis of their beliefs gives important insight into the development of contemporary mathematical natural philosophy.

In this paper, I will contextualize a particular approach to mathematical philosophy in the 17th century within the framework of a broader epistemological and philosophical movement: the early modern resurgence of the medieval tradition of nominalism. Nominalism has been connected by scholars to important epistemological and scientific developments in the 17th and 18th centuries, particularly in relationship to theological and biological questions.[2] It has not, however, been widely promoted as a factor in early mathematical practice and philosophy.[3] This paper will argue, nonetheless, that nominalistic strategies provided 17th-century practitioners, including Pierre Gassendi and Thomas Hobbes, with an important set of arguments for describing the ontological content of mathematical entities and magnitudes in a way that departed from Platonic realist accounts without sacrificing reference to empirical experience. This nominalistic approach, I will argue further, was closely linked with the development of a constructivist philosophy of mathematics, which has been linked by a number of recent scholars to the geometric and analytic practices of mathematicians such as Isaac Barrow and Isaac Newton. More generally, I hope to demonstrate the close relationship between mathematical philosophy and wider philosophical and theological beliefs during the scientific revolution, and to reinforce the historiographical point that, at least during the early modern period, the history of mathematics was inextricably linked with contemporary currents in broader intellectual culture.

[1] Cohen uses this term to refer to the historiographic model established by Burtt, Koyré, Dijksterhuis, and Herbert Butterfield.

[2] On the relationship between nominalism and early modern thought, see Dupre [1993, especially Chs. 3, 5, and 7] and Funkenstein [1986]. For a discussion of the relationship between medieval and early modern theology and nominalism, see Osler [1994, pp. 115–116]. On nominalism and the history of biology, see Stamos [1996, pp. 127–144] and Mayr [1976, pp. 429–430].

[3] Jesseph [1999, pp. 205–211] takes up the subject of Thomas Hobbes's nominalism, and he also discusses nominalism in relation to George Berkeley's formalist mathematics [1993, pp. 118–120].

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