In Memory of Mark Steiner

Locked down in our homes, like so many around the world, we, in Jerusalem, and elsewhere in the philosophical community, are mourning the loss of a beloved colleague, teacher, friend, and an outstanding philosopher of science and mathematics. Mark Steiner, Professor of Philosophy at the Philosophy Department of the Hebrew University of Jerusalem, passed away on Monday, the sixth of April after a relatively short struggle with the Coronavirus. A week earlier he was still preparing his classes on David Hume (via Zoom) and pursuing his work on Maimonides, work that continued to occupy him even during his first days in hospital. That his intense intellectual activity continued almost to the very end is perhaps some consolation, but at the same time it intensifies the feeling of loss and untimeliness.

Mark Steiner was a wonderful person, cheerful and optimistic, outspoken in his critique, but immensely generous in his evaluation of colleagues' and students' work. A loving spouse and devoted father, he was sensitive to the demands of students' personal lives, in particular the demands of motherhood. He not only believed in gender equality, he practiced it. His terrific sense of humor made his insightful classes and talks extraordinarily witty and amusing.

Born in New York City, Steiner graduated from Columbia College in 1965 (summa cum laude) and gained his Ph.D. from Princeton University in 1972. His teachers in Columbia, among them Isaac Levi, Sidney Morgenbesser, and Charles Parsons, became lifelong correspondents and friends, as did his Princeton Dissertation Director, Paul Benacerraf. He held several prestigious fellowships and grants, including a Fulbright Fellowship in Oxford in 1965-66, a Dibner Fellowship at MIT in 1997-98, and grants from the National Endowments for the Humanities (NEH), National Science Foundation and the Israel Academy of Arts and Sciences. He taught at Columbia University until 1977, when he moved to the Hebrew University of Jerusalem, his home

I am grateful to Carl Posy for reading these notes, written after the *shiva*, and correcting a number of infelicities, and to Joseph Stern for writing the section on Steiner's engagement with Jewish philosophy.

© *Iyyun • The Jerusalem Philosophical Quarterly* 68 (July 2020): 211–217

university ever since. Here he became Professor, Chair of the philosophy department (1989–1996), and, in the last decade, Editor of *Iyyun: The Jerusalem Philosophical Quarterly*. Of the numerous talks he gave at conferences and lecture tours in distinguished universities throughout the world, Steiner was especially proud of the connection he established with Chinese philosophers. In 2013, he gave a two-month graduate seminar on Wittgenstein at the Sun Yat-Sen University and on other occasions he delivered talks in Beijing, Shanghai, and Guangzhou.

In addition to the many papers he published in leading philosophical periodicals and collections, Steiner authored two influential books, *Mathematical Knowledge* (Cornell University Press, 1975) and *The Applicability of Mathematics as a Philosophical Problem* (Harvard University Press, 1998). He translated three volumes from the Yiddish (adding notes and an introduction): *Faith and Heresy*, *Principles of Philosophy*, and *Ancient Greek Philosophy*, all by Reuven Agushewitz (published by Yeshiva University Press, 2006, 2008, 2010, respectively). He is the Academic Editor of a translation into Hebrew of Hume's *A Treatise of Human Nature*, to which he wrote an extensive interpretive essay as introduction (translation by Iftach Brill, Shalem Press, 2013). In what follows, I will try to provide a brief survey of some of Steiner's major contributions to philosophy.

Making the assumption that "most people know some mathematical truths, and some people know many," *Mathematical Knowledge* (MK) raises the question of how that knowledge is *acquired*, how mathematical truths come to be known. Although in this form, the question has been mostly ignored, Steiner maintains that answers (purported answers) could be extracted from some of the central positions in the philosophy of mathematics. If these purported answers turn out to be unsatisfactory, or worse, if a philosophical position implies that mathematical knowledge is *impossible*, that would count, according to Steiner, against the position in question. The book consists in an in-depth examination of logicism, formalism, and Platonism from the perspective of their replies to the question regarding the acquisition of mathematical knowledge. The examination casts Platonism in a more favorable light than either logicism or formalism, but even Platonism, Steiner argues, is hard pressed when faced with the challenge of providing an epistemology for mathematics. Ontologically, Platonism is driven by an analogy between the concrete material world and the abstract realm of mathematics. But whereas the typical answer to the question of how we come to know the material world invokes perception, it is not clear that there is an analogue of perception that can play the same role in the mathematical realm. Epistemically, then, the analogy may break down.[1] Seeking to retain the analogy, Steiner concludes with a (cautious) defense of mathematical intuition. Like perception, intuition is not infallible, and does not provide conclusive justification, but acknowledging its existence throws light on how mathematicians (and sometimes ordinary people) come to 'see' mathematical truths.

Steiner's commitment to mathematical truth and mathematical knowledge sets him apart from positions that construe mathematics as formal, contentless, or conventional, and, more generally, from positions that drive a wedge between mathematics and the empirical sciences. Indeed, like Quine and Putnam, Steiner views mathematics as continuous with these sciences. "Mathematics is a science, whose methods differ little, in principle, from those of other sciences. … Mathematics can be distinguished from the other sciences only by its subject matter – not on the grounds that it has none" (MK, p. 21). Further, he is sympathetic to the indispensability argument according to which mathematics is part and parcel of science and is therefore justified in the very same way that scientific theories are justified, that is, by the truth of the observation sentences these theories imply. It would seem that this account of mathematics provides a different answer to the question of how we come to know mathematical truths than that reached at the end of *Mathematical Knowledge*, for we could say that the acquisition of mathematical knowledge is no different than the acquisition of scientific knowledge. Steiner distinguishes, however, between justification and acquisition. While it may be true that the indispensability argument is relevant to the justification of mathematical truths, it does not provide an answer to the question of how we come to know them.

Interestingly, Steiner's understanding of mathematics as a science, on a par with other sciences, led him (towards the end of *Mathematical Knowledge*) to dismiss the problem of the applicability of mathematics: "Only a pseudo problem, therefore, lurks in the 'applicability' of mathe-

[1] This worry is the focus of P. Benacerraf, "What Numbers Could Not Be," *Philosophical Review* 74 (1965): 47–73.

matics to the world" (MK, p. 129). As it turned out, Steiner could not leave it at that. His efforts to come to grips with the allegedly 'pseudo' problem culminated is another book – *The Applicability of Mathematics as a Philosophical Problem*. It's not (I guess) that Steiner thought he was completely wrong. Rather, he realized that there are several different problems going by the same name and that philosophical work is required to distinguish between them and sieve out the ones that had been solved from those that are still pending. Thus, Steiner argues, two of the problems often referred to as problems of the applicability of mathematics – the semantic problem (of how the deduction from arithmetical theorems to their applications works) and the metaphysical problem (pointing to the ontological gap between mathematics and the world) – had already been solved by Frege. In both cases, the crux of the matter is that for Frege numerals are second-order predicates and the laws of arithmetic are second-order laws that apply to *concepts*. The concepts, in turn, are applicable to the physical world.

It is the *un*solved problem of the applicability of mathematics, however, that occupies Steiner in this book and it is his response to this problem that makes this work so daring and original. The problem can be divided into two: First, how exactly is mathematics applied; in what ways does it underpin physical theory? Second, what makes this kind of application work? Steiner takes it to be an empirical fact that physicists describe the world in mathematical language and argues that in so doing they base themselves on mathematical *analogies*. Mathematical analogies, he maintains, have become crucial for physics with the exploration of the atomic and subatomic world. For it then became evident that as far as its physical laws are concerned, the new terrain is fundamentally different from the old and that in exploring it physical analogies would be of no avail. Mathematical analogies use laws that cannot be couched in nonmathematical terms, laws that *prima facie* have no nonmathematical meaning. Moreover, in some cases, the analogies used in modern physics are completely *formal*, that is, they are based on the notation of the theories in question, not on their contents. Steiner substantiates these claims in great detail by analyzing the development of quantum mechanics, quantum chromodynamics, and gauge theory. The abundance of examples leads Steiner to claim that it is the overall strategy that we should ponder, not its individual instances.

Why should this strategy work? As the title of the book indicates, grasping the depth of the question is no less important than answering it. According to Steiner, mathematics is anthropocentric! It is guided and defined by *human* criteria of beauty and convenience, attributes to which the world ‘out there’ is supposedly utterly indifferent. On this account of mathematics the success of mathematical physics is indeed mindboggling. Why should the world accommodate our idiosyncrasies? Mainstream philosophy of science is naturalistic, that is, it denies *homo sapience* a privileged standing in the universe. Giordano Bruno, Copernicus, and Darwin, we are told, heralded the naturalistic message, and modern astronomy and cosmology further confirm it. Steiner, however, begs to differ. The universe, he believes “is (or rather: appears to be) an intellectually ‘user friendly’ universe, a universe which allows our species to discover things about it” (p. 8). The applicability of mathematics thus provides strikingly new support for divine grace. Hence, also, “the importance of the enterprise of scientific inquiry from a religious point of view” (ibid.).

Let me now say a few words about some of Steiner’s philosophical papers. In the years following the publication of *Mathematical Knowledge*, Steiner turned his attention from the notion of knowledge to the notion of explanation. Noting that mathematical proofs, even when equally valid, can vary dramatically in explanatory force, he sought to find out what it is that makes a proof explanatory. Having shown that simple answers such as generality and abstractness won’t work, he proposed that “an explanatory proof makes reference to a characterizing property of an entity or structure mentioned in the theorem, such that from the proof it is evident that the result depends on the property.”[2] To support this claim Steiner goes over various proofs in different areas of mathematics, the most familiar of which is perhaps the proof of the Pythagorean Theorem based on the characteristic property of the right triangle – its decomposability into two triangles similar to each other and to the whole. While there are other proofs of the theorem, none of them passes Steiner’s test for explanatory import. This paper has spawned an ever growing literature about mathematical explanation itself and about the relation of mathematical explanation to scientific explanation.[3]

[2] Steiner, “Mathematical Explanation,” *Philosophical Studies* 34 (1978): 143.

[3] For more on these developments, see Paolo Mancosu’s entry, “Explanation in Mathematics,” in the *Stanford Encyclopedia of Philosophy*.

In "Mathematical Realism"[4] Steiner addresses the question of realism in mathematics, comparing it with the question of scientific realism. In both areas, he contends, the key is independence. If the same physical term (property, quantity) plays an essential role in two independent theories, there is good reason to see the entity referred to by this term as real. And similarly for mathematics. The number π is a salient example: Its independent appearance in two different areas of mathematics, in geometry and in analysis, attests, according to Steiner, to its reality.

From early on, Steiner was intrigued by Wittgenstein's philosophy of mathematics. Though critical of several of Wittgenstein's ideas, Steiner was attracted to the view that mathematical rules develop out of empirical generalizations 'hardened' into fixed rules. Steiner expounded this position both as a novel interpretation of Wittgenstein's later philosophy of mathematics and as a viable understanding of mathematics, one that ties mathematics to the empirical world.

Steiner had a long-standing interest in Jewish philosophy. His earliest work was on non-canonical figures like R. Israel Salanter (1810–1883), the founder of the *Musar* movement, in whose writings he identified a novel version of virtue ethics. As part of his impressive knowledge of rabbinics, which he pursued throughout his life, Steiner was also an accomplished scholar of Maimonides' halakhic, or legal, writings. But in the last decade Steiner "discovered," as he put it, Maimonides the philosopher and his *Guide of the Perplexed*, and over the last three years was deeply engaged in its study. He was especially interested in Maimonides' metaphysics (e.g., his conception of God, divine unity, and incorporeality, and the nature of divine knowledge), its ramifications for idolatry and freedom of action, and the relation between the philosophical views put forth in the *Guide* and in Maimonides' legal code, the *Mishneh Torah*. He also explored uncanny parallels between Hume's physics in the *Treatise* and the physical theory of the Kalam as presented by Maimonides and implications for our understanding of possibility and imaginability (including contemporary work on this topic by, e.g., Charles Parsons). At the time of his untimely passing, he was deeply engaged in exploring Maimonides' acquaintance with the great Islamic critic of the *falasifa* (Aristotelian philosophers), Al-Ghazali. Although their relation is a topic

[4] *Noûs* 17 (1983): 363–85.

of current lively debate, Steiner was focusing on surprisingly unexplored sources for Maimonides' arguments concerning creation, causation, and immortality. And philosopher that he was, Steiner, unlike most other contemporary Maimonides scholars, was most interested not in what Maimonides believed, but in whether he had the arguments that would justify his claims. Three papers on these subjects have been published in the last three years; additional manuscripts will hopefully be prepared for publication in the near future.[5]

Writing these notes was a painful experience, but at the same time it had a therapeutic effect in giving me the illusion of being able to continue the conversation, a conversation that went on for several decades and ended, traumatically for me, when Mark called from hospital but could no longer talk.

Yemima Ben-Menahem
The Department of Philosophy
The Hebrew University of Jerusalem

[5] Steiner's paper, "Principle K in Maimonides' *Commentary on the Mishnah, Mishneh Torah*, and *Guide of the Perplexed*," is published in this issue.