paradoxes were interpreted as a threat to logic.

The paper throws some light on the origins of modern logic and helps us to understand the fate shared by logic and set theory — and so to logic and mathematics — during this relevant period.

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Miguel Espinoza, "El desmigajador de la realidad: Wittgenstein y las matemáticas," *Mathesis* **X**, no. 2 (May 1994), 171–186.

Reviewed by

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In this thought-provoking paper, Wittgenstein's philosophy of mathematics is explained and criticized. Wittgenstein's view is classified as anthropocentric constructivism and also as empiricism or behaviorism. Espinoza asks: "¿Cómo no calificar de empirismo o de conductismo la idea de que el significada de un concepto sea dado por la práctica, por la acción o por su uso?" (p. 174). It is probably not *behaviorism* but the *pragmatisim* label which goes better with Wittgenstein's philosophy of mathematics. In any case, it is true that Wittgenstein denies that numbers have an essence and that there is a mathematical reality outside of and apart from the use we make of it. Espinoza argues that Wittgenstein's thesis of linguistic games has the effect of destroying mathematical unity and coherence and thus one of the roots or features of interest that mathematics has for our system of knowledge.

Espinoza considers that, for Wittgenstein, mathematics is essentially algorithmic and that this can be seen in the importance he attaches to proofs, The author stresses the similarities between Wittgenstein and Brouwer regarding their philosophies of mathematics and shows how Brouwer's view is deeper than Wittgenstein's. The philosophy of mathematics favored by Espinoza is *realism*, the thesis that mathematical objects are independent of our minds. From this point

of view, Wittgenstein's philosophy of mathematics seems completely wrong from beginning to end, and superficial at that. The main thrust of Espinoza's argument against Wittgenstein's position is that no anti-realist view of mathematics can explain its applicability to natural sciences.

Espinoza also sees Wittgenstein's philosophy of mathematics as a mere application of the philosophy of his second period (although there is no explicit distinction in this paper between Wittgenstein I and Wittgenstein II) and he concludes that Wittgenstein's conception is untenable: something must be wrong with his whole philosophy of meaning.

Although Wittgenstein's philosophy of mathematics is not the most popular part of his philosophy and, I would say, misconceived from the very beginning, I think that its refutation needs stronger arguments than those offered here. The paper is nevertheless a worthwhile contribution to the complicated topic of the nature of mathematics.

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William Aspray, *John von Neumann and the Origins of Modern Computing*. History of Computing, the MIT Press, 1990. xvii + 376 pp.

Reviewed by

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Interest in applications of mathematics is on the rise these days. As job opportunities in pure mathematics have become increasingly tight, many recent Ph.D.'s, as well as some less recent Ph.D's, look for Wall Street, engineering, business management, and so on, to put their talents to other good uses. Mathematicians oriented towards logic and foundations in oparticular seek and find opportunities in the field of computing. John von Neumann preceded them. William Aspray's