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Review of
MARTIN DAVIS, *ENGINES OF LOGIC*
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MARK FULLER

It is rare to run across a book—even rarer, a popular book—that adequately conveys the power of *ideas* behind the man-made part of the world around us. The book under review is just such a book. The lay reader should come away from it with a good "feel" for how much logic underlies the computer software that is ubiquitous in our lives today. There is a careful balance between the exposition of ideas and the biographical and historical elements connected to the main characters, imparting a good depth to the story. It would be an excellent companion to a formal logic text in an introductory logic course.

The first seven chapters take one main character in this history of ideas at a time: Leibniz, Boole, Frege, Cantor, Hilbert, Gödel, and Turing. An eighth chapter covers quickly the various prototypes of our present-day computer, beginning with Jacquard's programmable loom and ending with Turing's ACE (Automatic Computing Engine). A final chapter touches briefly on the ongoing controvery regarding how comparable to the human mind a computer might or might not be. Spanning the first seven chapters is a thin thread of historical ties which the author simultaneously follows: Leibniz's genealogical work helps to enable his patron, the Duke of Hanover, to become an English king, King George I; King George II's wife, the daughter-in-law of George I, instigates a correspondence between Leibniz and Samuel Cooke, whose proof for the existence of God is used by Boole as an application of his newly created algebraic logic; and King George II establishes the university at Göttingen, which, during the presidency of Felix Klein, lures Hilbert to come work there. Thus are precariously linked—to our utter bemusement!—Leibniz, Boole and Hilbert. The lengths of these time intervals (Leibniz-Göttingen, Göttingen-Boole, &c.) are, at the start, on the average of 70 years each, steadily contracting until Hilbert's sojourn at Göttingen begins, from which moment onward the intervals are mere years and the historical ties become more evident, the 'science'

of formal or symbolic logic having been firmly established by the end of Hilbert's life. Both Hilbert's initiative as well as his promotion gave a true direction to the field of mathematical logic: Hilbert's addresses to Mathematical Congresses in 1900, 1904 and 1928—beginning with his inclusion of three meta-mathematical problems among his famous list of problems in 1900—became increasingly precise in their formulation of meta-mathematical problems to be solved.

The most clear and continuous strands in this history of ideas leading to the birth of the computer comprise both Leibniz's idea of a *lingua characteristica* (a perfect symbolism expressing truths) as well as his idea of a *calculus ratiocinator* (a mechanical means of dealing with the symbolism, by which truth could be decided or deduced). Replayed through time is a desire to enable us all to become people 'of good will' who get out our pens and intone *Calculemus!*—let us calculate!—having no need for debate, only for soberly finding out the truth. Boole was really the first 'modern' logician to revive or keep alive the latter mechanical language with his algebraic logic. And Frege was the first to truly fully implement both of Leibniz's ideas.

Martin Davis's book is a gem. After you've read it, you'll want to buy extra copies for your students.

University of Wisconsin — Rock County, 2909 Kellogg Ave, Janesville, WI 53546

E-mail address: mfuller@uwc.edu