

BOOK REVIEW/COMPTE RENDU

Claude Rosental, *Weaving Self-Evidence: A Sociology of Logic*. Translated by Catherine Porter. Princeton, NJ: Princeton University Press, 2008, 296 pp. \$US 24.95 paper (978-0-691-13940-1), \$US 85.00 hardcover (978-0-691-13741-4)

Weaving *Self-Evidence* is a bold study in the sociology of knowledge. It is not merely a study of lay or everyday logic, but instead, of professional research in mathematical logic. There is such a wealth of empirical studies in science and technology studies (STS) that a study of logic might seem unremarkable. Yet, there is also something striking about an attempt to understand logic sociologically. Logic is often supposed to be the foundational, even of mathematics.

The status of logic as a foundation for other forms of reasoning and inquiry is complicated. Ordinary mathematics is well removed from logic, in that the work to formulate most mathematical proofs in the terms of mathematical logic would be overwhelming, and would introduce more potential errors and problems than it would remove. Indeed, formal logic is similar enough to (rather than foundational to) mathematics that Rosental's study could easily be one of mathematics; this is made obvious by the fact that much of the relevant literature on which Rosental draws is work in the sociology and philosophy of mathematics.

An early chapter of *Weaving Self-Evidence* draws on observations of an introductory class on logic for graduate students in philosophy. Much of the work of learning elementary logic is learning how to translate ordinary language into the formalism. Translation practices involve deciding what parts of ordinary language are formal and what parts are empirical, and then coding each in the formalism. Whereas students may begin their logic training believing that the distinction is arbitrary, they do exercises until they are able to consistently produce appropriate formalisms. After they learn to translate ordinary language into logical language, they learn to perform operations on the formalisms, until some operations become self-evident. Although logicians often portray (classical) logic as the structure of proper reasoning, Rosental places it as a set of material practices. Thus a discipline notable for studying the most abstract of objects can itself be studied through very concrete traces.

The bulk and core of Rosental's book is a detailed study of a single proof. In 1993, Charles Elkan, Assistant Professor in the Department of Computer Science at the University of California San Diego, put forward a putative proof of the inconsistency of fuzzy logic, as well as an argument that the successful technical uses of fuzzy logic were less remarkable than they seemed. Trained in classical logic, Elkan began thinking about fuzzy logic after reading a popular magazine article.

Elkan's proof concluded that fuzzy logic, which has many truth values between "true" and "false," collapses into classical logic, which has just the two truth values. The proof was submitted to the 1993 conference of the Association for the Advancement of Artificial Intelligence, published in the proceedings of that conference, and recognized as an important contribution to the field. Immediately following its publication, the proof was subjected to intense scrutiny and discussion on an online forum devoted to fuzzy logic. Thus this study has the advantage of working from a controversy, in which assumptions and questions are made manifest by the participants. Rosental was able to analyze the archive of the online forum at leisure, interview some of the contributors, and read subsequent publications.

Fascinating about that discussion was the diversity of views about the proof. Many people argued that the proof was flawed, but found the flaws in very different places and disagreed with each other's evaluations. As a result of the discussion, within the fuzzy logic community certain authoritative views stabilized as the correct assessment. By virtue of particular authors' status, bold assertions, and effective pedagogical techniques, the participating fuzzy logicians mostly came to agree that Elkan's proof illegitimately used the law of the excluded middle (either A or not-A is true), which does not apply within fuzzy logic. Thus fuzzy logicians rejected the proof as having made an elementary error. Indeed, Elkan had earlier submitted his paper to a conference on fuzzy logic, where it had been quickly rejected as being straightforwardly flawed.

The process of evaluating the proof involved many attempts to reveal or *show* what was in it, but could not be seen. Because of this, Rosental uses the term *de-monstration*, to emphasize the showing function of work in logic. Discussions literally made implicit premises appear and disappear, as parts of the proof were written and rewritten. Successful persuasion was a matter of stabilizing some appearances over others. Rosental's primary contribution in this book is probably his extremely detailed analysis of the rhetoric of logic, in different registers. His own *de-monstrations* show how the structure and meaning of a controversial proof is the result of rhetorical actions on it.

Elkan, however, was a skilled mediator, and had further ambitions for his proof. Rather than let the fuzzy logicians determine the status of his work, he engaged his critics one at a time, attempting to address their de-monstrations. He refined his claims in the final journal article presenting it, narrowing his sights on an “apparently reasonable” version of fuzzy logic, and making explicit the specific instance of the law of the excluded middle on which his proof depended. As a result, the critics could largely agree with him, construing the proof as showing the danger of a particular mistake that fuzzy logicians might make. The form, meaning, and implications of the proof had changed and stabilized.

The case is unusual in two ways. First, the proof was controversial, whereas the vast majority of proofs in logic and mathematics are not, at least once they reach the form in which they are publicly displayed. That controversy was one of the key factors allowing Rosental to do his rhetorical and more broadly sociological analysis, because it made features of the proof appear that would otherwise never have been visible. Second, the proof was initially a challenge of an entire logic, something we might see as a form of (research) life. Thus, some of the issues were of very large scope, and the disagreements profound. Elkan’s critics devoted considerable energy to the controversy because they saw in the proof a possible threat to funding of projects in fuzzy logic.

In the history of STS, hard cases, from mathematics to laboratory manipulations, have played key roles. This book should enter the field as an exemplary treatment of a hard case.

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