The British Journal for the History of Science (2025), 1–2
doi:10.1017/S0007087425101398

BOOK REVIEW

Kevin Lambert, *Symbols and Things: Material Mathematics in the Eighteenth and Nineteenth Centuries*

Pittsburgh: University of Pittsburgh Press, 2021. Pp. 330. ISBN 978-0-8229-8841-0. $55.00 (hardcover).

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Kevin Lambert does not quite call his long-awaited monograph an environmental history of mathematics. But his lucid and stimulating account of the material conditions and manifestations of a particular constellation of mathematical theorizing in Britain hinges on the meaningful weave of physical, technical, institutional, social, economic and other environments. With its recurring critical consideration of context and temporality, the book's methodological environmentalism is much more than a convenient metaphor.

The book brings fresh energy to two rich and interlinked areas of the historiography of mathematics and mathematical physics, integrating and going well beyond several interventions Lambert has made in these areas over his career. The first area is the development of a distinctive English symbolic algebra in the early nineteenth century. The second is the development of a distinctive British approach to physical theory and its culmination in Maxwellian energy physics by the late nineteenth century. Lambert treats both historiographies with generosity and nuance, including notes and bibliography that fill a full third of the work's printed pages.

Lambert approaches these subjects through a focus on the titular inscribed paper things with which his theoretical practitioners plied their titular mathematical symbols. There are some exquisite close readings of surviving examples of these paper objects with both print and manuscript markings. Lambert's analysis is illustrated with numerous figures whose reproduction in the book could be crisper but suffices for the argument's purposes.

But the book's real strength comes from how Lambert considers these things' relationships with their multifarious environments. The more Lambert looks downward to specific material things, the more these let him sling his analysis outward to communities, intellectual agendas, institutions, infrastructures and other contexts at different scales of time and space. He shows these latter to be *material* in the word's other sense, by explaining how they matter to the mathematics in question. His analysis draws on the thriving history of science literature on scientific objects and practices, on the extensive historiographies of books and communication (not just in science), and on selected concepts and analogies from anthropologists and philosophers of cognition.

The book's seven body chapters cleave into three parts. In the first, 'Distributing', Lambert devotes two chapters to a tangle of publishing genres related, respectively, to academic textbooks and scholarly journals. His meticulous depiction of the networks of authors, publishers and readers around these genres lets him establish productive distinctions between them that clarify and prise apart a number of developments in mathematical

communication which would prove significant especially in the first half of the nineteenth century. The second part, 'Assembling', examines collecting practices associated with specific museums and libraries. These let Lambert give an enticing social and intellectual account of major theoretical contributions from Charles Babbage, George Peacock, George Boole, George Green and Augustus De Morgan. The three chapters of the third part, 'Practicing', use diagrams, notebooks and postal correspondence to explain, respectively, James Clerk Maxwell's conception of space, William Thomson's confrontation with Maxwell's theories and Peter Guthrie Tait's influential assimilation of William Rowan Hamilton's quaternions, a lynchpin for the dominance of vector calculus in subsequent mathematical physics.

Each of the great men and ideas here is historically important and deserving of attention. More important, however, is Lambert's approach of embedding these peculiar figures in expansive and suggestive contexts that prod readers to wonder productively about the many other people and developments that did not make it into his account. Deborah Kent demonstrates this expertly in her review of the book (*Mathematical Intelligencer*, 2025 https://doi.org/10.1007/s00283-025-10421-1) with a long list of historical women just offstage from Lambert's narrative, and the variant questions their histories might raise about the social and material figurations of mathematical practices. While Lambert ventures some plausible overarching historical claims, his main contribution is a framework and model for reconsidering and investigating wider landscapes of historical mathematics.

As for the more specific historical claims, I think that to understand them properly it helps to make explicit a historiographical implication of Lambert's emphasis on material things. Where Lambert argues, for example, that the specific materiality of a specific letter book was key to the flourishing of quaternionic vector calculus in physics, one must first recognize in an almost Panglossian sense that the object was quite literally essential: historically there was one specific letter book that Tait used to make sense of his voluminous correspondence with Hamilton. Idealist histories take one away from the necessity of such specific objects by letting one imagine that the same thoughts might have transpired around other possible media; Lambert's description of the physical artefact is genuinely thrilling to read, and a jolting corrective centring the media that actually made history and that evidence this history today. You will not find a convincing explanation of causal necessity deriving Tait's vector calculus idea-by-idea from the material form of the letter book, nor likewise (*mutatis mutandis*) the book's other provocative assertions about specific mathematical representations and practices. Rather, the kind of environmental explanation and understanding that Lambert develops in this book requires a holistic and non-deterministic reckoning with mathematics and its materials and contexts together.

With a closing reference to 'carboniferous capitalism' and the entwined environmental and social–technological–economic legacy of the Industrial Revolution at the crux of the book's subject matter (p. 202), Lambert nods at the stakes of material (or indeed environmental) histories of theories. Historical things, here, anchor expansive understandings of connections and dependence among people and across times and places. When our world's most pressing historiographical and political challenges alike are those of interconnection and interdependence, these kinds of histories can be particularly vital.