

Mathematics in a Postmodern Age, edited by Russell W. Howell and W. James Bradley

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This review appears in the [March 22, 2003](#) issue.

For over 2000 years philosophers (and others) have cited mathematics as one of the few areas, if not the only one, where mortals could be certain of their knowledge. Indeed, the work of Copernicus, Galileo, Kepler and Newton was deemed successful precisely because it offered mathematical explanations for physical phenomena. Aristotle and his "tendencies" went out the window. Objectivity was the new standard, and the means of measuring objectivity was mathematical rigor.

The certainty of mathematics and the objectivity of science have been core values of what is often called the modern worldview. Though this worldview may have begun in the 17th century, we have only to look at the federal budget to see that its values persist. In fiscal 1999, for example, the U.S. government allocated over \$65 billion in federal money to mathematics, science and technology, but only \$150 million or so to the arts. Mathematicians have been happy to accept their privileged status as bearers of truth, even at the cost of public ignorance about their abstract pursuits.

On what basis, then, might one challenge modern mathematical and scientific paradigms? Could we say that maybe Aristotle had it right after all? Well, no. But there is an opportunity for substantive critique from what is now called the postmodern view. To cast doubt on the presumed objectivity of science, proponents of postmodernism point out the relevance of power, culture and gender in many areas, ranging from literature and history to political science and psychology.

Even the natural sciences, and especially medical research, have come in for questioning. Critics note, for example, that it is far easier to find funding for cancer and heart disease research than for malaria or other widespread diseases of the underdeveloped world. And until recently many medical studies used only white

males as subjects, even though most diseases strike far less discriminately. Science's objectivity loses a bit of its luster when one focuses on the scramble for funding, sometimes over-blown press releases, and the occasional scandal over fraud.

The postmodern challenge to scientists' claims to objectivity and privileged ways of knowing--dubbed the "science wars"--has not played well in the science faculty lounge. For the most part, the reaction has been of the "if we wait long enough it will go away" variety. In fact, the debate about how postmodern theory might inform the practice, the process and especially the content of science has mostly taken place in departments of philosophy and programs in gender and women's studies.

Thus the "science wars" of the 1990s actually involved relatively few scientists and even fewer mathematicians. Why? Perhaps postmodernists found few political or patriarchal agendas in mathematicians' abstractions, or perhaps mathematicians have been so insular that no one noticed their influential role in the wider world.

Whatever the cause of the lack of engagement between mathematics and postmodern thought, this book makes a convincing case for the need for such a dialogue. Not only does it try to draw mathematics into a conversation with postmodernism, it also seeks to provide a meta-analysis of this conversation from a Christian point of view, and to do so without the diatribe, polemic and clever verbal skewering that marked the earlier debate.

Who should read this book? Certainly it will interest mathematicians and philosophers of mathematics, but we hope that it will find a wider audience. While portions of some chapters are quite technical--mathematically, philosophically or both--much of the book is not only accessible but highly recommended. Even when the discussion gets technical, the general exposition is so clear that the persistent reader who is willing to skim should be able to grasp the overall argument.

Though Russell W. Howell and W. James Bradley are the editors of this volume, it is a compilation of the work of ten scholars from various academic disciplines. Each chapter represents the contribution of a principal author, and together the authors have signed off on the project. All have in common their commitment to the Calvinist tradition that embraces the integration of faith and learning, and an understanding of the purpose of Christian higher education: to magnify the glory of God and God's creation. From this view, the ability to do mathematics is an

inherently good gift from God, and the Christian mathematician must consider the consequences of that gift. Thus all scholars, including mathematicians, must recognize and respond to the cultural context in which they operate. This book is such a response.

The Christian perspective espoused by the authors clearly enjoins the thoughtful practice of mathematics. But what about the content of mathematics? According to the modernist, mathematical truths are immutable and independent of human experience. They are embodiments of sure knowledge about the natural world. This book, however, sets out to question that view. It asks whether mathematical truths really are independent of human experience. In particular, is our understanding of those truths culturally constructed?

The authors first look to the historical record for evidence. The Pythagorean Theorem, for example, was known to the Chinese well before Euclid wrote it down in 300 b.c.e. It would be unsettling, to say the least, if the Chinese version were different from the Greek!

So what does it mean to challenge the cultural universality of mathematics? One strategy the authors pursue is to compare mathematics in several premodern cultural contexts. The results provide grist for both modern and postmodern claims. The sameness of mathematical results across cultures and time periods lends credence to the modernists' claims of objective truth. Nevertheless, cultural differences did produce different methodologies, and that has consequences. For example, the ancient Greeks' insistence on axiomatic reasoning, as opposed to the proof-by-example method accepted by some other cultures, led to differences in the kinds of topics investigated.

Even if cross-cultural comparisons are inconclusive, we might look for some universality in how we conceive of mathematical objects. In an essay on "God and Mathematical Objects", Christopher Menzel tackles this tricky ontological issue. Menzel describes a "theistic activism" model for the existence of abstract mathematical objects: God thinks, therefore they are. Moreover, by constructing a model rather than "a grand narrative" Menzel dodges the postmodern bullet, because a model makes no claims to certainty. Thus "theistic activism" is an attractive explanation on both Christian and postmodern grounds. As a resolution of the universality question, however, Menzel's model only "works" to the extent that a concept of God is shared.

Some, including most mathematicians, would say that even then it doesn't work. According to the modern view, mathematics is not only universal but also certain, quite apart from any understanding of God. For centuries philosophers have pointed to mathematical knowledge as the most certain we can possess because of the sheer rigor of its proofs.

In the 1930s, however, Kurt Gödel showed that no mathematical system can be proven to be free from self-contradiction. Were mathematicians alarmed? Not in the least. While ceding absolute certainty, they retain confidence in their methods. They can boast of the only discipline whose results no one seriously questions. Nevertheless, we believe that it's both reasonable and interesting to ask, What is responsible for the mathematical community's confidence in its work?

In order to answer this question, William Dembski takes the postmodern approach of "following mathematicians around." That is, instead of focusing on what mathematicians say, he observes what they actually do, noting that the security of a mathematical claim depends at least as much on the effort of the mathematical community to verify that claim as it does on logic. Mathematicians (including these reviewers) may disagree with the consequences of Dembski's observation, but Dembski does well to raise this point.

The book presents no tidy resolution--no clear synthesis of points of view--nor is one advertised. The early chapters show the authors searching for a synthesis, trying out the ideas, so to speak, raising worthy questions. It is important to consider, argue about and attempt to articulate the relationship between mathematics and culture in the 21st century. Chapters seven and eight, "The Mathematization of Culture" and "Mathematics and Values," are at the heart of this book and should be read and discussed--especially by those who will disagree with the views presented.

As these chapters demonstrate, while American consumers may blissfully ignore all mathematics but arithmetic, as citizens we need to recognize how mathematical values and reasoning undergird powerful forces which continue to shape our culture. Here we think the authors could have made a more compelling case. Although the ever-present appeal to statistics is mentioned, the other examples are primarily of historical interest. Better choices might have included the computer revolution, genetic engineering and sophisticated methods of intelligence gathering. Or the fact that current debates about global warming or economics, for instance, hinge on mathematical models the public never sees. In light of such examples, few will

disagree with the proposition that the pervasive influence of mathematics on our culture needs public recognition and discussion.

The driving claim of this book--that aspects of Christian faith affect the practice of mathematics and vice-versa--is explicated later in the book. Regrettably, the artificial intelligence chapter is technical, and the intelligent design one coopts mathematics for an antievolutionary thesis. However, we highly recommend the chapters on mathematics education.

Although postmodern thought has had little impact on the content of mathematics, one of its progeny, constructivism, is changing the way we teach and learn mathematics. The traditional view is that mathematical concepts (such as " $1+1=2$ ") have some a priori reality and are "out there" just waiting to be discovered. Constructivism, on the other hand, holds that each learner actively constructs her or his own mathematical concepts. Such a view calls for a student-centered pedagogy which includes hands-on activities and projects in addition to (or perhaps instead of) traditional lectures and drill.

The foundation for this discussion is laid in the book's presentation of research on how children acquire mathematical concepts. The authors discuss the shift to constructivist pedagogies, the "back-to-basics" backlash and current trends, and conclude with an intriguing and thoughtful consideration of the proposition that constructivism and Christianity are not necessarily inconsistent. Parents, and indeed all citizens, have a stake in this controversy, to which the book provides a particularly accessible introduction.

The least successful part of the book is the Christian meta-analysis. More often than not the Christian perspective appears as a concluding section--almost a postscript--insufficiently connected to the preceding material. And although the editors' assumptions are on the table from the start, there are places where a reader without a background in theology (or the Calvinist tradition) might miss the point.

Finally, we found the relationship of editors to authors somewhat murky (and very postmodern!) As the editors explain, "signing-off" on this project does not mean that the contributors are in complete agreement. Nevertheless, the book is marked by an unsettling--and possibly misleading--uniformity of style. Unable to discern who wrote what, the reader finds it hard to see what the disagreements really are.

Nevertheless, this book not only prompted us to examine our assumptions about our discipline but provided an entire summer's worth of dinner-table conversation.