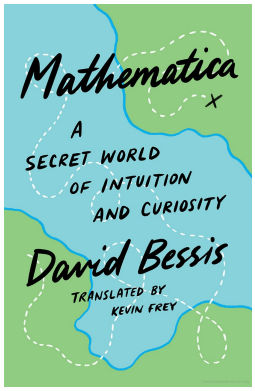
Book review

Mathematica: A Secret World of Intuition and Curiosity
by David Bessis (translated by Kevin Frey)

Reviewed by Noah Giansiracusa



What happens inside the mind of a mathematician when they do math? This is in essence the question that drives Bessis throughout his sharply insightful and daringly original book *Mathematica* (published originally in French, then translated into English by Kevin Frey). This overarching question is explored not through the technical lens of neuroscience or cognitive science; it is explored through the informal lens of one mathematician's introspection and personal journey. Bessis wants to know how the mathematical legends among us rose so high above the crowd, and how even ordinary mathematicians exhibit mathematical abilities that leave the non-mathematical public in awe.

Bessis looks for clues in a range of sources, from childhood games involving shapes and visualization, to graduate school experiences where mathematical concepts came more easily to some than others. Bessis also mines the more philosophical writings of giants such as Grothendieck and Thurston for kernels of wisdom and insight. The overarching answer Bessis finds to his overarching question of what transpires in the mind of a mathematician is, in a nutshell, that intuition plays a much bigger role in mathematical thinking than most of us realize.

The two deeply important corollaries of this finding that give the book a real *reason d'être* are that (1) mathematicians of all levels can up their game by learning how to do math more intuitively, and (2) everyone, even those who think of themselves as bad at math or math phobic, can do math—they just need to stop seeing math in terms of rigid rules and start seeing it as a world of imagination to explore and enjoy.

Early on the book offers a fantastic metaphor to convince readers that the enormous spread of mathematical abilities seen in society cannot be a mere matter of intrinsic talent: "math is so unequal that it's as if some people could run the one-hundred-meter dash in under a second, while the majority wouldn't make it in a week." In other words, there is surely some natural variance in math abilities just as there is in running—but the standard deviation in math is so absurdly large that something else must be going on. The explanation Bessis offers is that some people are inclined to think of mathematical objects intuitively and these are the people who hit no ceilings in their mathematical education, whereas others try to memorize definitions and formulas without wondering what they really mean and where they come from, an unsustainable (and unpleasant) way to learn and do math.

Those who do math more intuitively are not necessarily any more intelligent; I suspect Bessis would say that they are just lucky that the way their brain naturally operates happens to be the right way for doing math. But he sees this as a tremendous opportunity: if being better at math require more smarts, it only requires getting students to think differently about math, then we should help all students do this. Or, put another way, we should help everyone become privy to the "secret world" of intuitive mathematics. And as mentioned above, it is not just children who would benefit from this: working mathematicians of all levels could benefit by spending more time in mathematics' secret world.

I will resist the urge to summarize what this secret world looks like and how to access it, for that is Bessis's main task in *Mathematica* which he nicely develops in many directions over the book's twenty chapters. Personally, I very much agree with Bessis's arguments, and I am struck by the book's novelty—among other things, it is the first book I have come across that really conveys to general readers what it is like to do research mathematics.

That said, I find it a confusing task to pin down the book's readership. If the book is aimed at mathematicians, I do not know why it includes so many rudimentary details like what a conjecture is; but if it is aimed at non-mathematicians, then I am concerned that it spends all of its time explaining *how* mathematicians think without giving the non-mathematical reader any real motivation for *why* they should try to think like a mathematician. (Examples of a mathematical concept that a non-mathematical reader can grasp intuitively and then put to use practically in everyday life would

have gone a long way, in my view.) But while no single reader seems to be a perfect fit for the book, I nonetheless think that everyone will learn something important from this book and I have no hesitations about recommending it widely.

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