

# Logicomix: An Epic Search for Truth

*Reviewed by Judith Roitman*

---

## **Logicomix: An Epic Search for Truth**

*Apostolos Doxiadis and Christos H. Papadimitriou  
with art by Alecos Papadatos and Annie di Donna  
Bloomsbury USA, 2009*

*US\$22.95, 352 pages, Paperback  
ISBN-13: 1596914520*

---

### **Four-Sentence Description**

*Logicomix* is a graphic novel about Bertrand Russell, focusing on his and other's work on the foundations of mathematics. Its structure is a storyline within a frame within a frame. Being a graphic novel, art is a major component. And there is a terrific appendix, called *Notebook*, combining minibiographies of many mathematicians and philosophers (including Aristotle, Euclid, and Leibniz) with a detailed, clearly written glossary.

### **Art**

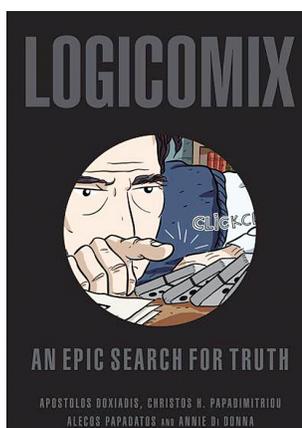
The art is superb, in the lineage of Hergé and his great creation Tintin (I'm not the first person to notice this), sometimes called the European style: no overmuscled superheroes, no depressed losers, and no extreme caricatures. People look reasonably natural, color is important but not overwhelming, there's a sense of life and movement and a visual sense of excitement when excitement is called for. Maybe too much excitement at times; see below.

### **Storyline**

Little Bertie grows up with enough family secrets, family insanity, and emotional deprivation to fuel several Brontë novels (by several Brontës). Like many other smart kids in similar circumstances, he turns to mathematics for stability. Unlike most other smart kids in similar circumstances, when he goes to college (Cambridge) he realizes

---

*Judith Roitman is professor of mathematics at the University of Kansas. Her email address is roitman@math.ku.edu.*



mathematics has no real foundations, so he decides to provide them. Only to discover the worm in the apple, a.k.a. Russell's paradox (the set of all sets which do not contain themselves). With Whitehead, he writes the *Principia Mathematica* to provide the foundation and cast the worm from the apple (via

the theory of types). He encounters many famous mathematicians and philosophers. Despite his attachment to reason, he falls in and out of love, marries several times, and has a huge crush on Whitehead's wife. He meets Wittgenstein. He questions his own work. He starts his long involvement in politics and has an unsuccessful flirtation with experimental education. This is not a chronological description; several of these things happen at once.

### **The Inner Frame**

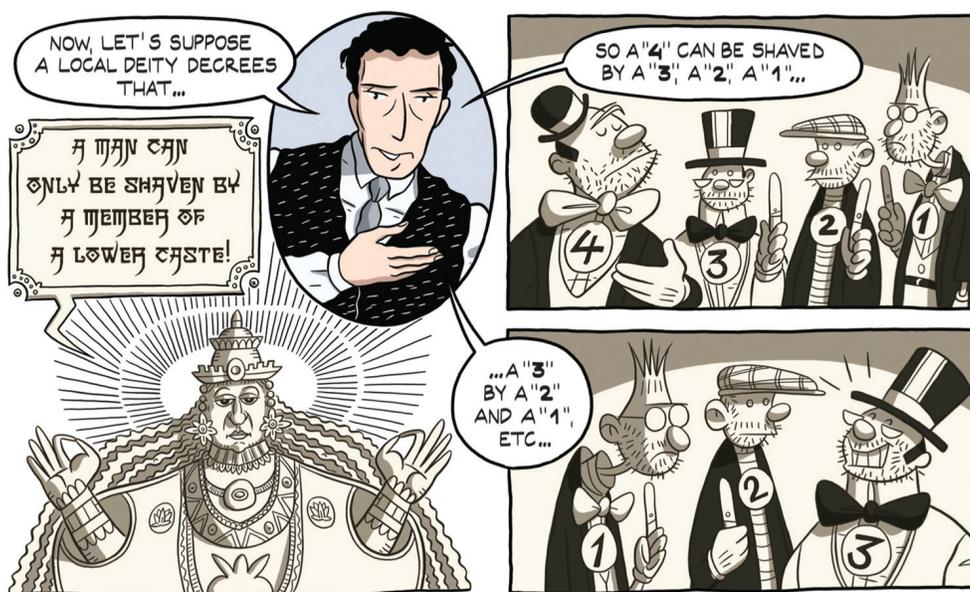
The story is told by Russell himself during a talk he gave at an unnamed American university on September 4, 1939, the day Britain declared war on Germany.<sup>1</sup> Accosted by a group of students wanting him to tell America not to go to war, he invites them into the talk, tells them that he disagrees with them, and tells the story of his life and work as a way of explaining his views.

### **The Outer Frame**

But the book does not open with Russell talking in 1939. It opens with Apostolos Doxiadis,

---

<sup>1</sup>*I'm not sure if there really was such a talk, and if there was, whether it took the form it took in the book. As we are reminded throughout, this is a graphic novel.*



the lead author, introducing us to his colleagues (including the dog Manga)<sup>2</sup> and describing what they are trying to do. The team will continue to appear periodically, sometimes explaining a little mathematics (Christos Papadimitriou does most of this), sometimes trying to figure out what tack to take, sometimes commenting on the greater human meaning of what they are writing about. The outer frame also ends the book, as the team watches a performance of the last scene of the *Oresteia*, when Athena invites the Furies to remain in Athens as a benevolent force, a.k.a. the marriage of reason (Athena) and passion (the Furies).<sup>3</sup>

### The Team

This is not the first time Apostolos Doxiadis has written a novel embedded in mathematics; he is the author of *Uncle Petros and Goldbach's Conjecture*. Christos Papadimitriou is an eminent computer scientist at Berkeley and the author of *Turing (A Novel About Computation)* whose eponymous hero is an interactive tutoring program. Alecos Papadatos (who did the drawings, and who became attracted to animation in high school as a way of explaining geometry to his classmates—think locus of points) and his wife Annie Di Donna (who did the color) both have extensive backgrounds in animation. Di Donna is French; the others are Greek.<sup>4</sup> The team (minus Papadimitriou) has branched

<sup>2</sup>Not a reference to Japanese graphic novels, but Greek slang for somebody who is really cool.

<sup>3</sup>Full disclosure: my classicist husband courted me by casting me in the role of Athena, with the great classicist Gareth Morgan as all of the Furies put together.

<sup>4</sup>So why, in the English translation of the Greek original, is Di Donna saddled with a French accent while her colleagues speak perfect English? Eet ees not fair!

out with a graphic piece in the *Financial Times*<sup>5</sup> on Claude Levi-Strauss, staying within the outer frame of the team itself.<sup>6</sup> Minor members of the team are the visual researcher and letterer Anne Bardy (who, through her involvement with a performance of the *Oresteia*, has an important role), Dimitris Karatzafaris, and Thodoris Paraskeva, the inkers.

### logicomix.com

Yes, there is a webpage, an excellent one. It is clear from the webpage that *Logicomix* has a lot of enthusiastic fans, some of them quite famous, and has won some well-deserved awards. There is a nice *Behind the scenes* tab which gives you

a glimpse of how a graphic novel is actually created. But most revealing are the links to talks that Doxiadis (with assistance from Papadatos) gave at Cambridge and Birmingham. The Cambridge talk, in particular, opens with Doxiadis talking about his own life: his extreme distaste for mathematics until, in early adolescence, he suddenly fell in love with it. Within a year he was at Columbia University doing mathematics, which he continued to do for about eight years both at Columbia and in Paris. Then, suddenly, faced with a difficult family situation back in Greece, he lost his love for the subject, left it not quite completely (aside from *Uncle Petros* and *Logicomix*, there's a play about Gödel), and returned to his original loves of writing, cinema, and theater. He has also been working with Barry Mazur for a number of years on a project about mathematics and narrative.

### Intellectual Content

If you are writing about people who are seriously invested in intellectual work, it's helpful to talk about their ideas, and, early on, Papadimitriou is introduced as the guy who will make sure that what the team says about logic makes sense. The way logic and mathematics is explicated is terrific and worth discussing. In one word: patience. In seven words: patience embedded in story embedded in art. You have to keep it interesting; your reader isn't worried about passing a test. But you can't pander, either; an insulted reader will stop reading. So, for example, type theory is explained during a croquet game by a caste society in which you can only be shaved by a lower caste member

<sup>5</sup>February 27, 2010.

<sup>6</sup>And using *Oresteia* to illustrate Levi-Strauss's structuralism.



Illustrations courtesy of LOGICOMIX, © Bloomsbury USA.

(since  $N$  is the index set, no one in the lowest caste gets shaved). It takes eleven panels to complete this intellectual arc, including panels with somewhat comically drawn men labeled 1, 2, 3, 4... carrying razors, and a so-called local deity who looks like a cross between Buddha and a maharajah. Plenty of time for the reader/viewer to come to grips with what is going on. Brilliant.

### What Art Brings to the Table and What It Takes Away

If *Logicomix* were just a nicely drawn graphic novel about Bertrand Russell and other mathematicians/philosophers with a few fairly clear explanations of basic set theory thrown in (such as the Hilbert Hotel and Russell's paradox), it would not have gotten nor have deserved the attention and praise it has received. What *Logicomix* does that few works in any medium do is to make intellectual passion palpable. That is its greatest strength. And it's here that its form becomes its substance. For example, flipping at random, there is a two-page spread of Wittgenstein with a thought bubble saying, "The **meaning** of the **world** does not reside **in** the **world**"<sup>7</sup> while he stands in the blasted landscape of a World War I battlefield with strange clouds and vapors, a visually muffled explosion in the near distance, and a haze around the dark moon.<sup>8</sup> Stunning. You just can't do this with words alone.

<sup>7</sup>Boldface as in the text, where it is done more subtly.

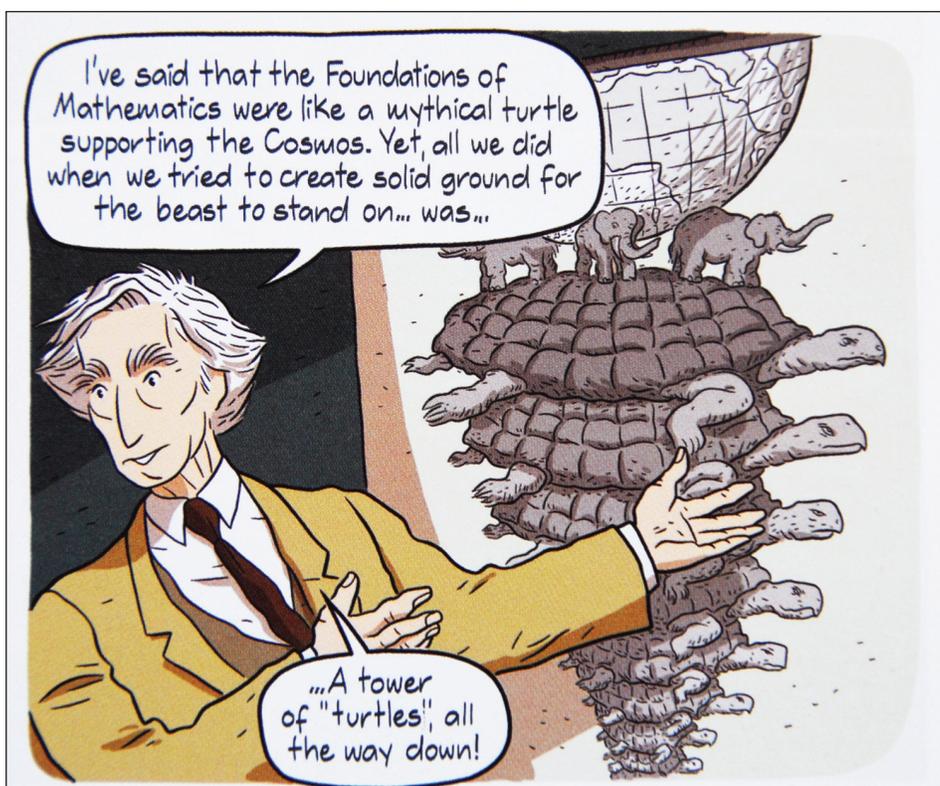
<sup>8</sup>Wittgenstein actually was a soldier in the front lines and wrote his revolutionary *Tractatus Logico-Philosophicus*—which he later disavowed—while a prisoner of war.

And that is where the problems come in. The team keeps reminding us that this is a graphic novel, but when it presents (1) powerful visual images of Russell visiting an insane Cantor and (2) powerful visual images of how this visit awakens Russell's personal demons resulting in (3) a powerfully drawn three-page nightmare, the admission in an afterword that Russell and Cantor actually never met doesn't overcome the image of Cantor that has been implanted in the reader's/viewer's mind. There are many scenes like this, powerfully drawn scenes that never happened, most of them involving some kind of madness. For me, the most problematic—the reality must have been painful enough—is depicting Hilbert lecturing on mathematics outdoors, pushing away his adolescent son who clings to him desperately to avoid being hauled away to an insane asylum. The son is pried away from the father, who, when someone expresses sympathy, responds "I have no son."<sup>9</sup>

### Crazy

Which brings us to a major theme of *Logicomix*: the connection between logic and insanity. I would say the purported connection, but it's clear that Doxiadis thinks there's something to this—the phrase used on p. 217 is "Logic from Madness"—and he certainly marshals his evidence: if his logicians aren't crazy (Gödel, Frege, Cantor)

<sup>9</sup>Hilbert did have a son who, at fifteen, was taken to an insane asylum where he eventually died; Hilbert never visited him there. Whatever judgment we may make of this, the situation depicted in *Logicomix* is far more cruel.



they have craziness in the family (Russell, Hilbert, Wittgenstein);<sup>10</sup> this linkage is a major subject of the team's discussions, and in some sense, the book is structured by it.

On the first page we learn that the story we are about to hear is "so sad". On p. 24 we have a reference to Gian-Carlo Rota's article "on the curiously high rate of psychosis in the lives of the founders of logic," and on this page the theme is declared: not madness from logic but: "They became logicians from madness." On p. 78 we learn that as a young man Russell wrote that he would have killed himself if not for mathematics. On p. 83 we have Russell saying that as a young man he decided that madness was a disease pulling weak spirits away from the natural harmony of reason,<sup>11</sup> and hence he should devote himself to reason as his way out of his "dark legacy".<sup>12</sup> On p. 201 Papadimitriou summarizes Doxiadis's thesis as that the foundational quest is a spiritual tragedy, which Doxiadis does not deny; two pages later we learn that "less tortured characters would not have found this price [e.g., 362 pages in the *Principia* to prove that  $1 + 1 = 2$ ] worth paying." On p. 217, after getting lost in the back streets of Athens relying on childhood memories to find his way, a

<sup>10</sup>The judgment on Wittgenstein's sanity is not clear.

<sup>11</sup>My paraphrase. I am not a Russell scholar and don't know if he really said anything like this, but if he did it's especially poignant since no one is as rational as a paranoid schizophrenic.

<sup>12</sup>It is certain that Russell was devoted to reason.

trip in which he was physically attacked and, in a separate incident, robbed, Papadimitriou decides that Doxiadis is correct and that the madness came from confusing reality with intellectual maps,<sup>13</sup> at which Doxiadis has the thought bubble "what a perfect definition of insanity!" On p. 230 we learn that it was Russell's "character, his insecurities, his neuroses which drove him to logic." On p. 282 Doxiadis conjectures that "maybe what brings them to logic is fear of ambiguity and emotion."

Sigh.

Your local neighborhood bartender is a bartender because of her character, her insecurities, her neuroses (and her socioeconomic situation at key times and places, not to mention her personal circumstances)—why should Bertrand Russell be any different? What's the big deal? People do not read carefully, and the casual reader could easily be left with an impression that logicians are crazy. My own first impression

was that the authors believed that logicians are crazy—the detail of the previous paragraph is meant to qualify this impression. The authors undercut their own case: not every logician who appears is crazy, not every logician is motivated by madness. Most important, the main character is a major counterexample. Madness did run rampant in Russell's family, in both previous and later generations.<sup>14</sup> He may have feared it, and various aspects of his personal life (sexual relationships, attitudes toward parenting, involvement with progressive education, and perhaps—depending on point of view—his politics) may have a bit of a meshugeneh quality, but he seemed nevertheless to have been eminently sane.

### Tragedy and Triumph

Was Russell's great effort in the *Principia*, as he himself seems to have felt, a failure? As an adolescent I delighted in Boole's locution "dog dog = dog" and repeated it to my friends, no doubt to their great annoyance, but " $x \cap x = x$ " is mathematically powerful in a way that "dog dog = dog" is not. Things explode when the right notation comes along; *Principia* was an important part of this.

<sup>13</sup>Relating to the map theme, on p. 241 Wittgenstein comes to a breakthrough understanding of the relation between language and reality while observing German army brass manipulating toy soldiers and toy cannons while planning a battle.

<sup>14</sup>Note that none of these mad relatives were logicians.

## Mathematics at Play

Yet, except for his paradox, Russell's name doesn't come up in logic texts. No mathematical logic text cites *Principia's* 362-page proof that  $1 + 1 = 2$ . Except perhaps as a historical curiosity, mathematical logic texts generally don't cite *Principia* at all. Mathematicians don't think about or work within the theory of types.<sup>15</sup> Mathematics is usually done without much regard for a foundational basis, and when you want a foundational basis you turn to the (quite different) Cantor-Zermelo-Fraenkel-von Neumann approach to set theory; or, if you prefer, you turn to category theory. The mathematically oriented pioneers of mathematical logic and set theory at the beginning of the twentieth century generally did not turn to Russell and Whitehead for inspiration, and neither do their descendants.

With at least one exception, and that's a big one: Gödel not only read the *Principia*<sup>16</sup> but entitled his pioneering monograph on incompleteness theorems *On Formally Undecidable Propositions of Principia Mathematica and Related Systems*. Of course, what the incompleteness theorems say is that Russell's quest for mathematical certainty is doomed. You can summarize this by: the *Principia* was, in some sense, crucial to that part of Gödel's work which, as a by-product, destroyed the purpose of *Principia*.

But while Doxiadis sees this as a tragedy, Papadimitriou sees the narrative arc as a triumph, leading to Turing and computer science: "No, it's a total triumph! and it abounds in happy endings, the happiest being that the tools of reason are at everybody's fingertips!" Cue the *Oresteia*.

### Gender

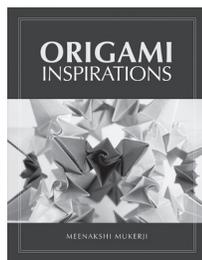
A final word on gender. The characters in *Logicomix* tend to be, if you'll excuse the expression, incomplete. The men tend to be bumbling fools caught up in their intellectual enthusiasms, occasionally commenting on the stupidity of women. The women tend to be practical, aware of the physical world that the men scarcely notice. There are, of course, counterexamples to this polarity (e.g., Evelyn Whitehead thinks that she is dying when it's only an anxiety attack), but the overall pattern is clear, even in the team's contemporary interactions. Anne rescues Papadimitriou from his disastrous adventure. Annie is full of clever commentaries on the intellectual action, but they are commentaries only; the actual ideas spring from Doxiadis and Papadimitriou. Only Athena seems to be completely human. Maybe you have to be a god to be fully human, but I would hope not.

<sup>15</sup>Except, of course, for mathematical logicians who specialize in it as one would specialize in, say, commutative groups.

<sup>16</sup>Perhaps the only person who ever did in its entirety, as *Logicomix* points out.

### Origami Inspirations

Meenakshi Mukerji



\$24.95; Paperback

"A whole book full of amazingly attractive new modular pieces. This book is highly recommended to all modular folders and those wanting to dabble in this pastime."

—DAVID PETTY,  
British Origami Society

"The comprehensive nature of this book makes it a wonderful selection for both beginners and experts alike."

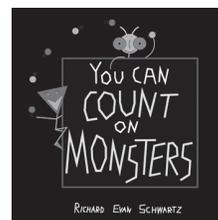
—RACHEL KATZ,  
OrigamiwithRachelKatz.com

### You Can Count on Monsters

The First 100 Numbers and Their Characters

Richard Schwartz

"This delightful book is a result of the author's desire to teach his daughters about primes and factorization. . . . The whole thing is a lot of fun. The book is well produced and nice to look at."



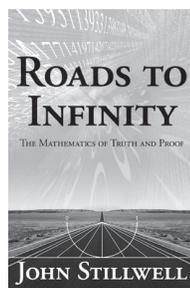
\$24.95; Paperback

—FERNANDO GOUVÊA, *MAA Reviews*

### Roads to Infinity

The Mathematics of Truth and Proof

John Stillwell



\$39.00; Hardcover

"I love reading anything by John Stillwell. If you've ever been tantalized by the puzzles of infinity, set theory, and logic, and want to understand what's really going on, this is the book for you. It's an exceptionally fine piece of mathematical exposition."

—STEVEN STROGATZ,  
Cornell University, author of  
*The Calculus of Friendship*

Save 20% at [www.akpeters.com](http://www.akpeters.com)  
Discount code 044MM • Free Shipping



A K PETERS  
[www.akpeters.com](http://www.akpeters.com)



CRC Press  
Taylor & Francis Group