

enjoy it to its fullest. I hope this advice can help ease a bit your anxiety for not being able to publish as you would've normally done, so that you can step into this exciting new page of life a bit more confidently.



Yumeng Ou

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## Self-Publishing & Mathematics

### Robert Ghrist

Academics tend to be leery of self-publication of scholarly works, given their desire for signaling quality and avoiding the appearance of being a *crank*. I have been experimenting with self-publishing since 2014. What follows is a survey of my reasons and processes, along with advice.

**Print texts.** In Fall 2014, I published a book, *Elementary Applied Topology* (“EAT” below), aimed at graduate students and researchers in the mathematical sciences. The book is dear to me and represents the synthesis of a significant portion of my professional career. It is an idiosyncratic text, but not unpublishable by a top venue. I chose to publish my book using Amazon’s print-on-demand service (at the time called *CreateSpace*, now rebranded under *Kindle Direct Publishing*) for the following reasons.

1. I retain the copyright and am completely unrestricted with regards to the publication of the text. I choose to keep pdf copies of EAT on my website, available for free. There are a few publishers who will do that (Cambridge is quite good about it), but not enough.
2. I set the price of the book. Subtracting Amazon’s costs yields the royalty payment. One can set differential pricing by country.
3. Nonconformity is tolerated. I wanted to put figures on the front and back cover of my text. Most monograph

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series have rigid style formats and will not allow that. I decided to hide some Joycean puzzles in the book (allusions, secret codes, mythologies) to keep me sane while dealing with writer’s block. Explanations and permissions were not needed.

4. Amazon takes care of payments, returns, tax forms, currencies, analytics, etc. It works in many (though by no means all) countries.
5. The quality is very good. They do not print hardbound books, but their softcover books appear to me to be of the same quality as other softcover math texts by leading publishers. I chose to make the book black-and-white, but color printing is available for a (much) larger price. The cover is always full-color.
6. Besides Amazon’s already large distribution network, the book can be made available to physical bookstores and for purchase by academic libraries (albeit with smaller royalties).
7. Publication turnaround time is quick. Upload the text and the cover, order a proof copy, then publish it with a click.

I have been and remain very happy with my decision and am convinced that academics—even pretenure academics—should use this (or a similar) platform for the self-publication of scholarly books.

The objections that I can think of are these:

1. “*It’s not refereed.*” It can be, but you have to ask friends to do it, and you need honest friends. Your readers also become your editors *ex post facto*. Because one can update the text at any time (simply upload a replacement pdf and run checks), it’s reasonable to wait for readers to contribute error reports. (Full disclosure: EAT is full of errors, and I still have not issued a correction, alas.)
2. “*Publishing with XXXX signifies quality.*” This is not quite true. Books on quantum knots and consciousness, the mystical golden ratio in nature, fractals and markets, and all manner of pseudomathematical claptrap are published by major presses (and those books will sell more than yours or mine). Publishers of higher mathematics are desperate for new books—the only way to make money on texts with low sales is to make a lot of books—and this situation is only getting worse. If you think to yourself, “*But all the books by XXXX Press that I own are high quality,*” then you are forgetting how natural selection works. Go to a catalogue of “New & Upcoming” to get the picture of quality at the margin, before evolution thins the herd.
3. “*But how will my book get noticed if I’m not already famous?*” Yes, you will not get any free marketing, though Amazon may promote its own books more highly—I suspect, but do not know. If you aspire to fame, there is good news: many books in mathematics are poorly written and very poorly illustrated. Assuming that we are all smart and doing good mathematics (a very good

assumption overall), it's not hard to beat the competition as far as making beautiful, readable books. Quality (and a good website and social media feed) matters.

That's the good news—you get a reconfigurable, fully-owned, pays-a-decent-royalty book with an excellent distribution network. What's the bad news? You must learn a few things about book production. It is not enough to be good at LaTeX—you also need to invest in the design process.

To publish via Kindle Direct Publishing as a paperback, upload the interior of your book as a single pdf. If using LaTeX, you will want a style file that is more customized than the usual "book.sty." It takes a lot of tweaking to get something that looks good but not generic. Most LaTeX fonts are not aesthetically pleasing (to my taste). It is very difficult to insert figures cleanly in LaTeX if you have many of them.

Amazon lets you specify the dimensions of your book among many industry-standard choices (please examine and measure the books in your library to decide what feels best). The margins of your pdf file must be exact, including the *gutter* (do not ignore this!), and you will need to alternate between even/odd pages. Amazon will provide you with a (free) ISBN and barcode, should you choose to have them assign one.

I use Adobe Acrobat Pro to finish the pdf formatting. This is nearly essential for the following.

1. You must embed all fonts: Acrobat will help with that.
2. Acrobat can crop the pdf to make the margins perfect. It can manage gutters and even/odd alternation.
3. You need to make sure the pdf is PDF/X-1a compliant (X-3 should be ok as well). The usual `pdflatex` or `dvipdf` commands may not suffice, unless you have set your flags properly (which I never got right). My solution was to use `dvips` and then feed this to Adobe Distiller. That program does a great job in setting up the pdf to be nearly 100% /X-1 compliant.
4. Great is not perfect, and you need perfect to pass Amazon's auditors. When you upload the pdf to the Kindle Direct Publishing bookshelf, it will run automatic checks for you. You may be disappointed to find hundreds of errors: do not panic. Most of them concern too-low resolutions on LaTeX'd formulae. These are ignorable and will not impact the print quality: their setup is unsurprisingly not optimized for LaTeX users.
5. If you get *any* errors on margins or figures, then you have more work to do. The best method I found for fixing these was to use Acrobat's Preflight (CTR+SHIFT+X) tool. Under PDF/X compliance tools, select Convert to PDF/X-1a (COATED FOGRA39). Clicking *Analyze and Fix* did the job for me.

Such is my process for the interior of the book. This is not the end. You need to make a cover. With EAT, I thought this would take me a day or so of work, as I have some artistic leanings. I was wrong. Consider hiring a designer.

Amazon will give you a downloadable template, but it is up to you to make the cover right. You need front, spine, and back on a single-page pdf. The artwork (please let there be artwork on the cover of your book) demands professional-grade drawing software: not LaTeX. I use Adobe Illustrator. Do not use a generic font on your cover. I wound up having to make my own for the title of EAT. You do not need to descend to that infernal ring, but, please, do not slap down a title with SliTeX. Make sure the cover is beautiful and uses color well, since the cover is what sells the book.

When you upload everything and it passes inspection, then the hardest part begins—waiting for Amazon to send you a proof copy. Once you approve and press the PUBLISH button, Amazon will have you listed and available for purchase within hours. Sales reports and rankings are compiled on an hourly basis, from what I can tell. Amazon gives global rankings of their books and breaks it down along a subject tree. I can track how well my book sells as compared to the other topology books out there. Sales data is available for the entire lifetime of the product. Tax forms are sent automatically, with all international royalties automatically compiled into one USD number.

The above covers printed books. Amazon also offers the ability to publish electronic books (e-texts) through the Kindle app, readable on phones, laptops, and Kindle devices. Most mathematics texts cannot easily, if at all, be published in a Kindle format. Flowable text (that reformats as you change font size) is not compatible with LaTeX.

**E-texts.** There is, however, an intriguing approach to publishing fixed-format mathematical e-texts. In 2015, I began working to write a new type of calculus "text" that would: (1) update the curriculum for modern applications, especially to data and deep learning; (2) be graphics-based but with text-based search features; (3) be fully electronic and look good on a cell phone or tablet. This was to be integrated with an animated video-text version available for free on YouTube (next section).

The result of this was the *Calculus BLUE* series, covering a full semester (and then some) of multivariable calculus. The course text is broken into four volumes: each of the four e-texts is a 400+ page electronic "comic book" of graphical content, specifically designed to look good when read on a phone.

Publishing this on Amazon's Kindle platform is much easier than print publishing. After generating the pdf of the e-text, including a cover image, one uses the free Kindle Textbook Creator (KTC) to process and package for uploading to the Kindle store. This is the right way to go for fixed-layout, structured content, and the resulting text will not reflow like most Kindle books: the formatting is fixed. The KTC software is, at present, retrograde in appearance. Do not be discouraged: it is very easy to use.

Amazon lets one set the price of these e-texts, with differential price based on country: my books costs much less in Brazil and India than in the USA and UK. As with print

texts, they automatically handle returns, royalties, currency conversions, and tax collection. Given that there are at least two dozen countries involved, that is helpful.

The royalty plan is 70% to the author if you publish exclusively with Amazon; otherwise it is 35% to the author. Danger: read the fine print. The 70% royalty plan comes with delivery fees on a per-megabyte basis. These fees are ridiculously high. With graphical content, one must settle for a 35% royalty; half of what Apple pays. Am I tempted to work with Apple? No: their distribution network is miniscule and their publishing tools are difficult to work with unless you generate all your content from within their system. If you are already in their system, you may wish to investigate their publication tools.

The difficult part of e-text production is getting something that looks good. Graphic design is hard and there are good reasons why you should find a designer to work with you. I do my own art and design with Microsoft PowerPoint as a base (it is faster than working with Adobe software, though less expressive). For the *Calculus BLUE* project, I had to learn font design, color theory, layouts, and, most difficult of all, how to graph surfaces, vector fields, and other 3-d objects (which required learning and fusing several software packages). Unless you want to wrangle with copyright issues for others' images, you may need some help with artwork.

**V-texts.** Since 2017, I have worked on producing several long series of short videos of mathematics content, in a format I call *video-texts* (or *v-texts*). I chose YouTube for distribution: there are few other viable options. This is less publishing and more outreach. All video is free and unlimited (though not available in all countries), and one must sign over nearly all rights to Google. Penn's mathematics department has been using these v-texts for teaching calculus during the pandemic and is continuing to use them.

I cannot recommend that early-career mathematicians follow this exact route. The process I've invented for animating and producing videos is byzantine, and those whom the gods wish to destroy they first inflame with a desire to rewrite the calculus. However, learning to produce videos to encapsulate and promote your research is a skill to be mastered *as soon as possible*. YouTube is ubiquitous, but good video production (as many more have learned during the pandemic) is not. YouTube itself is an excellent source for learning how to master the basics of audio production, illustration, animation, and compositing. If your university has a subscription to LinkedIn Learning, that is an even better resource for acquiring practical skills. I predict that maintaining your own YouTube channel will soon be as essential to an academic as maintaining your own website. Learn to do it well.

**Remarks.** This sounds like a lot of work. It is a lot of work, and publishers do provide a service in allowing one to focus only on the mathematics and not the publishing. My advice—especially to early-career colleagues—is to

take personal ownership of your creation and distribution of beauty. Expanding your skillset to include the graphic design and mathematical illustration/animation aspects of publishing will grant you long-term dividends in how you teach, write proposals, interview, and exposit.

I have not been a vocal participant in the anti-Elsevier or open-journal debates of the past decade. I have no animosity toward any individual publisher: my ire is for the collective industry, for which I predict well-earned hard times. I use and recommend Amazon's and YouTube's distribution services for their convenience. There are other self-publishing venues of which I have no experience. These remarks are less about the negative aspects of current academic publishing and more about the positive potential of using newer methods to disseminate mathematics broadly.



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