

---

## How $\TeX$ changed my life

Michael Barr

### Abstract

I describe the complicated process of writing math papers, getting them typed, and finally getting them published in the days before  $\TeX$  and how much things changed after.

### 1 Introduction

As I look back on a career writing papers that started with my 1962 PhD thesis, I am amazed how much things changed from before Don Knuth's amazing program  $\TeX$  to after. The process of getting math into type was long, messy, and extremely error-prone. It started with writing a fair copy in longhand that a typist could hope to read, followed by correction, submission, revision, rinse and repeat. At the end of the line, the whole exercise had to be repeated with typesetting, all of which changed with the coming of  $\TeX$  and  $\LaTeX$ .

### 2 My thesis

Even in retrospect, it was a mess, a long very detailed computation full of Greek letters and loads of subscripts. I was living at home, we rented a typewriter, my mother, who could type, did most of it (with me dictating for the most part) and I did a little. With most of the Greek letters, we left space and wrote them in with a pen. In a few cases, I was able to improvise something. For example,  $O$ , backspace, I would give a reasonable approximation of  $\Phi$ . Or  $+$ , backspace,  $0$  gave something like  $\oplus$ . There were no italics; in point of fact until  $\TeX$  came along, I was not consciously aware that theorems and the like were always set in italics and that math symbols were also italic. I don't believe journals used different fonts for text and math italics, incidentally.

### 3 Writing papers

I never made any attempt to publish my thesis, although in fact I published the results in much greater generality and without any computation seven years later. But I did start writing papers. To get a paper into print was a long messy process. First write a fair copy longhand. Give it to a department typist and hope that she (it was always a woman) could understand it. A typescript would emerge and I would have to correct it and give it back to the typist. After getting it corrected, I would have to add the Greek letters, symbols, script letters, etc. by hand.

We did have photocopiers, but copies cost ten cents a copy, probably more like a dollar in today's money. Still you made a copy. In an earlier era, the

typist might have typed a mimeograph master. I cannot imagine getting that corrected. Even earlier, the hand-written draft would be the one submitted for publication. I once looked up instructions for authors and discovered that the American Math. Society started requiring typewritten submissions only in the early 1920s.

At any rate you submitted your masterpiece to a journal, which sent it out for refereeing. The referee invariably wanted revisions. Many of them involved shortening the paper, removing details, making it harder to read. This wasn't perverse on their part: mathematics was very expensive to print. The paper would have to be revised, which meant starting the whole process over. Assuming the paper was finally accepted, it then got copy-edited. For mathematics, this meant marking up the theorem-like environments for italic, likewise with all the variables, Greek letters, script letters, Frakturs, and special symbols. Then it was sent to a typesetter, who tried to match the marked-up typescript as well as he could. He had about 250 characters that he could put into his machine and he would look at the paper to decide which ones to load. Any additional ones would have to be inserted by hand at extra cost. While 250 sounds like a lot, it has to include the standard alphanumeric characters, italic, bold, large sized for headers and whatever special characters the author might have chosen. Once he had done his best, proofs would be returned to the author, who had to read it again and find and mark errors. Minor author corrections were permitted but discouraged. And nothing that would change the size of paragraphs was allowed. Finally, publication!

Starting in the mid-1960s there were small improvements in the process. The first innovation was things called typits. A typit was a character (symbol or otherwise) on what looked like a typewriter key. You would hold it against the typewriter ribbon and hit any other key. That would hit the typit, which would impress the character on the page. I remember one typist in my department who had a box of typits on her desk and got very fast about finding the required character. Still the process was slow and error prone.

Next came the IBM Selectric typewriter with its typing ball replacing the typewriter keys. I will not try to describe the Selectric (you can google it), but only mention that you could change the ball to a symbol ball or another—there was likely an italic ball—and use that. Still it was a slow process. Replace the ball, find which character to type and do so, then put back the standard ball. But the whole process of writing a fair copy, getting it typed,

correcting it, really hadn't changed. You didn't have as much hand work and the typesetter's job must have been somewhat easier, but it was still slow and expensive.

I think it was in the summer of 1979 that I got so fed up with the whole process that I and my two older children found a book, vintage 1945, "Teach Yourself to Type" and sat down and learned to type. I then bought a second-hand Selectric typewriter along with a symbol ball, determined to learn how to do my own papers. But I never actually did that. Still learning to type was what I would eventually have to do.

#### 4 The coming of $\TeX$

In 1979 I started working on a book [TTT] jointly with the late Charles Wells of Case Western University. At first, we exchanged typescripts by mail. Unfortunately, mail between Cleveland and Montreal took a minimum of two weeks. In 1980, we discovered [T & M] and decided on the spot that we would try to use  $\TeX$  to do our book. My brother, a computer professional, told me we were nuts until we had access to an implementation we could use. We did it anyway. Most readers of this article will not realize the limitations of  $\TeX$  1. Most importantly, there were no add, multiply, or divide instructions. You could increment or decrement a counter by 1, but that was all. Anything like  $\LaTeX$  would have been impossible. Nevertheless we persisted. A big problem was the commutative diagrams. We basically left  $\TeX$  mode and drew them as best we could using horizontal arrows fabricated with `-` signs, vertical arrows drawn with `|` and diagonals with slash and backslash. Arrowheads were done with `<`, `>`, `v` and `^`. I guess I assumed that a publisher might do the diagrams in the old-fashioned way and insert them in the right places.

At some point we discovered computer networks and eventually, with much help from our computer centres, we learned to transmit our files electronically. Charles had bought an Apple II in 1979 and by 1982 I had an IBM PC. We once counted that we had used 9 distinct editing programs.

I actually wrote a program that was originally intended to just remove the  $\TeX$  code and print out a more-or-less readable manuscript. But in fact I discovered that, using the wonderful (for the time) abilities of the Epson FX-80 printer, I could give a reasonable interpretation of the  $\TeX$  code. I also wrote a font generator to generate special fonts for the nine-pin dot matrix printer. The results weren't pretty, but they were readable. It was all monospaced and unjustified.

But we actually had a great stroke of good fortune. We sent it to Springer-Verlag, who handed it off to the editor Roberto Mineo, who was at that time also a graduate student in computer science at Carnegie-Mellon University. He had discovered a beta version of  $\LaTeX$  and used it to do the required formatting and also used the  $\LaTeX$  picture mode to code all the diagrams. He printed it out at CMU and Springer printed it directly from his camera-ready text. Unfortunately, the printer he used was not the best quality and the original is not up to Springer's standards. A better version is on my website [www.math.mcgill.ca/barr](http://www.math.mcgill.ca/barr).

After that, PC versions of  $\TeX$  appeared and I never used a typist again. Life became so much easier. I could typeset a paper, make the necessary revisions in much less time and with much less effort than the old process of getting it ready for publication had been. I never actually used the Selectric and eventually gave it to one of my students who used it for a few years and then got his own computer and learned  $\TeX$ . Now I doubt there is a math journal in the world that will accept a paper not composed in  $\TeX$  or, most likely,  $\LaTeX$ .

Charles and I did one more book together a little later [CTCS]. We did the final version when we were both on sabbatical at Penn in 1990–91. It is interesting to compare timings. In 1990 on a 6 MHz IBM AT computer the compilation took about an hour. Conversion from `.dvi` to `.hp` took about an hour and a half and printing on an HP LaserJet took over an hour. I had occasion to recompile a 20% longer version of the book a few weeks ago and producing a `.pdf` file took all of 8 seconds.

#### References

- [TTT] M. Barr and C. Wells, *Toposes, Triples, and Theories*. Springer-Verlag, 1985.
- [CTCS] M. Barr and C. Wells, *Category Theory for Computing Science*. Prentice-Hall International, 1990.
- [T & M] D.E. Knuth,  *$\TeX$  and Metafont*. Addison-Wesley, 1979.

◇ Michael Barr  
 404-865 Plymouth Ave.  
 Mont-Royal, QC H4P1B2  
 Canada  
[michael.barr \(at\) mcgill dot ca](mailto:michael.barr@mcgill.ca)  
<https://math.mcgill.ca/barr>