

Web notes

In the following Web notes, the number at the beginning of a note is a page number; words or a topic from that printed text page then appear indicating the position on the page to which the note or reference relates; then comes the note or reference itself.

[***Editorial note: If the papers are accepted, we will convert the page numbers from being the numbers in the manuscripts to being the numbers of the printed pages.***]

From Part 1

- 1 **“has been told before”** Steve Ditlea, Rewriting the Bible in 0’s and 1’s, *MIT Technology Review*, September 1, 1999, tinyurl.com/bible0s1s
- 1 **“not close to the T_EX world”** T_EX originally meant “technical text”: Donald E. Knuth, *TAU EPSILON CHI: A System for Technical Text*, Stanford Computer Science Department Report No. STAN-CS-78-675, September 1978. Later T_EX became Tau Epsilon Chi with the logo T_EX, as T_EX is an abbreviation of $\tau\epsilon\chi\upsilon\eta$, Greek for both “art” and “craft”.
- 1 **TAOCP** Knuth’s TAOCP website, cs.stanford.edu/~uno/taocp.html
- 1 **Monotype** Fred Williams, The Monotype Story, spring 1984, tinyurl.com/williams-monotype
- 1 **“genesis of T_EX”** The Errors of T_EX, chapter 10 of Knuth’s *Literate Programming* CSLI Publications, Stanford, CA, 1992, tug.org/texlive/devsrc/Master/texmf-dist/doc/generic/knuth
- 1 **“breaking paragraphs into lines”** TUG Interview Corner, interview of Michael Plass, 2009-12-20, tug.org/interviews/plass.html
- 1 **“May 13 memo sketched the system’s design”** TEXDR.AFT, Chapter 24 of *Digital Typography* (see note above); or click on “[1,DEK]” at saildart.org/DEK
- 1 **“prototype implementation of T_EX”** TUG Interview Corner, interview of Franklin Liang, 2009-12-20, tug.org/interviews/liang.html
- 1 **“Plass remembers”** Plass interview (see note above).
- 2 **“In August other people began to use T_EX”** Email exchange with Guy Steele, June 2017.
- 2 **“invented for the job”** Chapter 7, How to Read a WEB, of Knuth’s *Literate Programming*, CSLI Publications, Stanford, CA, 1992.
- 2 **“With WEB, Knuth combined capabilities”** For more on WEB, see, for example, a description by Knuth at literateprogramming.com/knuthweb.pdf; and a significant-sized program in WEB, also by Knuth, but not related to T_EX, at literateprogramming.com/adventure.pdf
- 2 **“he considered his work done”** Donald Knuth, Remarks to Celebrate the Publication of *Computers & Typesetting*, *TUGboat*, vol. 7, no. 2, pp. 95–98, tug.org/TUGboat/tb07-2/tb15knut.pdf
- 2 **“allow arbitrary 8-bit characters”** Donald E. Knuth, The New Versions of T_EX and METAFONT, *TUGboat*, vol. 10, no. 3, pp. 325–328, tug.org/TUGboat/tb10-3/tb25knut.pdf
- 3 **“review bug reports accumulated in the interim”** See “Errata” at www-cs-faculty.stanford.edu/~knuth/abcde.html.
- 3 **“most recent two T_EX tuneups”** Knuth’s so-called “tune-up” reports for his two most recent reviews are readily available: Donald Knuth, The T_EX tuneup of 2008, *TUGboat*, vol. 29, no. 1, pp. 233–238, tug.org/TUGboat/tb29-2/tb92knut.pdf; Donald Knuth, The T_EX tuneup of 2014, *TUGboat*, vol. 35, no. 1, pp. 5–8, tug.org/TUGboat/tb35-1/tb109knut.pdf. They too are worth reading as an example of the care and careful explication Knuth puts into merely fixing a rare bug.
- 3 **“will be permanent ‘features’”** METAFONT has its own sequence of version numbers — increasingly precise approximations of e .
- 3 **close brace** One use of braces in T_EX is to indicate scope in the programming language sense.
- 4 **3:16 book** Donald Knuth, *3:16 Bible Texts Illuminated*, A-R Editions, Madison, WI, 1990.
- 4 **Fantasia Apocalyptica** www-cs-faculty.stanford.edu/~knuth/fant.html

- 5 **“Liang’s thesis research was completed”** Franklin Mark Liang, Word Hy-phen-a-tion by Com-put-er, Stanford University PhD thesis, August 1983, tug.org/docs/liang/
- 5 **“T_EX’s automatic line-breaking algorithm”** This algorithm was described in a classic paper by Plass and Knuth: Donald E. Knuth and Michael F. Plass, Breaking Paragraphs into Lines. The paper was originally published in 1981 in *Software — Practice and Experience*. It is reprinted in Knuth’s *Digital Typography*, pp. 67–155. It also was part of Plass’s 1981 PhD thesis: Michale F. Plass, Optimal Pagination Techniques for Automatic Typesetting Systems, Stanford University PhD thesis, June 1981, tug.org/docs/plass/plass-thesis.pdf
- 6 **“reported to the T_EX community”** tug.org/TUGboat/Contents/listauthor.html#Fuchs,David
- 6 **“part of his 1985 thesis”** John Douglas Hobby, Digitized Brush Trajectories, Stanford dissertation, August, 1985, ect.bell-labs.com/who/hobby/thesis.pdf
- 6 **“Hobby mostly designed the algorithms and Knuth wrote all the code”** TUG Interview Corner, Interview of John Hobby, tug.org/interviews/hobby.html
- 6 **Zambala’s Pascal implementation** tug.org/TUGboat/Contents/listauthor.html#Zabala,Ignacio
- 6 **“people at Stanford who helped Knuth”** To the above list of students who helped Knuth, one can also add faculty member emeritus Arthur Samuel who also found ways to support Knuth in his T_EX efforts. For instance, see his introduction to T_EX: i.stanford.edu/pub/ctr/reports/cs/tr/83/985/CS-TR-83-985.pdf; also check *TUGboat* for writings by Samuel, tug.org/TUGboat/Contents/listauthor.html#Samuel,Arthur
- 7 **.SAI files** Click on “[TEX,DEK]” at saildart.org/DEK
- 7 **Steele port to MIT** In addition to our 2017 email exchange (see note above), Guy Steele provided us with copies of his SAIL emails from July 28 to September 8, 1978, and his MIT emails from September 2 to October 28.
- 7 **Ports to PDP-10s** Other ports of T_EX to PDP-10s are noted in Nelson H. F. Beebe, The design of T_EX and METAFONT: A retrospective, presented at the Practical T_EX conference of 2005, tug.org/tugboat/tb26-1/beebe.pdf
- 7 **“TEXDVI, being optional replacement for”** TUG Interview Corner, Interview of David Fuchs, tug.org/interviews/fuchs.html
- 7 **“could be written using DVI output”** David Fuchs, The Format of T_EX’s DVI Files, *TUGboat*, vol. 1, no. 1, pp. 17–19, tug.org/TUGboat/tb01-1/tb01fuchs.pdf
- 7 **“regardless of form of floating point arithmetic”** Nelson H.F. Beebe, Extending T_EX and METAFONT with floating-point arithmetic, *TUGboat*, vol. 28, no. 3, 2003, pp. 319–328, tug.org/TUGboat/tb28-3/tb90beebe.pdf
- 7 **“based on user experience with T_EX”** METAFONT went straight from SAIL to WEB.
- 8 **“Rather than talk about”** Richard Palais email, 2017-11-30.
- 8 **“sketched his work with T_EX”** webofstories.com/play/donald.knuth/61
- 8 **Joy of T_EX** Michael Spivak, *The Joy of T_EX*, American Mathematical Society, Providence, RI, 1986.
- 8 **Michael Spivak** In addition to his AMST_EX work, Spivak early on also designed the MathTime professional fonts, based on and for use with the Times font or to replace the Computer Modern math fonts; these were made available via the PCT_EX company.
- 8 **“Gordon Bell remembers”** Email of 2017-08-03.
- 8 **“AMS commissioned Hermann Zapf”** Zapf mentions this in his own life story: linotype.com/1494/the-lifestory-of-hermann-zapf.html
- 8 **“goal of being more like how mathematicians handwrite”** *Digital Typography* (see note above), chapter 17—a reprint of a paper co-authored by Knuth and Zapf.
- 9 **“first meeting of the T_EX Users Group”** Palais interview, tug.org/interviews/palais.html; Beeton interview, tug.org/interviews/beeton.html; Fuchs interview, tug.org/interviews/fuchs.html
- 9 **“first issue (October 1980) of TUGboat”** tug.org/TUGboat/Contents/contents1-1.html
- 9 **“getting T_EX running on many different computers”** See the categories Output Devices, Site Reports, and “small” TeX at tug.org/TUGboat/Contents/listkeyword.html

- 9 **“developments in the T_EX world would be permanently documented”** *TUGboat* was originally subtitled as *The T_EX Users Group Newsletter*; as of 1988 its subtitle became *The Communications of the T_EX Users Group*.
- 10 **“TUGboat has served the typical role”** In parallel with *TUGboat*, TUG published 13 issues of the *T_EX and TUGboat News* from 1991–1995 and 20 issues of *The PracT_EX Journal* between 2005 and 2012. The news function of the former was merged into *TUGboat*; the latter’s goal was to publish only practical articles, where *TUGboat* has a spectrum of articles.
- 11 **“began to produce machine drawn letters”** Pages 64–72 of Donald E. Knuth, *Companion to the Papers of Donald Knuth*, Center for the Study of Language and Information, Stanford, CA, 2012.
- 12 **“fonts were improved again”** As described in this and the next subsection, Knuth redid his font design software and improved his set of fonts several times: the first version of the fonts was called Almost Modern; a second, never released, version was called Better Modern.
- 12 **“wider audience and to encourage support”** Jonathan Seybold email of 2017-09-03.
- 12 **“thought it deserved wider attention”** Barbara Beeton was also at Stanford in March 1980 (the visit timed so she could also attend the Seybold-organized seminar) “to learn how to program METAFONT and to create a prototype Cyrillic font for use in *Math Reviews*.” The Seybold-organized meeting was also where she first met Bigelow.
- 12 **“thought it deserved wider attention”** Bigelow notes (email of 2017-08-31), “The commercial typesetting systems guys [at the seminar] all said that T_EX was too complicated and slow to be commercially acceptable. Of course, they are all gone now.”
- 12 **“informal email text from Bigelow”** Emails of June 6 and August 31, 2017. A parallel version of the story is in his interview in *TUGboat*, tug.org/TUGboat/tb34-2/tb107bigelow-wang.pdf
- 13 **“a notable example being grammarology”** Which was based on an older notion of the study of letters, from the book *A Study of Writing: An introduction to the study of grammarology* by I.J. Gelb.
- 13 **“‘Concepts of Text’ course”** The syllabus for that course is available.
- 13 **“METAFONT for lunch bunch”** Before Bigelow got to Stanford, Knuth had a T_EX-for-lunch-bunch.
- 13 **Bernshteĭn polynomials** en.wikipedia.org/wiki/Bernstein_polynomial
- 13 **Lynn Ruggles** In 1983, Lynn Ruggles, a graduate student at Stanford, compiled a catalog of different approaches to digital type tools. (“Letterform Design Systems” by Lynn Ruggles, Stanford Technical Report No. STAN-CS-83-971), i.stanford.edu/pub/ctr/reports/cs/tr/83/971/CS-TR-83-971.pdf
- 14 **Southall also influenced Knuth** tug.org/TUGboat/tb36-2/tb113southall.pdf, i.stanford.edu/pub/ctr/reports/cs/tr/85/1074/CS-TR-85-1074.pdf
- 14 **“first academic conference”** visiblelanguagejournal.com/issue/73
- 14 **“first academic conference”** At the time, Bigelow was leading the committee on letterform education and research of ATypI (Association Typographique Internationale).
- 14 **“number of interesting reports came out”** Pijush K. Ghosh on Indian scripts, i.stanford.edu/pub/ctr/reports/cs/tr/83/965/CS-TR-83-965.pdf; John Hobby and Gu Guoan on a Chinese Meta-Font, i.stanford.edu/pub/ctr/reports/cs/tr/83/974/CS-TR-83-974.pdf; A formal approach to letter form design by Ghosh and Bigelow i.stanford.edu/pub/ctr/reports/cs/tr/83/966/CS-TR-83-966.pdf; Letterform Design Systems by Lynn Ruggles (cited above); *The Euler Project at Stanford*, a monograph by David R. Siegel, 1985.
- 14 **“commission to design the Euler typeface”** Stanford library guide to the Euler project archive, [pdf.oac.cdlib.org/pdf/stanford/uarc/sc0362.pdf](http://cdlib.org/pdf/stanford/uarc/sc0362.pdf)
- 14 **Table 1** While this was the end of work on Euler by Knuth and the Stanford group, in 2008 Hermann Zapf collaborated with Hans Hagen, Taco Hoekwater, and Volker RW Schaa on a “reshaping” of many of the letterforms (tug.org/TUGboat/tb29-2/tb92hagen-euler.pdf). For this update, Metafont was abandoned and the character outlines were manipulated directly in a font editor. This is the version of Euler currently distributed by AMS and included in T_EX distributions.
- 14 **“Knuth remembers that the digital typography program”** A summary of the T_EX project, video #70²

- 14 “**the METAFONT class which Knuth**” Donald E. Knuth, *A Course in METAFONT Programming*, *TUGboat*, vol. 5, no. 2, pp. 105–118, tug.org/TUGboat/tb05-2/tb10knut.pdf
- 14 “**May 2017 desktop publishing pioneers meeting**” [***Editorial note: We need to replace the following with the URL of the transcript of the video when the transcript is available.***]Last DTP meeting video, minutes 26 to 38.
- 16 **System Development Foundation** oac.cdlib.org/findaid/ark:/13030/tf429003m4/

From Part 2

- 1 “**TeX’s initial development**” Donald E. Knuth, *Digital Typography*, CSLI Publications, Stanford, CA, 1999.
- 2 “**in various other systems**” tinyurl.com/ms-blog-use-of-tex
- 2 “**disproportionately used in less developed countries**” Glyn Moody, *Rebel Code: The Inside Story of Linux and the Open Source Revolutions*, Perseus Publishing, 2001, p 317.
- 2 “**algorithms developed for TeX**” TeX has so much computer science in it that Victor Eijkhout built a university computer science course around TeX: Victor Eijkhout, *The Computer Science of TeX and L^AT_EX*, based on CS 594, fall 2004, University of Tennessee, pages.tacc.utexas.edu/~eijkhout/Articles/TeXLaTeXcourse.pdf; no doubt other word processors and desktop publishing systems also had lots of embedded computer science—lexing, parsing, semantic interpretation, optimization of searches, etc.—but their source files may not have been so thoroughly documented or may not be available for study.
- 3 “**line-break algorithm uses**” Donald E. Knuth and Michael F. Plass, *Breaking Paragraphs into Lines*, reprinted in Knuth’s *Digital Typography*, CSLI Publications, Stanford, CA, pp. 67–155; TEXDR. AFT, Chapter 24 of *Digital Typography*.
- 3 **dynamic-programming** TeX’s line-breaking algorithm is routinely used as an example in computer science algorithms courses in explaining dynamic programming.
- 3 **international collaboration on hyphenation** See hyphenation.org; also Mojca Miklavc and Arthur Reutenauer, *Hyphenation in TeX and elsewhere, past and future*, *TUGboat*, vol. 37, no. 2, 2016, pp. 209–213, tug.org/TUGboat/tb37-2/tb116miklavc.pdf
- 3 “**Knuth’s boxes-and-glue model**” Nelson Beebe, *Using boxes and glue in TeX and L^AT_EX*, math.utah.edu/~beebe/reports/2009/boxes.pdf
- 3 “**hz micro-typesetting method**” We know the details of Hàn Thế Thành’s pdfTeX development, but not of the development in InDesign. Both implementations got help from Zapf or his work: wikipedia.org/wiki/Hermann_Zapf; Hàn Thế Thành email of 2017-09-10; Hàn Thế Thành, *An Experience from a Digitization Project*, cahiers.gutenberg.eu.org/cg-bin/article/CG_1998__28-29_197_0.pdf; Hàn Thế Thành, *Microtypographic extensions to the TeX typesetting system*, dissertation, Masaryk University Brno, Faculty of Informatics, October 2000, reprinted in *TUGboat*, vol. 21, no. 4, December 2000, pp. 317-434, tug.org/TUGboat/tb21-4/tb69thanh.pdf
- 4 **John Warnock interview** Knowledge@Wharton, Adobe Co-founder, John Warnock on Competitive Advantages of Aesthetics and the “Right” Technology, January 20, 2010, tinyurl.com/wharton-warnock
- 4 “**easier to use and more productive than WYSIWYG systems**” This two-part paper, including the figures and the Webnotes, was composed and revised with L^AT_EX before being converted to Word for submission to the journal’s prepress process.
- 5 **Overleaf and ShareLaTeX** overleaf.com
- 5 “**a few small companies are making money**” The Wikipedia article on “comparison of TeX editors” (accessed in November 201) lists 49 editors for (L^A)TeX, with eight of them requiring payment. Most of the 49 editors work at the source code level; five claim a mix of source-code and WYSIWYG editing; two claim to be WYSIWYG; four claim What-You-See-Is-What-You-Mean editing. (LyX, for instance, lets one edit graphically with menu commands to declare what lines of text are, e.g., title line, in-line equation, etc.; and the program then turns the text into a L^AT_EX document out of view of the user.)
- 5 “**advertising section of TUGboat**” tug.org/TUGboat/Contents/listkeyword.html#CatTAGAdvertisements
- 6 “**L^AT_EX had come on the scene in 1983**” One brief overview of L^AT_EX is Open Source Documentation Software: An Overview, Shubhashree Savant and Sonal Sarnaik, International Conference on Advances in

Information Technology and Management ICAIM, 2016, research.ijcaonline.org/icaim2016/number1/icaim201635.pdf

- 6 “**surely contributed to their popularity**” In *TUGboat* L^AT_EX creator Leslie Lamport said, “I don’t think T_EX and L^AT_EX would have become popular had they not been free. Indeed, I think most users would have been happier with Scribe. Had Scribe been free and had it continued to be supported, I suspect it would have won out over T_EX. On the other hand, I think it would have been supplanted more quickly by Word than T_EX has been.”; *TUGboat*, vol. 22, no. 1/2, 2001, pp. 20–22, tug.org/TUGboat/tb22-1-2/tb70lamp.pdf
- 6 “**local user groups continued to expand**” Eric Frambach, T_EX user groups worldwide— what’s cooking?, *MAPS*, Autumn 2003, pp. 6–9, ntg.nl/maps/29/03.pdf
- 6 “**local user groups continued to expand**” Christina A. L. Thiele, The Future of T_EX and TUG, *TUGboat*, vol. 14, no. 3, 1993, pp. 162–166, tug.org/TUGboat/tb14-3/tb40thiele-future.pdf
- 8 **jT_EX and pT_EX** ctan.org/pkg/ptex, <https://ctan.org/pkg/uptex>; also Haruhiko Okumura, pT_EX and Japanese Typesetting, *The Asian Journal of TeX*, vol. 2, no. 1, April 2008, pp. 43–51, ajt.ktug.org/2008/0201okumura.pdf
- 8 “**specification of PostScript programs**” While PostScript is often thought of in terms of text fonts, it can specify any sort of drawing.
- 8 “**in the T_EX Live collection**” ConT_EXt is also frequently distributed independently of the T_EX Live collection.
- 8 **RUNOFF** J. H. Saltzer, TYPSET and RUNOFF, Memorandum editor and type-out commands, MIT Project MAC, MAC-M-193, November 6, 1964, web.mit.edu/Saltzer/www/publications/CC-244.html
- 10 **LuaT_EX project** luatex.org
- 10 “**David Grier has said**” Page 11 in the transcript of the Computer History Museum “PC Software Workshop: Marketing and Sales,” recorded May 6, 2004, CHM reference number X4621.2008.
- 10 “**Eplain is an example**” Originally created by Karl Berry, tug.org/eplain
- 11 “**sustained effort of Hàn Thế Thành**” Interview of Hàn Thế Thành, tug.org/interviews/thanh.html
- 11 “**notable example of how**” Hàn Thế Thành, The PDFT_EX Program, *Cahiers GUTenberg*, no. 28–29, 1998, pp. 197–210, cahiers.gutenberg.eu.org/cg-bin/article/CG_1998__28-29_197_0.pdf
- 11 “**comprehensively documented piece of software**” Victor Eijkhout, *T_EX by Topic*, Addison-Wesley, 1991, particularly chapters 11–14, ctan.org/pkg/textbytopic
- 11 “**kicking and screaming**” Peter Seibel, *Coders at Work*, Apress, 2009, p. 597.
- 12 “**world of users groups**” en.wikipedia.org/wiki/History_of_free_and_open-source_software
- 13 “**Gaudeul did an extensive study on T_EX**” Alexandre Gaudeul, The (L^A)T_EX project: A case study in open-source software, working paper, September 17, 2004 (quite different text than in the 2003 *TUGboat* publication); Alexandre Gaudeul, Competition between open-source and proprietary software: the (L^A)T_EX case study, working paper, January 6, 2005; Alex Gaudeul, Do Open Source Developers Respond to Competition? The (L^A)T_EX Case Study, March 27, 2006 (a different paper than the next paper with the same name); Alexia Gaudeul, Do Open Source Developers Respond to Competition? The (L^A)T_EX Case Study, working paper, March 2007, perhaps a preprint of a paper of the same name in *Review of Network Economics*, vol. 6, no. 2, June 2007, pp. 239–263.