

The Grapholinguistic Model of T_EX / “All Questions Answered” Session

Donald E. Knuth, interviewed by Yannis Haralambous

Abstract. This is the transcription of the interview and “All Questions Answered” session of Donald E. Knuth at the 2024 *Grapholinguistics in the 21st Century* conference, on October 24th, 2024. The text has been (slightly) edited and annotated with footnotes by the interviewer. In June 2026, Knuth read through the text and provided several remarks of his own, which have been incorporated into the footnotes and typeset in Xerox PARC’s Cream font to set them apart from the interviewer’s text.



1. The Grapholinguistic Model of T_EX

DEK (Donald E. Knuth): Okay. So you introduce me and so on, and then I just talk.

YH (Yannis Haralambous): Well, I’m not sure you need an introduction, but since you asked for it, Donald Ervin Knuth is one of the greatest computer scientists of the 20th century, and the beginning of the 21st, obviously.

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He wrote the *Art of Computer Programming* (TAOCP),¹ which is somehow the Bible of computer science. He is also the creator of the T_EX typesetting language, which is a programming language for producing beautiful documents of any kind, whether mathematics, dictionaries, or whatever you can think of. When he created T_EX, he noticed that the fonts were not optimal. So he created another programming language called METAFONT to describe fonts, going back to the parametric descriptions of typefaces in the Renaissance.² He used T_EX to typeset the code of METAFONT and METAFONT to create fonts for using with T_EX. So you have all of these tools and technologies combined, always with the goal of producing efficient and beautiful documents.

And they are used by millions of people today.

DEK: Okay. Gosh, I couldn't have improved on that. So are people watching me now? Can they see you?

YH: Yes. People are watching you.

DEK: Okay. Hello, everyone! The hardest thing when you're Zooming is that I don't have feedback as to what the audience is thinking, but I'm

1. This series of books (Knuth, 1968-) is DEK's magnum opus. He began working on it in 1962; the first volume was published in 1968, the second in 1969, and the third in 1973. In 1974, he received the Turing Award, whose citation honored the series as a whole, along with his foundational work on the analysis of algorithms. The most recent installment of TAOCP at the time of writing is Volume 4, Fascicle 7 ("Constraint Satisfaction"), published in February 2025, which will eventually be folded into the bound Volume 4C; Volume 4 has been appearing in parts (4A in 2011, 4B in 2022), and Volumes 5–7 are still planned to complete the series. Around 1977, he realized that if he wanted these books to be typeset properly, he would have to create his own typesetting tools. This marked the birth of T_EX and METAFONT, as well as Knuth's other legendary series of works: the series *Computers & Typesetting* (C&T), whose five volumes are, respectively, A a T_EX manual, B the T_EX source code, C a METAFONT manual, D the METAFONT source code, and E the source code for the Computer Modern typefaces, written in the METAFONT language. Here we witness the different scales of a single universe: the characters in TAOCP and C&T are generated by programs (in METAFONT); the works themselves are generated by a program (T_EX); and TAOCP explains how to write programs. Producing even a single comma in these works took a METAFONT program to draw it and a T_EX program to insert it into the text; C&T reveals these programs to us in their finest detail, and TAOCP teaches us how to understand these, and other programs, how to write them, and how to become a creator of universes just as DEK is. We live in an era where we see only the tip of the iceberg: most technologies are hidden from ordinary people, and soon, with the rise of LLMs in programming, the technology may even be hidden from the programmers themselves. TAOCP and C&T, on the other hand, are worlds where everything is open, explainable, and accessible—worlds in/on which humans have total control.

2. One of DEK's seminal texts, "Mathematical Typography," a J.W. Gibbs Lecture given on January 4th, 1978, and reprinted in his collection *Digital Typography* (Knuth, 2016), contains ruler-and-compass constructions for the letters B and S by Feliciano, Pacioli, Torniello, Palatino, Tory, and Jaugeon.

glad if you could wave and so on. I mean, if nobody laughs at my jokes, then I don’t know if anybody’s hearing me.

YH: Maybe we can start with the interview.

DEK: I only want to say one thing first, which is that Yannis did not tell me any of these questions in advance. Because I always think it’s better to have somebody stumble and give a bad answer, you get more information that way than if I had a canned presentation and was following a script. The mistakes I make might be more important than the correct answers I give.

YH: Okay. I wanted to call this part of the interview “the graphematic model of T_EX”. I sent you some definitions of what we could call a *grapheme*. It’s a distinctive unit for a given language system. A *graph*—I’m so sorry, this term has been used a lot, and is very polysemic—in this context, a graph is just a representation, the material support of a grapheme. We have people in the audience who are specialists in that. Functionally, the notions and concepts of grapheme and graph can be compared to Unicode characters and glyphs, even though the definitions are completely different.³ Graphemes and graphs are specific to a given language system, whereas Unicode nourishes the illusion of being universal.

Now, in T_EX, the T_EX source document uses characters. ASCII characters at the time evolved into Unicode characters today. These characters, when read by T_EX, become tokens and then nodes in a list. They end up being *set char* commands in a DVI file.⁴ These *set char* commands, as well as the nodes, are font-dependent. So they are just positions in a font and the font information. Then, to make this visible, you create bitmaps using METAFONT. You load them as bitmap files when printing

3. See Haralambous and Dürst (2019, pp. 139–145) for more details.

4. The distinction between “tokens” and “nodes” is reminiscent of Unicode’s dichotomy between “characters” and “glyphs” (Haralambous, 2007, pp. 54–58) in the sense that the former are abstract, more-or-less linguistic, entities while the latter are references to slots in a font, and therefore to images. DVI (“Device-independent”) is a static document format that is both minimalistic and very powerful. It is minimalistic since it contains only seven kinds of commands: (1) page initialization, (2) horizontal and vertical relative positioning, (3) nesting, (4) glyph setting (among which also the *set char* command mentioned in the text), (5) black box drawing, (6) font definition and activation, (7) “special” commands that have no semantics and the arguments of which are directly transmitted to the printer driver. The entire list of commands is explained in two and a half (!) pages of Volume B of C&T (Knuth, 1982a, §585). By way of comparison, the PostScript manual is a 912-page-long book (*PostScript Language Reference* 1999) and the PDF manual a 1310-page-long PDF file (*PDF Reference* 2006). Another feature of DVI is the fact that it is very precise since all calculations are done in the microscopical unit sp (a unit equal to 5.363 nm). Besides its extreme precision, DVI is powerful because it supports arbitrary nesting, enabling any kind of alignment between visual elements.

the DVI document. The only place where we still have some information on the identity of the glyph, in this case, is in the METAFONT code, where you have the name of the character.

My question is: What was the original idea behind an “electronic T_EX document”? Would it be just the source code that needs to be compiled? Would it be the source code plus DVI plus METAFONT? Or would it be these, plus the process of building the document, using also the format and all other resources?

DEK: Of course, I didn’t start out with the idea that I was making something extremely general. But I was faced with the problem of typesetting one book. My original idea was that I had just learned that there was good technology to print books that used pixels, you know, bits, instead of chemistry and metallurgy and photography and all that scary stuff. But the task of making beautiful books had turned out to be a computer science problem, which was just zeros and ones. I was faced with a situation where mathematicians and computer scientists were left behind because the printing technology had switched over, but we didn’t have anybody to figure out what the theory of it should be. So I needed something that would keep my own books from looking terrible. The drafts that I got from the proofs of volume two of TAOCP, well, you can find them in the Stanford archives,⁵ but I don’t recommend that anybody really look at them because it’s so painful to the eyes.

The shift from the quality typesetting of the 1960s to the unspeakable quality of the middle 1970s made me wonder whether I should ever write another book. So I had this problem: how to make my books look good again for the second edition. I found salvation when I learned that there were actually new machines that could print something that looked like real books using just zeros and ones.

Okay, I started out, and I didn’t have any idea about DVI or any of this stuff. All I know is I have a book, and I want to get it done. Well, I found out at that time what the state of the art was and what the best publishers of mathematics texts were doing. One of the main centers was in Belfast,⁶ and so they would compose onto paper tape, and they had skilled compositors who spent a lifetime composing mathematics. These people prepared things that went to paper tape, and then to another machine, and eventually a book would come out.

5. See https://archives.stanford.edu/catalog/sc0097_aspace_ref128_jpj, as well as footnote 8

6. The Universities Press in Belfast was a groundbreaking printing house using Monotype equipment, founded in 1959. It was dissolved in 2013.

So I learned what their system was,⁷ just so I could see what kind of basic functions need to be included. But I also knew about the system that Bell Labs had, and it’s one of the systems people used to access documents in electronic form. Those were only imitations. But this one in Belfast was state-of-the-art for real printers, and not toy experiments. I wanted something state-of-the-art, and I also investigated different machines being made for printing at the time, so that eventually I’d be able to send the zeros and ones to a good device.

Okay, so how did I start creating this model that you described? Well, it was simple. I looked at my book and found about eight pages’ worth of stuff, including all the different kinds of things that had to happen. I mean, I certainly needed ordinary text. I had to have equations. I had to have tables. I had to have computer programs. And line art for illustrations. In my book, I really didn’t need any photographs. But anyway, I made myself a mini-book consisting of eight pages, and I said, “Okay, now suppose this was my whole book. What language would I use? How would I enter this into a computer? What would I like to do?”

Then it remained to write a compiler that would compile for this little language into instructions for a machine. My test program is reproduced in full in my book, *Digital Typography*.⁸ So you can see the very first trial

7. The Universities Press in Belfast was using the Monophoto system (Boag, 2000), a transitional adaptation of the Monotype hot-metal composition caster. Reading the same punched paper tape from the keyboard as regular Monotype hot-metal machines, the Monophoto produced a high-quality film negative with the characters exposed on it instead of casting metal. See the beautiful documentary video <https://www.youtube.com/watch?v=DXfZjk9Mu9s>.

8. We can’t help but share the beginning of this test program—so different from the L^AT_EX code we’re used to—with the reader, both for the nostalgia it evokes and for the fabulous von Neumann quote it contains (Knuth, 2016, pp. 508–509):

```
\require ACPhdr
%Example TEX input related to Seminumerical Algorithms
\ACPages starting at page 1:
\titlename %This tells the page format routine not to put a page number on top
\runninglefthead{RANDOM NUMBERS}
\ljustline{\hexexpand 11 pt {\:p CHAPTER \hskip 10 pt THREE}}
\vskip 1 cm plus 30 pt minus 10 pt
\rjustline{\:q RANDOM NUMBERS}
\vskip .5 cm plus 1 pc minus 5 pt
\quoteformat{Anyone who considers arithmetical \cr
methods of producing random digits \cr is, of course,
in a state of sin. \cr} author{JOHN VON NEUMANN (1951)}
```

The attentive reader will have noticed the missing backslash before “author” on the last line. This is not an error. In fact, DEK writes in (ibid., p. 512): “The word ‘author’ which appears in this definition is not preceded by the escape character \ since it is scanned as part of the \quoteformat macro. Please don’t expect to understand this mess now, T_EX is really very simple; trust me.”

that I made as an input language that I thought I'd be able to handle. Then there was a second version a couple of months later. So anyway, that was where it started.

But there was this chicken-egg problem because we didn't have fonts, as you mentioned. First, I had to write something that would make fonts. But then, to have fonts, you needed something that would use them. So I had to do both things at once. There was a period of six months where I didn't have anything working. I just had ideas on paper.

Finally, I guess it was April of 78, when I spent every night from midnight to 10 o'clock, when the computer wasn't crowded, putting these systems together.

So anyway, it started with something I was designing for myself and my secretary, and it was supposed to solve problems I could foresee and that I'd be interested in. Well, but I was working at Stanford's AI lab, and there were about 100 people there, and it's very open, and everybody's watching, say, "What are you doing, Don?" So people said, hey, maybe we'd be interested to do it, too. Guy Steele⁹ was there, and he decided to port my system so that people at MIT could take a look at it. Eventually, I got to a point where 100 people were using it, and I had to write a manual.

Then there was a time when it reached 1,000 people, and every group had suggestions I hadn't included.

So it evolved over time: the idea of making things more and more universal at every stage, and a better understanding of which kinds of abstractions are going to be useful.

So I probably answered less than what you wanted or more than what you wanted, but I'll let you ask another question, and then I'll know.

YH: So you never had the dream of Project Gutenberg full of $\text{\TeX}$ documents, all books ever written in $\text{\TeX}$ on a server?

DEK: I didn't have this as a dream. That came later. I mean, that was too much to hope. I mean, I'm not that good at predicting the future. I'm not any good at predicting the future.

But I mean, my only dream at first was quality for at least one book.

YH: My next question is about spaces. Can I remind the public that in the DVI format, you have the *right* command,¹⁰ which is used both for

9. Guy Steele is the co-inventor of the Scheme programming language and one of the great language designers. He is the co-author of the 1983 edition of the *Hacker's Dictionary* (Steele et al., 1983), which is especially interesting to linguists since it describes language mechanisms that are specific to hackerese English (see also footnote 16), such as verb doubling, sound-alike slang, the -P convention, overgeneralization, spoken inarticulation, <anthropomorphization> and implicit comparatives.

10. See footnote 4 and (Knuth, 1982a, §585). The *right* command belongs to the category of DVI horizontal and vertical relative positioning commands.

spaces between words and for kerning. It’s the same command. There is no distinction between kerning between letters and spaces between words.

I’m asking because the role and function of spaces are hot topics in grapholinguistics. We had a very nice talk about that today.¹¹ I wanted to ask, was it a deliberate choice to match the two concepts, the concept of kerning and the concept of interword space, even though in the input file you have the space character between words and nothing between letters?

So was it a deliberate choice to merge these two concepts?

DEK: I think it’s independent. In the DVI, for all the same reasons as in PostScript, you just have this question of having to have coordinates where everything is being placed. So whatever commands you need to tell you how to go to a new x, y position, you could give full coordinates every time, or you could give relative coordinates, relative to where you are.

So there’s no difference among positioning commands. There’s no semantics in there. That’s specifically just to identify where to plant the next bit.

But in the input, I started out naively only knowing what normal Americans know about spaces. The main thing I thought about spaces was that I had seen a word processor where people used two spaces instead of one. By mistake, they wouldn’t know that they were inserting different amounts of space.

I was careful to say that if you have to type two spaces, it doesn’t get into your document unless you somehow say, “I meant this to be an extra space”. There’s also a question, you know, when you get to the end of a line, does that imply a space or not? I was careful to look at that. I didn’t know about kerning in those days. I picked that up a little bit later in my reading. I spent a lot of time in Stanford’s typography collection, looking at all the books I could find about how to do it well. That kind of spacing was not part of my original thoughts.

The spacing in mathematics was very, very strongly a part of my original quest because I studied and found what I call the standards of excellence in mathematical typesetting. I took a lot of measurements of how they did it. I also saw how the people in Belfast had manually said “Oh, here I’m inserting a thick space or a thin space in a mathematical formula”.

I knew what kind of primitives for that kind of space were going to be needed. But what actually goes into a DVI file has nothing to do with

11. Amalia E. Gnanadesikan, “Mind the Gap: Spaces and Boundaries in Spoken and Written Language,” <https://www.youtube.com/watch?v=sldNkvkyQlY>.

the meaning of space. The meaning of space in DVI is only about getting me from here to there.

YH: My third and last question is about the sentence ending full-stop. You are clearly distinguishing in the *T_EXbook*,¹² the sentence ending full stop and the abbreviation point, which is, a point followed by a backslash and a space. We talked about this today, and it's a syntactic distinction between the end of a sentence and an abbreviation point for staying in the same noun phrase. This distinction between the full stop and the abbreviation point exists only in T_EX. Unicode doesn't know about this. Even in TEI,¹³ you only have an XML element for abbreviations, but nothing specifically for the difference between the full stop, which in the typewriter will be followed by two spaces, and the abbreviation point, while the abbreviation point is followed by one space.

So my question is, do you believe that a typesetting system like T_EX should go beyond legacy encodings like Unicode or should it remain within the boundaries of universal standards?

In other words, if Unicode had existed in the early seventies, would you have based T_EX strictly on it, or would you have left some room for users and developers?

DEK: I'm thinking that standards grow. So, I mean, the Unicode standard wasn't there, but I certainly learned later about all kinds of standards that were enforced in different countries at different times.

I know that, for example, in France, putting an accent on a capital letter gets in and out of fashion every 20 years, and in Germany, they had strict rules for how you typeset the Roman numerals. They were extremely pedantic and awful. Just because something is a DIN standard meant nothing to me. I'm saying, what should the world really be

12. In Chapter 12 ("Glue") of the *T_EXbook* (Knuth, 1982c), DEK explains that the period after an abbreviation "doesn't count as a sentence-ending full stop." T_EX's method to mark this property is either by using a non-breakable space ~ or a _ command after the abbreviation period. The example `Proc.\ Amer.\ Math.\ Soc.` is commented as follows: "Granted that this input looks a bit ugly, it makes the output look right. It's one of the things we occasionally must do when dealing with a computer that tries to be smart." This text is followed by Exercise 12.4: *Explain how to type the following sentence*: "Mr. & Mrs. User were married by Rev. Drofnats, who preached on Matt. 19:3-9." The answer is `Mr.~\& Mrs.~User were married by Rev.~Drofnats, who preached on Matt.~19\thinspace:\thinspace3--9`. Using the ASCII tilde character for nonbreakable spaces is still part of a T_EXist's most basic instincts.

13. The Text Encoding Initiative defines element <abbr> to contain abbreviations of any sort (Sperberg-McQueen, Burnard, et al., 2025, §3.6.5) but does not mention the change of behavior of the period included in the abbreviation. Here is an example given in the documentation: <abbr>Dr. M.</abbr> Deegan is the Director of the <abbr>CTI</abbr> Centre for Textual Studies. Nothing in this example serves to distinguish the role of the period character in the abbreviation from that of a regular full-stop.

like? Now, as far as full stops are concerned, the sentence also ends with question marks and exclamation marks. Then there are quite different conventions in France and America that I didn’t realize. We have something in America we call French spacing, which, I think, means that you don’t put extra space after a full stop, while in America we’re more accustomed to having more space at the end of a sentence, whether it’s a full stop or a question mark or whatever.

My original design was to make it look like American books, but later on, I learned that, for example, some books were banned in America because they were, you know, too sexually explicit.¹⁴ So they were typeset in France, and I found in the library that they used French spacing there.¹⁵

I learned later that in France they have this peculiar idea of putting a little space before a colon, which never occurred to me when I was designing things. The original thing was that I had read a lot of books, and I wanted my book to look like the ones I liked best. But it would make sense that, after the number of users went past 1,000, then 10,000, then 100,000, and spread to other countries, I learned about these other things and tried to adapt them.

In my original design, I had no idea I would do anything that would be used all over the world. I wouldn’t have dreamed of that. And actually, I had to decide, really, what I do best, and I decided that, like, what I do best is write TAOCP.¹⁶ So I had to go through a period when I had to

14. DEK is referring to books published by the Obelisk Press in the 1930s and the Olympia Press in the 1950s, both based in Paris. Obelisk was founded by the Manchester-born Jack Kahane; Olympia was founded by his son Maurice Girodias, who took his French mother’s maiden name and continued in his father’s line of work after the war. Books such as Nabokov’s *Lolita* and Beckett’s *Molloy*, both Olympia titles, were bought by American and British travelers and smuggled back into the US and the UK. [DEK: Actually I was thinking primarily of *Lady Chatterley’s Lover*, which indeed was published by Obelisk.]

15. French spacing is in fact a loss of linguistic information, since sentence endings are left unmarked. Preserving that information, however, comes at a cost: English spacing requires the typesetter to examine each period to decide whether it ends a sentence or marks an abbreviation point. This can amount to a great deal of effort when one considers that a book may contain thousands of periods (*Moby Dick*, for example, contains 7,385).

16. The importance of TAOCP is such that, as indicated in *The New Hacker’s Dictionary* (Raymond, 1991), in hackerese language, the term “Knuth” is used as a reference to TAOCP. Here is the entry for ‘Knuth’ in this dictionary: “**Knuth** [Donald E. Knuth’s *The Art of Computer Programming*] n. Mythically, the reference that answers all questions about data structures or algorithms. A safe answer when you do not know: “I think you can find that in Knuth.” Contrast **literature, the**.” And here is the entry for ‘literature’: “**literature, the** n. Computer-science journals and other publications, vaguely gestured at to answer a question that the speaker believes is trivial. Thus, one might answer an annoying question by saying, “It’s in the literature.” Oppose **Knuth**, which has no connotation of triviality.”

find an endgame. How can I leave the work on further refinements of typography to other people?

So I would wake up in the morning and not say, “What great new model should I have to improve, to get better and better ligatures in Tamil or something?” But I wake up in the morning and say, “How can I finish this project and get it over with?”

YH: OK, and one last question, very short. You know that in grapho-linguistics, we are very much interested in phenomena that are purely in the written modality of language. One of these phenomena is hyphenation. So you have worked a lot on hyphenation. You even had a PhD student¹⁷ to create a generator of hyphenation patterns.

My question is: In the Stanford Linguistics Department, was there ever a linguist interested in your work on hyphenation?

DEK: That’s a great question. I don’t think any of the people here, any of my colleagues, expressed special interest in that. So all these things are really important. I’m so delighted whenever I read your papers, in particular, to see how beautifully you’ve taken care of these details. The interesting thing is that they’ve evolved in so many different cultures and by so many different kinds of influences. So it’s a marvelous tableau to see people striving for beauty in different ways. It’s an endless quest. But it’s also that, that’s the point of life, to be engaged in these wonderful journeys.

YH: Thank you very much. So I will stop monopolizing you. We can start with the “All Questions Answered” session.

2. An “All Questions Answered” Session

GG (Giulio Galli): Good evening. Thanks for being here. So my question is, it seems to me, coming from typeface design education, that other than the content and the implications of both METAFONT and T_EX themselves, what also stuck very much in literature and mostly in people’s mind today is the debate between you and Professor Hofstadter,¹⁸ back

17. Frank Liang, “Word Hy-phen-a-tion by Comp-put-er,” 1983 (Liang, 1983), in which he considers hyphenation as a data compression problem and invents a new data structure, the *packed trie*, to efficiently store and search hyphenation patterns.

18. This “debate” may rest on a misreading of DEK’s original claims. In No. 1 of the 1982 volume of the *Visible Language* journal, DEK presented the parametric possibilities offered by the METAFONT programming language (Knuth, 1982d). In No. 4 of the same volume, Hofstadter characterized Knuth’s position as “falsely optimistic,” attributing to it two claims: “(1) that underneath all ‘A’s there is just one grand, ul-

in the 80s, about parametrizing typefaces. It is more often than not presented as a contrast. I even had a full module back in my master’s year titled “Knuth vs. Hofstadter”. But now, my personal takeaway, after reading both your and his articles, is that the overlap between your views may be greater than is sometimes communicated.

So I guess my question is: how do you reflect on that debate that seems to have struck a chord for you, and on the many more debates on the topic in the typographic community?

DEK: Let me introduce my colleague here, Luis Trabb Pardo. He was my right-hand man on T_EX in the early days.¹⁹ Can you see? No, you can’t see it, but they want to see you now, yes.

Okay, so anyway, Luis, did you understand his question?

LTP (Luis Trabb Pardo): I didn’t follow that particular question.

DEK: Okay, you mentioned Hofstadter? My favorite story is that Doug said at one point, “The most important question in artificial intelligence is, ‘What is the letter A?’ And I said, ‘Yes. And the second most important question about AI is: What is the letter I?’”²⁰ You don’t get it, but anyway,

timate abstraction that can be captured in a finitely parametrizable computational structure—a ‘software machine’ with a finite number of ‘tunable knobs’; and (2) that every conceivable particular ‘A’ is just a product of this machine with its knobs set at specific values” Hofstadter (1982, pp. 309–310). Hofstadter further argued that “to fill out the full ‘space’ defined by a category such as ‘chair’ or ‘A’ or ‘waltz’ is an act of infinite creativity, and that no finite entity (inanimate mechanism or animate organism) will ever be capable of producing all possible ‘A’s and nothing but ‘A’s” Hofstadter (ibid., p. 310). However, a close reading of DEK’s article does not straightforwardly support this attribution. DEK argued that any given typeface can be described by some METAFONT program, and that a single program can, with appropriate design, parametrize several typefaces simultaneously and generate interpolations among them. He did not claim that a single, universal program could generate *every conceivable font* solely by varying parameter values. Hofstadter’s critique, while philosophically substantial in its own right, appears to engage with a stronger claim than DEK actually advanced, which calls into question whether a genuine disagreement over DEK’s position ever existed.

19. Luis Trabb Pardo, originally DEK’s PhD student (Trabb Pardo, 1978) and then working on the T_EX project (with the title “Associate Director, T_EX Project”), is known for the TPK (Trabb-Pardo-Knuth) Algorithm (Knuth and Trabb Pardo, 1980), which allows programming languages to be compared. See also <https://www.tug.org/interviews/trabb-pardo.html>.

20. In fact, this exchange between Douglas Hofstadter and DEK is documented in the former’s essay “Waking Up from the Boolean Dream, or, Subcognition as Computation”: “I hereby make the following claim: The central problem of AI is the question: *What is the letter ‘a’?* Donald Knuth, on hearing me make this claim once, appended, “And what is the letter ‘i’?”—an amendment that I gladly accept. In fact, perhaps the best version would be this: The central problem of AI is: What are ‘a’ and ‘i’?” (Hofstadter, 1985, p. 633)

there are definitely, in all, I mean, the older I get, I see more different art forms, and font design is one of them, it covers more than one art form, and it involves so many different things about, you know, not only the optical illusions, but also a great deal more. I had fun reading Yannis' description from some years ago about emojis, and all these, okay, so, but your specific question is what?

GG: I just wanted to ask you, how do you see 40 years later, how do you reflect on that debate around the possible or not parametrization of typefaces, that debate you had with Professor Hofstadter back in those days?

DEK: Okay, well, I still believe that it's wise to think of parameters in every project you do, some projects are one-off, but other ones, you know that you have certain things that you can vary, and it's very important to focus on how you would vary the design, if your boss came in the next day and told you that he wanted it to be different.

If you understand this notion of parameter, that's great, but I don't think you're going to get to a point where we've universally decided what all the parameters are, that's like saying we've all decided what kind of novels can be written and what kind of statues can be made, or what kind of puzzles can be formed, or what kind of jokes can be told? Apparently, a best-selling book is coming out that says all literature falls into one of these seven plots or something.

DB (Doris Behrendt): Hello, my name is Doris. I have greetings from the German-speaking T_EX user group, by the way, and I wanted to ask for your opinion on the Comic Sans font.

It has a reason. The reason is that this year I saw a lot of famous people giving talks, and their slides were with Comic Sans. I just wanted to get your opinion on it, since it's going viral a bit.

DEK: Yeah, that could be a danger. But also, I was at a conference at MIT where several of the best talks were illustrated with Comic Sans. I first saw it, I think, probably in Christos Papadimitriou's graphic novel,²¹

21. This graphic novel is called *Logicomix*. It appeared first in Greek (Δοξιάδης, Παπαδημητρίου, Παπαδάτος, and Di Donna, 2008) and then in English (Doxiadis and Papadimitriou, 2009). It is the story of the lives and works of Georg Cantor, Ludwig Wittgenstein, G. E. Moore, Alfred North Whitehead, David Hilbert, Gottlob Frege, Henri Poincaré, Kurt Gödel, and Alan Turing, narrated by Bertrand Russell. Typographically, it is quite interesting, since the texts by characters from the present are typeset in all uppercase, while Russell's narration is always in mixed case. On page 54 (of both editions), Goethe's *Mailed* is even set in (badly kerned but otherwise correct) Schwabacher script.

Besides its other qualities, *Logicomix* is also interesting from a grapholinguistic perspective, for the following reason: On page 69, the young Russell uses Greek script

which talks about famous logicians. But in that work, it was only all-caps. I probably went through five or ten years seeing only the capital letters of Comic Sans.

But now, okay, we’re engaged in a project where a wonderful friend, Siobhan Roberts,²² is compiling a strange biography of me, where we’ve gone through all of my memorabilia, and we’ve photographed all kinds of ephemera from every period of my life, and letters written, and so on. But also, I kept a diary, a daily diary of technical things that I was doing. So, this book that she’s planning, we’re working on it, probably, hoping maybe in a year it’ll be done, but she’s going to be quoting a lot from my diary.

The question was, what font to use for the diary entries? I said immediately, “Comic Sans.” But now, if you say it’s going viral, it’s going to be too much a part of the furniture.²³ But certainly, I’m going to see the proofs of it next month. I don’t know the history of that font, or who created it. When I was working on T_EX in the 70s, we had a font that ev-

to transcribe the entries in his diary so that his tyrannic grandmother is unable to read them (the title on the diary’s cover being “Greek Exercises” for camouflage). The graphic novel shows a page of this diary, written in English transcribed phonetically into Greek. What is interesting is that the phonetic transcription of English *differs* between the Greek and English versions of *Logicomix*. In the former version, it adopts the modern pronunciation of Greek and the monotonic system (the monotonic system is an abomination that was introduced in Greece in 1982, many decades after Russell supposedly wrote those lines), and in the latter version, it adopts a more-or-less Erasmian pronunciation of Greek. So, for example, the words “humans behave” are transcribed “ὕμανς μιχαίηβ” (no breathings, a mu-pi digraph for the /b/ and a beta for the /v/) in the former, and “ὕμανς βιχαίηφ” (rough breathing on the upsilon to express the /h/, a beta for /b/ and a phi for /v/—even though a digamma would be more appropriate than a phi here) in the latter. This variation in the transcription scheme clearly demonstrates that transcriptions are not only linguistic but also cultural adaptations. But the comparison between the two transcriptions is even more interesting since it reveals failures, *quasi-Freudian slips*: on the one hand, in the English and supposedly polytonic version, many monosyllabic words (such as “Μοστ, μορ, το, κορς” for “Most, more, to, course”) are unaccented, something that would never happen in polytonic Greek; on the other hand, in the Greek version of *Logicomix*, an upsilon is used for the word “humans,” as a trace of the /h/, and an omega is used for the words “all” and “also,” as indicator of the length of the syllables. These linguistically sound practices were common before the 1982 monotonic reform (Haralambous, 2019), but quite seldom in as late as 2010. It would be interesting to determine the extent to which these phenomena are accidental versus intentional.

22. Siobhan Roberts is a Canadian author and science journalist, and a regular contributor to the *New York Times*. She authored “The Yoda of Silicon Valley,” a beautiful text on DEK in the Profiles in Science series (Roberts, 2018), which ends with a troubling quote about AI: “I am worried that algorithms are getting too prominent in the world. It started out that computer scientists were worried nobody was listening to us. Now I’m worried that too many people are listening.”

23. Quoting Siobhan Roberts (personal communication, June 5th, 2026): “the book is in the works. There is no publication date yet. I am still writing. I’d say it is uncertain as to whether Comic Sans will be used, but perhaps in some shape or form.”

everybody loved on our Xerox graphics printer. I can't remember its name now.²⁴ But it was rather similar to Souvenir. A lot of people know the font called Souvenir, and it was used so much.²⁵ Everybody loved it for 10 years, but all of a sudden, everybody started hating it. So, I don't know when the last book printed in Souvenir was, but there was a time when more than half of the publications used Souvenir.

LML (Lothar Meyer-Lerbs): Hi, my name is Lothar. The big question is, as you said, you have not planned T_EX and METAFONT to do all these things, but in hindsight, what would you add to these programs? What features are missing? What would you like to see in a version that's no longer yours? What should people put into these programs to make them better?

DEK: Now, let me first give a joke answer, you can look online for a talk that I gave called "An Earthshaking Announcement".²⁶ This was, in fact, I view that as my last technical paper of my life. I mean, there's going to have to be a last one. I decided that that was going to be the last one. Everything else will be a blog or something. It was a talk I gave at a T_EX user group meeting in San Francisco. It was in the same place where Steve Jobs used to announce the newest features for Apple products. I described the future *²⁷ project, the successor to T_EX, which is called iT_EX. But you had to pronounce it with tones. You also, if you did it correctly, should ring a bell as well. It had a special logo that included the

24. The interviewer searched in Stanford Artificial Intelligence Laboratory Operating Note 74 "Find a FONT" (Earnest, 1976), and it appears that the font that is visually closer to Souvenir was probably called Meteor. DEK: By chance, I was looking at Find a Font a few days ago, and I did NOT find the font that I was talking about. [With Gemini's help, I also found what is no doubt the most comprehensive list of font samples from that era, namely Christman (1980).] So I decided that the font in my mind must have been on the Dover printer, NOT the XGP. Sure enough, Gemini was able to help me identify it—the name was "Cream"—and to show me its actual bitmaps. Cream, designed by Bob Flegal, was wildly popular, adopted by Smalltalk for example, and is now available via KreativeKorp as "Parc Place.ttf" and "Parc Place Legacy.ttf". The thing that marries Cream to Souvenir is mainly the lowercase letters like e, v, w, y. (The fonts can be downloaded from <https://www.kreativekorp.com/software/fonts/index.shtml>.)

25. People think of Souvenir as a paradigmatic 70s font, but it was originally designed by Morris Fuller Benton for ATF in 1914. In 1971, Ed Benguiat redrew and expanded it for ITC, and it became ubiquitous. Quoting Jeremiah Shoaf, in his *Type-wolf* Web site, "Due to its rampant overuse in the 1970s, ITC Souvenir is notable as one of the most hated typefaces by designers active in that time period—I like to think of it as the Comic Sans of the 70s."

26. The talk can be viewed here: https://www.youtube.com/watch?v=eKaI78K_rgA and the transcription can be found in Knuth (2010) and in Knuth (2011, pp. 707–715).

27. Here and in Knuth (2010), the asterisk signifies that any phonetic (or synesthetic, see footnote 28) realization of this logo should include the ring of a bell.

bell. Anyway, you can see a video of this talk. It lasts half an hour. It was a satirical thing that essentially said I learned I have no talent for writing programs, so I should instead hire somebody to do the programming properly. They were going to use all of the techniques of software development that satisfy all the buzzwords. Not only did it include improvements to fonts and kerning and so on, but it also did three-dimensional things. It would include 3D printing. It would include music. It would also include, well, search features. It did mathematical computations.

Essentially, it was a combination of Google, Facebook, and Mathematica. I didn't have ChatGPT as part of it at the time, but I would have included it if it existed at the time. Anyway, the idea was that this successor to T_EX was going to be everything to all people, and it was only going to cost—of course, it had to be charged for, because that was one of my big mistakes, my biggest mistake was putting T_EX in the public domain—it was only to cost \$100 a month, but if you could get 10 other people to sign up, you could get it for nothing. So there was this Ponzi scheme associated with it as well. And so, you know, the other big mistake I made was using literate programming, etc. Actually, I sort of—this would be my final paper, because my first paper was a satire that was published in *MAD Magazine* when I was in high school.²⁸ Okay, now, we're

28. Here, DEK puts his two seminal texts into perspective: his incipit, the *MAD Magazine* article in which he presents his own system of measurement (one *potrzenie* corresponds to the thickness of issue 26 of *MAD Magazine* (1957), one *blintz* corresponds to the mass of a halavah cake with a volume of 1 cubic dekapotrzenie, etc.) and his own calendar (long before January 1st, 1970, which is the origin of the Unix calendar, DEK introduced October 1st, 1952, as the origin of the MAD calendar); and its excipit, the text of his presentation “An Earthshaking Announcement” published in TUGboat in 2010, in which he presents his supposedly new version of T_EX. Aside from his ability to satirize the spirit of the times, we notice a very strong commonality between the two texts: their human depth. The meter was, in the past, defined as one forty-millionth of the Earth's meridian—but how do you really calculate such a length? The *potrzenie* is a measure accessible to ordinary people, and fundamentally honest: its lack of precision is right there, before our eyes; there's no need to hide it behind pseudo-scientific rhetoric. The *potrzenie* is just as fragile as we are in the face of technological advances: how will we measure it on the day the last copy of MAD #26 is reduced to dust? DEK's * project reminds us that communication has always been multimodal (we can hear the rustling of a book's pages, we can smell it, we can even eat it like Gérard Philipe, cf. Cloux, 2007; Haddad, 1984) and that the simplification of transmitting only text (as defined by Unicode) is a historical aberration. His idea of ringing a bell every time the * logo is spoken, aside from the reference to Catholic liturgy or to the ASCII BEL character (0x07), creates a synesthetic experience, not to mention the symbolic aspect of this bell: “to ring a bell” means both “to physically ring a bell” and “to spark a previously forgotten memory.” He thus adds a psychoanalytic dimension to the sensory and synesthetic dimensions. To conclude this 1957/2010 comparison, the first article reveals a young mind who had already grasped that all formal systems rest on informal choices—his final article shows us that so-called progress increasingly consists of forgetting things: stability,

probably talking about more. The things that have come out in X_YT_EX and so on are probably the things that are—who is it, Jonathan Kew?²⁹ He knows a lot about many languages, and I think his insights were especially valuable for preparing for the future. I think it's important to have something that can change, but it has to be archival. It should be that, for an important document somebody writes, you should be able to see it again 50 years later. If your conventions are changing all the time, because it depends on somebody's rendering engine or something like that, that's impossible. One of the most important things was to keep it small, well enough defined that you can say this is a permanent document, and not a trendy, ephemeral document. I mean, the World Wide Web has a subset of HTML that I can use, which they say they're going to keep going forever.³⁰ I think that's very important.

YH: Okay. There are many font designers in this room, so I cannot help but ask: When you started collaborating with Hermann Zapf, were you speaking the same language? I don't mean German and English. I mean, between a computer scientist and a font designer, were there any terminological or perceptual hurdles?

DEK: I think Hermann and I hit it off rather well. I mean, he was thinking about using brushes and pens. And he, you know, he taught me what he

literate programming, the “do-it-yourself-to-better-understand” approach—all of this is disappearing in the era of LLMs, and DEK traces, with gentle precision, the outline of what is being left behind. Furthermore, both papers share a structural joke: they present absurdity in the form of rigorous technical specification. The Potrzebie System has conversion tables; * has pricing tiers and certification levels. The comedy in both cases comes from the mismatch between the seriousness of the form and the playfulness of the content—which is, of course, exactly what all of DEK's serious work does in reverse: serious content in a form made as accessible and even playful as possible. The two satirical papers are his serious work seen in a mirror.

29. Jonathan Kew (SIL International) is the developer of X_YT_EX, an extension of T_EX that communicates with the surrounding operating system in order to render “complex” scripts such as Arabic, Hebrew, CJK, etc. (Robertson, Hosny, and Berry, 2025). Unfortunately, ever since 2020, X_YT_EX is considered unmaintained and has not seen any evolution. As of the writing of this text (June 2026), the most promising extension of T_EX is LuaT_EX, which uses an internal programming language (Lua) to access the various data structures inside T_EX in real time (Hagen, Henkel, Hoekwater, and Scarso, 2025).

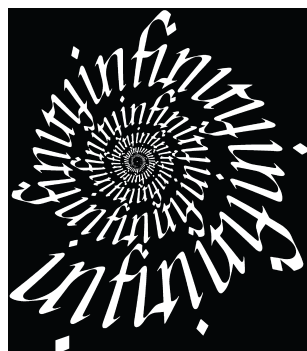
30. In 2004, the W3C founded the Web Hypertext Application Technology Working Group (WHATWG) to manage the evolution of W3C standards and tests. In their FAQ (<https://whatwg.org/faq>), they claim that their foundational principle is backward compatibility—parts of the standard that have matured and been implemented generally cannot be changed in ways that are backward-incompatible without extreme care. But they also say, more candidly, that “if the web is replaced by something better and dies, the HTML Standard will die with it,” which is a bit less optimistic.

meant by this. And our early discussions about the Euler typeface³¹ went through, you know, we had dreams that couldn’t be fulfilled because they were probably trying to do too much. So I dedicated METAFONT to Hermann, and I said, you know, “To Hermann Zapf: Whose strokes are the best.”³² I meant that in two senses. Not only the marvelously beautiful strokes that he would draw, but in English, there’s another meaning of strokes, which means “compliments”. Whenever I did something that he didn’t approve of, he would tell me right away. So I knew that when he did occasionally give me a compliment, it was real. I really appreciated the strokes that were slaps in the face, as well as the strokes that were saying, “Okay, Don. You’re starting to get it.”

YH: Any other questions?

GG: I have a very quick question. What is the poster behind you? Is that an ambigram?³³

DEK: That is by Scott Kim, one of my students,³⁴ yes. I’m glad it shows up. Let’s see that.



31. The Euler font family was commissioned by the AMS to Hermann Zapf. The first book entirely typeset in Euler was “Concrete Mathematics” (Graham, Knuth, and Patashnik, 1989), and, in a way, the font’s originality matches the originality of the contents, where “Concrete Mathematics” is used both as an antidote to “Abstract Mathematics” and as the contraction of “CONTinuous and disCRETE Mathematics.” As the authors explain in the Preface, “The underlying philosophy of Zapf’s design is to capture the flavor of mathematics as it might be written by a mathematician with excellent handwriting. A handwritten rather than mechanical style is appropriate because people generally create mathematics with pen, pencil, or chalk. [...] This new type family has been named AMS Euler, after the great Swiss mathematician Leonhard Euler, who discovered so much of mathematics as we know it today. We are especially pleased to be able to inaugurate the Euler family of typefaces in this book, because Leonhard Euler’s spirit truly lives on every page: Concrete mathematics is Eulerian mathematics.”

32. Dedicatory sentence on page ii of the *METAFONTbook* (Knuth, 1982b).

33. The concept of *ambigram* has been coined by Hofstadter. He defines it as “a visual pun of a special kind: a calligraphic design having two or more (clear) interpretations as written words. One can voluntarily jump back and forth between the rival readings, usually by shifting one’s physical point of view (moving the design in some way) but sometimes by simply altering one’s perceptual bias towards a design (clicking an internal mental switch, so to speak). Sometimes the readings will say identical things, sometimes they will say different things” (Hofstadter, 1987).

34. Scott Kim is a computer scientist, DEK’s PhD student (Kim, 1987, with Charles Bigelow in his thesis committee), puzzle and video game designer, artist, author, and recreational mathematician. He wrote one of the first books on ambigrams, called *Inversions* (Kim, 1981), with a foreword by Hofstadter and a backword by Jef Raskin.

By the way, I saw Scott last Sunday, and so he now has kids getting out of college, and he's having fun making some YouTube videos with one of his sons.

Were any of you at Stanford last year at the event that Tom Mullaney organized?³⁵ I mean, look, there were many shared interests. Like, I talked to the people who did the cuneiform fonts, for example, and Chuck Bigelow was one of the keynotes. Well, we had quite a few great speakers.

MD (Martin Dürst): Hello, Don, this is Martin Dürst. I have a question, a little bit less technical. You were extremely healthy and active and so on. I wanted to ask if there's anything that, well, that keeps you healthy and going?

DEK: Well, I've been lucky, although, okay, so a week ago, I had a cataract removed in my left eye. Next week, they're going to take the cataract off my right eye. At the moment, I don't see, I mean, I see differently with different eyes. I'm trying to learn how to stay healthy. So I swim typically four days a week and ride a bicycle. But while I'm recovering from this eye surgery, I'm supposed to go a whole month without swimming, biking, or gardening.

But generally, I do think it's, you know, the human body was designed to do certain things. So I look for opportunities to walk rather than to ride. Let's sort of put it that way. My balance is getting worse. I'll have to do some more exercises to improve my balance. Who knows what's ahead? But if some illness hits me, I'm not going to be angry about it. I'll be thankful for all of the good health I have had.

While I stay healthy, I'm going to do my best to continue producing, producing more of TAOCP that's sitting in my files, waiting to be written.

The book is printed in a square format so it can be turned at a right angle without compromising symmetry. The ambigram on DEK's wall is called *Infinity* and appears in Kim (1981, p. 35). In the comments, we discover that using a circle avoids loose ends and that stacking the lines solves the problem of extra dots: the dots hanging below one layer now become part of the next layer. On his blog (<https://www.scottkim.com/post/infinity-circle-1981>), Kim gives further technical details on a circular one-layer version of *Infinity*: "I programmed this design originally in JaM, the predecessor to PostScript. The mathematical transformation from straight to circular lettering was programmed by John Warnock, the co-creator with Martin Newell of JaM, and co-founder with Charles Geschke of Adobe Systems."

35. Thomas S. Mullaney (author of the very interesting *The Chinese Typewriter: A History*, Mullaney, 2018), is the director of SILICON (Stanford Initiative on Language Inclusion and Conservation in Old and New Media) and organizer of the *Face/Interface 2023* conference at Stanford (<https://digitalhumanities.stanford.edu/face-interface-2023/>), which is the event DEK is referring to (see also Veytsman, 2024).

Some of you might know this novel by Laurence Sterne from the 1700s called *Tristram Shandy*.³⁶ It’s a story of the life of Tristram Shandy. The first ten chapters cover the first week of Tristram Shandy’s life. So then he starts to realize he’s not going to get through the whole story. But the next year, the second volume or something of *Tristram Shandy* came out, and Laurence Sterne said, “You know, I plan to just come to my publishers and deliver more copy as long as I can.”

Somebody asked me, “What do you do, Don?” And I said, “Well, I eat, sleep, and write content”.

YH: Since we are asking less technical questions, in the T_EXbook, you say to the reader, *GO FORTH and create masterpieces of the publishing art*.³⁷ Nowadays, ChatGPT is also doing T_EX. And so theoretically, it can also do masterpieces of typesetting art, and even inspect T_EX’s code.

So my question is, what will you do if you receive a bug report coming from an artificial intelligence?

36. Besides its diary-like process of content production, *Tristram Shandy* is extremely interesting to (typo)grapholinguists due to the very innovative use of the typographic medium (see, e.g., Voogd, 2018 and Barchas, 2003). A precursor in typographic methods (see Haralambous, Landragin, and Handa, 2020) Sterne used an entirely black page to express mourning of Yorick, and even a pair of contiguous black and marbled pages he commented as “you will no more be able to penetrate the moral of the next marbled page [...] than the world with all its sagacity has been able to unraval the many opinions, tranfactions and truths which ftill lie myftically hid under the dark veil of the black one”. A ubiquitous feature of his work is the use of variable-width dashes (ranging from a few points to a complete line of text), sometimes 4–5 of them on the same line. I would like to compare his use of dashes with the way emphasis was given on the harpsichord (see, e.g., Couperin, 1716). Indeed, Sterne’s page and the harpsichord meet the same constraint and resolve it the same way: denied any control over intensity, each manufactures emphasis out of time. The harpsichord’s plucked action fixes a note’s loudness, whatever the force of the touch, so the player privileges a note not by striking it harder but by isolating it temporally—the agogic accent, to borrow Riemann’s later term, produced through articulation and the slight silence that, falling before an onset, makes the ear register it as stressed. Sterne’s typography works under an analogous poverty. The mid-eighteenth-century page possessed no instrument of graded emphatic weight—nothing answering to boldface—and italics signaled only difference of kind, a name or a foreign word or an altered voice, rather than difference of degree; emphasis proper had therefore to be constructed, as in music, from duration and silence. This is the work of the Shandean dash, and of the calibrated lengths Sterne assigns it: not a louder word but a suspended one, a withholding that loads the phrase to come exactly as the micropause loads the note to come. The parallel is finally historical as much as structural, since both temporal expedients are dissolved by the same order of invention—the fortepiano restoring intensity to the fingers and so retiring the agogic detour, the latter economy of boldface lending the page a direct typographic stress that the dash had until then been obliged to counterfeit in time.

37. This is the “final exhortation,” at the end of “Chapter 27: Recovery from Errors” in Knuth (1982c, p. 303).

Will you pay the hexadecimal dollar?³⁸ And to whom?

DEK: Oh, whoever sent it, if it's a valid correction, the reward is justified.³⁹

A month ago, the publisher said, "We're going to reprint volumes 1, 2, 3, and 4A". Every time a new printing comes out, I go through all of the error reports that have come in. So, since February, it turned out that there were more than 150 separate issues that people had raised. I would say only about 30 of them were really, really bad or not worthwhile. Even when someone thought there was an error, but the text was okay, I could still improve it so that a person wouldn't think there was an error. So I went through these 150 things, and each one is independent of the others, so it took me more than two weeks. That was only for four of the books that I have in print. So I've got a big stack of mail to answer after I finish the next thing.

But my current project is: I'm hoping to finish volume four, fascicle seven, which, if all goes well, will be printed in December.⁴⁰ I'm writing the last 10 pages now, and next week I'll start on the index to it.

But certainly, these Large Language Models are tremendous fakers, and so they're so good at saying plausible things, and if I get something like a distributed denial of service attack with reports, then I'll have to figure out how to cope with that. But right now, I would check whether the comment is plausible. Boy, I hope nobody tries it, though. Long ago, in the 60s, Joshua Lederberg made a model of what constitutes a viable protein, and so then there was a question of whether you could write a computer program that would come up with a million viable proteins, and the question is, well what if he sends them all to the US patent office to get a patent on it?⁴¹ To me, all connections with money are the least important in my life, but I know that it's not true for everybody.

38. DEK awards checks for finding technical, typographical, or historical errors, or making substantial suggestions for his publications (the interviewer is the proud recipient of two such checks). Since 2008, these checks have been issued by the Bank of San Serriffe (https://hoaxes.org/archive/permalink/san_serriffe) in the country's national currency, namely the *hexadecimal dollar*.

39. DEK: Incidentally, when I issue the next round of checks in a week or so (e.g., in mid-June 2026), one of them will be to Claude... at the request of the man who was the go-between.

40. And indeed, TAOCP, Volume 4, Fascicle 7, *Constraint Satisfaction* has been released on February 5th, 2025.

41. Joshua Lederberg was a molecular biologist, winner of the 1958 Nobel Prize in Physiology or Medicine, professor at Stanford, and founder of Stanford's Department of Genetics. This appears to refer to ideas circulating around Lederberg's DENDRAL project (1964–), a program capable of systematically enumerating all possible molecular structures satisfying given constraints. The patent thought experiment DEK describes does not appear to correspond to a published text; it may derive from personal conversations at Stanford, where both men were colleagues.

YH: I think we’re finished.

DEK: I appreciate you guys staying up late to watch this.

ALL: Thank you very much,⁴² Don, and bye! (Applause.)



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42. The interviewer would like to take this opportunity to thank DEK for bringing beauty and humanity to his, and to so many other people’s, lives. Expressing one’s gratitude to DEK (see also Haralambous, 2018) is a never-ending task, a task that makes you introspect and think about what is important in life, and what your GO FORTH targets are. May the last words of the unusually long series of 42 (not just any number!) footnotes be another attempt to transmit gratitude, von Herzen zu Herzen, φιλίας ἔνεκεν. Thank you Don!

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