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## I. VISIBLE LANGUAGE

In the early 1980s, on the pages of academic design journal *Visible Language*, a classic thesis-antithesis-synthesis played out around the technological and philosophical fine points of computer-assisted type design. Stanford professor Donald Knuth begins with his article, "The Concept of a Meta-font" (Winter 1981). Two years prior, Knuth had conceived and programmed MetaFont – a software that enabled users to generate unlimited numbers of fonts by controlling a limited set of parameters.

The article is a performative account of his intervening attempts, using MetaFont to harness the essential "intelligence" of letterforms. In Knuth's view, the way a single letter is drawn—an a priori A, say—presupposes and informs all other letters in the same font. This information can be isolated, turned into a set of instructions, and put to work computer-automating the generation of new characters by filling in the features between two or more variables such as weight or slant.

Such intelligence is (and has always been) implicit in any typeface, but Knuth is out to omit all ambiguity and install a more definite system. He acknowledges that this preoccupation with designing meta-level instructions rather than the fonts themselves is typical of the contemporary inclination to view things "from the outside, at a more abstract level, with what we feel is a more mature understanding." From this elevated vantage, MetaFont was set up to oversee how the letters would change in different circumstances.

[The Concept of a Meta-font]

(using document camera)

+ A single drawing of a single letter reveals only a small part of what was in the designer's mind when that letter was drawn. But when precise instructions are given about how to make such a drawing, the intelligence of that letter can be captured in a way that permits us to obtain an infinite variety of related letters from the same specification. Instead of merely describing a single letter, such instructions explain how that letter would change its shape if other parameters of the design were changed. Thus an entire font of letters and other symbols can be specified so that each character adapts itself to varying conditions in an appropriate way. Initial experiments with a precise language for pen motions suggest strongly that the font designer of the future should not simply design isolated alphabets; the challenge will be to explain exactly how each design should adapt itself gracefully to a wide range of changes in the specification. This paper gives examples of a meta-font and explains the changeable parameters in its design.

+ meta ... what does "meta" mean? greeks, knuth definition

+ \*\* demonstrate a metafont program for an "A" by drawing, laying out points, and using pens

+ The idea of a meta-font should now be clear. But what good is it? The ability to manipulate lots of parameters may be interesting and fun, but does anybody really need a font that is one fourth of the way between Baskerville and Helvetica?

A year later, fellow mathematician Douglas Hofstadter responded with his "MetaFont, Metamathematics, and Metaphysics" (Autumn 1982). While "charmed" by Knuth's thesis, and admitting the bias of his own interests in artificial intelligence and aesthetic theory, Hofstadter proceeds to shoot down his colleague's apparent claim that the shape of any given letterform is "mathematically containable." To support his case, he invokes mathematician Kurt Gödel's Incompleteness Theorems, which assert that any account of a logically coherent system always contains one root-level instance that cannot itself be contained by that account. Hofstadter's antithesis then usefully couches the debate in terms of "the letter of the law" versus "the spirit of the law," a familiar antinomy that posits an absolute deference to a set of set rules against a consistent-yet-fluid set of principles. Our prevailing legal system is, of course, based on both: judges base their decisions on firmly established precedent, but also map uncharted territory by bringing the full range of their experience to bear Knuth's "The Concept of a Meta-font", *Visible Language*, 16:4 (1982:Autumn) p.309 on specific cases "in a remarkably fluid way." In this manner, the law itself adapts.

Hofstadter argues that an accordingly \*spirited\* conception of type design would therefore renounce Knuth's ur-A-FORM in favor of a yet-higher-level abstraction, an ur-A-ESSENCE; the fundamental difference being that Hofstadter's notion of "intelligence" extends beyond a Platonic shape, allowing for the concept of \*what constitutes an A\* to change, too-beyond what we can reasonably conceive of this possibly being in the future. Each new instance of an A adds to our general understanding of this idea (and ideal), which is necessarily assembled backwards over time.

Hofstadter includes this illustration of two letters vying for the same "typographic niche," to make himself clear:

[Metafonts, Metamathematics, and Metaphysics]

(using document camera)

+ metamathematics, mathematization of categories, Gödel incompleteness

- + "knobbed category machine"
- + Baskerville --> Helvetica, parameterizing two types is much more difficult than one. even harder is between arbitrary types
- + Helvetica --> Helvetica Shattered (a posteriori, ai frame problem )
- + roles, fluid roles, \*\* sets of differences \*\*, typographic niches
- + vertical and horizontal problems (letter, spirit) -- doc camera: 2-d, 3-d, 4-d ?

Neatly enough, the following year a linguistics professor called Geoffrey Sampson drafted a brief response to Hofstadter's response to Knuth, titled "Is Roman Type an Open-Ended Question?" (Autumn 1983), which, it turns out, is decidedly rhetorical. Sampson argues that Hofstadter's hairsplitting unfairly and unnecessarily exaggerates Knuth's claims to the point of warping both his meaning and intentions. There is enough metaphysical latitude, the linguist referees, to accommodate both points of view without recourse to the misery of analytical one-upmanship. Sampson's synthesis of letter and spirit contends that it is perfectly reasonable to conceive of letterforms as both a closed system (Knuth's A-shape) AND as an open-ended system (Hofstadter's A-ness).

Relatively speaking, it depends \*what you're after.\*

- + The Art of Computer Programming
  - TeX, Metafont
  - Computer Modern
- + Gödel, Escher, Bach
  - ambigrams
  - Bach, A Musical Offering, The Crab Canon
 invited to demonstrate a novel instrument, fortepiano, for Frederick II of Prussia, 1747 (Leonard Euler spent 30 years in court of). bach improvised based on a theme from the King

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Exercise: Take any two (arbitrary) A's from Visible Language cover and draw 5 intermediate steps.

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## II. RATIONALIZING THE ALPHABET

The history of typography is marked by a persistent drive to rationalize. Following the invention of movable type in the mid-15th century, the Renaissance saw several attempts to prescribe the construction of the Roman alphabet: Fra Luca Pacioli's alphabet of perfect relations, Albrecht Dürer's letters of mathematical instructions, and Geoffroy Tory's humanistic rationalizations. These attempts were, however, essentially calligraphic exercises in determining "divine proportions;" the first to apply Enlightenment rationality to properly technical ends was the so-called Romain du Roi, or the "King's Roman." Commissioned by Louis XIV in Paris at the end of the 17th century, it was a typical Age of Reason project—the imposition of a mathematically-rigorous structure on forms that had, until now, developed organically, initially shaped by the human hand (calligraphy, inscriptions, woodcuts) and adapted according to the various demands and opportunities of the printing press and its attendant technologies. Designed by "a royal committee of philosophers and technologists" from the Academy of Sciences, the Romain du Roi was initially plotted on an orthogonal 48 x 48 grid, and a corollary "sloped Roman" italic variant derived by skewing the upright version.

The coordinates were first engraved as a set of instructions, then cut into punches to make metal type, which were to be used exclusively on official or state-approved materials. In this way, the King's letters exerted state power like a great seal or particular signature.

Such ratiocination was revived at the Bauhaus in the 1920s, in line with two of the school's foundational principles set up to meet the demands of industrialization: the omission of ornament and the reduction to geometric elements. The most celebrated outcome was Herbert Bayer's 1925 Universal Alphabet, a pared-down sans-serif comprised exclusively of lower-case characters. Bayer adapted the basic glyphs for typewriter and handwriting, experimented with phonetic alternatives, and proposed a wide family of variants, such as the condensed bold version drawn on this panel:

Alongside the basic character set (minus a presumably redundant o, but with alternatives to a and g, as well as two d's that anticipate lighter weights), Bayer has further abstracted the tools he used to draw it: ruler, T-square, set square, compass and protractor. As such, the drawing captions itself, pointing to its point – that this is a project \*intrinsically concerned with a particular mode of construction.\* Around the same time, fellow Bauhausler Josef Albers followed similar principles to slightly different ends with his Stencil Alphabet. This, too, was a single-case font, now entirely configured from ten rudimentary shapes, also typically isolated and presented alongside the assembled letters. Drawn and photographed for exclusive use in the school's own publications and publicity, these elemental Bauhaus fonts remained closeted explorations rather than properly industrial products. Neither was properly developed into a "working" typeface, mass-manufactured in metal for wider use. Outside the school, though, prominent Werkbunder Paul Renner toned down the hard geometry with gentler, "humanist" sensibilities—more modulation, less harsh on the eye—to yield his commercially successful Futura. When it was issued in 1927, godfather of the nascent "New Typography," Jan Tschichold, wrote that

it cannot be open to one person to create the letterform of our age, which is something that must be free of personal traces. It will be the work of several people, among whom one will probably find an engineer.

During the 1930s, British type designer Stanley Morison was in charge of Monotype, the most significant type foundry of the day. Morison was solicited by The Times., London's principal newspaper, to take out a £1,000 full-page ad. Morison responded yes, as long he could typeset the page himself, because the newspaper's existing design was in such a dire state. This conversation reportedly carried itself up the Times' chain of command, prompting its director to invite Morison to oversee a complete overhaul of the paper's typography. Morison accepted, again on one condition – that the paper abolish the use of full points after isolated proper nouns, which he (rightly) considered superfluous and a prime example of the sort of typographic depravity he intended to stamp out. The paper removed the offending punctuation, and Morison climbed aboard.

Newspaper typography is a particularly sensitive art. Minute adjustments have critical knock-on effects for the amount of news that can be issued—especially when multiplied by the massive circulation figures of The Times. In a 25-page memorandum, Morison concluded that the house typeface needed to be updated. What became Times New Roman, however, was neither redrawn from scratch nor merely an amendment of the existing version, but rather \*amalgamated\* from a number of different typefaces made at various points over the previous 400 years. The mongrel result was effectively collaged from past forms, so the lowercase e doesn't exactly “match” the lowercase a—at least not according to the usual standards of typographic consistency. Up close, Times New Roman is full of such quirks.

The design of letterforms usually manifests an individual designer's aesthetic impulse at a given point in time, but Times New Roman was the bastard offspring of MANY designers working ACROSS time, with Morison's role something like that of producer, editor, or arranger. The most frequently repeated account of the type's development suggests that Morison gave an existing type sample and some rough sketches to an assistant in the paper's advertising department, who duly cobbled together the new font. Whatever the story, in a note on HIS type, Morison concluded, auspiciously enough: “Ordinary readers, for whom a type is what it does, will be pleased to leave them to analyze the spirit of the letter.”

French type designer Adrian Frutiger took the rational mapping of the Romain du Roi to another plateau with Univers, released by the foundry Deberny & Peignot in 1957. In line with the all-encompassing aspirations of mid-20th century Swiss design—locus of the so-called International Style—Univers was conceived as an unusually extended family of fonts. The standard palette of variants, traditionally limited to regular, italic, bold, and sometimes bold italic, was expanded sevenfold, yielding a total of 21 fonts to be cut at any given size. In the foundry's publicity, the family was usually housed in a two-dimensional matrix: an X-axis charts relative WIDTH interspersed with POSITION (Frutiger's term for slant), while the Y-axis charts relative WEIGHT. The family DNA is manifest in a few eccentricities, such as a square dot over the i and a double-barred lower-case a, while individual character sets are named according to their position in the matrix—55 for standard roman, 56 for standard oblique, 65 for medium roman, 66 for medium oblique, and so on.

Univers' matrix implies that the family could potentially procreate in any direction ad infinitum, and, in fact, the project has remained notably open since its inception. Frutiger himself reworked the typeface for digital release by Linotype in 1997, raising the total number of distinct character sets from the original 21 to 63. These included additions to both ends of the chart (Ultra Light and Extended Heavy), along with new monospace variants, requiring a third number to be added to the identifying code. In the wake of Univers' popularity, further dimensions have since been introduced, including extended character sets such as Central European, and non-Latin alphabets such as Greek, Cyrillic, Arabic, and Japanese . This globalization culminated in 2011 with Linotype rechristening the entire design “Univers Next.”

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Exercise: p.62, Intuitive Concepts in Elementary Topology, B.H. Arnold (block letters)

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### III. META-THE-DIFFERENCE-BETWEEN-THE-TWO

In “A Note on the Type” (2010) we previously offered a history and extension of Knuth's MetaFont project. Our appreciative “note” (more a love-letter written 30 years late) was then typeset in our own updated version of MetaFont—basically Knuth's project rebooted for the PostScript generation and, following a throwaway remark by the late David Foster Wallace, rechristened Meta-The-Difference-Between-The-Two-Font. That “single”note has since been published in multiple contexts and formats—on screens, pages, and walls. While all conform to the same basic essay template, each new instance adds three bits of writing by other people, each typeset in unique, freshly-generated MTDBT2-fonts to demonstrate the software's essential plasticity. These extra texts have alluded to various facets of the project—\*repetition,\* \*habit,\* or \*the gray area between art and design,\* for example—that have suggested themselves as it has rolled palimpsestuously along.

Meta-The-Difference-Between-The-Two-Font picked up where Knuth's MetaFont left off. In fact, the only OSTENSIBLE difference between the two is that the new version was re-scripted in contemporary code to run on current computers. When typefaces are reduced to on/off bits of information, the typographic norms established by metal type (and carried over into photocomposition) are no longer bound to material necessity – they can be ignored and modified, and this is precisely what Knuth did. However, it was only with the advent and proliferation of PostScript in the early 1980s that typefaces became “device independent,” freed from their association with particular composing machines and their controlling companies. But beyond this nominal “language difference,” MTDBT2F remained more or less faithful to MetaFont's founding principles—not least its wacko parameters borrowed from Knuth's Computer Modern font, which include “SUPERNESS,” “CURLINESS,” and so on.

The ACTUAL difference between the two, on the other hand, is less easy to discern. One clue is the

simple difference in time: what it meant to make it \*then,\* and what it means to make it \*now.\*

In his essay "On the New"(2002), Russian art theorist Boris Groys wrote:

Being new is, in fact, often understood as a combination of being different and being recently-produced. We call a car a NEW car if this car is different from other cars, and at the same time the latest, most recent model produced ... But as Kierkegaard pointed out, to be new is by no means the same as being different ... the new is a DIFFERENCE WITHOUT DIFFERENCE, or a difference which we are unable to recognize because it is not related to any pre-given structural code.

He continues:

for Kierkegaard, therefore, the only medium for a possible emergence of the new is the ordinary, the "non-different," the identical – not the OTHER, but the SAME.

MTDBT2F is, more-or-less, the same as MetaFont, abiding the obvious fact that it swallows its predecessor. Although the result may look the same, it clearly can't be, because in addition to the "productive" software, the new version embeds its "intellectual" backstory—a story which is not merely supplementary but absolutely essential. MTDBT2F is a tool to generate countless PostScript fonts, sure, but it is \*at least equally\* a tool to think around and about MetaFont.

This broader notion is already ingrained in that original Visible Language debate, again most keenly foreseen by Hofstadter, who wrote that one of the best things MetaFont might do is inspire readers to chase after the intelligence of an alphabet, and "yield new insights into the elusive 'spirits' that flit about so tantalizingly, hidden just behind those lovely shapes we call 'letters.'" Hofstadter is still referencing fonts and computers here, but his sentiments can easily be read under what art critic Dieter Roelstraete recently called "the taunting of thought." In fact, Walter Benjamin closed "The Author as Producer" with the following summary:

You may have noticed that the chain of thought whose conclusion we are approaching only presents the writer with a single demand, the demand of REFLECTING, of thinking about his position in the process of production.

At least as much as MTDBT2F serves as a functioning typeface, or set of typefaces, then, it is also a red herring, a carrot, and a mirror. It is a nominal setup for a nominal subject to play out, typically moving in and out of focus, veering off into other fields, and trespassing on other topics. In this unruly manner, the font serves us (or anyone else) exactly as it serves language—as rubber cement, a bonding agent.

How to keep things moving?

MetaFont and MTDBT2F were both set up to generate an infinite number of individual typefaces by tweaking a few simple parameters at different points in time. But what if we make one of those parameters \*time itself\*?

First let's transpose the extant ones onto a 3-D graph, running WEIGHT (a kind of bold) along the X-axis, SLANT (more or less italic) up the Y, and extending SUPERNESS (a kind of chutzpah) off into the Z beyond. We'll ignore CURLINESS for the time being, but we do have to account for a fourth factor, PEN, best conceived as a digital "nib" that determines the line's fundamental shape and angle at any given point.

Now let's send that point \*constantly moving\* through this imaginary cube. As it wanders randomly and aimlessly through the space, it trails a script that renders an alphabet whose form morphs according to its position relative to the other parameters—not forgetting the fact that the point-nib-pen itself is in perpetual flux. And, crucially, it never stops. The outcome might be usefully apprehended as the potentially endless matrix of Frutiger's Univers, amalgamated over time like Morison's Times New Roman, articulating itself in the manner of Bayer's Geometric Alphabet, over the precise wireframe of Louis XIV's Romain du Roi. Which amounts to a typographic oxymoron: a SINGLE typeface that's simultaneously MANY typefaces and never stops moving.

> mtdbt2f4d demo

Naming this shapeshifter is easy enough—just shunt another couple of boxcars onto the end of the night train to arrive at (deep breath) Meta-The-Difference-Between-The-Two-Font-4-D, or MTDBT2F4D for short.

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Writing in one place inevitably \*performs\* in another. Here, for example, reflecting on Hofstadter's and Morison's and Groys' various assimilations of the terms "letter" and "spirit" fosters a more robust, compound sense of their allegorical purpose. It produces a cosmopolitan thought. When grappling with ideas in one domain is brought to bear on another, those ideas are more firmly grasped and so more readily utilized somewhere else ... towards considering (say) the ways in which relative chauvinism and relative open-mindedness manifest themselves in daily life and work.

Or, equally, writing the first small script when learning a new programming language, the sole purpose of which is to generate two words that mark the border between instruction & instance. Swaddled in asterisks and set without a full point, this text always reads:

\*\*Hello world\*\*

P.S. "LETTER SPIRIT"

+ The Letter Spirit Project

<http://goosie.cogsci.indiana.edu/farg/mcgraw/lspirit.html>

+ <https://blog.otoro.net/2016/04/01/generating-large-images-from-latent-vectors/@hardmaru> -- "I make simple things with neural networks." Google researcher

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