METAFONT, METAMATHEMATICS, AND METAPHYSICS*

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Comments on Donald Knuth's Article "The Concept of a Meta-Font"

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Abstract

It is argued that readers are likely to carry away from Donald Knuth's article "The Concept of a Meta-Font" a falsely optimistic view of the extent to which the design of typefaces and letterforms can be mechanized through an approach depending on describing letterforms by specifying the settings of a large number of parameters. Through a comparison to mathematical logic, it is argued that no such set of parameters can capture the essence of any semantic category. Some different ways of thinking about the problem of the "spirit" residing behind any letterform are suggested, connecting to current research issues in the field of artificial intelligence.

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The "Mathematization of Categories" and Metamathematics

Donald Knuth has spent the past several years working on a system allowing him to control many aspects of the design of his forthcoming books -- from the typesetting and layout down to the very shapes of the letters! Never has an author had anything remotely like this power to control the final appearance of his or her work. Knuth's TEX typesetting system has become well-known and available in many countries around the world. By contrast, his Metafont system for designing families of typefaces has not become as well known or as available.

In his article "The Concept of a Meta-font" [Knuth 82], Knuth sets forth for the first time the underlying philosophy of Metafont, as well as some of its products. Not only is the concept exciting and clearly well executed, but in my opinion the article is charmingly written as well. However, despite my overall enthusiasm for Knuth's idea and article, there are some points in it that I feel might be taken wrongly by many readers, and since they are points that touch close to my deepest interests in artificial intelligence and esthetic theory, I felt compelled to make some comments to clarify certain important issues raised by "The Concept of a Meta-font".

Although his article is primarily about letterforms, not philosophy, Knuth holds out in it a philosophically tantalizing prospect for us: that with the arrival of computers, we can now approach the vision of a unification of all typefaces. This can be broken down into two ideas: (1) that underneath all "A"'s there is just one grand, ultimate abstraction that can be captured in a finitely parametrizable computational structure -- a "software machine" with a finite number of "tunable knobs" (we could say "degrees of freedom" or "parameters", if we wished to be more dignified); and (2) that every conceivable particular "A" is just a product of this machine with its knobs set at specific values.

Beyond the world of letterforms, Knuth's vision extends to what I shall call the "mathematization of categories": the idea that any abstraction or Platonic concept can be so captured -- i.e., as a software machine with a finite number of knobs. (For more on this notion, see [Hofstadter 82b].)