The genome and the stored program concept

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Abstract

The extension of the concept of information to genes continues to generate controversy. A closely related debate in the philosophy of biology concerns the existence of a "genetic program". Among those who do embrace the idea that genes carry information, many would also say that the entire collection of an organism's genes can be properly described as containing a kind of program. More specifically, the idea is apparently that a genome realizes a program in something like the way a set of symbol strings in the memory of modern computer can realize a program.
In this paper, I argue that the program concept has a real, albeit partial, application to the structure of genomes, particularly those of higher organisms. My basic proposal is that, to the extent that an organisms's genome can be properly said to realize a program, it is in virtue of the fact that it contains two different types of information-carrying entities, namely, *instructions* and *data symbols*. The instructions are realized by genes coding for transcription factors recognized by regulatory regions of certain classes of genes. The data symbols are realized by genes that code for purely "structural" proteins (i.e., non-transcription factors).

In the remainder of the paper, I explore a deep and fascinating analogy between the stored program architecture of modern computers, and the functional architecture of genomes. I argue that this is likely an example of evolution and intelligent agents converging on the same optimal design.

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