1. INTRODUCTION

This essay is a reply to James H. Fetzer’s essay in this journal, “Minds and Machines: Limits to Simulations of Thought and Action” (Fetzer, 2011). I treat three topics: computationalism, semiotic systems, and cognition (the mind), offering what I feel is the proper treatment of computationalism. From this, certain views about semiotic systems and minds follow (or, at least, are consistent): First, I argue that computationalism should not be understood as the view that (human) cognition is computation, but that it should be understood as the view that cognition (simpliciter) is computable (§2). On this view, it follows that computationalism can be true even if (human) cognition is not the result of computations in the brain. Second, I argue that, if semiotic systems are systems that interpret signs, then both humans and computers are semiotic systems. Finally, I suggest that minds can be considered as virtual machines implemented in certain semiotic systems, primarily the brain, but also AI computers. In doing so, the author takes issue with Fetzer’s arguments to the contrary.
2. THE PROPER TREATMENT OF COMPUTATIONALISM

Computationalism is often characterized as the thesis that cognition is computation. Its origins can be traced back at least to Thomas Hobbes:

“For REASON, in this sense [i.e., “as among the faculties of the mind”], is nothing but reckoning—that is, adding and subtracting—of the consequences of general names agreed upon for the marking and signifying of our thoughts...” (Hobbes 1651, Part I, Ch. 5, p. 46)²

It is a view whose popularity, if not its origins, has been traced back to McCulloch and Pitts (1943), Putnam (1960 or 1961), and Fodor (1975) (Horst, 2009; Piccinini, 2010). This is usually interpreted to mean that the mind, or the brain—whatever it is that exhibits cognition—computes, or is a computer. Consider these passages, more or less (but not entirely) randomly chosen:

- A Plan is any hierarchical process in the organism that can control the order in which a sequence of operations is to be performed. A Plan is, for an organism, essentially the same as a program for a computer (Miller et al., 1960, p. 16).⁴

- [H]aving a propositional attitude is being in some computational relation to an internal representation. ...Mental states are relations between organisms and internal representations, and causally interrelated mental states succeed one another according to computational principles which apply formally to the representations (Fodor, 1975, p. 198).

- [C]ognition ought to be viewed as computation. [This] rests on the fact that computation is the only worked-out view of process that is both compatible with a materialist view of how a process is realized and that attributes the behavior of the process to the operation of rules upon representations. In other words, what makes it possible to view computation and cognition as processes of fundamentally the same type is the fact that both are physically realized and both are governed by rules and representations…. (Pylyshyn, 1980, p. 111).

- [C]ognition is a type of computation (Pylyshyn, 1985, p. xiii).

- The basic idea of the computer model of the mind is that the mind is the program and the brain the hardware of a computational system (Searle, 1990, p. 21).

- Computationalism is the hypothesis that cognition is the computation of functions. …The job for the computationalist is to determine…which specific functions explain specific cognitive phenomena (Dietrich, 1990, p. 135, emphasis added).

- [T]he Computational Theory of Mind… is…the best theory of cognition that we’ve got…. (Fodor, 2000, p. 1).

- Tokens of mental processes are ‘computations’; that is, causal chains of (typically inferential) operations on mental representations (Fodor, 2008, pp. 5-6).

- The core idea of cognitive science is that our brains are a kind of computer…. Psychologists try to find out exactly what kinds of programs our brains use, and how our brains implement those programs (Gopnik, 2009, p. 43).

- [A] particular philosophical view that holds that the mind literally is a digital computer…, and that thought literally is a kind of computation…will be called the “Computational Theory of Mind”…. (Horst, 2009).

- Computationalism…is the view that the functional organization of the brain (or any other functionally equivalent system) is computational, or that neural states are computational states (Piccinini, 2010, p. 271).

- These remarkable capacities of computers—to manipulate strings of digits and to store and execute programs—suggest a bold hypothesis. Perhaps brains are computers, and perhaps minds are nothing but
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