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Spontaneous Generations

Review of *The Information Manifold: Why Computers Can't Solve Algorithmic Bias and Fake News* by Antonio Badia Cambridge: MIT Press, 2019. 334pp.

Author(s):
Jeff Pooley
Muhlenberg College

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Information Manifold is an idiosyncratic book, in the welcome sense that it provides a fresh perspective. The author, Antonio Badia, is a professor of computer science who aims to address a set of topics—algorithmic bias and fake news—that have been largely claimed by the social sciences. Badia's approach, in the dense first half of the book, is to work through various theories of information. In the volume's second half, he applies his conclusions about information to the world of computing—including machine learning. The main argument is that computers are fundamentally incapable of processing information at the level of meaning [and pragmatics]—and that we should, as a result, withdraw some of our faith in AI to address knotty problems like algorithmic bias.

The title is arguably misleading. The phrase "information manifold" does not appear in the text, and the subtitle—"Why Computers Can't Solve Algorithmic Bias and Fake News"—implies that algorithmic fairness and spreadable misinformation will come in for major treatment. Of the book's 315 pages, however, only twenty are directly devoted to those topics. The themes announced in the subtitle are more like the punchline. Even so, the book's carefully bootstrapped arguments about the basic limitations of computing have important implications for, say, the viability of automated social-media filtering. Badia gestures at those practical implications, but devotes far more space and argumentative energy to the core thesis.

The thesis can be briefly summarized. Information has four levels, each one dependent on the level below: (1) syntactic, (2) semantic, (3) pragmatic, and (4) networked/emergent. Computers operate within the first, syntactic level, while human meanings and communication may include one or more of the "higher" layers. Here is the informational rub: "*The issues we care about—bias in data, algorithmic fairness, truth in information—exist at the semantic and pragmatic level*" (italics in original, p. 300). We should, as a result, be humbled by the inherent limitations of computers. They are syntactic machines; the other levels are beyond their reach. With vexing human problems like algorithmic bias, we can't assume—even with the awesome computational achievements of machine learning AI—that they are up to the job. Or not at least without lots of careful tending and supervision.

The underlying limitation-of-computing argument is resonant with early philosophical critiques of AI, like those advanced by Herbert Dreyfus and John Haugeland.[1] Badia's computational skepticism also recalls Joseph Weizenbaum's

[1] Herbert L. Dreyfus, *What Computers Can't Do: The Limits of Artificial Intelligence* (New York: Harper and Row, 1972); John Haugeland *Artificial Intelligence: The Very Idea* (Cambridge: MIT

landmark *Computer Power and Human Reason*; Weizenbaum was a computer scientist too, and well-acquainted with his subject. Like Badia, but with far more humanist urgency, Weizenbaum sought to distinguish machine and human intelligence. It is an index of *Information Manifold*'s narrower register that none of these works are mentioned.[2]

The argument is built-up internally, as it were, from Claude Shannon's engineering-inflected information theory. As supplemented by Russian mathematician Andrey Kolmogorov, Shannon's theory supplies for Badia the syntactic layer of information—patterned, but devoid of meaning. The next, narrower layer is semantic, the realm of symbolic meaning; here the book engages with analytic philosophy, especially Fred Dretske's treatment of the information concept[3] and more recent work by Luciano Floridi. Badia's conclusion is that the strenuous efforts of Dretske and others to link Shannon's information theory to semantics ultimately fails to bridge what the book calls "the great divide" (p. 88). Computing, we are informed in the book's second half, can't make the leap from syntactic to semantic information.

Before launching into that discussion, however, the book stacks two additional layers of information atop the syntactic and semantic. The third, pragmatic layer refers to information relevant to message receivers. The fourth and final layer is the emergent, networked communication produced by the circulation of messages. We arrive, finally, at what is, presumably, the information manifold—a pyramid-shaped conception of information, with a wide syntactic base narrowing with each level up—"progressively more constrained views of what constitutes information" (p. 169). The problem is that "our favorite tool," the computer, "does not share our desire and ability to work" at the semantic and pragmatic levels (p. 187).

Badia's writing is austere, and peppered with equations. There is, however, an admirable lucidity, paragraph by paragraph, that makes non-technical reading possible. It is a delightfully strange book, from the vantage point of a social scientist, whereby familiar conclusions are arrived at by way of foreign-seeming arguments.

Badia's main point is that we should approach problems like algorithmic bias with the limitations of computing front of mind. Badia admits that the sheer volume of data, and parallel advances in machine learning, is helping to bridge the syntactic-semantic divide, insofar as better "surrogates" for human meaning are possible to generate. Here again, he insists, we should acknowledge the inherent limitations dictated by the "semantic cliff." Human reason, guided by science and awareness of its own limits, should steward the responses to hard human problems like fake news.

Press, 1985).

[2] Joseph Weizenbaum, *Computer Power and Human Reason: From Judgment to Calculation* (New York: W. H. Freeman and Co, 1976).

[3] Fred I. Dretske, *Knowledge and the Flow of Information* (Cambridge: MIT Press, 1981).