Disagreements, Problems, Possibilities

Most AI theorists and researchers would agree with Hofstadter’s arguments or at least be in close sympathy with them, as would information theorists like MacKay. Jackson, for example, contends that ‘There is no known a priori limit to the extensibility of a computer’s language capability other than those limits of a purely practical nature (memory size and processing speed)’ and that, ‘Although the difficulties involved with understanding natural language should not be minimized, no one has been able to show . . . that English is theoretically outside the language capability of all computers . . .’. However, a number of computer scientists and others, like Steiner, would deny that any formalism ever could simulate natural-language processes fully, even in theory. Weizenbaum’s opinions in that regard are well known and representative.

Weizenbaum would seem to have little patience with the MLM metaphor. He regards any theory as ‘merely a text’(!), a kind of map that can ‘guide and stimulate intelligent search’. Moreover, he says, ‘A theory written in the form of a computer program is thus both a theory and, when placed on a computer and run, a model to which the theory applies’; as such, it ‘is always a simplification, a kind of idealization of what it is intended to model’ and not a reproduction of ‘reality in all its complexity’. In sum, his somewhat informal argument is that natural-language processes have not been and (therefore?) cannot be captured \textit{in toto} by capturing what ‘is computable and only that’.\footnote{2}

Bronowski is similarly sceptical. Taking a hint from von Neumann, he is loath to consider the brain/mind as resembling a computer at all and therefore rejects any computer-like formalism for modelling it. He suggests vaguely that ‘the brain must be using some kind of statistical language which is quite unlike human language’ and yet to be discovered and decoded.\footnote{3} He contends that the brain can be characterized as ‘a machine with a
formal procedure' only if 'its language is as strict and as artificial (in the logical sense) as any of our own marks on a magnetic tape'. In other words, if it can be characterized as a machine with a language more complex than that, then it is not a machine but a brain – a Lucas-like debater's escape hatch. He uses Gödel's Entscheidungsproblem ('decision problem') and the theorems of Turing, Tarski, and others to argue the various facets of his position: that 'there cannot be a universal description of nature in a single, closed, consistent language'; that 'the mind cannot extricate the laws of nature from its own language', because its view of nature is conditioned absolutely by that language and its 'formal logic is not that of nature . . .'; and that, therefore, since the brain/mind is a part of nature, it cannot be simulated by a formal system.\(^4\) His argument, like Weizenbaum's, does not entirely persuade – though it is appealing in some ways – and lacks the subtlety of Hofstadter's.

But these arguments are not foolish and might point toward insurmountable problems – if not in principle, then in practice. Miller and Johnson-Laird note, for example, that 'intensional rules seem to introduce an infinitude of abstract entities that in formal logic or mathematics might better be omitted entirely'. Though they recognize that natural and formal languages share many features, they also are aware of severe differences and observe that verifiability theories of meaning, which 'hold rigorously only for formal languages like logic or mathematics', are 'not psychological theories'.\(^5\) Perhaps consideration of some other examples of problems that have been encountered will illustrate the magnitude of the overall problem of constructing a natural-language formalism.

Janet Dean Fodor observes that there are many parallels between a generative natural-language grammar and a system of formal logic:

The syntactic rules of grammar license the move from one syntactic representation of a sentence to another just as the inference rules of logic . . . license the move from one logical formula to another. In both types of system the derivations are quite mechanical, in the sense that whether or not a certain rule applies to a formula can be determined by reference solely to the configuration of symbols in the formula and the formal statement of the rule. Syntactic derivations therefore formally