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The "Embedded World" of Artificial Intelligence

By Phoebe Sengers

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Abstract

Dynamic texts offer new possibilities for reading and new challenges in how we approach the reading object, forcing the final object away from the idea of a fixed form on a fixed surface. In order to *read* such an object, one must look deeper, into the code itself, and one must consider the various ramifications inherent in a code-based work. Ultimately, one must explore the edge where language apparatuses engage.

Artificial Intelligence (AI) has long been seen, by both its supporters and its critics, as an attempt to develop formal representations which are equivalent to human abilities. The complexity of human behaviour and existence in the world, by this way of thinking, is reduced to or replaced by formal algorithms. When all physical objects and agents are encoded as logical propositions and all action is encoded as changes to those propositions, then behaving can be reduced to thinking, which in turn can be understood as search through sets of logical propositions. The messy properties of the real world can be left behind, as we enter the rarefied realm of the "closed world" of logic, based on the Closed World Assumption: All knowledge can be logically derived from what is already formalized; i.e. the world and everything in it is fully encodable.

Supporters of classical AI rejoice in the formal elegance of this reduction, while detractors lament the limitations of this "closed world" of AI. In particular, discussions on social and cultural issues inherent in AI are difficult. AI researchers tend to have difficulty reflecting on AI's social embeddedness because technology is seen as existing in a separate sphere.

For this reason, many artists and others critical of AI have supported an oppositional strand in AI termed situation action. These critics within AI, notably Rodney Brooks, Philip Agre, and David Chapman, argued that instead of modeling the world, one should act on it, following the slogan "the world is its own best representation."

Situated action states explicitly that the world is not adequately encodable, and that intelligence comes into being in interaction with this complex world. Its commitments to embodiment and the incompleteness of formal approaches to understanding the world seem, on the surface, more compatible with artists' and humanists' ways of conceptualizing reality and friendly to discussions about the limits of AI as a formalism itself.

Yet, for many situated action researchers, while the world is not encodable, the mind is. Intelligent behavior is often said to be reducible to simple rules. The apparent complexity of behavior is due largely to the complexity of the world with which an agent acts. Consciousness itself, it is said, is an epiphenomenon - an illusion overlaying the simple encodings which science has revealed as our actual essence. Subjective human experience as discussed in the arts and humanities is irrelevant, replaced by objective scientific fact. Rather than a "closed world," we are here dealing with something we might call "closed minds."

Yet a radically different epistemological stance is becoming apparent in contemporary offshoots of AI, including statistical natural language processing and machine learning as well as the work of hybrid artist-technologists like Warren Sack and Michael Mateas. By this way of thinking, the power of formal representations is not based on their existence in a separate, clean closed world, but on their embeddedness in a complex, incompletely formalizable outside world. Web search systems like Google, for example, work not by creating an abstract, formal representation of human life, but by computing directly on language and links created by humans for one another. The goal with such systems is not to replace the human world with a formalized ideal, but to opportunistically discover patterns in partial formalizations of a much more complex reality.

In these cases, instead of a closed world, we can speak of an "embedded world" in which formalisms can tell us something about social and cultural issues *not* because they represent them but because they *arise* from them. We can create technical systems which explore such issues without needing to create limited formalisms for them. Warren Sack's Conversation Map, for example, uses simple algorithms to identify links between and topics discussed by participants in netnews groups - links and topics whose meaning can then be interpreted by the human observer, rather than the system itself ¹. Similarly, Richard Rogers and Noortje Marres's project mapping the web around the debate around greenhouse warming uses formal link structure to illustrate and talk about the power relations and politicking inherent in web structure - for example, the number of links out of the site of a non-governmental organization(NGO) tends to be inversely proportional to its power; small NGOs link promiscuously, while Greenpeace sees no need to link at all ². In these cases, we can speak naturally in one breath about formalisms, algorithms, politics, and the social embeddedness of technologies, with an

awareness of the relationships between the representations in the program and nonrepresented realities outside.

Notes

1. Warren Sack, "Stories and Social Networks," in *Narrative Intelligence*, Phoebe Sengers and Michael Mateas, Editors (Amsterdam: John Benjamins, 2003).
2. Richard Rogers and Noortje Marres, "Landscaping Climate Change: Mapping Science & Technology Debates on the World Wide Web," *Public Understanding of Science*, no. 9, 2000, pp. 141 - 163.