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Sign Use and Cognition in Automated Scientific Discovery: Are Computers Only Special Kinds of Signs?

The paper aims to analyze Machine Discovery field from cognitive and semiotic perspective. James Fetzer criticizes the paradigm, prevailing in Cognitive Science, that cognition is computation across representations. He argues that if cognition is taken to be a purposive, meaningful, algorithmic problem solving activity, then computers are incapable of cognition. Instead, they appear to be signs of a special kind, that can facilitate computation. He proposes the conception of minds as semiotic systems as an alternative paradigm for understanding mental phenomena, one that seems to overcome the difficulties of computationalism.

Now, I argue, that with computer systems dealing with scientific discovery, the matter is not so simple as that. The alleged superiority of humans using signs to stand for something other over computers being merely “physical symbol systems” or “automatic formal systems” is only easy to establish in everyday life, but becomes far from obvious when scientific discovery is at stake. In science, contrary to everyday life, the meaning of symbols is, apart from very low-level experimental investigations, defined implicitly by the way the symbols are used in explanatory theories or experimental laws relevant to the field.

Moreover, recent attempts to apply genetic programming to automatic generation of cognitive theories seem to show, that computer systems are capable of very efficient problem solving activity which is neither purposive nor meaningful, nor algorithmic. This, I think, undermines Fetzer's argument that computer systems are incapable of cognition *because* computation across representations is bound to be a purposive, meaningful, algorithmic problem solving activity.

References:

- Bridewell, W., Langley, P. (2010): Two Kinds of Knowledge in Scientific Discovery, *Topics in Cognitive Science*, 2, pp. 36-52.
- Fetzer, J. (1997): Thinking and Computing: Computers as Special Kinds of Signs, *Minds and Machines*, 7, pp. 345-364.
- Giza, P. (2002): Automated Discovery Systems and Scientific Realism, *Minds and Machines*, 22, pp. 105-117.
- Lane, P., Sozou, P., Addis, M., and Gobet, F. (2014): Evolving process-based models from psychological data using genetic programming, in: R. Kibble (ed.), *Proceedings of the 50th Anniversary Convention of the AISB*.
- Thagard, P. (2012): *The Cognitive Science of Science*, Cambridge, The MIT Press.