Information, Life and Evolutionary Robots: a systemic approach

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Meaningful information and action

The relation between meaningful information, self-organization and action constitutes our main subject of investigation. Based upon Aristotle's characterization of touch and its relation to action and the survival of organisms, we investigate the nature of information in the domain of action. We argue in defense of the distinction between information, conceived from a mechanistic view, and meaningful information understood as a systemic property of agency, in order to provide a framework for the following hypotheses:

1. Living organisms, differently from non-organic systems, deal with meaningful information. This, in turn, can be understood as a self-organizing process of patterns generation for action.

2. Action, in contrast to pure movement, involves the inter-exchange of meaningful information between various levels of complexity developed in accordance with the process of self-organization.

3. Touch - understood as one of the fundamental modalities of sense perception - constitutes the "touchstone" of the organism's possibilities for actions involving meaningful information.

The hypotheses 1-3 are initially investigated in the context of Philosophy, with special emphasis on Aristotle's ideas on the nature of touch and its relation to action. These ideas are claimed to provide foundations for contemporary approaches to information, perception and action, such as those developed by Gibson (1986), Bateson (2000) and others.

We propose a preliminary characterization of information in terms of self-organizing patterns (Haken, 2000) that are available to a receiver. This characterization is further developed in order to contemplate the notion of meaning. Based upon Gibson's conception of mutuality, we conceive meaningful information as an evolutionary, self-organizing process of correlation between organism and environment.

Finally, we consider some implications of the distinction between 'touch' and mere 'contact' for studies of meaningful information in the area of Robotics (Brooks, 1992, 1999; Nolfi, 1998; Nolfi & Floreano, 2000; Ziemke, 2003). Our provisory conclusion is that: in so far as non-organic systems (like contemporary robots) deal only with contact, rather than with touch, they do not operate with meaningful information. As a consequence of this conclusion, we argue that cognitive modeling of perception-action, based upon these artificial systems, is severely limited in its explanatory power, in the sense that it misses a fundamental characteristic, i.e. its meaningful properties.

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