CSC: Classic Paper Review/Analysis

Title and Author

Title Embodied Cognition: A field guide

Author Michael L. Anderson

Summary/Hook

Good chunk of text on views of embodied cognition. Anderson presents quite a few views on embodiment but keeps a consistent viewpoint running. He bases the different paths that embodied cognition may take by keeping it grounded in biological realism. But he does not constrain his viewpoints to that an intelligent agent has to embody or at the other end is embodied while still internally unintelligent and not capable of artificial agency. He also does not commit that an intelligent agent has to be on the level of human or animal intelligence, where we can see many different levels of emergent behavior looking like or embodying intelligence.

Knowledge Relating to the Cognitive Science Program Learning Outcomes

1. 8.Embodiment, Emergence, and Distributed Cognition

   It is true that despite vast improvements in the speed of microprocessors, and significant advances in such areas as computer vision, knowledge representation, non-monotonic reasoning, and planning there has yet to be an SMPA system that can operate in a complex, real-world environment on biologically realistic time-scales. The twin scale-up of environmental richness and real-time dynamics has so far proved insurmountable. On the other side of the coin, all these areas are advancing, and so perhaps the achievement of real-time SMPA intelligence is just a matter of time. Showing that something has not yet happened is a long way from showing it won't.

2.1. Foundational Assumptions

   At the very least it is a fundamental issue for any representational system, for at the root of the relevance problem is that most basic question for any representation: what should be modeled, and what ignored or abstracted away?

3.4. Darwinian Processes and Phenomena

> Still, if EC is on anything like the right track she cannot live by symbols alone; her representations must be highly selective, related to her eventual purposes, and physically grounded. This strongly suggests that her faculty of representation should be linked to, and constrained by, the 'lower' faculties which govern such things as moving and acting in a dynamic environment,13 without questioning the assertion that complex agency requires both reactive and deliberative faculties.14 The central moral coming from EC is not that traditional AI ought to be given up, but rather that in order to incorporate into real-world agents the sort of reasoning which works so well in expert systems, ways must be found to systematically relate the symbols and rules of abstract reasoning to the more evolutionarily primitive mechanisms which control perception and action.

4. 2. Symbol Systems

> According to Lakoff and Johnson, the mind is inherently embodied not just because all its processes must be neurally instantiated, but also because the particulars of our perceptual and motor systems play a foundational role in concept definition and in rational inference. Color concepts, for instance, are characterized by a "center-periphery" structure, with certain colors being "focal" and others conceptualized in terms of the focal hue. ...
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> Thus does the physiology and design of the visual system have a rather direct effect on the contents and overall structure of the representations (or, more generally speaking, the useful abstractions) which can emerge from it. One part of the physical grounding project, then, is spelling out such direct physiological constraints on higher-level abstractions.

5. 8.Embodiment, Emergence, and Distributed Cognition

> Steels describes a simple robot, which is programmed with two distinct behaviors: (1) it takes a zig-zag path toward any light source, and (2) whenever it encounters an obstacle, it turns before moving again. In the environment contrived for this robot, it must feed itself by going between two poles at the recharging station whenever the light at the station turns on. This recharging behavior is nowhere programmed into the system, but it nevertheless emerges when the robot is placed in the described environment.
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> Emergence, then, constitutes a third way to relate complex behavior to its physical, or evolutionary grounds. In this case any explanation of the recharging behavior must include reference to the simple behaviors with which the robot was endowed, but the recharging behavior itself is not directly attributable to these, but only to the dynamic interaction between the basic capacities of the robot and its given environment.