Representation Revisited: Lessons Learned from Artificial Life

Monica R. Cowart (mrcowart@facstaff.wisc.edu)
Department of Philosophy; 600 North Park Street
Madison, WI 53706 USA

Cognitive scientists have long assumed the existence of representations to make sense of the complex behaviors of organisms. This widely held presupposition, characterized as the traditional representationalist view, states that the external world has pre-existing characteristics that an organism's cognitive system accurately recovers through the means of a representation. In response to this received view, Rodney Brooks advances the radical thesis that representations are not necessary for cognition (1991). He bases this claim on the recent successes, attributed to the Artificial Life research program (hereafter AL), which demonstrate that complexly behaving systems can be constructed from simple processes that interact locally without either a central processor or representations. These systems deviate from the standard computational model of cognition in two key respects: 1) the occurrence of the desired behavior results from the development of emergent properties, instead of dependence on a central processor issuing directives and 2) the system's interaction with its surroundings is a result of unmediated detection of environmental cues, rather than the creation of a model of the environment. These principles enable the creation of organisms which utilize local cues to generate complex behavior unaided by representation.

Yet, some cognitive scientists argue that the preliminary successes in AL do not warrant a reconception of mind as non-representational. Most notably, Kim Sterelny criticizes AL successes for depending too heavily on agent neutral or agent friendly environments where representation requiring features are absent (1997). Sterelney contends that evolution mandates the existence of representations if organisms are to survive in hostile environments where reaction time and perceptual constancy capacities are key.

I argue that Sterelney's criticism of AL assumes part of the traditional representationalist model of cognition where an organism utilizes an information processing model to perceive X in the world (the input), generate a representation of X, and determine a behavior to execute in response to X (the output) (Varela, Thompson, & Rosch, 1991). Such an account presupposes that the organism must create a model or map of its surroundings which, once processed, enables it to react appropriately in its environment. Consequently, every interaction within the environment, ranging from finding food to avoiding prey, is merely a new "problem" that the organism solves by appealing to a representation. The representation then enables the problem space to be adequately defined so that the appropriate output behavior can be calculated. Sterelney grants that AL successes, utilizing a subsumption architecture, have produced complex behavior unaided by representation. However, he claims that the success of these projects is the function of the fact that the induced behaviors occurred in either agent neutral or cooperative environment. Sterelney then denies that subsumption architectures are capable of enabling an organism to successfully navigate in hostile environments. His idea here is that mere detection is not enough to "do the job" of provoking successful behaviors in hostile environments. Thus, representation is an ineliminable part of any cognitive model capable of explaining how an organism can survive unfriendly circumstances.

I argue that Sterelney returns to his representationalist roots before adequately examining the possibilities of the AL program. In particular, the enactive/embodied model of cognition advanced by Varela et. al. demonstrates that it's a mistake to characterize AL behaviors as involving mere detection (1991). According to this model, organisms don't react to a perceiver-independent world. Rather, the organism and its local environment, friendly or unfriendly, co-evolve so that mutual specification occurs. This picture replaces adaptation with the complex notion of structural coupling between local habitat and organism. Thus, the current status of the environment and the organism result from their influence on one another. In effect, the history of the organism's sensorimotor capacities determine how it views/interacts in the world and the structure of the world jointly determines the way these sensorimotor capacities act upon it. This type of mutual specification does not draw its explanatory power from representation. Representation is not needed, even in hostile environments, since the organism has co-evolved to detect the local cues of the other organisms existing within its environment. Such detection results in various "coping strategies" and the ones that work will appear in subsequent generations. These "strategies" develop as a result of the close coupling of organism with its environment. Moreover, these strategies are so finely tuned to the specifics of the organism and its history within its local habitat that the same predictive success can not be assumed if the organism were placed in a different environment. Thus, the enactive model explains how organisms can exist in hostile environments unaided by representation.

References

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