

The Insect Mind: Physics or Metaphysics?

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Abstract. When we attempt to infer from an animal's overt behavior whether its brain might be thinking or merely computing, a variety of intuitively suggestive lines of evidence become unreliable. Many behavioral traits such as adaptive behavior, behavioral variability, complexity, flexibility (including learning), and even the phenomenon of culture can be - and in insects at least have been proven to be - the results of genetic programming. The demonstrated effects of programming can be so intricate and subtle that even what seems to be insight or creativity must be suspect. A versatile and more reliable guide to the inner workings of minds is communication. Experimental manipulations of signals can show, through their effects on the behavior of the receiver, how the incoming information is being processed. This line of inquiry has laid open much of the insect mind, particularly that of the honey bee, but no compelling evidence for awareness has emerged. Instead, insects stand more than ever as testaments to the power of blind behavioral programming, and as such remind us to be wary of attributing to vertebrates anything more than larger, more interesting on-board computers.

THE PROBLEM

The sources of the knowledge and the motivations which guide the behavior of animals continues to provoke interest and controversy. Spalding, for example, marvelled at the seemingly prescient behavior of the female wasp who would labor tirelessly to "gather food...she never tasted" to feed "larvae she would never see" (49). The remarkable intricacies of the wasp's behavior must result either from instinct or from

learning: the information necessary for digging her tunnels, for hunting and paralyzing her one species of prey, for navigating back home, and for laying an egg and sealing the chamber after having collected the correct number of victims is either innate - coded for by the genes as "instinct" - or learned through experience.

Even the most determined advocates of the role of nurture over nature now generally concede that the clockwork behavior of wasps and other insects is largely prewired. But when it comes to higher animals - humans in particular - many of us are more reluctant to invoke the notion of instinct to explain at least certain examples of seemingly intelligent, adaptable, and highly complex behavior. But the mind is a private organ whose inner workings must normally be inferred from observation of the overt behavior it directs. When we watch an animal, how are we to know whether it is consciously thinking or merely computing; whether it is a sentient being, or simply an unconscious, well-programmed robot; whether the knowledge which guides behavior represents the intelligence of the individual, or of evolution? Since the question of what is going on in the brains of animals, whether encumbered by backbones or not, must usually be approached so indirectly, what are the crucial, telltale signs which might indicate a glimmer, however faint, of self-awareness, self-direction, and everything else that "animal consciousness" implies?

ADAPTIVE BEHAVIOR

One possible argument in favor of awareness is that animals regularly face difficult situations and resolve them in an intelligent way. Perhaps this implies that they have some "intellectual" grasp of the problem. A goose, for example, spotting an egg which has unaccountably managed to escape from the confines of her nest will stare at it, rise, extend her neck over the egg, and roll it gently back into the nest with her bill. Does this thoroughly sensible solution to what must be a fairly rare contingency represent the goose's personal evaluation of the problem? Alas, as Lorenz and Tinbergen showed,