MINDS, MACHINES AND EVOLUTION
Minds, machines and evolution

Philosophical studies

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Introduction

Since the publication of the Origin of Species in 1859, it has been recognized that the theory of evolution through natural selection has massive implications for our understanding of the properties and capacities of human beings. From the nineteenth-century Social Darwinists to modern defenders of sociobiology, thinkers have hailed a new science of man based upon a naturalistic view of *homo sapiens* as an animal subject to evolution through processes of this kind. The hope has been that such a theory could account for the full range of human mental and intellectual characteristics. Since natural selection allowed for naturalistic explanations of, for example, goal-directed patterns of behaviour in animals which were more complex than anything that could be accommodated by earlier naturalistic or physicalist doctrines, it was natural to hope that human behaviour, although much more complex than that of animals, could be explained in the same general fashion; we can understand the mind by seeing it as the product of evolution. Thought and consciousness are not irreducibly mental phenomena which inevitably escape the net of physical or biological explanation, but are rather determined by complex biological and physical processes. This might involve the claim that the most perspicuous vocabulary for describing and explaining mental phenomena is explicitly drawn from evolutionary biology. But it can also be captured in a less reductionist claim: a description of a mental capacity is unsatisfactory if it cannot be shown how a capacity of that kind could have evolved through natural selection. Either way, the view places a substantial constraint upon our understanding of *homo sapiens*, and, at the same time, holds out the hope of an exciting new source of scientific knowledge of mind and its place in nature. Consequently there is now a substantial literature that explores the evolutionary origins of particular human capacities, and attempts to pin down more precisely just how our capacities differ from those of animals – for example by showing that ethological models adequate for explaining animal behaviour may not be sufficiently sophisticated for explaining human behaviour. Such studies are important even for those who do not share the naturalistic perspective which informs many – but not all – of
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them. If someone supposes that there is an irreducible residue of the mental which cannot be accounted for in naturalistic terms, information about what can be explained in virtue of the fact that we are organisms that have developed through natural selection is required if we are to come to an informed clarification of just what that residue is.

Since the 1950s, philosophical speculation about the mind had been largely guided by a different, although related, naturalistic model – that of the computer. We naturally talk of computers reasoning and remembering, of the tasks and calculations that they perform, and it is clear that they can be brought to simulate a wide variety of human intellectual accomplishments. In cognitive psychology and Artificial Intelligence, there has been the assumption that computer models of our capacities provide illuminating descriptions or analyses of those capacities. Since the robot or computer is ‘just a machine’ this too supports a naturalist or physicalist view – if a machine can simulate our mental activity, then our mental activity cannot be taken to show that we are more than very complicated physical objects. This development is complementary to that produced by the theory of natural selection. Traits and capacities are selected for because of their functions, because of the way their effects contribute to the ability of the organism to survive and reproduce and to nurture its young. Accounts of states and capacities provided within Artificial Intelligence similarly allude to the function of the states and capacities – they show how they enable the agent to utilize available resources to solve particular problems. The close relations between the two models are discussed in the early chapters of Dennett’s Content and Consciousness (Dennett 1969); and it emerges again in his paper in this volume, when he argues that the claim of a computer simulation to explain how we perform a task must be rejected if it can be shown that the practice of performing the task in that way could not be the product of natural selection.

The papers in this volume are concerned with problems that arise within the kinds of approaches to the understanding of behaviour that I have just outlined. Some deal with general issues about the sorts of explanations that are provided when we make use of the theory of natural selection or the techniques of Artificial Intelligence. Others deal with the application of such models to the explanation of animal and human behaviour, with a particular stress upon the problems raised by consciousness and on what can be learned about the differing capacities of animals and people.

My own paper is more purely philosophical than the others, but it deals in general terms with some aspects of the issue of naturalism. It is particularly concerned with the role of naturalistic models of human cognitive capacities in logic and epistemology, by contrasting the views of two American ‘pragmatist’ philosophers, both of whom attach importance.
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to science, evolutionary biology and psychology. The first of these, Charles S. Peirce, insisted that epistemology was wholly prior to the natural sciences and should make use of no material drawn from their investigation. The second, W. V. O. Quine, holds that the role of traditional epistemology has been usurped by evolutionary biology and psychology. The paper explores the differing conceptions of truth and rationality which ground the two approaches.

The remaining papers deal more directly with philosophical issues in biology and Artificial Intelligence. The first two of these explore the character of explanation through natural selection. David Hull argues that species, the subjects of evolutionary change, should not be viewed as natural kinds or classes, but rather as historical individuals – individuals which exist in space and time and change or evolve through time. It is a consequence of this that there are no universal laws which apply to all and only the members of a particular species. When we explain the behaviour of a species by reference to natural selection, he urges, what we do should not be assimilated to explanations in the physical sciences employing the familiar covering law model. Rather, these explanations resemble those produced by historians. Moreover, since there cannot be a science which articulates laws governing the behaviour of all members of a single species, Hull’s view has consequences for our understanding of the human and social sciences. General laws may have a role in explaining human behaviour, but, if a science is understood as involving a body of laws, there cannot be a distinctively human science. Freud’s theories, for example, must be viewed as part of an historical description of the species *homo sapiens*, and not as an attempt to construct universal laws governing the human psyche.

There has recently been extensive debate about the unit of selection – whether traits become widespread only when they benefit individual organisms, or whether they may be selected for because they benefit a larger group; a third influential view is that traits are selected for because they benefit individual genes. Elliott Sober attempts to expose some errors which are present in many of the arguments for group selection or genic selection. He is chiefly concerned to insist that selection is a causal process, and that fitness is a real disposition, so that the issue of at what level selection occurs concerns the causal processes that it involves. From the fact that natural selection leads to the spread of a particular gene in the population, it does not follow that the gene was ‘selected for’. Examining metaphors and arguments employed by the defenders of genic selection, he shows that they fail to see the consequences of this point.

John Maynard Smith describes two important ideas in recent work on the social behaviour of animals: kin selection and evolutionary game
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theory. The former considers how a gene may spread in a population because it benefits those related to the animal that has it, even where it reduces the individual fitness of the animal itself. Evolutionary game theory considers how phenotypes evolve when their fitness depends crucially upon the kinds of responses made by others, and applies techniques drawn from ordinary game theory to study this. Maynard Smith displays some of the applications of these ideas, and uses them to indicate some of the differences between the capacities of animals and people – there are game theoretic solutions to problems available to people which are not available to animals.

Neil Tennant’s paper provides a wide ranging speculation on the evolutionary origin of language. In the first part of his paper, he considers what differentiates human language from simpler forms of animal ‘communication’, and attempts to link the evolution of recursive syntactic structure to the capacity for complex higher-order communicative intentions: it is because we can have a reflexive understanding of our communicative activity that we can come to use structured communicative systems. The second part of the paper draws from an examination of experiments on chimp language the conclusion that ‘recursively structured language’ is ‘a unique accomplishment of our species’, and considers some different explanations of this result.

The remaining papers are primarily concerned with Artificial Intelligence. Yorick Wilks introduces a number of concepts from computer science which, he suggests, might be used to formulate an account of some of the most familiar features of consciousness and self-consciousness, such as privacy and the unity of consciousness. He uses this discussion as the basis for a critical discussion of the accounts of consciousness and self-consciousness offered by other philosophers interested in Artificial Intelligence. One of the philosophers whose views are discussed by Wilks is Daniel Dennett, the author of the next paper, ‘Cognitive Wheels’. He provides a philosophical discussion of the problem that researchers in Artificial Intelligence refer to as the ‘frame problem’ – roughly, the problem of how we are able to engage so efficiently in fallible *ceteris paribus* reasoning. Having introduced philosophers to what he thinks is an issue of general epistemological interest that has emerged from research in Artificial Intelligence, Dennett surveys some of the responses to it found in the literature, and draws the general moral that Artificial Intelligence has a tendency to rely upon proposals that are ‘profoundly unbiological’, that could not have emerged through natural selection.

The final paper, by Margaret Boden, brings together the themes of Artificial Intelligence and the understanding of animal behaviour; she investigates how the cognitive models employed in AI can be used to help
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us to understand the perceptual capacities of animals. Explaining a variety of recently developed ideas in the field, she discusses the issue of when a computer simulation of a form of behaviour can be taken to illuminate the cognitive processes going on within the organism whose behaviour is being studied, and she defends the view that AI can help us to understand the phenomenological character of experience.

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REFERENCE

Dennett, D.C. 1969, Content and Consciousness, London.