

although the four basic features of nutrition receive thorough attention. Klasing's book is highly recommended to all professionals who recognize the importance of nutrition and dietary husbandry in the successful management of captive birds of any species.

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***Species of Mind: The Philosophy and Biology of Cognitive Ethology***

Colin Allen and Marc Bekoff (1997). MIT Press: Cambridge, USA. 209pp. Hardback. Obtainable from the publishers, 5 Cambridge Centre, Cambridge, MA 02142-1493, USA; or for European orders from, Fitzroy House, 11 Chenies St, London WC1E 7ET, UK (ISBN 0262011638). Price US\$47.50 or £29.50.

The subheading 'the philosophy and biology of cognitive ethology' of this ambitious book reflects the two authors' basic disciplines and interests in philosophy and cognitive ethology respectively. Cognitive ethology is defined by the authors as the 'comparative, evolutionary and ecological study of animal thought processes, beliefs, rationality, information processing and consciousness' – what a brainful! In some places the authorship seems obvious, for instance where considerable detail is given on play bows in canids, but generally the text is a comfortable meld.

The major focus of the book is the experiences of animals other than man, and the more fundamental question of how we identify which animals possess conscious states, which could imply different states for different animals of different species, for different animals of the same species, and even different levels of consciousness at different times in the same animal. The first question has been made contemporaneously famous by Nagel (1974), who asked, 'What is it like to be a bat?', although the question had been actively discussed in scientific circles for at least a century. For example, Geoghegan's (1879) letter to *Nature* provoked a considerable debate amongst leading biologists of the day, including Darwin: Geoghegan wrote: 'The window-sills of my drawing room are supplied with bread for the benefit of the birds. One day a large water-rat was seen on a window-sill, helping himself to the bread. Neither instinct or experience will easily account for his conduct: since he never found food there. . . He seems to have said to himself – I observe that the birds are thronging that window all day . . . it may be they find there something to eat: if so, perhaps I too might find there something which I should like.'

Allen and Bekoff suggest that 'cognitive ethology can trace its origin to the writings of Charles Darwin, an anecdotal cognitivist, and some of his contemporaries and disciples'. Certainly the authors must be counted as disciples. The answer to Nagel's question must be that only a bat can ever properly 'know' what it is like to be a bat, as we have discussed elsewhere (Piggins & Phillips 1998). Indeed such an appreciation can only be accomplished in full intra-species, while even this can be fraught, as in: 'My wife does not understand me.'

In considering a theory of mind in animals, Allen and Bekoff suggest that the stotting display of gazelles may indicate third order intentionality in prey animals – 'I know that you know I am here'. The remaining mainstream behaviourists amongst us may well be horrified, as consciousness, self consciousness, awareness, intentionality (as demonstrated in any complex behaviour) are paraded as apt topics of empirical research. As Chalmers (1996) said: 'What science is good at is easy questions ...consciousness, however, raises hard

questions.’ Allen and Bekoff address the latter bravely in this well-argued interdisciplinary book. There is something for everyone, although mercifully they have not attempted to be everything to everyone. Their stated aims are, first to ‘promote an interdisciplinary approach to theories of mind with a wide naturalistic perspective’; and second, to pursue ‘Darwinian continuity as one plausible route to a naturalistic theory of mental phenomena’, with ethology and cognitive ethology as essential to this. They also seek to ‘explore how evolutionary accounts of mental phenomena can inform and be informed by philosophical accounts’. As with any nascent discipline involving the behaviour of sentient organisms, cognitive ethology will only endure if mental matters can be investigated empirically, thus one thrust of the book is to show (optimistically!) how such a research programme might emerge.

A broad canvas is painted, commencing with a useful preface which stands on its own merits. In total there are nine chapters, each with a succinct résumé, which consider: the interdisciplinary approach; a history of classical and cognitive ethology; ‘what is behaviour?’; ‘can it be studied scientifically?’ (yes!); folk psychology; intentionality, social play and communication; anti-predatory behaviour; consciousness; and, finally, cognitive ethology as a science-synthesis. Increasingly humour creeps in, as do double negatives, which abound. As befits the authors, a non-Cartesian approach is espoused, together with more than a few physical analogies to the investigation of the ‘mental’.

Inevitably when tackling such a broad subject area, they sometimes display some lack of the current state of knowledge when straying from the confines of their fields of interest, as in discussing whether animals can display nutritional wisdom. It is now well established that animals are aware of the nutritive consequences of what they have eaten, and use this information in diet selection. However, depth is not usually sacrificed for breadth, as demonstrated by the chapters on social play and anti-predatory behaviour, where there is some reliance upon work best known to the authors, their own. Social play has been chosen since it exemplifies theoretical cognitive ethology issues and involves a gamut of complex behaviours – communication, role playing and the elusive intention. It has clearly been chosen since it may provide insight into animals’ abilities to understand the intentions of others. However, the authors disappointingly fail to acknowledge that play may provide mental as well as physical stimulation for animals. Consider, a herd of cows taking delight in charging around a field when the herdsman is trying to collect them for milking; or a penned animal playing with a gate latch, learning open the gate. Play includes a variety of different behaviours, often incomplete versions of adult ones, performed mainly in young animals for the purpose of learning and development. The authors’ suggestion that animals performing acrobatics during play sequences do so to learn self awareness is contentious: it is normally ascribed to increasing muscle tone and development.

Allen and Bekoff also consider the relationship between dominance and play in detail, and their finding that subordinates perform more bows and signal submissiveness is interesting. To us this suggests that play has an affiliative function, which is also recognized in grooming behaviour, where the attention of subordinates to the grooming requirements of their seniors appeases the latter and reduces aggression in a social group. They end by discussing whether playing animals realize different intents. We believe they do, eg lambs gambolling across a field know that they are not doing it with the objective of reaching a specific reward at the other side of the field. The reward is intrinsic to the play, a feature that often distinguishes play from other behaviours. Predators play with their prey to familiarize themselves with responses, for example.

The chapter on anti-predatory behaviour considers vigilance, classification, number estimation, conceptualization, social cooperation and again, communication. The authors propose that such behaviours are 'all likely to have had their evolution affected by predation'. In this chapter they bravely compare anti-predator responses, which are governed by survival of the fittest and dependent on the genetic advantage passed between generations, with those of a computer. Although the latter gives instantaneous, tit-for-tat responses, the increasing trend for networking and sharing of software might provide a similar selection pressure.

Much time is spent considering mental states, and the authors display considerable realism: '...there are quite simply no grounds for hope that anyone will be able to provide a simple set of behavioural criteria for the attribution of mental states ...it is quite likely that animals will present a confusing array of abilities to meet certain criteria for intelligence, whilst failing others'. Such remarks could also well be addressed to human intelligence, chronically quantified by the Stanford-Binet IQ test. Allen and Bekoff are also thankfully aware that, while interspecific differences need very careful consideration, what is important for a dog may not be for a sheep.

The authors' suggestion that the most parsimonious explanation of much stimulus-free behaviour is one which involves cognitive processing is persuasive, and they even suggest that this applies to some stimulus-driven behaviour, eg spacing behaviour in gregarious animals. However, we also have sympathy with Heyes in her attempts to refute the suggestion that animals have thought processes that are at all similar to our own. Regrettably, Allen and Bekoff pay only scant attention to language, that quantum leap between 'us' and 'them', which is now believed by many to be central to the formation of human mental images and may perhaps even use some of the same cerebral pathways as speech.

Animals almost certainly have quite different priorities in cognition. Consider the grazing animal, which needs to maintain a constant distance and orientation to its nearest neighbours, and remain in a constant position in relation to the other animals. This cannot be achieved without a mental map, to indicate when action must be taken to adjust its positioning. The form of this map could derive from visual images, audible signals or pheromonal information. Most grazing animals have particularly good peripheral vision, so the first is quite possible. However, creating and maintaining such a map would require constant surveillance. Indeed animals in small groups do indeed increase their surveillance. Unlike humans, audible signals are rarely used and are unlikely to be involved. An olfactory map would be difficult for us to construct, since we probably do not have the capacity to adjust the map for, for example, the direction of the wind; but most herbivores have extensive olfactory capabilities. Herbivores may well be able to piece together a positional map using combined information from wind speed and direction, and pheromonal concentrations. Such hypotheses could be tested quite simply with anosmic and temporarily blinded animals, and in this respect we welcome the plea by Allen and Bekoff for more research on this topic. Research on avoidance of faecal deposits by grazing herbivores has already indicated that olfactory mechanisms are important.

Complex mental imagery has its disadvantages as well as advantages, in particular the time lost and energy required for the computations. This could be critical for birds, which are able to maintain some of the most precise three-dimensional positioning skills, comparable with shoals of fish. However, humans, and other primates, show little aptitude in this cognitive process, as any comparison between synchronized swimming and schooling behaviour in fish will demonstrate.

The authors also discuss individual differences in cognitive ability within a species, which has generally been considered less than between-species comparisons. Thus an animal's personality could be the subject of empirical, non-anecdotal evaluation.

The book is definitely to be recommended to anyone interested in animal behaviour and consciousness, anthropomorphism and even animal welfare. It will appeal as much to theoreticians as to practical animal welfarists, and it should be required reading for neuroscientists. If we agree that animal behaviour is both rich and subtle and that we are scraping the surface currently, then a deeper understanding of any of the behaviours mentioned in the text must yield a greater appreciation of both fellow humans and 'lower' animals. Remember Darwin, as quoted by Allen and Bekoff: '...the lower animals, like man, manifestly feel pleasure and pain, happiness and misery'. He believed, as they clearly do, in a mental continuity between 'us' and 'them'. If we knew more about the mentalistic attributes they share with us, we could determine their needs more easily. This being so, the cursory mention of language is particularly disappointing. Another pertinent omission concerns mental representation in the form of imagery and of mental (ie cognitive) mapping. The reviewers were reminded of this by Jeffrey and O'Keefe's comments on how animals' memories resemble those of humans. Recent research emphasis has been upon episodic memory in animals, such as when a number of bird species demonstrate memory for the 'what, where and when of food caches'. (Jeffrey and O'Keefe 1998). Birds, as vertebrates, share a common ancestry with humans about 250 million years ago. For a while, the word 'cognitive' appeared almost indiscriminately as a convenient prefix to almost any behaviour discussion. Time has engendered some discipline in this, and demonstrably for ethology. Will we ever know what it was like to be a Neanderthal – a consideration for cognitive archaeologists? What will it be like to be a computer-cognitive artefact? Does cognitive ability lead inevitably to mind, or is it all physics after all?



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### *Interpreting Minds: The Evolution of a Practice*

Radu J Bogdan (1997). MIT Press: Massachusetts. 314pp. Hardback. Obtainable from the publishers, 5 Cambridge Centre, Cambridge, Massachusetts MA 02142, USA; or for UK orders from, Fitzroy House, 11 Chenies St, London WC1E 7ET, UK (ISBN 0262024195). Price US\$47.50 or £29.50.

I believe that scientists interested in animal welfare need to know about animal cognition. Although this book contains much useful information on animal cognition, it does not specifically relate to animal welfare. The following review may therefore be slightly unfair in that I have evaluated the book from the perspective of an animal welfare scientist, when perhaps it was written only for philosophers.

The first sentence of this book states: 'This essay is about common sense psychology, also known in philosophy as folk psychology, as theory of mind or mind-reading.' Immediately the author has identified the problem that dogs the study of animal cognition at the moment, namely the interchangeable use of so many terms. I personally prefer the use of the term 'theory of mind', as it most accurately describes what is being studied. Journalists would no doubt prefer the term 'mind-reading' as it fits in with the present media obsession with 'X-file' type stories and PMT (Pre Millennium Tension). Although many of these terms sound quite grand or mystical, what they all basically refer to is the animal's ability to impute mental states to other animals and to use this to its advantage – or in layperson's terms, 'being able to put oneself in another's shoes'. Thus, mind-reading in animals is not telepathy. However, those animals that have theory of mind (ie those that can mind-read) can, to a degree, predict and therefore manipulate the behaviour of other animals (this is often referred to as 'Machiavellian Intelligence'). What has all this to do with animal welfare? Well, it gives scientists a handle on the cognitive ability of animals, and this is useful in assessing their potential to suffer as animal welfare is ultimately about how an animal feels.

The inference I derived from the first sentence of this book (see above) was that it was going to further our understanding of animal cognition and provide new insights. I must