

accommodates motor differences between observer and demonstrator (right versus left handed, size differences, etc). Byrne (Ch 8) similarly considers the cognitive processes involved in imitation, although in this instance his focus is the preparation of nettles for eating by gorillas. He proposes that, unlike Wohlschläger *et al*'s human subjects, apes such as gorillas make use of a purely mechanistic process, the 'behaviour parsing model', to learn elaborate, adaptive skills from others. Great apes, although apparently limited in their capacity to mentalize, nevertheless show clear transmission of skills, particularly in the significant areas of food acquisition and preparation. Yet this transmission appears to lack the flexibility shown by humans. Byrne suggests that, by identifying correlations between performed actions and environmental consequences, and the order in which these occur, apes such as gorillas are able to copy conspecifics' behaviours without an understanding of intentions or causal logic. Indeed, even in humans, apparently 'mentalized' outcomes may in fact often result from simple, fast and mechanistic processes, common to many species. On the other hand, the correlational processes used by great apes might also be critical components of the later evolutionary development of full-blown mentalizing in humans.

The third and final section of the book is entitled 'Mentalizing: closing the communication loop'. A more diverse collection of chapters than those in the previous sections, contributions here include a variety of approaches to the more exclusively human facets of mentalizing. These include an illuminating chapter by Blair (Ch 11) on the neural systems involved in the recognition of facial expressions, and a detailed analysis of interpersonal interactions and dyadic 'interdependence' in romantic couples, by Griffin and Gonzalez (Ch 12). Of particular interest to those studying the nature of people's relationships with non-human animals is Johnson's contribution (Ch 10) about the mechanisms employed by humans (babies and adults) to detect 'agents'. Agents are other beings who are presumed by the observer to have intentions and goals, and are thereby regarded as 'like us'. Johnson points out that babies and young children appear to treat certain inanimate objects as if they are agents, with attentional abilities, communicative abilities and goal directed behaviour (such a tendency used to be called 'animistic' thinking). Through a series of experiments, she shows that facial features such as eyes and a mouth, as well as behavioural ones, such as responses contingent on the observer's behaviour, lead 12 to 15 month old children to regard simple machines as agents. Objects that merely look like an animal, move independently, or are treated by an adult as if they are agents, do not elicit such reactions in the infants. Johnson also shows that even adults, who *know* that something is not actually an agent (eg a robot), cannot help but use mentalistic language to describe it if it is showing agent-like behaviour. She concludes that assigning person-like agency status relies on a fundamental representational system that is not open to revision, even in adulthood. Moreover, this system appears to be based on a fairly limited number of cues, which many animals (particularly mammals and birds) share with humans.

This book originated from a themed volume of Philosophical Transactions of the Royal Society, Series B, in 2003. Not surprisingly, its chapters are all of a high standard and offer detailed overviews of a number of aspects of recent research into motion perception, imitation and mentalizing. Although not likely to be of great relevance to the wider animal welfare audience, anyone interested in higher cognitive processes, such as those involved in theory of mind, would be well advised to browse through it.

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### **Animal Innovation**

Edited by SM Reader and KN Laland (2003). Published by Oxford University Press, Great Clarendon Street, Oxford OX2 6DP, UK; <http://www.oup.com>. 344 pp. Paperback (ISBN 0 19 852622 9); price £19.99. Hardback (ISBN 0 19 852621 0); price £55.00.

This book grew out of a symposium held at the International Ethological Congress in 2001, which emphasised both the interest in animal innovation and the relative neglect of the topic. As the editors point out, this is especially surprising when animal innovation overlaps with current research areas focusing on the animal mind, culture, social intelligence, and learning and evolution of the brain. This book comprises 15 chapters grouped into topics: comparative and evolutionary analysis of innovation; patterns and causes of animal innovation; innovation, intelligence and cognition; and human innovation.

The book starts with an introduction by Reader and Laland. This reviews the topic and sets out clear definitions, which are referred to and built on in following chapters. These definitions are critically examined in terms of both the product of innovation and the process of innovation, and the authors present two operational definitions as a result. An innovation is a new or modified learned behaviour not previously found in the population (innovation as product); and innovation is the process that results in new or modified learned behaviour and that introduces novel behavioural variants into a population's repertoire. In this and other chapters, innovation is distinguished from invention, improvisation and immigration. The chapter considers innovation from numerous perspectives, including the processes underlying it, costs and benefits, and ecology and evolution, and ends with a list of 10 questions that highlights areas of further research.

This well-written chapter sets the scene for the rest of the book. All authors have been encouraged to be explicit about their definitions, to make comparisons across taxa where possible, and to highlight questions and areas for further research. Thus the book provides a state-of-the-art compendium of different approaches to animal innovation, with several chapters neatly summarising the results of several years' work, and is rich in ideas for further work. This should make it invaluable to students, especially post-graduates, interested in the area.

The section on comparative and evolutionary analyses of innovation contains five chapters. Lefebvre and Bolhuis examine correlates of feeding innovations in birds, using a database derived from the short notes section of avian journals. The size of the database (eg in North America, 619 reports on 256 species) allows a variety of predictions to be tested, and the authors present data on correlations with neurobiology, ecology and evolution, and cognition.

Sol's chapter is based on the theme that innovative behaviours are of considerable importance to understanding the ecology and, in turn, evolution of animals. He examines invasion of novel environments, extinction risk, and evolutionary implications such as adaptive radiation. Again there is strong emphasis on the future, with topics and predictions in areas such as niche expansion, geographic range size, migratory behaviour, population regulation and species coexistence set out. Reader and Macdonald examine environmental variability and primate behavioural flexibility. They argue that innovation frequency correlates with relative brain size in primates and may be a good measure of behavioural flexibility. Primate innovation rate correlates with measures of individual learning, variety of tool use, and with social learning, suggesting that these cognitive capacities have co-evolved. Slater and Lachlan ask if innovation in bird song is adaptive. They conclude that song is a classic case of social learning and discuss changes that occur in elements, song types and repertoires, as well as the different ways that novel songs may arise in a population. There is an interesting discussion on the tensions between and relative pros and cons of innovation and conformity. Galef's chapter on social learning, promoter or inhibitor of innovation, summarises much work on social learning about food in rats, using studies of both wild and captive animals. He also emphasises the implications of laboratory studies for interpretation of field observations.

The next section on patterns and causes of animal innovation contains three chapters, each on different taxonomic groups, starting with one by Laland and van Bergen on experimental studies of innovation in guppies. These demonstrated that guppies are capable of social learning. Variation in novel problem solving was best explained by state-dependent factors such as size, hunger, etc. The authors suggest that 'necessity is the mother of invention' well describes foraging innovation in guppies, and may apply to other species as well. The next chapter by Greenberg explores the role of neophobia and neophilia in the development of innovative behaviour in birds, and that by Box examines the characteristics and propensities of marmosets and tamarins and the implications for studies of innovation, which have hardly begun in these species. She argues that their particular characteristics, including the energetic demands of twinning, female feeding priority and cooperative breeding, as well as a range of foraging strategies, mean they would make interesting models for the exploration of innovation.

Information in these chapters, as well as the first in the next section on innovation, intelligence and cognition, by

Kummer and Goodall, show that neophobia is more characteristic of adults and neophilia of juveniles. The other two chapters in this section also focus on primates. Byrne, also using a database of anecdotes and reports, looks at novelty in deceit, and catalogues a large set of behaviours used by primates. He concludes that primate tactical deception typically involves behaviour that is idiosyncratic to individuals and that the most common deception by far is using a normal part of the repertoire in an unusual context. Lee examines innovation as a behavioural response to environmental challenges from a cost-benefit approach, ie as an adaptive strategy for coping with unpredictability, and explores how ecological variation might affect behavioural and demographic changes and innovation potential. She also looks at how forms of knowledge (ecological, social and goal-specific) relate to learning and the capacity to innovate.

The final chapter in this section, by Russon, looks at innovation and creativity in forest-living rehabilitant orang-utans, focusing on cognitive aspects of palm foraging. These apes need to be innovative to overcome their impoverished backgrounds (usually separated from their mothers in infancy) and lack of conspecifics from whom to learn (recent releases are all in areas devoid of wild orang-utans), and this chapter is rich in examples.

The next section on human innovation contains one chapter, by Simonton, on two Darwinian analyses of human creativity. He argues that creativity may have been selected for by both natural and sexual selection, positing that sexual selection was probably more important (primary Darwinism), and that human creativity can also be seen from the blind-variation and selective-retention model (secondary Darwinism). Simonton points out that we know far more about the latter than the former, yet each person is the product of both biological and socio-cultural forces. Indeed he suggests that creative behaviour may constitute another example (like altruism) where individuals sacrifice reproductive fitness for the sake of their socio-cultural system, citing Michelangelo, Newton and Beethoven as examples.

The book is rounded off by a discussion chapter by Hauser in which he focuses on three main points. The first is historical and looks at the use of human behavioural terms for describing animal behaviour. The second emphasises the importance of exploring the mechanisms underlying innovation, and the third is methodological, providing suggestions for future research and experiments.

In summary, this is an informative and stimulating volume. It covers a broad range of perspectives on innovation, and includes studies on fish, birds and primates. Several chapters include anecdotes and examples, which nicely illustrate the behaviours under discussion, as well as a few photos. The volume has been carefully edited with cross-referencing of chapters, which means that the whole hangs together rather well. Each chapter has its own references. My only criticism would be a degree of overlap in some of the earlier chapters. There are several points in this book that have implications for animal welfare. For example, wild animals may be expected to innovate in a foraging context when times are

hard and when the benefits of finding a novel food source are high (avoid starvation), compared to the costs of innovation such as increased predation risk. In contrast, when animals are not food deprived, the benefits of innovation might be diminished. However, the costs of innovation may also be reduced in the 'luxurious' situation of captivity (low predation risk, plenty of food), and this may explain why innovations are often reported in captive, provisioned primate populations, such as found in zoos. The importance of an enriched environment promoting exploratory behaviour is well known from work on rats, but applies broadly. Juveniles are shown to be more exploratory and attracted to novelty than adults, there may be particular windows for song learning early in the life of birds, and all these factors can inform captive management. Innovation may be particularly important for animals destined for release to the wild (whether captive born or rehabilitants), and although there is evidence to suggest that pre-release training may have little influence on survival to two years in lion tamarins, exposure to variety and novelty and opportunities to explore and manipulate may still be important, especially in the long-lived, slow-maturing orang-utans. This book has demonstrated that animal innovation occurs in a broad variety of taxa and that innovation may be underpinned by novelty responses, exploration and curiosity, individual and social learning, insight, creativity and behavioural flexibility. This suggests that captive environments that are rich in opportunity (through offering diverse environmental, foraging and even social opportunities) may also provide good conditions for studying the expression of innovation.

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### **Animal**

E Fudge (2002). Published by Reaktion books Ltd, 79 Farringdon Road, London EC1M 3JU, UK; <http://www.reaktionbooks.co.uk>. 184 pp. Paperback (ISBN 1 86189 134 2). Price £12.95.

The human animal is a very particular one. She does not only go on living her life but also reflects on why she does what she does and how she should do it, and on what makes her different from (or similar to) the other animals. It is this latter topic — of sameness or otherness — that Erica Fudge sets out to explore in this small but intriguing book. It is edited in a series called 'Focus on Contemporary Issues', and its cover carries a picture of a grinning chimpanzee; one we later get to know was called Ham, and became famous in 1961 when he made a NASA space trip and experienced weightlessness.

In addition to the introduction and conclusion, the book has three main chapters. In the first chapter, 'Visible and invisible: questions of recognition', Fudge explores the ways in which humans interpret animals in their different roles: as pets and as producers of the meat we (might) eat and the furs we (might) wear. She provides a brief historical

overview of the status of pets, and questions — both from a historical and a more contemporary perspective — whether pets are really to be considered animals at all. A pet is maybe rather "a pet first, an animal second". In bringing up the topic of food-producing animals, Fudge draws upon her own childhood experience of seeing rabbits as cute pets and being served rabbit pie (albeit disguised as 'chicken pie'). She discusses the distinction that the English language makes between the animal and the meat that comes from it (originating from the time of the Norman invasion, when those who looked after the animals were Saxons and used the English terms, whereas those who talked about the meat were Normans and spoke French), and other processes which serve to place a distance between living animal (same) and meat (other). The final section of this chapter shows us how wearing fur has moved from being an enviable demonstration of wealth and sexuality to an immorality, and back again to something nearly acceptable. Fudge suggests the backlash of the anti-fur movement or the return of the fur industry has to do with the success of fake furs: as fake furs have become nearly indistinguishable from real furs, wearing something that looks like fur no longer means running the risk of being publicly offended.

In the second chapter, 'Real and symbolic: questions of difference', Fudge explores the paradoxes of similarity and difference in how animals are represented in literature and films for children. A feature that many texts and films have in common is the communication between animals, or between humans and other animals. Fudge suggests that this represents a wish to be able to communicate with animals and asks us:

"Why is it that these other beings are so central to the child's engagement with the world? Animals in books speak to us, sometimes literally. The reason for this centrality of representations of animals in these books might be that they offer a fulfilment of one of the key desires of our lives. This is a desire that begins with ease in childhood and which becomes — as the adults in some of these books [sic] show — more and more complex and melancholy with age. We might argue that the desire to comprehend and communicate with animals is infantile, but if we do not have these narratives of communication ... then we will lose contact with a large part of our world. If I cannot say that a dog is sad, what can I say that it is? In a sense, without anthropomorphism we are unable to comprehend and represent the presence of an animal. This is one of the problems of anthropomorphism that needs to be explored."

(I couldn't agree more with this later statement but, unfortunately, Fudge doesn't explore the question further in this book, so it is just to be hoped that she will in coming writings.)

From our early XXIst century viewpoint, the border between human and non-human may seem rather distinct, but, in the two last sections of this chapter, Fudge suggests that this may be a temporary position. She does this by pointing both backwards and forwards in time: backwards to the medieval Bestiaries, in which animals were described as representatives of different moral characters rather than