

punishers, such as sticky tape or piled up objects. She also includes electric shock mats in this list, which are generally not used in the UK because of welfare concerns over their use. Chapter 10 discusses grooming behaviour, including the function and patterns of normal grooming. The problem behaviours in this section include excessive grooming, lack of grooming and hyperaesthesia. The book also includes useful appendices on feline vocalisations, the development of sensory and motor responses pre- and post-natally in the kitten, and the doses of commonly used psychopharmacologic agents.

In conclusion, the whole book is extremely well researched and referenced, making it an invaluable addition to the library of anyone working in clinical behavioural medicine. The approach taken by the author, of evaluating normal patterns of behaviour and then examining where problems occur with these behaviours, is a very rational one. This approach effectively directs the reader to understand the normal before considering the abnormal, and is to be commended. Enhancing the understanding of feline behaviour both amongst owners and veterinary surgeons is an important way of improving the welfare of pets, and hence this book is an important tool in improving the welfare of cats within the domestic environment.

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**The Neuroscience of Social Interaction:
Decoding, Imitating, and Influencing the Actions
of Others**

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At first glance, the title of this volume appears alarmingly over-ambitious. Of course, social interactions continue to be studied extensively by sociologists, social psychologists, and, in non-human animals, by behavioural biologists. But the field is so diverse and so complex, it would seem to me almost impossible to decide where to start attempting to underpin such a variety of behavioural and cognitive processes at the level of neuroscientific analysis. Chris Frith and Daniel Wolpert's solution is to limit their remit radically: to the neuroscience of people's (and perhaps some animals') capacities to decode, imitate and influence the actions of others. Central to their interest in these areas is the phenomenon described as 'mentalizing' — the perception and communication of mental states such as beliefs and desires. Their aim is to uncover the variety of neural mechanisms underlying this ability — effectively to 'read other minds' — and to show how these mechanisms might have evolved. To this end, they have grouped chapters into three broadly themed sections: 'Biological motion', 'Mirror neurons' and 'Mentalizing'.

The first section, 'Biological motion: decoding social signals' contains four contributions concerning the hierarchical processes by which biological actions (eg movement, gaze direction, pointing gesture) are detected and interpreted. Puce and Perrett (Ch 1), and Rittscher *et al* (Ch 4) focus on the most basic of these: the detection and interpretation of biological, particularly animate, systems on the basis of perceived motion alone. The neural processes involved, it is proposed, can be localised to a specialised brain area called the superior temporal sulcus (STS). Interestingly, this area also appears to be concerned with discerning socially important facial movements, such as mouth opening (indicating the initiation of an utterance) and gaze aversion (indicating that the other's attention is diverted away from the observer). Thus, the STS apparently has specialised functions concerning the allocation of attention within the context of human social interactions. Csibra (Ch 2) also considers the perception of gaze direction, this time from a developmental perspective. Even infants as young as 12 months show an appreciation that emotional expressions (eg by their mother) reference the affective relevance specifically of objects towards which gaze is directed. The same aged children also show strong tendencies to follow the gaze of others, demonstrating 'joint attention', a relatively sophisticated process regarded as an important marker for subsequent language acquisition. Such skills may or may not be interpreted as 'theory of mind', but are, at the very least, important skills involved in the understanding of humans as agents who act in an intentional manner. Frith and Frith (Ch 3) consider further developmental steps towards full human 'mentalizing', such as explicitly understanding the events that give rise to a false belief (and thus the capacity to deceive). Again, they return to the neural structures involved in this process, proposing a multi-layered capacity, involving several brain structures including the STS, and, at the highest level of sophistication, the medial pre-frontal cortex.

The second section, 'Mirror neurons: imitating the behaviour of others' takes as its starting point the relatively recent discovery that certain neurons in the pre-motor cortex of rhesus macaques respond both when an action is observed and when the same action is performed. Potentially a key neural substrate for imitation, empathy and certain aspects of perspective taking and theory of mind, the finding of these mirror neurons has stimulated considerable research and renewal of interest in the investigation of such processes in humans and primates. Of particular interest to evolutionary biologists is the issue of the layers of cognitive processing that may be needed to translate basic mirror responses in monkeys to full imitative learning in humans. With this in mind, Wohlschläger *et al* (Ch 6), working with children and adults, propose a theory of 'goal directed imitation' in which the task to be learnt is *not* imitated slavishly. Instead, it appears that the perceived task, and in particular its goal, is identified and broken down into its (more and less critical) component parts. The imitator/learner is thereby able to identify the essential features of the task, and thus achieve the goal in a manner that is flexible and

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

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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.