

the behaviourists of the past to spin gently in their graves, but even the rotationally challenged among the living could hardly but admire the vitality and technical ingenuity of the work presented here.

The twenty chapters range widely over the field of animal cognition, but a common theme is perception of or learning about *complex* events, as opposed to the discrimination of simple stimuli, or elementary learning processes. In some cases, technically innovative methods are used, as in the study of pigeons' tracking of moving stimuli (Rilling), or the investigation of imagery in the same species (Neiworth), but even when the techniques used are ones that Hull might have recognized, the theoretical focus is ambitiously cognitive, as illustrated by the chapter on memory organization in the rat by Capaldi. Some chapters discuss the learning of relations between relatively simple stimuli, for example pair-comparisons of stimulus durations (Dreyfus), or relative judgements of event or response number (Fetterman, Stubbs, & MacEwen); others employ stimuli derived from real-world locations or events (Wilkie, Wilson, & MacDonald, and Kendrick, on memory for places, Weisman & Ratcliffe on perception of pitch in bird songs). Some workers use complex mazes or enclosures modelled on real-life environments (the chapters by Roberts, Phelps, & Schacter, and Sherry), whereas for some other work a traditional Skinner box—albeit one equipped with projection facilities that would put some cinemas to shame—suffices.

Lack of space forbids a detailed discussion of all the chapters, although all deserve it, so I will mention just a couple of personal favourites. In chapter 3, Spetch and Rusak review evidence for the tantalizing phenomenon of "subjective shortening" in pigeons' memory for stimulus duration, and they wrestle bravely with some facts that they must wish they had never discovered (e.g. not only does stimulus duration apparently seem shorter to pigeons as the time since stimulus presentation increases, a neat and clear finding, but the interval between trials also plays a similar role). In chapter 13, Blough reviews an elegant body of work on visual search in pigeons (with some human subjects added for comparison), in an attempt to understand the features that govern perception of forms. Blough argues persuasively for the utility of reaction-time measures, common in human psychology but rare in animal studies, in unravelling the underlying psychological processes of form perception, and also draws extensively for theoretical nourishment on previous work on human perception by A. Treisman and others. Both these chapters seem to provide coherent reviews of work that can be difficult to appreciate overall as it comes piece by piece in successive journal articles, and both can be recommended to readers wishing to acquaint themselves with these areas.

What about imagery in the pigeon, and transitive inference in the rat? Neiworth's chapter on the former phenomenon went a long way to convince this reader that the issue can be investigated fruitfully, with a dazzling

display of technical skill, including an apparent demonstration on pigeons of the "representational momentum" effect found by Freyd and her co-workers with humans. Davis's work on inference in rats (ironically containing a quote from other authors to the effect that "No one in their right mind would look for evidence of [it] . . . in rats . . ."), while likewise representing tour de force of experimental ingenuity, may have deep significance. Primitive reasoning processes are at the core of some accounts of instrumental conditioning, and the ability of animals to exhibit discriminative performance that goes beyond repetition of the trained responses may relate to the phenomenon of "equivalence", currently all the rage among operant psychologists. The authors of the sceptical quote seem to have been at least partly right, as Davis and his colleagues have clearly had to struggle to obtain the evidence they wanted, possibly longer than colleagues who *were* in their right minds would have judged reasonable. However, with a complicated series of olfactory discrimination (A-B, B-C, etc., with the positive stimulus first), they find evidence of transfer to novel conditions, involving stimulus pairs never previously presented (like B-D)—a result that is, to say the least, provocative. Having demonstrated the impossible, however, Davis shows admirable caution in considering a variety of explanations of the results, some of which are non-cognitive.

This seemed to me a most impressive collection of studies, showing that the old dog behaviourism, along with its puppies like "animal cognition" and "animal psychophysics", has lots of life left in it yet. The volume itself is also a credit to the publishers and printers, being nicely presented, free of typographical errors and badly-set lines, and at just over 10p per page reasonably priced (providing that you don't have to buy it with your own money). Anyone even casually interested in finding out what modern behavioural psychologists can persuade animals to reveal about their internal worlds (and by means of humane techniques too, I might add) would profit from reading this book.

JOHN WEARDEN

McGrew, W.C. (1992). *Chimpanzee material culture: Implications for human evolution*. Cambridge: Cambridge University Press. Pp. xvi + 277. ISBN 0-521-41303-6. £40.00 (Hbk.). ISBN 0-521-42371-6. £16.95 (Pbk.).

Bill McGrew has spent four of the last twenty years observing free-living chimpanzees from Tanzania in east Africa to Senegal and Gabon in the west. His broad personal experience of chimpanzee behaviour across the

species' range places him in an enviable position both to describe the striking differences in behaviour of chimpanzees at different study sites and to discuss, from an insider's perspective, the causes of this thought-provoking behavioural variability.

Chimpanzees at Gombe eat oil palm nuts, whereas those at Mahale (less than 100 miles away) do not, although groves of oil palms are common at both sites. The grooming-hand-clasp (in which two chimpanzees simultaneously extend one arm overhead, clasp elevated hands and then use their opposite hands to groom their partner's exposed underarm) is common at Mahale and unknown at Gombe. Although a few populations of chimpanzees regularly use stone hammers to break open nuts, most have never been observed to do so. Such behavioural variability, frequent in chimpanzee populations, is unquestionably intriguing, and McGrew has done the field a real service both in detailing the geographic distribution of chimpanzee tool-using behaviours and in focussing attention on the potential significance of observed behavioural variability across chimpanzee populations for our understanding of the evolution of human culture.

McGrew's book is surely written for experts in the field. Even simple instructional aids are lacking. This is a book on African biogeography that contains not a single map of the continent of Africa. Further, despite being a monograph, the book reads rather like a collection of solicited chapters by different authors. Although complementary, chapters do not flow smoothly one into the next. Basic material is repeated in several chapters, and contradictory interpretations of controversial studies are to be found at different places in the book. A few of these inconsistencies are important. For example, Boesch and Boesch are described (correctly) on page 83 as providing "suggestive anecdotal evidence for teaching" by chimpanzees and less accurately on page 215 as "forc[ing] us to abandon cherished clichés of human uniqueness, such as that only human beings intentionally teach their offspring." The reader clearly has work to do, but it is worth the effort to arrive at an overview both of the breadth of chimpanzee use of objects to achieve goals and of the extent of variability in chimpanzee behaviour in natural settings.

The central intellectual challenge McGrew faces is to decide whether the different patterns of behaviour found in different chimpanzee populations are the result of "culture", of social learning of some kind. McGrew's response to this challenge seems to me unnecessarily defeatist. On the one hand, he is suspicious of data from the behavioural laboratory: "interpreting behavioural data from captive subjects is at best a ticklish salvage operation" (p. 36). On the other, McGrew despairs of undertaking causal analyses in the field: "It is logically impossible to do an experiment in nature. To control for variables is to intervene and intervention of the kind required is unnatural" (p. 37). If, as McGrew suggests, laboratory data cannot reveal behavioural capacities of use in interpreting behaviour in

natural settings, and if manipulation in the field destroys the usefulness of subsequent observations for understanding "natural" behaviour, then analysis of the causes of the intriguing differences in behaviour among free-living chimpanzee populations is a hopeless enterprise indeed.

McGrew acknowledges that a critical issue in deciding whether a behaviour is traditional in some population is to determine whether social learning is involved in the acquisition ("dissemination") of that behaviour. However, he dismisses the possibility of undertaking studies of social influences in chimpanzee behavioural development for a seemingly trivial reason—our inability to observe "the development of an *asocial* chimpanzee in the wild (p. 38)". Obviously, approaches other than comparing the development of "social" and "asocial" chimpanzees can provide information of use in deciding whether social learning plays a role in the development of particular behaviours in young chimpanzees. For example, studies of variability in rate of acquisition of behaviours of interest by new recruits to a free-living population offer opportunities for hypothesis testing. Within a population, do young born to mothers who rarely or never fish for termites or use hammers to crack nuts develop such behaviours more slowly than do young born to mothers that frequently engage in these behaviours?

Perhaps most disconcerting is McGrew's treatment of alternatives to the hypothesis that cultural processes produce the behavioural diversity seen in chimpanzees. For example, in discussing the observation that chimpanzees' use of hammer and anvil to crack open oil palm nuts is geographically limited, McGrew (p. 14) considers alternatives to cultural explanations to account for the data: "it may be that oil palm nuts vary in hardness across the range of the species, such that some kinds lend themselves more easily to being smashed open. However, grasping at such straws has an air of desperation about it." Elsewhere (p. 13), McGrew considers plausible, non-cultural explanations of the observation that only some populations of chimpanzees exploit oil palms as food (for example, the possibility that chimpanzees have a preferable alternative food in one area but not in another). He dismisses these alternative explanations as "forced and unlikely".

It would be fairly easy to examine the relative hardness of samples of oil palm nuts taken from areas where chimpanzees either do or do not use hammers to break them open. Foods from areas where chimpanzees do not feed on oil palms could be introduced into areas where chimpanzees do feed on them to see whether such manipulations blocked subsequent exploitation of oil palms. Experiments would surely be of more use in analysing causes of behavioural diversity than are unsupported assertions.

At several points in the book, McGrew expresses dissatisfaction with the fact that ethnographers do not ascribe behavioural variability to culture when discussing chimpanzees, whereas they readily use the term when

neighbouring human social groups display differences in behaviour similar to those seen in groups of free-living chimpanzees. Given the current state of knowledge of causes of variability in chimpanzee behaviour, McGrew's dissatisfaction is unjustified. We know that humans both teach their young and learn by imitation. We lack compelling evidence, from either laboratory or field, that chimpanzees can teach or imitate in problem-solving situations. Analysis of the causes of the intriguing differences in the behaviour of chimpanzees in different locations is a necessary precursor to our acknowledging that they share with humankind that most powerful of behavioural capacities, a capacity for culture.

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McGregor, P.K. (Ed.) (1992). *Playback and studies of animal communication*. NATO ASI Series Vol. 228. New York: Plenum Press. Pp. x + 231. ISBN 0-306-44205-1. US\$90.00 (Hbk.).

Playback is an experimental approach to investigation of the meaning of signals in animal communication systems. Commonly, playback refers to the reproduction of acoustic signals (natural or synthetic), and observing the animal's response. So far, most playback studies have been conducted on birds.

Based on a symposium held at Thornbridge Hall in 1991, *Playback and the study of animal communication* is a collection of 15 short chapters, including a manifesto on the design of playback experiments, the "Thornbridge Hall NATO ARW Consensus" authored by the plenary of the participants. The consensus aims to contribute to the so-called "pseudoreplication debate," which goes back to Kroodsma's critique of the limited generality of many playback designs (e.g. Kroodsma, 1989). The chapter also discusses the common pitfalls of playback experiments. Although the consensus chapter gives the impression that the entire book will be a discussion of these issues, it is, instead, a collection of chapters dealing with very different topics. However, the majority (11) of the contributions focus on birds. The remaining three chapters are dedicated to anurans (2) and mammals (1).

Falls gives an impressive review of the history of playback studies. His report on birds is thorough and exhaustive. In contrast, the overview of studies conducted on taxa other than birds and anurans remains brief and incomplete. Catchpole's article shows how to integrate field observations with experiments. He argues in favour of the kind of studies he has conducted himself, and demonstrates in steps how to link work in the laboratory and in the field. In the following chapter, Pepperberg talks about social learning and playback. Gerhardt's chapter deals with technical and acoustical aspects that affect the fidelity of sound reproduction and per-

ception by an animal. He also discusses the possible advantages of the use of Bayesian statistics in avoiding Type II errors. The subsequent contribution by McGregor raises the question of whether "one, many, or composite multivariate measures" should be used. Including a worked example, this didactic chapter is easy to understand, well written, and likely to be of use in other areas, too. Dabelsteen discusses the advantages of the use of computers and synthesizers in interactive playback trials in the field. McComb provides an article on "Playback as a tool for studying contests between social groups", in which she shows how female lions assess the strength of other groups based on their vocal activity.

The remaining seven chapters of the book deal with variability of signals and signalling behaviour. Nelson gives an account of song overproduction and song matching during ontogeny. Lambrechts focuses on the topic of singing and male quality in birds. He endeavours to present a number of approaches but concedes that many questions remain open, as singing is a complex phenomenon governed by a variety of factors. Klump and Gerhard give a good description of call-timing in frog male-male interactions. They present models derived from playback experiments to determine temporal features such as refractory periods or call activation phases. Searcy provides an interpretative review of an area that has been neglected for a long time—that is, playback with female birds. This chapter is clear and informative and includes a compilation of the most important papers on the subject. The following one, by Horn, deals with the perception of song. He presents three different methods that may produce conflicting results and discusses their conclusions. Weary includes a description of operant experiments and song perception. He points out that many tests confuse the issue of how vocalizations function and how they are perceived, and provides (yet another) discussion of the problem when subjects show no difference in response. Keeping the drawbacks (cost, animal welfare) of this technique in mind, he suggests that operant experiments may form a valuable addition to the repertoire of methods. Finally, Ratcliffe and Weisman's chapter deals with pitch-processing strategies in birds in the laboratory and in the field.

There are two problems with this book: (1) The title is somewhat misleading, as it suggests that the book deals with the communication of several taxa, whereas the book is almost completely dedicated to birds. Furthermore, the contributions are exclusively related to acoustic communication, although, as the authors concede, there are other communication channels that might be used for playbacks. Reports of newly developed techniques, such as the playback of videotapes or the reproduction of olfactory stimuli certainly would have been welcome. (2) It remains unclear to whom this book is addressed. Should it serve as an introduction, or is it directed at scientists working in this area? If the book is designed to be introductory, methodological problems with the playback technique