ters a year. I was disappointed with Chivers's attempt, in an otherwise excellent article, to estimate the total number of gibbons in the wild. Basically, his method involves multiplying the density estimates from detailed studies in a very few, small areas by the amount of existing forest that is considered suitable for gibbons in each country (based on Landsat and aerial photos, some 15 years old). Although Chivers discusses the potential inaccuracies in using this grossly simplified method, he has not considered the dangers. For, as Oates points out in an earlier chapter, once these estimates are in print they become established as fact, to be used and misused by conservationists and exploiters alike. Relevant to this, I found some of the entries in Chivers's tables V to VII to be incorrect or in need of explanation. For example, in table V the entry for *muelleri* at Ulu location with 28 gibbons in 5 square kilometers should give a density of 5.6 per square kilometer, rather than 10.5. Likewise the figure at Kutai for the same species should be 14.8 per square kilometer, not 11.7. In this same table, footnote c is not clear: how is encounter frequency converted to a density estimate? In table VI, for *muelleri* in eastern Malaysia, the total area of its distribution (547,700 square kilometers) apparently exceeds the total area available (198,000 square kilometers). Tables VI and VII are not consistent in the estimates of densities for *muelleri*.

Goodall and Groves review in detail the taxonomic, geographical, ecological, behavioral, and population dynamics data for the eastern gorillas, emphasizing the variety and plasticity of ecology and behavior found in differing habitats, a factor that must be considered in any conservation effort. The gorillas are hunted for meat, witchcraft purposes, and curios; they are disturbed by cattle and human intruders, including tourists; but the most serious threat, as with most of the species described in this book, is habitat destruction.

Most of the contributors offer valuable and detailed recommendations for the conservation of the species described. Although the editors suggest captive breeding programs as the principal means of saving endangered species, most of the authors maintain hope that measures will be taken by the countries involved to protect the animals in their natural habitats and emphasize the necessity for such measures. Primate conservation involves not only the propagation of a species but also its maintenance as a vital component of a viable ecosystem. This is feasible only through conserving the species concerned in large numbers in the full range of its habitats, which also helps maintain maximum genetic diversity. Moreover, since the majority of threatened primate species live in tropical rain forests that are themselves threatened with extinction, most of primate conservation is essentially the conservation of tropical rain forests. These complex and fragile ecosystems not only are essential for nonhuman primates but are also vital elements of our own life-support system. For example, extensive deforestation in the tropics has a significant deleterious effect on rainfall there, as well as in the temperate regions, where the impact may even be greater (as has been documented elsewhere by Potter *et al.*). Green and Minkowski and other authors in this volume clearly outline other vital services to humans that undisturbed rain forests provide.

The establishment of large national parks and nature reserves with diverse and representative ecosystems is strongly recommended by the contributing authors, as well as enforcement of already existing laws protecting these natural resources. They also stress the necessity of educating the indigenous people to the value of conservation, not only to themselves but to future generations. Without their support in upholding the laws (and holding down the human population) conservation efforts by the concerned few will be meaningless.

This volume has provided us with a valuable collection of information and has clearly shown the problems and possible solutions in this aspect of natural resource management. It remains to be seen if the warnings will be heeded and the lessons implemented.

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Perceptual Modes

Modes of Perceiving and Processing Information. Papers from two workshops, 1974 and 1975. HERBERT L. PICK, JR., and ELLIOT SALTZMAN, Eds. Erlbaum, Hillsdale, N.J., 1978 (distributor, Halsted [Wiley], New York). viii, 232 pp., illus. $14.95.

This volume presents a diverse collection of papers on the topics of perception and information processing. The chapters range from discussions of basic perceptual mechanisms to a functional analysis of the child's expression of meaning and from original experimental contributions to speculations on general issues in perception. The theme unifying these varied selections is the concept of "perceptual mode," which is explicitly discussed in the introductory chapter by Pick and Saltzman. According to these authors, perception is adaptive in that special-purpose systems have evolved for processing alternative forms of information and engaging in alternative patterns of action. Different systems, or perceptual modes, are evident when different types of information are extracted from the same pattern of stimulation. A given perceptual mode is general in that the same type of information will be extracted from quite different patterns of stimulation. Different perceptual modes may involve very different ways of processing extracted information. Indeed, Pick and Saltzman suggest that the processing mechanisms underlying alternative perceptual modes should be distinguishable at the neural level.

Examples of modal distinctions in perception that Pick and Saltzman propose include processing acoustic signals for speech-relevant versus non–speech-relevant information, visual processing of general information about orientation in space versus processing of detailed information specifying object identity, and extracting information with respect to a body-spatial or subjective frame of reference versus an environmental or objective reference system. In the nine chapters that follow, the various contributors to the volume attempt to apply the concept of perceptual mode to their own research or discussion. In the case of some of the papers, this effort seems strained. In other papers, though, an analysis in terms of perceptual modes works quite well. For example, Posner, Nissen, and Ogden distinguish between automatic and attended modes of processing, and they use this distinction as a framework for discussing their experiments on the role of set in detecting the location of input signals. One of the most provocative findings they report is that prior knowledge of the modality of an upcoming signal results in greater processing benefits than knowledge of its spatial position. In another chapter, Mack distinguishes between proximal perception, which is determined by local information in the retinal image, and constancy perception, which is true to some aspect of an external object despite changes in the retinal image. She further divides constancy perception into the subject-relative mode

and the object-relative mode. The former mode is determined by both strictly proximal information and information about some relation between an object and the observer, whereas the latter mode is determined exclusively by information about relations between visual objects. The subject-relative–object-relative distinction provides an excellent framework for interpreting Mack's interesting experiments on the perception of motion and stability during pursuit eye movements.

In addition to the central notion of perceptual modes, several other themes are evident in many of the papers in the volume. One of these is an interest in the adaptive nature of perception as a basis for action. Trevarthen quite directly discusses the relation between perceiving and acting, from psychobiological and developmental perspectives. This concern with the perception-action link is also found in Lee's nice analysis of the types of visual information used for planning and controlling such general activities as balancing, orienting, and locomoting. A second theme common to several of the chapters is the idea—attributable primarily to J. J. Gibson—that perception is the direct, unmediated pickup of information over time. Shaw and Pittenger adopt a strong Gibsonian position in their discussion of the relation between perceiving events of short duration (such as the motion of the second hand on a clock) and events of long duration (such as the motion of the hour hand). They argue against an overly simplified constructivist account of the perception of slow change, namely the view that change is inferred from successive comparisons of static images of the object undergoing change. Instead, they claim that perception of both slow and fast change is the pickup of information specifying the continuous transformation underlying the change. This concern with the direct perception of invariant information is echoed in the final summary chapter by Turvey and Prindle. And an information-based view of perception is evident in Hagen's discussion of the factors contributing to judgments of depth and distance relations in pictures.

In the introductory chapter, Pick and Saltzman suggest that the use of different perceptual modes might result in patterns of individual differences or in discontinuities in the development of processing skills. These are very interesting suggestions, I think, and it is disappointing to find little systematic consideration of developmental trends or individual differences in the subsequent chapters. Another issue which Pick and Saltzman point to, but which none of the other papers addresses, concerns the organization and control of sets of perceptual modes. Do the various dimensions on which modal differences in perception are found operate independently, or are they perhaps organized in a hierarchical fashion?

Despite some of these shortcomings, the papers in this volume demonstrate that the concept of perceptual mode is a promising one that will provide a useful theoretical and empirical tool for other perceptual psychologists.

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Brain Biochemistry

Interactions between Putative Neurotransmitters in the Brain. Papers from a symposium. S. GARATTINI, J. F. PUJOL, and R. SAMANIN, Eds. Raven, New York, 1978. xvi, 416 pp., illus. $27.50. Monographs of the Mario Negri Institute for Pharmacological Research, Milan.

The symposium upon which this book is based took place before any comprehensive mapping of neuropeptide pathways and is therefore confined to an account of interactions between the more traditional transmitter candidates. Relatively few brain regions are covered in any detail and almost 200 pages are devoted to the organization of nigrostriatal circuitry.

Of the authors dealing with the nigrostriatal system, Ladinsky *et al.* and Costa and Cheney present exhaustive evidence for an inhibitory dopaminergic input onto striatal cholinergic neurons. The relationship between acetylcholine and dopamine in the striatum is likely to be rather more involved, however; Hery *et al.* present evidence that the release of dopamine in the striatum is enhanced by cholinergic agonists acting at presynaptic nicotinic and muscarinic receptors. The emphasis on neurochemistry in these chapters is representative of the book as a whole, and it is a pity that many pertinent neurophysiological studies are not included. For instance the work of Kitai (*Exp. Brain Res.* **24**, 351 [1976]) and others has provided strong evidence that dopamine may in fact be excitatory, not inhibitory, in the striatum.

A similarly complex picture is emerging in the substantia nigra. Cuello and Iversen present evidence that dopamine released from dendrites may act presynaptically to regulate raphe and striatopallidal inputs to the nigra. Cheramy *et al.* describe the elegant in vivo push-pull techniques they have used to examine the effects of transmitters on dopamine release from both the dendrites and the terminals of nigrostriatal neurons. On the basis of their experiments they suggest the possibility of multiple target sites for GABA (gamma-aminobutyric acid) within the nigra, both directly on dopaminergic neurons and on inhibitory nigral interneurons. The application of neuronal spike train analysis to investigate inputs to nigral cells is discussed by Groves *et al.*, although rather more is made of the technique than of the results generated by it.

The most rewarding section of the book examines the organization of the serotonergic projection from the raphe nuclei to the locus ceruleus. An excellent chapter by Sakai *et al.* on the anatomy of projections to the raphe and locus ceruleus is followed by compelling autoradiographic (Descarries and Léger) and immunocytochemical (Pickel *et al.*) evidence for the serotonergic innervation of noradrenergic neurons in the locus ceruleus. Complementary biochemical studies are summarized by Pujol *et al.*, but again a chapter on the neurophysiology of this system is missing.

Two of the remaining chapters, by Costa and by Hoffer *et al.*, examine the roles of GABA and noradrenaline in the cerebellum although neither chapter is strictly concerned with transmitter interaction. Muricidal behavior in rats, which is discussed by Mandel *et al.*, does not readily lend itself as a model for transmitter interactions and is rather out of context in this book.

The most disappointing aspect of the book is its limited choice of subject matter; many regions, such as the hippocampus, in which the anatomy is sufficiently well characterized to provide a firm basis for the analysis of transmitter action are mentioned only in passing. However, many chapters in the book provide objective reviews and should prove useful, particularly to those interested in the central actions of the monoamine transmitters. A volume with similar aims that incorporated studies of neuropeptides would make the diagrams of synaptic circuitry included in many chapters seem greatly oversimplified.

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