Sound stuff

David Pye

The Sonar of Dolphins. By Whitlow W. L. Au. Springer-Verlag: 1993. Pp. 277. DM 148, £58.50.

How must the world appear to other species, whose senses differ in varying degrees from our own? It is hard to imagine what it must be like to use natural echolocation, at which dolphins and bats excel. Although we now have a thorough understanding of echo principles and can

comprehensive review of the dolphin story, and a 'batty' equivalent is devoutly to be desired.

For Whitlow Au has written a splendid book, which is likely to become a classic in its field, and of considerable interest well outside it. This is not only an authoritative reference work but it also contains a clear historical perspective and a treatment of all the fundamentals for a reader new to the subject. There is no excuse afterwards for thinking a decibel is a unit of sound intensity or for confusing peak-to-peak with root mean square amplitudes. (But is it merely an unfortunate slip to say, contradicting the adjacent equation,

that sound pressure level, rather than intensity, decreases with square range?) The succinct accounts of time versus frequency domains, Fourier transformation, near and far fields, psychophysical methods and detection theory should all do much good.

There follows a detailed and systematic survey of dolphin ears, hearing and acoustic discrimination. Sound production, emission and directionality lead into analysis of the signals themselves and a comparative account of the pulses of 21 species (although echolocation has not actually been demonstrated in all of these) out of a possible 65. Inevitably parts of this will be seen by some as contentious, for matters lacking firm evidence have often given rise to heated dispute, some of which cannot yet be resolved — even the source of sound within the dolphin's head is still a mystery. But the author deals fairly and confidently with the confusion and conflict, presenting evidence and opinion in an admirably even-handed way that is both

stimulating and reassuring.

Eventually the stage is set for reviewing the very impressive capability of dolphin echolocation, followed by its interpretation by acoustic theory and speculations on the neural processing involved. Again, some of this may be contentious but that is not the point — its stimulus will be justified if it leads to more than verbal dispute. At least this is a new starting point.

Finally Au takes a careful look at bat systems for comparison and concludes with a brief, moderate consideration of outstanding problems, deficiencies of past approaches and indications of future potential. The whole is beautifully produced and copiously illustrated with admirable clarity. □

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Thinking in circles

Susan Greenfield

The Creative Loop: How the Brain Makes a Mind. By Erich Harth. Addison-Wesley: 1993. Pp. 196. \$21.

SCIENTISTS are finally waking up to the question of consciousness. The nature of the mind, for so long regarded as the terrain of philosophers, psychiatrists and cognitive psychologists, has become a growth industry among those with a detailed knowledge of physics and biology. Like most scientists who have produced books on the subject, Harth is not a neuroscientist; he is a physicist who nonetheless succeeds in keeping his background well under control. The chapters follow each other effortlessly in a witty yet authoritative style that should immediately capture the imagination of the general reader.

Harth starts with a refreshing departure from other forays into the mind-brain problem by reflecting on the frequently neglected question of the actual nature of life itself, and hence of the divergent development of animate, purposeful organisms away from inanimate objects. This approach brings a new perspective on the hoary issue of the physical versus the mental: the author focuses attention on the difference in objective time and space, where there is only local causality and isolated entities in a perpetual present, in contrast to the vast spans in time and space by which we bond together a subjective universe. In attempting to relate the objective to the subjective, Harth espouses a 'physicalist' standpoint: this approach, which has already been broached by such diverse authorities as the mathematician Roger Penrose and the philosopher Thomas Nagel, is that science may ultimately account for the talent of our brains to translate the physical into the phenomenological. But the current laws and relations that might be thought adequate by the 'materialist' to explain the mind will need to be supplemented by as yet unknown principles and laws.

The central question around which this book is written is basically that already publicized by Dennett as the 'Cartesian Theatre', the fallacious anatomical locus of consciousness. Like most who have contemplated this issue, Harth rejects the idea of a hierarchical pyramid of neurons leading to a final set of 'gnostic neurons' as a centre of consciousness. By contrast, he is reluctant to embrace the only apparent alternative, parallel processing. He rejects the idea of transiently salient 'multiple drafts' or 'bundles' of consciousness as ducking the issue of the undeniable cohesion and continuity of our individual awareness. If we 'demystify the brain' by

Fathoming the mystery.

produce excellent sonars for use in water and radars for air and space, there are still many problems in understanding the sonar of animals.

Sonar study itself has never been cohesive. Quite apart from the obvious differences between the size and needs of dolphins and bats, there are fundamental differences in the way they operate. These are probably associated less with their separate evolution than with differences between air and water as acoustic media, which also demand different techniques in their study. So there have always been 'bat people' and 'dolphin people', who only meet at the splendid but infrequent joint conferences run as NATO Advanced Study Institutes. Even the literature on dolphins often seems (to a bat person) to be in quite obscure publications, so the conferences were occasions of delight as everyone discovered what the 'other side' had achieved. Now at last there is a