"folk psychology" come from? How do we know about our own minds and the minds of others?

Philosophers have been concerned with questions like these for centuries, and more recently they have been investigated by psychologists. The past five years have seen a growth of interest in them within the field of developmental psychology—with when and how children begin to understand such concepts as belief, desire, imagination, and emotion. The study of "children's theories of mind" has become a hot topic and was the subject of innumerable graduate student presentations at the 1991 Society for Research in Child Development convention—one of the indicators, or possibly one of the perils, of success.

Much of the appeal of the recent work in "theories of mind" is exemplified in Josef Perner's new book. It is a fine instance of Piaget's original project—the attempt to use developmental evidence to illuminate epistemological questions—even while it rejects the great majority of Piaget's empirical and theoretical claims. The book is also an example of cognitive science at its best. Philosophical ideas and ideas from artificial intelligence blend seamlessly with Perner's ideas about developmental psychology. At the same time Perner is an extremely careful and sometimes dazzlingly ingenious experimenter.

In fact, one important factor in the recent ascendency of the "theory of mind" was an experiment conducted by Perner with his colleague Heinz Wimmer. The experiment was actually inspired by a problem in comparative psychology (as well as by the German children's book *Max and Moritz*). How would you know if a creature really understood belief? The answer is to see if it could appreciate that beliefs may differ from reality. For example, suppose we show a child a candy box, and when she opens it she finds, to her surprise, pencils inside. We close the box, and Max enters the room. Then we ask the child, "What does Max think is inside the box?." Three-year-olds consistently say that Max thinks there are pencils in the box; they don't understand that his belief may be false. Perner and others have subsequently conducted many additional experiments demonstrating that this result taps a genuine conceptual difference between adults and children and is not simply the result of superficial performance limitations.

Understanding the Representational Mind takes off from this experimental finding. The book has a clear and focused thesis. Perner is concerned with how we come to understand the representational character of the mind: the fact that beliefs, and other mental states, refer to a world outside the mind. In many philosophical views, the representational character of the mind is one of its most central and distinctive traits. If children do not understand that mental states are representational, then their "folk psychology" is deeply, radically different from that of adults. Perner argues that this understanding does not emerge until about age four and that it is indexed by the child's performance in the false-belief tasks.

One problem for this view is the fact that children as young as 18 months old appear to be capable of understanding that we can pretend or imagine or hypothesize things that aren't actually true. When a child says "I'm pretending that this is an apple, but really it isn't" or "I think this could be an apple, but maybe it isn't" she seems to be demonstrating a capacity to think about representations. Perner's solution to this problem is derived from philosophical work on "situation semantics." From 18 months to four years, in his view, the child sees herself and others as psychological beings related to situations, some of which are real, some imaginary, some hypothetical. Of course, from the psychologist's point of view, the imaginary and hypothetical situations are, in fact, only representations. But this is not the three-year-old child's view. The three-year-old, we might say, represents the world, both the real world and possible or imaginary worlds, but doesn't know that this is what she is doing.

Much of the book plays out the contrast between the three-year-old "situation theorist" and the four-year-old "representation theorist" in a wide range of areas. Though those outside the field have focused on the false-belief task, Perner recognizes that this task is only interesting insofar as it indicates a more general conceptual change. He uses this framework, for example, to explain John Flavell's pioneering work on the development of perspective-taking and the appearance-reality distinction. He also applies it to the developing ability to understand symbolic systems such as drawing and to changes in children's social behavior and memory. The general picture that emerges from Perner's work is that children construct the idea of representation as a way of explaining certain features of action and experience. They do this in much the same way a scientist might construct a new theory. Developing this new theory, moreover, makes an important difference in the way the child acts in the world.

Generally, Perner's extensions of his ideas to other areas of development are ingenious, and usually they are convincing, particularly when they concern the experiments in Perner's own research program. Occasionally, however, they seem forced. Perner sometimes seems to skimp on the psychological abilities of three-year-olds in an attempt to make the achievements of the four-year-old seem all the more impressive.

The book is admirably written, which is rare in psychology, and also admirably argued, which is even rarer. Still, the central idea of the child as "situation theorist" is a slippery one and seems to turn slipperier at crucial junctures of the argument. Largely, this reflects the philosophical complexity of the problem of representation and the difficulty of characterizing minds that are so different from our own. Though Perner doesn't completely solve these problems (what mortal could?), his important achievement is to show how they can be mutually illuminating. Trying to understand the child's ideas about belief can clarify the nature of belief itself. If this field continues to produce work of this caliber, it stands a fair chance of surviving its success.

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Some Other Books of Interest

Human Paleopathology. Current Syntheses and Future Options. DONALD J. ORTNER and ARTHUR C. AUFDERHEIDE, Eds. Smithsonian Institution Press, Washington, DC, 1991. vii, 311 pp., illus. $70. From a symposium, Zagreb, Yugoslavia, July 1988.

As outlined by Ortner and Aufderheide the field of human paleopathology (the interpretation of indicators of health and disease in ancient peoples) has four main strands—research on soft tissue, research on skeletal tissue, analysis of historical and archeological materials, and biochemical research—and has been characterized by a "commensal" relationship between anthropologically and medically trained researchers. In organizing the symposium on the subject that was part of the 1988 International Congress of Anthropological and Ethnological Sciences, Ortner and Aufderheide report that they were motivated in part by a sense that the field had reached a plateau and was in need of assessment and perhaps redirection. To that end they brought together some 70 scholars from Europe, the Americas, and Australia.

The resulting proceedings open with a group of six papers headed Theory. Among the issues raised here and in the editors' concluding synthesis are the need for more universal descriptive methods and better classificatory systems, problems with overreliance on clinical diagnostic criteria, the relevance of paleopathology to contemporary

health patterns, zoonoses in relation to the evolution of disease, interaction among diseases, and the diagnosis of paleopathologies related to occupation. There follow 10 papers on methods, concerned among other topics with analysis of ancient brain tissue, paleoparasitology, soft tissue calcification, and interpretation of ceramic representations of medical conditions and procedures. An ensuing group of seven papers is focused on assessment of health and disease in particular populations—North American Plains Indians, Afro-Americans of the post-Reconstruction era, Japanese of various periods, prehistoric Danes, and aboriginal peoples of Chile and Australia. The remainder of the volume is given over to particular pathologies, with two to three papers each on tuberculosis, leprosy, arthritis, trauma, tumors, dental disease, and miscellaneous conditions. Geographical areas represented by these studies range from ancient Egypt through Britain to California and the Andes.

Noting "the problems inherent in writing in another language," the editors assume responsibility for some rewriting of the contributions. They have also provided brief summaries of discussions that followed the original presentations. Their final conclusion is that "the ultimate adoption of even a fraction of the new methods discussed [in the volume] can be expected to change the nature of paleopathologic study more during the coming decade than it has enjoyed during the past century."—**K.L.**

AIDS Research Reviews. Vol. 1. WAYNE C. KOFF, FLOSSIE WONG-STAAL, and RONALD C. KENNEDY, Eds. Dekker, New York, 1991. xviii, 458 pp., illus. $150.

AIDS Research Reviews joins an earlier annual series, *AIDS Clinical Reviews*, from the same publisher. In keeping with the general plan for the series, this first volume contains reviews (usually five each) in five general areas. The treatment of the first area, molecular biology, opens with a discussion of the regulatory proteins of the human immunodeficiency viruses by Rosen and Dillon and includes papers on cellular regulation of HIV gene expression (Nabel), HIV envelope variability (Goudsmit *et al.*), and the relations among primate lentiviruses (Johnson *et al.*). A second group of reviews is devoted to host responses, authors here being Rosenberg and Fauci, Vermund *et al.*, Goedert, Fenijo and Norrby, and Kunsch and Wigdal and topics discussed including sexual and perinatal transmission and the possible role of cofactors, among others. A group of papers on animal models then includes considerations of infection in chimpanzees, horses, and mice (SCID and transgenic). Discussions of efforts to develop drugs and vaccines occupy the rest of the volume. Authors concerned with drug development focus on HIV-1 protease, CD4 molecules, hybridization inhibition, immunotoxins, and retroviral vector-mediated gene transfer. The treatment of vaccines includes considerations of the use of whole inactivated simian immunodeficiency virus, synthetic peptides, neutralizing antibodies, recombinant live-virus vectors, and anti-CD4 idiotypes. Each chapter has its own reference list (in some cases extending to 1990), and for the volume as a whole there is a 22-page subject index.—**K.L.**

Reprints of Books Previously Reviewed

Aldo Leopold. His Life and Work. Curt Meine. University of Wisconsin Press, Madison, 1991. Paper, $19.95. *Reviewed* **241**, 1237 (1988).

At the Heart of the Bomb. The Dangerous Allure of Weapons Work. Debra Rosenthal. Addison-Wesley, Reading, MA, 1991. Paper, $9.95. *Reviewed* **250**, 574 (1990).

Bryozoan Evolution. Frank K. McKinney and Jeremy B. C. Jackson, Eds. University of Chicago Press, Chicago, IL, 1991. Paper, $15.95. *Reviewed* **245**, 422 (1989).

Night Thoughts of a Classical Physicist. Russell McCormmach. Harvard University Press, Cambridge, MA, 1991. Paper, $9.95. *Reviewed* **216**, 880 (1982).

What Little I Remember. Otto R. Frisch. Cambridge University Press, New York, 1991. Paper, $10.95. *Reviewed* **207**, 1068 (1980).

Books Received

Atherosclerosis. Cellular and Molecular Interactions in the Artery Wall. Avrum I. Gotlieb, B. Lowell Langille, and Sergey Fedoroff, Eds. Plenum, New York, 1991. x, 278 pp., illus. $79.50. Altschul Symposia Series, vol. 1. From a symposium, Saskatoon, Canada, April 1990.

Atlas of IR Spectra of Organophosphorus Compounds (Interpreted Spectrograms). R. R. Shagidullin, *et al.*, Eds. Nauka, Moscow, and Kluwer, Boston, MA 1990. viii, 344 pp. $182. Translated from the Russian edition (Moscow, 1984).

Atmospheric Aerosols. Global Climatology and Radiative Characteristics. Guillaume A. d'Almeida, Peter Koepke, and Eric P. Shettle. Deepak, Hampton, VA, 1991. xx, 561 pp., illus. $110. Studies in Geophysical Optics and Remote Sensing.

The Avian Model in Developmental Biology. From Organism to Genes. Nicole Le Douarin, Françoise Dieterlen-Lievre, and Julian Smith, Eds. Centre National de la Recherche Scientifique, Paris, 1990. x, 319 pp., illus. 250 F. From a workshop, Paris, Dec. 1989.

A–Z of Snake Keeping. Chris Mattison. Sterling, New York, 143 pp., illus. $24.95.

Biology of Methylotrophs. Israel Goldberg and J. Stefan Rokem, Eds. Butterworth-Heinemann, Boston, MA, 1991. xxii, 360 pp., illus. $89.95. Biotechnology Series 18.

Biology of the Chemotactic Response. J. P. Armitage and J. M. Lackie, Eds. Published for the Society for General Microbiology by Cambridge University Press, New York, 1991. xvi, 404 pp., illus. $110. Symposia of the Society for General Microbiology, 46. From a symposium, Dec. 1990.

Biotechnological Innovations in Health Care. Published on behalf of Open Universiteit and Thames Polytechnic by Butterworth-Heinemann, Stoneham, MA, 1991. x, 300 pp., illus., + index. Paper, $29.95. Biotechnology by Open Learning Series.

Biotechnology in Japan. A Comprehensive Guide. Rolf D. Schmid. Springer-Verlag, New York, 1991. xiv, 769 pp., illus. $259.

Biotechnology in the Food Industry. M. P. Tombs. Prentice Hall, Englewood Cliffs, NJ, 1991. x, 189 pp., illus. $52. Prentice Hall Advanced Reference Series.

Botany. An Introduction to Plant Biology. James D. Mauseth. Saunders, Philadelphia, PA, 1991. xxiv, 800 pp., illus., + appendixes + index. $53.25.

Brain and Perception. Holonomy and Structure in Figural Processing. Karl H. Pribram. Erlbaum, Hillsdale, NJ, 1991. xxxii, 388 pp., illus. $69.95.

British Plant Communities, Vol. 1, Woodlands and Scrub. J. S. Rodwell, Ed. Cambridge University Press, New York, 1991. x, 395 pp., illus. $150.

Chemical Aspects of Enzyme Biotechnology. Fundamentals. Thomas O. Baldwin, Frank M. Raushel, and A. Ian Scott, Eds. Plenum, New York, 1991. x, 359 pp., illus. $85. Industry-University Cooperative Chemistry Program Symposia. From a symposium, College Station, TX, March 1990.

Chemical Carcinogenesis, 2. Modulating Factors. Amedeo Columbano *et al.*, Eds. Plenum, New York, 1991. xii, 653 pp., illus. $129.50. From a meeting, Cagliari, Italy, Sept. 1989.

Comets in the Post-Halley Era. R. L. Newburn, Jr., M. Neugebauer, and J. Rahe, Eds. Kluwer, Boston, 1991. 2 vols. xxviii, 1360 pp., illus. $196. Astrophysics and Space Science Library, vol. 167. Based on a colloquium, Bamberg, Germany, April 1989.

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Comparative Physiology of the Vertebrate Digestive System. C. E. Stevens. Cambridge University Press, New York, 1991. xii, 300 pp., illus. Paper, $24.95. Reprint, 1988 ed.

Compartmentation of Plant Metabolism in Non-Photosynthetic Tissues. M. J. Emes, ED. Cambridge University Press, New York, 1991. xiv, 204 pp., illus. $59.50. Society for Experimental Biology Seminar Series, 42. From a meeting, Edinburgh, U.K., 1989.

Computational Aspects of Lie Group Representations and Related Topics. A. M. Cohen, Ed. Centrum voor Wiskunde en Informatica, Amsterdam, 1991. ii, 144 pp. Paper, Dfl. 39. CWI Tract 84. From a seminar, Amsterdam, 1990.

Computational Techniques for Fluid Dynamics 1. Fundamental and General Techniques. C. A. J. Fletcher. 2nd ed. Springer-Verlag, New York, 1991. xiv, 401 pp., illus. Paper, $49. Springer Series in Computational Physics.

Condensed Matter Theories. Vol. 6. S. Fantoni and S. Rosati, Eds. Plenum, New York, 1991. x, 453 pp., illus. $125. R From a workshop, Isola D'Elba, Italy, June 1990.

Condensed Systems of Low Dimensionality. J. L. Beeby *et al.*, Eds. Plenum, New York, 1991. xiv, 830 pp., illus. $159.50. NATO Advanced Science Institutes Series, vol. 253. From a workshop, Marmaris, Turkey, April 1990.

The Correlative Brain. Theory and Experiment in Neural Interaction. Jos J. Eggermont. Springer-Verlag, New York, 1991. xii, 307 pp., illus. $173. Studies of Brain Function, vol. 16.

Corticonics. Neural Circuits of the Cerebral Cortex. M. Abeles. Cambridge University Press, New York, 1991. xiv, 280 pp., illus. $54.50; paper, $24.95.

Cosmic Rays and Particle Physics. Thomas K. Gaisser. Cambridge University Press, New York, 1991. xvi, 279 pp., illus. $65; paper, $24.95.

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Disordered Materials. Science and Technology. Selected Papers by Stanford R. Ovshinsky. David Adler, Brian B. Schwartz, and Marvin Silver, Eds. Plenum, New York, 1991. xiv, 397 pp., illus. $69.50. Institute for Amorphous Studies Series.

Drug Biotechnology Regulation. Scientific Basis and Practices. Yuan-yuan H. Chiu and John L. Gueriguian, Eds. Dekker, New York, 1991. iv, 563 pp., illus. $135. Biopress Technology Series, vol. 13.

Dynamics of Magnetic Fluctuations in High-Temperature Superconductors. George Reiter, Peter Horsch, and Gregory C. Psaltakis, Eds. Plenum, New York, 1991. xii, 370 pp., illus. $95. Nato Advanced Science Institutes Series B, vol. 246. From a workshop, Aghia Pelaghia, Crete, Oct. 1989.

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