VOLUME 10 NUMBER 2 JUNE 1987 An International Journal of Current Research and Theory with Open Peer Commentary

Behavioral and Brain

Sciences

Appearing in this issue, with Commentary . . .

How brains make chaos in order to make sense of the world Christine A. Skarda & Walter J. Freeman

Dopamine, schizophrenia, mania, and depression: Toward a unified hypothesis of cortico-striato-pallido-thalamic function Neal R. Swerdlow & George F. Koob

Primate handedness reconsidered Peter F. MacNeilage, Michael G. Studdert-Kennedy & Bjorn Lindblom

Also, Continuing Commentary on "Social versus reproductive success: The central theoretical problem of human sociobiology" (Vining) "Can human irrationality be experimentally demonstrated?" (Cohen) "The impending demise of the icon: A critique of the concept of iconic storage in visual information processing" (Haber) "Choice, optimal foraging, and the delay-reduction hypothesis" (Fantino & Abarca) "Unconscious cerebral initiative and the role of conscious will in voluntary action" (Libet) "Supplementary motor area structure and function: Review and hypotheses" (Goldberg) "Matrilineal inheritance: New theory and analysis" (Hartung) "Are there independent lexical and nonlexical routes in word processing? (Humphreys & Evett)

CAMBRIDGE UNIVERSITY PRESS

Behavioral and Brain Sciences

Editor Stevan Harnad 20 Nassau St., Suite 240 Princeton, NJ 08542

Assistant Editor Laura Triest

Associate Editors

Behavioral Biology
Jack P. Hailman/U. Wisconsin
Hubert Markl/U. Konstanz

Biosocial Behavior Glendon Schubert/U. Hawaii, Manoa

Cognition and Artificial Intelligence Zenon Pylyshyn/U. Western Ontario

Cognitive Development Annette Karmiloff-Smith/MRC, London and MPI, Nijmegen

Evolutionary Biology
Michael T. Ghiselin/California Academy of Sciences

Experimental Analysis of Behavior

A. Charles Catania/U. Maryland, Baltimore County

History and Systems Julian Jaynes/Princeton

Language and Cognition
Philip Johnson-Laird/MRC, Cambridge
Peter Wason/University College, London

Language and Language Disorders
Max Coltheart/Birbeck College, London

Linguistics
Robert Freidin/Princeton

Neurobiology Irving Kupfermann/Columbia

Neuropharmacology
Susan D. Iversen/Merck Sharp and Dohme, Ltd.

Neuropsychology Jeffrey A. Gray/Inst. Psychiatry, London

Neurophysiology Sten Grillner/Karolinska Institutet

Paleoneurology Stephen Jay Gould/Harvard

Perception Richard Gregory/U. Bristol

Philosophy
Daniel C. Dennett/Tufts
Gilbert Harman/Princeton

Quantitative Methods

Philosophy of Science Adolf Grünbaum/U. Pittsburgh

Psychobiology Victor H. Denenberg/U. Connecticut David S. Olton/Johns Hopkins

Donald B. Rubin/Harvard Vision and Artificial Intelligence Stuart Sutherland/U. Sussex

Editorial Policy Behavioral and Brain Sciences (BBS) is an international journal providing a special service called Open Peer Commentary* to researchers in any area of psychology, neuroscience, behavioral biology, or cognitive science who wish to solicit, from fellow specialists within and across these BBS disciplines, multiple responses to a particularly significant and controversial piece of work. (See Instructions for Authors and Commentators, inside back cover.) The purpose of this service is to contribute to the communication, criticism, stimulation, and particularly the unification of research in the behavioral and brain sciences, from molecular neurobiology to artificial intelligence and the philosophy of mind.

Papers judged by the editors and referees to be appropriate for Commentary are circulated to a large number of commentators selected by the editors, referees, and author to provide substantive criticism, interpretation, elaboration, and pertinent complementary and supplementary material from a full cross-disciplinary perspective. The article, accepted commentaries, and the author's response then appear simultaneously in BBS.

Commentary on BBS articles may be provided by any qualified professional in the behavioral and brain sciences, but much of it is drawn from a large body of BBS Associates who have become formally affiliated with the project.

Qualified professionals are eligible to become BBS Associates if they have (1) been nominated by a current BBS Associate, (2) refereed for BBS, or (3) had a commentary or article accepted for publication. A special subscription rate is available to Associates. Individuals interested in serving as BBS Associates are asked to write to the editor.

This publication was supported in part by NIH Grant LM 03539 from the National Library of Medicine.

*Modelled on the 'CA Comment' service of the journal Current Anthropology. Copying This journal is registered with the Copyright Clearance Center (27 Congress St., Salem, MA 01970). Organizations in the U.S.A. who are also registered with the CCC may therefore copy material (beyond the limits permitted by sections 107 and 108 of U.S. Copyright Law) subject to payment to the CCC of the per-copy fee indicated in the code on the first page of the article. This consent does not extend to multiple copying for promotional or commercial purposes.

ISI Tear Sheet Service, 3501 Market Street, Philadelphia, PA 19104, is authorized to supply single copies of separate articles for private use only.

For all other use, permission should be sought from the Cambridge or New York offices of the Press.

Subscriptions Behavioral and Brain Sciences (ISSN 0140-525X) is published quarterly in March, June, September and December. Four parts form a volume. The subscription price, which includes postage, of Volume 10 (1987) is US \$140.00 net in the U.S.A. and Canada (£83.00 in the U.K. and rest of the world) for institutions; US \$61.00 net (£39.00) for individuals; US \$35.00 net (£23.00) for BBS Associates; and US \$35.00 net (£23.00) for students (in the U.S.A. and Canada only) who provide proof of eligibility with order. Single parts cost US \$39.00 net (£23.00) plus postage. Institutional orders may be sent to a bookseller or, in the U.S.A. and Canada direct to: Cambridge University Press, 32 East 57 Street, New York, N.Y. 10022; in the U.K. and rest of the world to: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, England. Individuals must order direct from the Press. Second class postage paid at New York, N.Y. and at additional mailing offices. Postmaster: send address changes in the U.S.A. and Canada to Behavioral and Brain Sciences, Cambridge University Press, 32 East 57 Street, New York, N.Y. 10022.

Advertising Inquiries about advertising should be sent to the Journals Promotion Department of the Cambridge or New York Office of Cambridge University Press.

Contents Volume 10:2 June 1987 Zelfzen



Skarda, C. A. & Freeman, W. J. H make sense of the world	ow b	rains make chaos in order to	161
Open Peer Commentary Babloyantz, A. Chaotic dynamics in brain activity Barnden, J. A. Chaos, symbols, and connectionism Boynton, R. M. Spatial analysis of brain function: Not the first Brown, R. Can brains make psychological sense of neurological data? Corner, M. A. & Noest, A. J. When the "chaos" is too chaotic and the "limit cycles" too limited, the mind boggles and the brain (model) flounders Earle, D. C. On the differences between cognitive and noncognitive systems Garfinkel, A. The virtues of chaos	174 174 175 175 176 177 178	Grossberg, S. Stable self-organization of sensory recognition codes: Is chaos necessary? Levine, D. S. Is chaos the only alternative to rigidity? Perkel, D. H. Chaos in brains: Fad or insight? Rosenfeld, R., Touretzky, D. S. & the Boltzmann Group Connectionist models as neural abstractions Thom, R. Chaos can be overplayed Werner, G. Cognition as self-organizing process Authors' Response Skarda, C. A. & Freeman, W. J. Physiology: Is there any other game in town?	179 180 180 181 182 183
Swerdlow, N. R. & Koob, G. F. Domania, and depression: Toward a cortico-striato-pallido-thalamic fun	unifie	ed hypothesis of	197
cortico-striato-panido-trialanne fun	CHOII		191
Open Peer Commentary Alheid, G. F. & Heimer, L. The "extended		Kalivas, P. W. Where have all the peptides gone? Kelley, A. E. Dopamine and mental illness:	218
amygdala" as a receptor area for psychotherapeutic drugs	208	Phenomenological and anatomical considerations Kolb, B., Jacobs, W. J. & Petrie, B. Searching for a	219
Beart, P. M. Roles for glutamate and norepinephrine	208	technology of behavior Le Moal, M. Toward a neurological psychiatry	220 221
in limbic circuitry and psychopathology Chute, D. L. Intracellular considerations in models of		Phillips, A. Unified theories of psychoses and affective	
psychopathology Cools, A. R. The relevance of feedforward loops	209 210	disorders: Are they feasible without accurate neural models of cognition and emotion?	222
Fallon, J. H. The ghost in the machine: What if the midbrain output is excitatory?	210	Soubrié, P. & Carnoy, P. Neuropsychiatry: Pitfalls of inferring functional mechanisms from observed drug	
Fibiger, H. C. Neural circuit models of psychopathology: Dancing on the precipice of		effects Stevens, J. R. Psychopharmacology of psychosis: Still	222
neuromythology?	212	looking for missing links Tassin, J. P. Dopamine and mental illness: And what	223
Gardner, E. L. The neuropathology of schizophrenia, mania, and depression: Diseases of cognitive		about the mesocortical dopamine system?	224 225
initiation and switching? Grace, A. A. An electrophysiologist's eye view of the	213	Wolkin, A. & Cancro, R. Madness and clarity	220
basal ganglia Gray, J. A. & Baruch, I. Don't leave the "psych" out	214		
of neuropsychology Jaskiw, G. E. & Weinberger, D. R. The prefrontal	215	Authors' Response Swerdlow, N. R. & Koob, G. F. Toward a unified	
cortex-accumbens circuit: Who's in charge?	217	neuropsychiatric hypothesis	226
MacNeilage, P. F., Studdert-Kenne handedness reconsidered	edy, l	M. G. & Lindblom, B. Primate	247
Open Peer Commentary		Calvin, W. H. On evolutionary expectations of	005
Annett, M. Handedness as chance or as species characteristic	263	symmetry and toolmaking Cicchetti, D. V. On viewing the evidence for primate	267
Bradshaw, J. L. But what about nonprimate asymmetries and nonmanual primate asymmetries?	264	handedness: Some biostatistical considerations Corballis, M. C. Straw monkeys	268 269
Brésard, B. & Bresson, F. Reaching or manipulation: Left or right?	265	Deuel, R. K. & Schaffer, S. P. Patterns of hand preference in monkeys	270
Bryden, M. P. & Steenhuis, R. E. Handedness is a matter of degree	266	Ettlinger, G. Primate handedness: How nice if it were really so	

Glezer, I. I. The riddle of Carlyle: The unsolved problem of the origin of handedness Goodale, M. A. Two hemispheres: One reaching hand Guiard, Y. Precursors to what? Theory is lacking for handedness in humans Heuer, H. Does a hand preference indicate a hemispheric specialization? Jerison, H. J. Which hand lost its cunning? Kolb, B. & Fantie, B. Reaching for the brain Lehman, R. A. W. On the other hand LeMay, M. Evolution of handedness McKeever, W. F. Primate handedness should be considered – but not "reconsidered" at this point McManus, I. C. On the one hand, on the other hand: Statistical fallacies in laterality research Michel, G. F. & Harkins, D. A. Ontogenetic considerations in the phylogenetic history and	273 275 276 276 277 278 279 280 281 281 282	adaptive significance of the bias in human handedness Steklis, H. D. & Marchant, L. F. Primate handedness: Reaching and grasping for straws? Tomasello, M. Why the left hand? Vauclair, J. & Fagot, J. Visually guided reaching in adult baboons Walker, S. Or in the hand, or in the heart? Alternative routes to lateralization Warren, J. M. Primate handedness: Inadequate analysis, invalid conclusions Authors' Response MacNeilage, P. F., Studdert-Kennedy, M. G. & Lindblom, B. Primate predatory, postural, and prehensile proclivities and professional peer pressures: Postscripts	283 284 286 287 288 288	
Continuing Commentary				
On Vining, D. R., Jr. (1986) Social versus problem of human sociobiology. BBS 9:			305	
Cattell, R. B. Fitness and intelligence: The more		Author's Response		
concrete problem Flinn, M. V. Resources, reproduction, and mate	305	Vining, D. R., Jr. Modern human sociobiology: Some further observations	308	
competition in human populations Machalek, R. Are the socially successful an	305			
intelligence cartel?	307			
On Cohen, L. J. (1981) Can human irratio 4:317-370.	nality	be experimentally demonstrated? BBS	311	
Taylor, J. E. Cohen on cognitive competence: Can human rationality be philosophically demonstrated?	311	Author's Response Cohen, L. J. What are the foundations of normative theories about human reasoning?	312	
On Haber, R. N. (1983) The impending demise of the icon: A critique of the concept of iconic storage in visual information processing. BBS 6:1-54.				
Chow, S. L. Iconic memory or icon?	313			
On Fantino, E. & Abarca, N. (1985) Choice, optimal foraging, and the delay-reduction hypothesis. BBS 8:315–330.				
Wynne, C. Mechanisms of optimal choice	316	Authors' Response		
		Fantino, E. & Abarca, N. Delay-reduction theory: Straddling the functional-mechanism continuum	317	
On Libet, B. (1985) Unconscious cerebral voluntary action. BBS 8:529–566.	initiat	ive and the role of conscious will in	318	
Davis, L. H. What are W and M awarenesses of?	318	Author's Response Libet, B. Awarenesses of wanting to move and of moving	320	
On Goldberg, G. (1985) Supplementary m hypotheses. BBS 8:567–616.	notor a	area structure and function: Review and	321	
Preilowski, B. The role of corollary motor discharges, the corpus callosum, and the supplementary motor cortices in bimanual coordination	322	Author's Response Goldberg, G. Premotor systems, motor learning, and ipsilateral control: Learning to get set	323	

On Hartung, J. (1985) Matrilineal inheritary	nce: N	lew theory and analysis. BBS 8:661–688.	329
Fox, R. Paternity uncertainty: Cause or consequence?	329		
On Humphreys, G. W. & Evett, L. J. (19) routes in word processing? An evaluation 8:689-740.	85) Ar n of th	re there independent lexical and nonlexical ne dual-route theory of reading. BBS	331
Bridgeman, B. Is the dual-route theory possible in phonetically regular languages? Brown, G. D. A. On the difference between the regularity and the frequency of spelling-to-sound	331	Authors' Response Evett, L. J. & Humphreys, G. W. Extending the multiple-levels approach to word processing	334
correspondences Danks, J. H. Independent or interactive routes: What	332		
are the constraints?	333		

A major new international journal for 1988!

VISUAL NEUROSCIENCE

EDITOR Katherine V. Fite

University of Massachusetts/Amherst

Bringing together in one forum a broad range of studies reflecting the diversity and originality of contemporary research in basic visual neuroscience, the contributions will utilize neuroanatomical, neurophysiological, neurochemical, neuroimmunological, and behavioral methodologies in addition to computerassisted theoretical formulations.

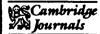
The journal's primary emphasis will be on retinal and brain mechanisms underlying visually-guided behaviors and visual perception.

Among the topics of interest are Photoreception and transduction Retinal anatomy, physiology and neurochemistry Retinothalamic pathways and nuclei Thalamocortical pathways, visual cortex and telecephalic correlates of visual perception and cognition Subcortical visual pathways; oculomotor and visuomotor functions Comparative visual system organization and evolutionary perspectives Developmental processes, patterns and neuronal specificity Theoretical and computational models of vision and visual processes

Published Quarterly Annual Subscription Rates

US and Canada: \$100 (institutions); \$50 (individuals); \$35 (students) paid in US dollars or Canadian dollar equivalent.

All other countries: £65 (institutions); £35 (individuals); £25 (students) paid in UK sterling.



Cambridge University Press 32 East 57th St., New York, NY 10022, USA; or The Edinburgh Building, Cambridge CB2 2RU, England