

## CATEGORICAL PERCEPTION

*The Groundwork of Cognition*

Edited by Stevan Harnad

How do we sort the objects, people, events and ideas in the world into their proper categories? What transforms the "blooming, buzzing confusion" that enters our eyes and ears when we are born into the orderly world we experience and interact with?

This most basic of questions about human (and animal) perception and cognition is the subject of this exhaustive survey of the findings in a diversified area of research known as "categorical perception." With contributions from a wide range of international experts, this volume brings together all the known examples of categorical perception, in humans and animals, infants and adults, in all the sense modalities: hearing, seeing and touch. The findings are then interpreted in terms of the available cognitive and neuroscientific theories of how categorical perception is accomplished by the brain.

This research on our elementary perceptual and psychophysical categories is then integrated with the work on higher-order categories: objects, patterns, abstract concepts. From a focus on the most thoroughly investigated case of categorical perception—speech perception—the book proceeds to an integrative view of categorization in general.

**Categorical Perception** will be of interest to cognitive scientists, neuroscientists, developmental and comparative psychologists, behavioral biologists, linguists, anthropologists and philosophers—and anyone concerned with category representation.

1987 599 pp. 26758-7 \$59.50

### CONTENTS

#### Introduction

Psychophysical and Cognitive Aspects of Categorical Perception: A Critical Overview  
*Stevan Harnad*

#### Psychophysical Foundations of Categorical Perception

Categorical Perception: Some Psychophysical Models *Richard E. Pastore*

Beyond the Categorical/Continuous Distinction: A Psychophysical Approach to Processing Modes  
*Neil A. Macmillan*

#### Categorical Perception of Speech

Phonetic Category Boundaries Are Flexible *Bruno H. Repp & Alvin H. Liberman*

Auditory, Articulatory and Learning Explanations of Categorical Perception in Speech  
*Stuart Rosen & Peter Howell*

On Infant Speech Perception and the Acquisition of Language *Peter D. Eimas, Joanne L. Miller,  
& Peter W. Jusczyk*

#### Models for Speech CP

Neural Models of Speech Perception: A Case History *Robert E. Remez*

On the Categorization of Speech Sounds *Randy L. Diehl & Keith R. Kluender*

Categorical Partition: A Fuzzy-Logical Model of Categorization Behavior *Dominic W. Massaro*  
**CP in Other Modalities and Other Species**

Perceptual Categories in Vision and Audition *Marc H. Bornstein*

Categorical Perception of Sound Signals: Facts and Hypotheses from Animal Studies  
*Guenther Ehret*

A Naturalistic View of Categorical Perception *Charles T. Snowdon*

The Special-Mechanisms Debate in Speech Perception: Nonhuman Species and Nonspeech  
Signals *Patricia K. Kuhl*

Brain Mechanisms in Categorical Perception *Martha Wilson*

#### Psychophysical Indices of CP

Electrophysiological Indices of Categorical Perception for Speech *Dennis L. Molfese*

Evoked Potentials and Colour-Defined Categories *D. M. Regan*

#### Higher-Order Categories

Categorization Processes and Categorical Perception *Douglas L. Medin & Lawrence W. Barsalou*

Developmental Changes in Category Structure *Frank C. Keil & Michael H. Kelly*

Spatial Categories: The Perception and Conceptualization of Spatial Relations *Ellen Bialystok &  
David R. Olson*

#### Cognitive Foundations

Category Induction and Representation *Stevan Harnad*

### COMMENTS

"CATEGORICAL PERCEPTION offers a fine sample of the state of the art. Anybody who cares about cognitive science should have this stuff at his fingertips."

*Jerry A. Fodor, Philosophy Department, CUNY Graduate Center*

"[I am] very impressed by the magnitude and quality of the general enterprise . . . [CATEGORICAL PERCEPTION is] an important contribution to a fundamental problem in cognitive psychology."

*George A. Miller, Psychology Department, Princeton University*

"[A]n impressive volume. Harnad's introduction is a particularly clear, economical and thorough survey of the field, its current state and its importance, in his usual crisp and entertaining style."

*Patrick J. Hayes, Computer Science Department, Stanford University*

"CATEGORICAL PERCEPTION is essential reading for anyone interested in how we categorize what we perceive."

*Philip N. Johnson-Laird, MRC Applied Psychology Unit, Cambridge*

At bookstores or order from

**Cambridge University Press**

32 East 57th Street, NY, NY 10022

Cambridge toll-free numbers for orders only:

800-872-7423, outside NY State. 800-227-0247, NY State only.

MasterCard and Visa accepted.

# Journal of the Experimental Analysis of Behavior

IF YOUR FILES ARE CLUTTERED WITH JEAB REPRINTS...

Why not buy them in the handy, prepackaged, indexed form? Enter a personal subscription for 1988 and receive all six issues.

## MARCH 1988

- S. P. Ragotzy, E. Q. Blakely, & A. Poling. Self-control in mentally retarded adolescents: Choice as a function of amount and delay of reinforcement.
- F. van Haaren, A. van Hest, & N. E. van de Poll. Self-control in male and female rats.
- A. McPherson & J. G. Osborne. Control of behavior by an establishing stimulus.
- J. A. Dinsmoor, C. A. Bowe, L. Green, & J. Hanson. Information on response requirements compared with information on food density as a reinforcer of observing in pigeons.
- A. Ohta. Conditioned reinforcement by conditional discriminative stimuli.
- J. L. Arbuckle & K. A. Lattal. Changes in functional response units with briefly delayed reinforcement.
- G. B. Biederman, K. G. McDonald, G. A. Heighington, & M. Vanayan. Color preference in pigeons: Stimulus-intensity and reinforcement-contingency effects in the avoidance of blue stimuli.
- D. B. Peele & S. P. Baron. Effects of scopolamine on repeated acquisition of radial-arm maze performance by rats.
- J. Myerson & S. Hale. Choice in transition: A comparison of melioration and the kinetic model.
- J. E. R. Staddon. Quasi-dynamic choice models: Melioration and ratio invariance. (*Theoretical Article*)
- J. Czubaroff. Criticism and response in the Skinner controversies. (*Review Article*)

## MAY 1988

- A. Silberberg, F. R. Warren-Boulton, & T. Asano. Maximizing present value: A model to explain why moderate response rates obtain on variable-interval schedules.
- M. Davison. Concurrent schedules: Interaction of reinforcer frequency and reinforcer duration.
- B. Alsop & M. Davison. Concurrent-chain performance: Effects of absolute and relative terminal-link entry frequency.
- T. C. Jacob & E. Fantino. Effects of reinforcement context on choice.
- J. R. LeFrancois, P. N. Chase, & J. H. Joyce. The effects of a variety of instructions on human fixed-interval performance.
- R. Lipkens, P. F. M. Kop, & W. Matthijs. A test of symmetry and transitivity in the conditional discrimination performances of pigeons.
- L. L. Howell, L. D. Byrd, & M. J. Marr. Differential effects of cocaine and pentobarbital on fixed-interval and random-interval performance.
- V. L. Lee. The language of action. (*Review Article*)

## SCHEDULED FOR 1988

- A special section of several retrospective reviews of *The Behavior of Organisms*, on the 50th anniversary of its publication
- A special issue on biological factors influencing the behavior of individual organisms

## AND IN THE FUTURE

- A special issue focusing on the experimental analysis of human behavior
- A special issue focusing on the experimental analysis of cognition

Enter your personal subscription NOW and receive all six 1988 issues. And make certain your library subscribes. Full-time students, \$10.00; other individuals (personal use only), \$20.00; institutions, \$60.00. Subscribers outside the U.S. should add \$4.00 for postage. Please send orders and checks (payable to JEAB) to

Kay Dinsmoor, JEAB  
Psychology Department  
Indiana University  
Bloomington, IN 47405-1301 U.S.A.

VISA and MasterCard orders are accepted.

# Cognitive Science from Harvard University Press

## The Computer and the Mind

An Introduction to Cognitive Science

**P.N. Johnson-Laird**

In a field choked with seemingly impenetrable jargon, Philip Johnson-Laird has done the impossible: written a book about how the mind works that requires no advance knowledge of artificial intelligence, neurophysiology, or psychology, providing the single best introduction to cognitive science available.

"Philip Johnson-Laird has that rare gift of being a cognitive scientist of the first order, yet he addresses himself to the deep classical issues in psychology, in the philosophy of mind and in linguistics. He never avoids the hard problems in order to make life easier for the cognitive sciences. This is an admirable book."

--Jerome Bruner  
\$29.50



Photo by Alan Copeman

## Intention, Plans, and Practical Reason

**Michael E. Bratman**

The nature of intention is a matter of concern to philosophers of mind and action, moral philosophers, social scientists, and workers in artificial intelligence, cognitive science, and decision theory. Bratman shows that intentions are neither desires nor beliefs but *plans*, and that plans have an independent place in practical thinking.

"Bratman has an original theory, with strong roots in philosophical tradition, which could well establish itself as standard."

—Alan Donagan,  
California Institute  
of Technology  
\$25.00

## Children of Different Worlds

The Formation  
of Social Behavior

**Beatrice Blyth Whiting  
and  
Carolyn Pope Edwards**

"Since Margaret Mead's first efforts in New Guinea, psychologists and anthropologists have been working toward a comprehensive theory that could combine developmental, cognitive, and social learning processes. Whiting and Edwards have finally done this. Their theory is elegant and lucid. At last the biosocial bases of sex differences are beginning to look understandable." —Robert R. Sears,  
Stanford University

\$35.00

## The Point of Words

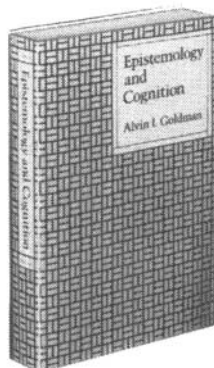
Children's Understanding of  
Metaphor and Irony

**Ellen Winner**

Psychologist Ellen Winner studies the creative, nonliteral discourse of children's spontaneous speech, examining how their abilities to use and interpret figurative language change as they grow older, and what such language shows us about the changing features of children's minds. Examining the development of the child's ability to use and understand metaphor and irony, the ways these forms of language differ structurally, and the cognitive and social capacities required for each, Winner offers the first account that spans the realm of figurative language and a valuable synthesis of research in the area.

\$22.50

Now available in paperback



## Epistemology and Cognition

**Alvin I. Goldman**

"A major work. It defines the subject of epistemology in a new and highly plausible way which makes the results of research in psychology and artificial intelligence extremely relevant to philosophical epistemology. This is a book that all philosophers should read." —Gilbert Harman  
"The scope of the book is enormous . . . Well-written and remarkably clear in exposition, Goldman's book gives an overview of the state of the art in both epistemology and cognitive science at the same time that it presents an important, original position." —*Choice*

\$12.95 paper

Available at  
bookstores, or from

**H**arvard  
University  
Press

79 Garden Street  
Cambridge, MA 02138

**Editor-in-Chief:**  
**W. Reichardt,**  
Tübingen

# Biological Cybernetics

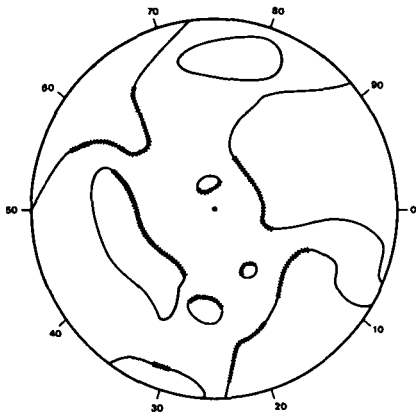
## Communication and Control in Organisms and Automata

The concepts of processing of information, transmission of information and automatic control originated within physics, computer science and technology. In the meantime these concepts have also proved powerful in the biological sciences, where analogous processes are encountered. Despite the differences between nonliving and living systems, many of the logical procedures, the experimental and theoretical approaches and mathematical techniques applicable to the physical sciences also find important applications in the realm of the life sciences. By adopting this approach to sensory and central neurophysiological problems new insight has been gained into the principles by means of which organisms handle and utilize information. Conversely, physicists, computer scientists and engineers have shown increasing interest in natural mechanisms of computation, communication and control, including genetic communication and control of development.

A fundamental idea that has emerged from the field of computer science and artificial intelligence is that information processing tasks must be understood independently of the physical mechanisms that embody the computations. As a consequence, a new computational science of sensory as well as central and motor information processing is now taking shape with important implications for both neurobiology and artificial intelligence. Computational studies are also extending the scope of classical neurobiology with the goal of understanding how the brain processes information.

Biological Cybernetics provides an interdisciplinary medium for the exchange of experimental and theoretical information in the following fields:

- quantitative analysis of behaviour;
- quantitative physiological studies of information processing in receptors, neural systems, and effectors
- computational studies of perceptual and motor information processing tasks;
- biologically relevant studies in the fields of artificial intelligence, robotics, control system theory, information theory and automata theory;
- mathematical models of information processing, control and communication in organisms, including mechanisms of genetic expression and development.



Two dimensional test environment. Visible sections are crosshatched

**Springer-Verlag**  
Berlin Heidelberg New York  
London Paris Tokyo

Heidelberger Platz 3, D-1000 Berlin 33  
175 Fifth Ave., New York, NY 10010, USA  
28, Lurke Street, Bedford MK40 3HU, England  
26, rue des Carmes, F-75005 Paris  
37-3, Hongo 3-chome, Bunkyo-ku, Tokyo 113, Japan  
Room 1603, Citicorp Centre, 18 Whitfield Road,  
Causeway Bay, Hong Kong

### Subscription information:

1988: Vols. 58 + 59 (6 issues each) DM 1.192,- plus carriage charges  
ISSN 0340-1200 Title No. 422

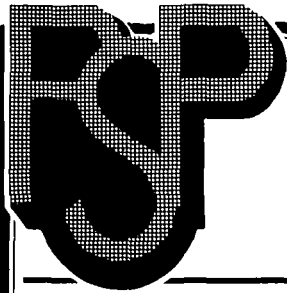
For further information and sample copies write to:  
Springer-Verlag, Heidelberger Platz 3, 1000 Berlin 33

**Springer**



sb. 10.251/4/1





# Psychobiology

Lynn Nadel, *Editor*

*Associate Editors:* Michela Gallagher

C. A. Barnes

Jeff Wilner, *Assistant Editor*

Bryan Kolb

**Psychobiology** publishes articles concerned with the biological substrates of behavior and cognitive function. Experimental and theoretical contributions in a wide range of disciplines—*anatomy, biology, clinical neuropsychology, computational neuroscience, electrophysiology, endocrinology, pharmacology, physiology, psychology*—are included, as are studies with a developmental perspective. Invited reviews and book reviews focus on important new findings or theories in the field. Short communications and letters to the Editor are published with minimal delay—**Psychobiology** is published quarterly (March, June, September, and December). The subscription rates for Volume 16 (1988): \$45 for Institutions; \$22 for Individuals. Please add \$4 for foreign/Canadian postage. Special student rates and back issues are also available.

RECENT ARTICLES include:

- “What is Physiological Psychology?” by Peter M. Milner and Norman M. White
- “Sensorimotor Modulation and the Variable Action Pattern (VAP): Toward a Noncircular Definition of Drive and Motivation” by Roy A. Wise
- “Memory, Amnesia, and Frontal Lobe Dysfunction” by Daniel L. Schacter
- “Retrograde Amnesia Following Combined Hippocampus-Amygdala Lesions in Monkeys” by David P. Salmon, Stuart Zola-Morgan, and Larry R. Squire
- “Performance and Dominant Strategies on Place and Cue Tasks Following Hippocampal Lesions in Rats” by Hiroshige Okaichi
- “Isolating Attentional Systems: A Cognitive-Anatomical Analysis” by Michael I. Posner, Albrecht Werner Inhoff, Frances J. Friedrich, and Asher Cohen
- “Visually Mediated Trace Conditioning in Young Rats: Evidence for Cholinergic Involvement in the Development of Associative Memory” by Thomas B. Moyer and Jerry W. Rudy
- Book Review: “The Hitchhiker’s Guide to *The Hippocampus*” by R. J. Sutherland

A SPECIAL ISSUE

In the Fall of 1988, a special issue of *Psychobiology* devoted to the Psychobiology of Sexual Differentiation and Gender-Related Behaviors will be published. This issue will be guest edited by Jane Stewart, Concordia University, Montreal, and will include both empirical research and review papers.

Name \_\_\_\_\_

Institution \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State (Country) \_\_\_\_\_ Zip \_\_\_\_\_

Please enter my 1988 subscription to  
*Psychobiology* (Vol. 16)

- Bill me (institutional rates only)
- Payment (in U.S. dollars) enclosed (\$\_\_\_\_\_)

Please send information on:

- Other Psychonomic publications
- Back/Special issues
- Psychonomic Society membership
- Student rates
- Other \_\_\_\_\_

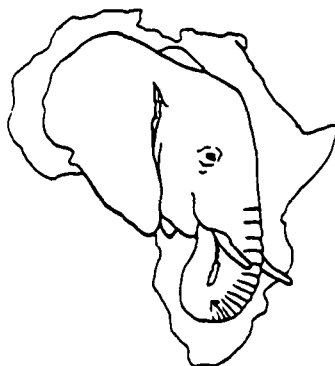


Psychonomic Society Publications •

1710 Fortview Rd. •

Austin, Texas 78704

# THE AFRICAN



# ELE-FUND

## PRACTICAL ELEPHANT CONSERVATION

The African Ele-Fund aims to improve the protection of elephants and their habitat wherever they are threatened and to raise public awareness throughout the world of the plight of the largest land animal on earth.

Elephant populations are declining in virtually all of Africa: every year East Africa loses 8.1%, Central and West Africa lose 17.8% and parts of southern Africa are losing 8.2%; only in the southern African countries where poaching is under control, is there a slight increase of 0.7% per annum, (figures from data compiled by Dr. Iain Douglas-Hamilton for UNEP in Nairobi). Surveys show that elephant numbers are declining more slowly in protected areas - National Parks, Reserves, etc. - than elsewhere, but that protection **MUST** be improved if the downward trend is to be halted.

The major cause of the decline in elephant numbers is the illegal ivory trade. Poachers are often better equipped, better armed and better paid than the park guard and rangers who try to enforce the law. Anti-poacher work is frequently hampered by the lack of simple equipment - sometimes just a spare part for a vehicle, or boots and waterproof clothing for foot patrols. The African Ele-Fund is appealing for donations and bequests to help even up the odds in favor of the elephants. Every penny and every cent given will be spent in the field; the Ele-Fund is organized by volunteers and administered at no cost by the *Wild in Britain* and by the *Eastern African Wildlife Society of Kenya*. The *Fauna and Flora Preservation Society* (UK and USA) has also agreed to accept donations earmarked for the Ele-Fund, as has *WWF-International* in Switzerland.

## ELE-FUND RAISING

Fund-raising is centered around a series of Park Profiles, drawn up by scientists and conservationists working in the field. Problem areas are thus pinpointed and lists of urgent needs prepared and costed for each park. Individuals, schools and societies will focus their fundraising on certain items of equipment or sums needed to cover vital work. For example, the Mount Elgon National Park in Kenya needs a minimum of £3,500 (US \$6,020) for vehicle repairs, and £15,000 (US \$25,800) per year to cover the costs of extra anti-poacher patrols. Without this help, the unique salt-mining elephants will be wiped out by the current spate of ivory poaching.

Kindly send a SASE (self-addressed stamped envelope) along with your donation to an address below if you wish to receive a list of Ele-Fund raising ideas:

*IWC/Care for the Wild*, 26 North Street, Horsham, West Sussex, RH12 1BN, UK

*IWC USA*, 1807 H Street NW, Washington, DC 20006, USA

*IWC Canada*, 542 Mount Pleasant Road, Suite No. 104, Toronto, M4S 2M7, Canada

*East African Wildlife Society*, PO Box 20110, Nairobi, Kenya

Please make cheques, postal orders, or money orders payable to the African Ele-Fund.

**Co-ordinators:** Ian Redmond, 60 Seymour Avenue, Bristol BS7 9HN, England;  
Telephone (0272) 46489

Hezy Shoshani, Dept. of Biological Sciences, Wayne State University,  
Detroit, MI 48202, USA; Telephone (313)577-2865

# Behavioral and Brain Sciences

## Instructions for Authors and Commentators

*Behavioral and Brain Sciences* (BBS) is a unique scientific communication medium, providing the service of Open Peer Commentary for reports of significant current work in psychology, neuroscience, behavioral biology or cognitive science. If a manuscript is judged by BBS referees and editors to be appropriate for Commentary (see Criteria below), it is then circulated to a large number of commentators selected (with the aid of systematic bibliographic searches) from the BBS Associateship\* and the worldwide biobehavioral science community, including individuals recommended by the author.

Once the Commentary stage of the process has begun, the author can no longer alter the article, but can respond formally to all commentaries accepted for publication. The target article, commentaries and authors' response then co-appear in BBS. Continuing Commentary and replies can appear in later issues.

**Criteria for acceptance** To be eligible for publication, a paper should not only meet the standards of a journal such as *Psychological Review* or the *International Review of Neurobiology* in terms of conceptual rigor, empirical grounding, and clarity of style, but it should also offer a **clear rationale for soliciting Commentary**. That rationale should be provided in the author's covering letter, together with a **list of suggested commentators**. The original manuscript plus **eight copies** must be submitted.

A paper for BBS can be (i) the report and discussion of empirical research that the author judges to have broader scope and implications than might be more appropriately reported in a specialty journal; (ii) an unusually significant theoretical article that formally models or systematizes a body of research; or (iii) a novel interpretation, synthesis, or critique of existing experimental or theoretical work. Occasionally, articles dealing with social or philosophical aspects of the behavioral and brain sciences will be considered.

The service of Open Peer Commentary will be primarily devoted to original unpublished manuscripts. However, a recently published book whose contents meet the standards outlined above may also be eligible for Commentary. In such a BBS Multiple Book Review, a comprehensive, article-length précis by the author is published together with the commentaries and the author's response. In special cases, Commentary will also be extended to a position paper or an already published article dealing with particularly influential or controversial research. Submission of an article implies that it has not been published or is not being considered for publication elsewhere. Multiple book reviews and previously published articles appear by invitation only. **The Associateship and professional readership of BBS are encouraged to nominate current topics and authors for Commentary.**

In all the categories described, the decisive consideration for eligibility will be the desirability of Commentary for the submitted material. Controversiality *simpliciter* is not a sufficient criterion for soliciting Commentary: a paper may be controversial simply because it is wrong or weak. Nor is the mere presence of interdisciplinary aspects sufficient: general cybernetic and "organismic" disquisitions are not appropriate for BBS. Some appropriate rationales for seeking Open Peer Commentary would be that: (1) the material bears in a significant way on some current controversial issues in behavioral and brain sciences; (2) its findings substantively contradict some well-established aspects of current research and theory; (3) it criticizes the findings, practices, or principles of an accepted or influential line of work; (4) it unifies a substantial amount of disparate research; (5) it has important cross-disciplinary ramifications; (6) it introduces an innovative methodology or formalism for consideration by proponents of the established forms; (7) it meaningfully integrates a body of brain and behavioral data; (8) it places a hitherto dissociated area of research into an evolutionary or ecological perspective; etc.

In order to assure communication with potential commentators (and readers) from other BBS specialty areas, **all technical terminology must be clearly defined or simplified, and specialized concepts must be fully described.** Authors should use numbered section-headings to facilitate cross-reference by commentators.

**Note to commentators** The purpose of the Open Peer Commentary service is to provide a concentrated constructive interaction between author and commentators on a topic judged to be of broad significance to the biobehavioral science community. Commentators should provide substantive criticism, interpretation, and elaboration as well as any pertinent complementary or supplementary material, such as illustrations; all original data will be refereed in order to assure the archival validity of BBS commentaries. Commentaries and articles should be free of hyperbole and remarks *ad hominem*.

**Style and format for articles and commentaries** Articles must not exceed 14,000 words (and should ordinarily be considerably shorter); **commentaries should not exceed 1,000 words.** Spelling, capitalization, and punctuation should be consistent within each article and commentary and should follow the style recommended in the latest edition of *A Manual of Style*, The University of Chicago Press. It may be helpful to examine a recent issue of BBS. A title should be given for each article and commentary. An auxiliary short title of 50 or fewer characters should be given for any article whose title exceeds that length. Each commentary must have a distinctive, representative **commentary title**. The contributor's name should be given in the form preferred for publication; the affiliation should include the full institutional address. **Two abstracts**, one of 100 and one of 250 words, should be submitted with every article. The shorter abstract will appear one issue in advance of the article; the longer one will be circulated to potential commentators and will appear with the printed article. A list of 5–10 keywords should precede the text of the article. Tables and figures (i.e. photographs, graphs, charts, or other artwork) should be numbered consecutively in a separate series. Every table and figure should have a title or caption and at least one reference in the text to indicate its appropriate location. Notes, acknowledgments, appendices, and references should be grouped at the end of the article or commentary. Bibliographic citations in the text must include the author's last name and the date of publication and may include page references. Complete bibliographic information for each citation should be included in the list of references. Examples of correct style for bibliographic citations are: Brown (1973); (Brown 1973); (Brown 1973; 1978); (Brown 1973; Jones 1976); (Brown & Jones 1978); (Brown, Jones & Smith 1979) and subsequently, (Brown et al. 1979). References should be typed in alphabetical order in the style of the following examples. **Journal titles should not be abbreviated.**

Kupfermann, I. & Weiss, K. (1978) The command neuron concept. *Behavioral and Brain Sciences* 1:3–39.

Dunn, J. (1976) How far do early differences in mother-child relations affect later developments? In: *Growing points in ethology*, ed. P. P. G. Bateson & R. A. Hinde, pp. 1–10. Cambridge University Press.

Bateson, P. P. G. & Hinde, R. A., eds. (1976) *Growing points in ethology*. Cambridge University Press.

**Preparation of the manuscript** The entire manuscript, *including notes and references*, must be typed **double-spaced** on 8½ by 11 inch or A4 paper, with margins set to 70 characters per line and 25 lines per page, and should not exceed 50 pages. Pages should be numbered consecutively. It will be necessary to return manuscripts for retyping if they do not conform to this standard.

Each table and figure should be submitted on a separate page, not interspersed with the text. Tables should be typed to conform to BBS style. Figures should be ready for photographic reproduction; they cannot be redrawn by the printer. Charts, graphs, or other artwork should be done in black ink on white paper and should be drawn to occupy a standard area of 8½ by 11 or 8½ by 5½ inches before reduction. Photographs should be glossy black-and-white prints; 8 by 10 inch enlargements are preferred. All labels and details on figures should be clearly printed and large enough to remain legible even after a reduction to half size. It is recommended that labels be done in transfer type of a sans-serif face such as Helvetica.

Authors are requested to submit their double-spaced original manuscript with **eight copies** for refereeing, and commentators their original plus **two copies**, to: Steven Harnad, Editor, Behavioral and Brain Sciences, 20 Nassau St., Suite 240, Princeton, NJ 08542. *In case of doubt as to appropriateness for BBS commentary, authors should write to the editor before submitting eight copies.*

**Editing** The publishers reserve the right to edit and proof all articles and commentaries accepted for publication. Authors of articles will be given the opportunity to review the copyedited manuscript and page proofs. Commentators will be asked to review copyediting only when changes have been substantial; commentators will not see proofs. Both authors and commentators should notify the editorial office of all corrections within 48 hours or approval will be assumed.

Authors of target articles receive 50 offprints of the entire treatment, and can purchase additional copies. Commentators will also be given an opportunity to purchase offprints of the entire treatment.

\*Individuals interested in serving as BBS Associates are asked to write to the editor.



# Behavioral and Brain Sciences

To appear in Volume 11, Number 2 (1988)

## Sex differences in mathematical reasoning ability in intellectually talented preadolescents: Their nature, effects, and possible causes.

C. P. Benbow, *Iowa State University*

Several hundred thousand intellectually talented 12- to 13-year-olds have been tested nationwide over 15 years with the Scholastic Aptitude Test (SAT). Although no differences in verbal ability have been found, sex differences in mathematical reasoning ability favoring males have persistently appeared. These differences are most pronounced at the highest levels of mathematical reasoning. They can predict subsequent sex differences in achievement in mathematics and science. To date a primarily environmental explanation for the difference in ability has not received support. In addition, several physiological correlates of extremely high mathematical reasoning ability have been identified. It is therefore proposed that the sex difference in SAT-M scores among intellectually talented students results from both environmental and biological factors.

**With Commentary from** R Bleiler; L Bloom; L Braine; HJ Eysenck; P Goldman-Rakic & AS Clark; D Kimura; J Money; N Newcombe & M Baenninger; R Rosenthal; RJ Sternberg; L Tiger; SG Vandenberg; SF Witelson; and others.

## Précis of *Sensory Analysis*

D. Laming, *University of Cambridge*

Sensory analysis is that initial, preconscious stage of perception at which primitive features (edges, temporal discontinuities, and periodicities) are picked out from the random fluctuations that characterize the physical stimulation of sensory receptors. Sensory analysis may be studied by means of signal detection, psychometric function, and threshold experiments, and *Sensory Analysis* presents a succinct, quasiquantitative account of the phenomena revealed thereby. This account covers all five sensory modalities, emphasising the similarities between them.

This précis is organized in three parts: Part I surveys *Sensory Analysis* as economically as may be, beginning from the simplest, most fundamental ideas and working towards phenomena of increasing complexity. A rather shorter Part II reviews the most important alternative models addressed to some part or other of the phenomena surveyed. Finally, a very short Part III contributes some metatheoretic remarks on the function of a theory of sensory discrimination.

**With Commentary from** CR Cavonius; LO Harvey, Jr.; M Jarvilehto; JJ Kulikowski; GR Lockhead; JC Malone, Jr.; JA Nevin; E Poppel & N Logothetis; DH Raab; KA Stevens; DL Tomko; M Wagner; P Wenderoth; WA Yost; and others.

## Tactical deception in primates

A. Whiten & R. W Byrne, *University of St. Andrews*

Because of the nature of primate societies, tactical deception is likely to be subtle and relatively rare. This makes it an elusive topic for scientific analysis, despite its theoretical significance as a sensitive indicator of primate social cognition. Our strategy has been systematically to collate records contributed by a broad sample of research primatologists and to identify repeated patterns. The range and scope of tactical deception so revealed are analyzed within a classification system that makes distinctions among the functions the acts perform. Each category has different implications as to which aspects of the minds of others must be represented in the mind of an individual acting with deceptive intent.

**With Commentary from** SA Allmann; JD Baldwin; J Bennett; IS Bernstein; GM Burghardt; AC Danto; D Dennett; FBM de Waal; GG Gallup, Jr.; DR Griffin; N Humphrey; WC McGrew; V Reynolds; S Chevalier-Skolnikoff; and others.

### Among the articles to appear in forthcoming issues of BBS:

R Verleger, "Event related potentials and memory: A critique of the context updating hypothesis and an alternative interpretation of P3"

E Donchin, "Is the P300 component a manifestation of context updating?"

RA Gardner & BT Gardner, "Feedforward versus feedback: An ethological alternative to the law of effect"

Multiple book review of DC Dennett, *The Intentional Stance*

AW Logue, "Research on self-control: An integrating framework"

TD Johnston, "Developmental explanation and the ontogeny of birdsong: Nature-nurture redux"

H Davis & R Perusse, "Numerical competence in animals: Definitional issues, current evidence, and a new research agenda"

D Lightfoot, "The child's trigger experience: Degree-0 learnability"

Cambridge University Press

The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, England

32 East 57 Street, New York, N.Y. 10022

10 Stamford Road, Oakleigh, Melbourne 3166, Australia

Printed in the United States of America  
by Capital City Press, Montpelier, Vermont