BEHAVIORAL DEVELOPMENT

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The Bulletin of the DEVELOPMENT & BEHAVIOR ANALYSIS Special Interest Group of the Association for Behavior Analysis

Editor: Martha Peláez-Nogueras

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BEHAVIORAL DEVELOPMENT *is published twice each year. This bulletin publishes developmental articles, research reports, review articles, theoretical papers, news, notes from ABA members, position openings, and announcements. Please submit your articles to Martha Peláez-Nogueras, Editor, Department of Educational Psychology & Special Education, Florida International University, Miami, FL 33199.* ***Three photocopies of each manuscript, prepared according to the format requirements published by the American Psychological Association should be submitted to the Editor for review process.***
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DEVELOPMENT & BEHAVIOR ANALYSIS SIG PRESENTATIONS AT ABA, ORLANDO 1998

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5/23/98
1:00 P.M. - 2:20 P.M.
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DEV

Strategies for Doing and Publishing Research in Experimental and Quantitative Analysis of Behavior in the Present Job Market
Chair: Michael Commons (Harvard Medical School)
• MICHAEL COMMONS (Harvard Medical School)
• PATRICE MILLER (Salem State College)
• STEPHANIE STOLARZ-FANTINO (San Diego State University)
• EDMUND FANTINO (University of California, San Diego)

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DEV

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Chair and Discussant: Slobodan Petrovich (University of Maryland, Baltimore County)

• J. P. SCOTT (Bowling Green State University)

#44
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5/23/98
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Asia 3
DEV

Reinforcers in Animals and Humans
Chair: Lewis Lipsitt (Brown University)
• JACOB GEWIRTZ (Florida International University)
• LEWIS LIPSITT (Brown University)
• J. P. SCOTT (Bowling Green State University)
• WILLIAM VERPLANCK (University of Tennessee)

#55
Poster Session
5/23/98
5:00 P.M. - 6:30 P.M.
Northern Hemisphere B, C, D
DEV

Human Development; Gerontology

80. Similarities between Monkeys and Children in Performance of a Delayed Matching-to-Sample. MERLE G. PAULE (Behavioral Toxicology Laboratory), John J. Chelonis, and Donna J. Blake (University of Arkansas for Medical Sciences)

81. Exercise for the Elderly: Measuring Exercise Adherence and Evaluating the Use of Behavioral Contracts. CHRISTIE ZUNKER and Carl Johnson (Central Michigan University)

82. Assisting Infant Sleep with Continuous White Noise. MARGARET M. BORKOWSKI and Carl Johnson (Central Michigan University)

83. Self-Concept Clarity and Social Knowledge: A Two-Dimensional Model. Timothy Kelly and VALERI A. FARMER-DOUGAN (Illinois State University)

84. The Effects of the Concurrent Training of Two Relations on Human Performance in a Conditional Discrimination Task. HECTOR MARTINEZ, Adriana Gonzalez, Gerardo Ortiz, and Katia Carrillo (Universidad de Guadalajara)

85. DRL and Self-Control in Infants. RIVIERE VINCA, Darcheville Jean Claude, Cuvelier Gwenaelle (Universite de Lille III, France)

86. Effects of Gender and IQ on Performance of a Delayed Matching-to-Sample Task in Children Ages 4 to 12 years Old. JENNIFER L. DANIELS (University of Arkansas at Little Rock), John J. Chelonis, Donna J. Blake (University of Arkansas for Medical Sciences), and Merle G. Paule (National Center for Toxicology)

87. Performance of Inattentive and Hyperactive Children on an Operant Test Battery. JAMIE C. MAY (University of Arkansas at Little Rock), John J. Chelonis, Donna J. Blake (University of Arkansas for Medical Sciences), and Merle G. Paule (National Center for Toxicology)

88. Time Perception in Children ages 4 to 12 years Old. JOHN J. CHELONIS, Donna Blake (University of Arkansas for Medical Sciences), and Merle G. Paule (National Center for Toxicological Research)

89. Performance of Hyperactive Children on a Delayed Matching-to-Sample Task. DONNA J. BLAKE, John J. Chelonis, Ron Baldwin (University of Arkansas for Medical Sciences), and Merle G. Paule (National Center for Toxicology)

90. Transferring Control from Experimenter to Individuals with Developmental Disabilities. JAY BUZHARDT, Irene Grote, and Donald Baer (University of Kansas)

91. Nonverbal Self-Instruction: Two cases of Evoking Motor Mediators of Problem Solutions. AMANDA JAY, Irene Grote, and Donald Baer (University of Kansas)

92. Patterns in Childhood Choice Making under Non-Compliant Conditions. NATHAN A. CALL and Gretchen A. Gimpel (Utah State University)

#69a
SIG Dinner
5/23/98
6:30 P.M. - 8:30 or 9:00 P.M.

Developmental Special Interest Group (DEV)
Chair: Jacob Gewirtz (Florida International University)
Social/Dinner - 6:30 p.m. to 8:30 or 9:00 p.m. in **Gulliver's Grill,** on e of the restaurants at the Swan Hotel, the conference site.

ABA EXPO
5/23/98
9:00 P.M. - 11:00 P.M.
Northern Hemisphere B, C, D

ABA EXPO!

Featuring displays from behavioral programs in graduate training, around the world, and ABA committees and special interest groups.

A. Graduate Training Programs

1. Graduate Programs in Special Education at The Ohio State University. Gwendolyn Cartledge, John Cooper, Donna Ford-Harris, Ralph Gardner III, Timothy Heron, William Heward, Richard Howell, and Mark O'Reilly (The Ohio State University)

2. Louisiana State University: An Applied Behavior Analysis Program. JOSEPH C. WITT, John Northup, George Noell, Dorothea Lerman, Henry S. Roane, and Bruce P. Mortenson (Louisiana State University)

3. Behavior Analysis Program at University of Nevada. LINDA J. HAYES, Ramona Houmanfar, and Monica M. Garlock (University of Nevada)

4. Graduate Program in the Department of Human Development and Family Life at the University of Kansas. DAVID G. BORN and Edward K. Morris (University of Kansas)

5. Behavior Analysis at Auburn University. CHRISTOPHER NEWLAND (Auburn University)

6. Internship in Behavior Analysis and Developmental Disabilities The Children's Seashore House and The University of Pennsylvania School of Medicine. PATRICK R. PROGAR (Children's Seashore House)

7. Graduate Training Opportunities at the New England Center for Children. D. DANIEL GOULD (New England Center for Children)

8. The Behavior Analysis Program at WVU. JOHN CROSBIE and Kennon A. Lattal (West Virginia University)

9. Internship and Practicum Training in Applied Behavior Analysis: The May Institute, Inc. ANNE S. KUPFER, Robert F. Putnam, and Dennis C. Russo (The May Institute)

10. Queens College of the City University of New

York. MARCIA J. GRANICK and Jennifer J. McComas (Queens College of the City University of New York)

11. NSSA: The Martin C. Barrell School. HOWARD C. SCHNEIDER and Nancy Shamrow (NSSA: The Martin C. Barrell School)

12. Clinical Behavioral Psychology Program at Eastern Michigan University. MARILYN K. BONEM and Dennis J. Delprato (Eastern Michigan University)

13. The Connecticut Center for Child Development: Graduate Training, Internships and Employment. SUZANNE LETSO, Victoria L. Ford, and Douglas P. Field (Connecticut Center for Child Development)

14. Graduate Training at East Carolina University. KIM A. MEYER and Jeannie Golden (East Carolina University)

B. Chapters, SIGs, and other Organizations

15. The B. F. Skinner Foundation. ERIC MESSICK (West Virginia University) and Julie Vargas (West Virginia University)

16. Developmental Special Interest Group (DEV). JACOB L. GEWIRTZ (Florida International University)

17. Bridges at Newmeadow Preschool. HELEN BLOOMER, Maria LeClaire, and Kelly Young (Bridges at Newmeadow Preschool)

18. Organizational Behavior Management Network. LINDA J. HAYES (University of Nevada)

19. ABA Student Committee. Peter C. Dams, Judy Honeywell (Western Michigan University), and Mark R. Dixon (University of Nevada)

20. ABA Education Board. Linda J. Hayes and Mark A. Adams (University of Nevada)

21. The Behavior Programmer Newsletter. BOBBY NEWMAN (Room to Grow)

22. Cambridge Center for Behavioral Studies. BETSY J. CONSTANTINE (Cambridge Center for Behavioral Studies)

23. AdvoServ Programs. JAMES E. MCGIMSEY and Gretchen T. Jacobs (AdvoServ)

24. The BALANCE SIG: Working to Ensure the Accurate Representation of Behavior Analysis. ROGER F. BASS (Carthage College)

25. BALANCE SIG Stephen R. Flora (Youngstown State University)

26. The May Centers for Professional Development: Future Directions of the May Institute, Inc. ANNE S. KUPFER, Karen E. Gould, James K. Luiselli, Robert F. Putnam, and Michael J. Cameron (The May Institute)

C. Around the World

27. Mexican Journal of Behavior Analysis. LAURA ACUNA, Carlos Bruner, and Patricia Lacroix (National Autonoma University of Mexico)

28. The Latin American Association for Analysis and Modification of Behavior ALAMOC-COLOMBIA AND ABA-COLOMBIA: Twenty-Four Years in Service of Colombian Behavioral Psychology. WILSON L. LOPEZ (Fundacion Universitaria Konrad Lorenz), Ruben Ardila (National University of Colombia), Olga Valencia, Constanza Aguilar, Monica Alzate, Adriana Gomez, and Fredy Reyes (Latin American Association for Analysis and Modification of Behavior)

29. A Conceptual Model of Community Participation in a Child Survival Program in Honduras. YOLANDA SUAREZ-BALCAZAR (Loyola University of Chicago) and Fabricio Balcazar (University of Illinois at Chicago)

#73
Business Meeting
5/24/98
8:00 A.M. - 8:50 A.M.
Oceanic 2

Program Committee
Program Coordinators: Edelgard Wulfert (State University of New York at Albany) and Frances McSweeney (Washington State University)
• AUT: Jack Scott (Florida Atlantic University)
• CBM: David Greenway (University of Southwestern Louisiana)
• CSE: Mark Mattaini (Columbia University) and Richard Rakos (Cleveland State University)
• DDA: Kent Johnson (Morningside Academy)
• DEV: Jacob Gewirtz (Florida International University)
• EAB: William Palya (Jacksonville State University)
• EDC: Laura Frederick (Georgia State University)
• OBM: Linda Hayes (University of Nevada, Reno)
• SQUAB: William Palya (Carthage College)
• TBA: Richard Bass (Carthage College)
• TOX: Steven Dworkin (University of North Carolina at Wilmington)
• TPC: Michael Markham (Florida International University)
• VRB: Mark Sundberg (Behavior Analysts, Inc.)

#85
Panel Discussion
5/24/98
9:00 A.M. - 10:20 A.M.
Asia 3
DEV

Behavioral History: Earlier Experiences (Learning) can Inflect Subsequent Learning
Chair: Wendy Roth (Florida International University)
• BABARA WANCHISEN (Baldwin Wallace College)
• THOMAS TATHAM (USUHS)
• SHARON ALEXANDER (Florida International University)
• HIROTO OKUCHI (West Virginia University)

#101
Invited Address
5/24/98
10:30 A.M. - 11:20 A.M.
Asia 3
DEV

Accounting for Equivalence Classes and Natural Categories From Simpler Behavioral Processes
Chair: Carol Pilgrim (University at North Carolina at Wilmington)
Discussant: Carol Pilgrim (University at North Carolina at Wilmington)
• LANNY FIELDS (Queens College)

#113
Symposium
5/24/98
11:30 A.M. - 1:20 P.M.
Asia 3
DEV

Advances in Behavioral Gerontology: Interventions in Community and Residential Settings
Chair: Mark Mathews (University of Kansas)
Discussant: Michelle Bouregeois (Florida State University)
• Increasing Engagement of Persons with Dementia in an Alzheimer's Special Care Unit. KIMBERLY ENGELMAN, Deborah Altus, and Mark Mathews (University of Kansas)
• Attracting New Membership to Senior Center Recreation Programs. PAMELA XAVERIUS and Mark Mathews (University of Kansas)
• Improving Communicative Interactions between Nursing Aides and Residents with Dementia. KATINKA DIJKSTRA and Michelle Bourgeois (Florida State University)
• Setting Events That Promote Participation in Discussions of News by Adult Day Care Clients. DAVID BORN and Campbell Thompson (University of Kansas)
• RSVP: Increasing Personal Correspondence Received by Widowed Persons. NANCY GNOTTA BRECHT, Deborah Altus, and Mark Mathews (University of Kansas)

#132
Symposium
5/24/98
1:30 P.M. - 2:20 P.M.
Asia 3
DEV

Explanation versus Description in Science and Behavior Analysis
Chair: Wendy Roth (Florida International University)
Discussant: Joel Greenspoon (University of North Texas)
• The Use and Meaning of "Explanation" and "Description" in Science. JACK MARR (Georgia Tech)
• Explanation in Behavior Analysis. STEVEN HAYES (University of Nevada, Reno)
• Explanation is Not Description. HAYNE REESE (West Virginia University)

#147a
Symposium
5/24/98
2:30 P.M. - 3:50 P.M.
Asia 3
DEV

The Role of Contingency-Contact Density during Skill Acquisition
Chair: Noel Crooks (Florida International University)
Discussant: Jack Scott (Florida Atlantic University)
• Contingency-Contact Density and Acquisition of Complex Response Sequences. DAVID LUBIN (Behavior Therapy Group)
• Increasing Contingency-Contact Density through Rate-Based Discrete-Trial Programs to Facilitate Learning in Young Children with Autism. SHARON ALEXANDER (Florida International University)
• Differential Reinforcement of High and Low Rate Schedules During Repeated Acquisition of Complex Response Sequences: A Method for Analyzing the Role of Contingency-Contact Density during Learning. LORI COONS (Florida International University)
• Stimulus Density: The Effects of Differential Stimulus Density Across Situations. WENDY ROTH (Florida International University)

#198
Symposium
5/25/98
10:00 A.M. - 11:20 A.M.
Northern Hemisphere A1
DEV

Reinforcers in Infant Operant Learning
Chair: Lewis Lipsitt (Brown University)
Discussant: Sidney Bijou (University of Nevada, Reno)
• Attention Reinforcers in Infant Operant Learning. JACOB GEWIRTZ and Martha Peláez-Nogueras (Florida International University)
• The Nature of Attention and it's Reinforcer Efficacy for Infant Behaviors. HISELGIS PEREZ and Jacob Gewirtz (Florida International University)
• Reinforcer Attributes in Neonatal Learning. T.G.R. BOWER (University of Texas at Dallas)
• Parents' Understanding of How Reinforcement Influences Childhood Behaviors may be Limited. KERRIE LUM LOCK (Florida International University)

#213
Symposium
5/25/98
11:30 A.M. - 12:50 P.M.
Northern Hemisphere A1
DEV

Behavior-Analytic Interpretations of Vygotsky, Fischer, Ribes and Piaget's Theories of Human Development
Chair: Martha Peláez-Nogueras (Florida International University)
Discussant:s Sidney Bijou (University of Nevada, Reno) and Bryan Midgley (University of Kansas)

• A Behavioral Interpretation of Vygotsky's Theory of Thought, Language, and Culture. ERIC BURKHOLDER (University of Nevada, Reno) and Martha Peláez-Nogueras (Florida International University)
• A Behavioral Interpretation of Piaget's Stage - Theory of Cognitive Development. LISA BRITTON (University of Nevada, Reno) and Martha Peláez-Nogueras (Florida International University)
• Fischer's Skill Theory and Cognitive

Development. GARY NOVAK (California State University, Stanislaus)
• An Interpretation of Ribes' Theory of Language as a "Contingency Substitution Behavior". JACQUELINE COLLINS (University of Nevada, Reno) and Martha Peláez-Nogueras (Florida International University)

#228
Symposium
5/25/98
1:00 P.M. - 2:20 P.M.
Northern Hemisphere A1
DEV

Environmental and Biological Explanations of Individual Differences in the Development of Behavior
Chair: Patrice Marie Miller (Sales State College)
Discussant: Slobodan Petrovich (University of Maryland, Baltimore County)
• Biological and Environmental Influences on Behavioral Inhibition. MARJORIE HARRISON (University of Massachusetts at Boston)
• Temperament and Adult Behavior as Influences on Infant Behavior in Interactions with Mothers and Strangers. PATRICE MARIE MILLER (Salem State College)
• The Biological Basis of Adult Gender Roles. PATRICE MARIE MILLER (Salem State College) and Michael Lamport Commons (Harvard Medical School)
• Solving the Most Highly Hierarchically Complex Problems. MICHAEL LAMPORT COMMONS (Harvard Medical School)

#244
INTERNATIONAL
Symposium
5/25/98
2:30 P.M. - 3:50 P.M.
Northern Hemisphere A1
DEV

Recent Conceptual Advances in Developmental Behavior Analysis
Chair: Sidney Bijou (University of Nevada, Reno)
Discussant: Sidney Bijou (University of Nevada, Reno)
• Stimulus Equivalence and the Evolution of Language. ULLIN PLACE (University of Wales Bangor)
• A Radical Perspective on the Development of Self: Attributional Styles and Rule-Governed Behavior. M. CARMEN LUCIANO SORIANO, Inmaculada Gómez Becerra, and Francisco Molina Cobos (Universidad Almería, Spain)
• A Developmental Study of Social Competence: Contributions of Behavioral Sociometry. CARLOS SANTOYA and Marco Pulido (Universidad Nacional Autonoma de Mexico)
• Cause and Effect Relationships between Verbal Input and Verbal Learning in Special Populations. ERNST MOERK (California State University, Fresno)

#257
Business Meeting
5/25/98
6:30 P.M. - 7:20 P.M.
Oceanic 1

Developmental Special Interest Group
Chair: Jacob Gewirtz (Florida International University)
Expansion of SIG; agenda for next year's meeting; newsletter (information); 1 hour reception to follow.

#272
Symposium
5/26/98
9:00 A.M. - 10:50 A.M.
Northern Hemisphere A1
DEV

Experimental Analyses in Applied Settings: New Controlling Variables for the Behavior of Young Children with Autism or Language Delays
Chair: R. Douglas Greer (Columbus University Teachers College)
Discussant: Jack Gewirtz (Florida International University)
• Functional Relations Between Verbal Behavior or Social Skills Training and Conversational Units and Aberrant Behaviors of Young Autistic Children. HUI-CHUAN CHU and R. Douglas Greer (Columbia University Teachers College)
• Peer Effects on the Conditioning of a Generalized Reinforcer in Young Children. CATHERINE SALES (Fred S. Keller School) and R. Douglas Greer (Columbia University Teachers

College)
• An Analysis of the Effects of Pairing Vocal Sounds with Reinforcing Events as an Antecedent on the Frequency of Free Operant Vocalizations and the Subsequent Acquisition of Mand Functions in Young Children With Autism. SO YOUNG YOON (Fred S. Keller School)
• The Effects of Teaching Mands to Young Autistic Children and Their Emission of Conversational Units with Uncategorized Peers. MELISSA REINA (Columbia University Teachers College)
• Behavioral Momentum across Response Classes to Induce Echoics and Mands with Children with Autism who had no Prior Vocal-Verbal Repertoires. DENISE ROSS and R. Douglas Greer (Columbia University Teachers College)

#285
INTERNATIONAL
Symposium
5/26/98
11:00 A.M. - 12:20 P.M.
Northern Hemisphere A1
DEV

Development of Operant Responses in Infants
Chair: Slobodan Petrovich (University of Maryland, Baltimore County)
Discussant: Maricel Cigales (Behavior Services Inc.)
• Incidental Teaching of Stimulus Equivalency to Infants. SUSAN SCOTT and Gary Novak (California State University, Stanislaus)
• Operant Conditioning of the Visual Smooth Pursuit in Newborn Infants. JEAN-CLAUDE DARCHEVILLE, Laurent Madelain, Cathy Buquet, Jacques Charlier, and Yannick Miossec (Université de Lille III, France)
• Toward a Discrimination Between Children's Respondent and Operant Responses Denoting Fear. AIDA SANCHEZ, Jacob Gewirtz, and Martha Peláez-Nogueras (Florida International University)

1997 SIG Dinner

The Developmental SIG dinner this year will be held Saturday, May 23, 1998, from 6:30 to 8:30 or 9:00 p.m. The venue for the dinner is a semi-private room in **Gulliver's Grill,** one of the restaurants in the Swan Hotel, next to the conference site. The meal choices will be chicken **or** fish, soup **or** salad, and desert.. The cost of the dinner will be $30.00, gratuity and tax included, payable individually. Tea, coffee, and alcoholic beverages will be extra. We have discovered that the dinner arrangement in the Swan Hotel is best, for restaurants on the Disney property would be too expensive, and arrangements for a venue in or around Orlando City would be distant.. When you enter Gulliver's, request the maitre d' to seat you with the developmental (or Jack Gewirtz) party in the semi-private space.

Don't Miss the

Developmental SIG Social Hour !!

Monday, May 25
6:30 pm - 7:20 pm

Right after our Annual Business

Meeting at the Oceana 1 Room

Join us for refreshments-cash bar

Reinforcer Identification in Infants

Thomas S. Higbee
University of Nevada

Martha Peláez-Nogueras
Florida International University

Abstract

Recent research with adults and children with disabilities has yielded procedures for systematically identifying potential reinforcers. Used primarily with adults with developmental disabilities, this methodology, stimulus preference assessment, has been shown to accurately identify stimuli as reinforcers and rank them according to effectiveness. Although preference procedures have been used in basic infant research, no methodology specifically designed to compare various potential reinforcers for infants has been developed. As many operant interventions with infants involve reinforcer-based procedures, reliable knowledge about potential reinforcers would be of great value. An adaptation of the stimulus preference assessment procedure for use with infants is proposed and discussed along with the potential practical benefits of such a procedure.

Operant conditioning procedures have been used to investigate various developmental phenomena in infants, including: attention, perception, memory, language, and emotional and socialization processes (Gewirtz & Peláez-Nogueras, 1992). Interventions based upon operant principles have also been used to change maladaptive infant behaviors (e.g., Lamm & Greer, 1988; Mathews, Friman, Barone, Ross, & Christophersen, 1987). Although methods have been developed to evaluate infant preferences for various stimuli (e.g., DeCasper & Spence, 1986), a systematic methodology specifically designed to assess effectiveness of potential reinforcers for infant behavior is lacking. This is unfortunate, as most behavior analytic research studies and applied interventions with infants use reinforcement-based procedures (Peláez-Nogueras, 1998). Recently, a technology for the identification and ranking of stimuli as potential reinforcers has been developed and successfully implemented with adults and children with developmental disabilities. This method, termed stimulus preference assessment, does not require that the person being assessed possess extensive language skills or a large behavioral repertoire. As a result, it is ideal for use with nonverbal individuals. As infants also lack sophisticated language skills and typically have fairly limited behavioral repertoires, an adapted version of current stimulus preference assessment methods could yield valuable information about potential reinforcers for at risk infants or infants with developmental disabilities. Knowledge of these potential reinforcers could allow professionals to design more effective reinforcement based interventions for these infants.

Stimulus Preference Assessment

Behavior analytic researchers have recently developed a systematic method for identifying potential reinforcers and predicting their effectiveness. This method, called stimulus preference assessment, has been shown to accurately predict reinforcers for adults with developmental disabilities (Fisher, Piazza, Bowman, Hagopian, Owens & Slevin, 1992; Green, Reid, White, Halford, Brittain, & Gardner, 1988; Pace, Ivancic, Edwards, Iwata, & Page, 1985), children with developmental disabilities (Paclawskyj & Vollmer, 1995), and children with attention deficit hyperactivity disorder (Northup, Jones, Broussard, & Vollmer, 1995). The identification of powerful reinforcers is important since reinforcement-based interventions are often used in the treatment of behavioral excesses and deficits in adults and children with disabilities. The success or failure of these interventions is often determined by the potency of the reinforcer(s) identified. Reinforcer identification is often difficult in these populations, especially in pre-verbal individuals or those who lack expressive language skills. Stimulus preference assessment provides a way to overcome this obstacle by identifying probable reinforcers beforehand and increasing the probability of designing effective reinforcer-based interventions.

Methods of Assessing Stimulus Preference

By expanding on the work of Pace et al.

(1985), Fisher et al. (1992) developed a concurrent operants choice procedure to assess stimulus preference in adults with developmental disabilities. Piazza, Fisher, Hagopian, Bowman, and Toole (1996) validated and refined the procedure by adding a structured interview component to select the stimuli to be examined. In this concurrent operants choice procedure, 12 to 16 stimulus items are selected either from a standard list (Fisher et al., 1992) or through the use of a structured caregiver interview (Piazza et al., 1996). Each item is then presented in a pair with every other item in a randomized fashion. During each pair presentation, the individual being assessed is allowed to choose between the two stimuli. A choice response is defined as approaching or reaching toward one of the stimuli. The individual is then allowed access to the chosen stimulus for five seconds. Attempts to reach for both stimuli are blocked. If no choice is made, the individual is prompted to sample both stimuli for five seconds and then the two stimuli are presented again. If the individual fails to approach either stimulus following the sampling procedure, both stimuli are removed and the next pair is presented. After all of the presentations are completed, the percentage of times each stimulus was chosen when it was available for selection is calculated. Data from this procedure yield a rank-order of the stimuli according to preference.

Alternate methods of assessing stimulus preference have been developed by other behavior analytic researchers. For instance, Windsor, Piche, and Locke (1994) and De Leon and Iwata (1996) used a method in which multiple stimuli are presented in an array rather than in pairs during the stimulus preference assessment. This multiple stimulus presentation method of assessing stimulus preference has been demonstrated to achieve outcomes comparable to the paired stimulus method while reducing the time required for an assessment by more than half (DeLeon & Iwata, 1996). However, for reasons discussed later, this method is not well suited for use with infants.

Validation of Stimulus Preference Findings

To determine if the more preferred stimuli function better as reinforcers than the less preferred stimuli, a procedure called a "reinforcer assessment" is conducted. Stimuli are divided into categories of high, medium, and low preference based upon the data from choice procedure. Stimulus items from these categories are then compared using a reinforcer assessment procedure involving concurrent operants, where the behavior of sitting in a particular chair or standing in a particular square, for example, results in access to the stimulus associated with that chair or square (Fisher et al., 1992; Piazza et al., 1996). During the assessment, three chairs (or squares) are concurrently available for the individual to sit (or stand) in. The individual is taught which reinforcer is available for each chair before the assessment trial begins. One of the three is designated as a control, and no reinforcement is provided for sitting in it. Thus, two stimuli can be compared during each trial. Results from the reinforcer assessment showed that the high-preference stimuli consistently functioned as reinforcers for all subjects (Piazza et al., 1996). High-preference stimuli were also shown to be more effective reinforcers than either the middle- or low-preference stimuli.

Other, perhaps simpler, types of reinforcer assessments have been conducted to validate preference assessment findings. For example, De Leon and Iwata (1996) used a reversal design methodology to test reinforcer effectiveness. First, baseline rates of behavior were measured for a specific operant response. Then, items from the stimulus preference assessment were provided contingent on the response. Only one stimulus item was used during each phase of the reinforcer assessment and return to baseline phases occurred following each phase change. Changes in response rate compared to baseline levels were then examined to determine reinforcer effectiveness. Data from this reinforcer assessment confirmed the findings of the preference assessment.

Current Preference Procedures in Basic Infant Research

Operant research with infants has involved the contingent provision of a variety of reinforcing stimuli, including infant feed formula, sucrose water, auditory stimuli (e.g., the infant's mother's voice), olfactory stimuli, visual displays (e.g., the movement of a mobile, a video image, or picture

of a human face), tactile and kinesthetic stimuli, and social stimuli (Peláez-Nogueras, 1996). Diverse behaviors have also been used as target responses, including eye-contact and visual fixations, vocalizations and discrete voice sounds, lateral head turns, cries, protests, reaching and grasping an object, arm and leg movements, kicking, and sucking. Several procedures have been used in basic infant research to determine infant preference for various types of stimulation (Peláez-Nogueras, 1996).

Although not a choice procedure per se, the conjugate reinforcement procedure used in studies by Rovee-Collier and her colleagues (e.g., Rovee-Collier and Capatides, 1979) demonstrates the ability of infants to respond differentially to visual cues in the environment. In this procedure, the infant is placed on his/her back in a crib with a mobile suspended above his/her head. A ribbon connects the infant's foot to the mobile so that each time the infant kicks, the mobile moves proportionately. Infants learned to respond (i.e., kick) when reinforcement (movement of the mobile) was made contingent on responding in the presence of a discriminative stimulus and not to respond when that stimulus was absent or other discriminative stimuli were present.

Other methods, which more closely approximate the choice procedures described previously, have also been used. For example, DeCasper and Spence (1986) studied the effect of systematic prenatal auditory exposure on postnatal learning. The behavior they was a non-nutritive sucking response. Infants showed higher rates of nonnutritive sucking when their mothers read a passage that had been recited repeatedly during the last trimester of pregnancy than when a novel passage was read. In a later study, using the same nonnutritive sucking procedure, the mother's voice was shown to more effectively function as a reinforcer than a stranger's voice (Spence & DeCasper, 1987). Thus, rate of nonnutritive sucking was used to determine which of the two stimuli functioned better as a reinforcer with a higher rate of sucking indicating a greater reinforcing effect.

Recently, a procedure has been developed that is more directly aimed at determining infant preference for various kinds of stimulation. This method, the synchronized reinforcement procedure, was developed by Peláez-Nogueras and her colleagues to investigate infants' preferences for different types of tactile stimulation (Peláez-Nogueras, Field, Gewirtz, Cigales, Gonzales, Sanchez, & Clasky, 1997; Peláez-Nogueras, Gewirtz, Field, Cigales, Malphurs, Clasky, & Sanchez, 1996). In this procedure, the infant is seated facing an adult caregiver. Each time the infant makes eye contact, the adult continuously provides a specific type of stimulation (e.g., stroking the infant's leg) until the infant looks away. When the infant again makes eye contact, the adult again provides stimulation for the duration of the eye contact. The procedure is repeated with different types of stimulation. The amounts of eye contact given during each condition is then compared, with more eye contact indicating greater reinforcer efficacy.

Although these three procedures yield information about infant preference for various kinds of stimulation, each has some limitations. For example, the conjugate reinforcement procedure, although allowing the infant to respond differentially, does not directly compare the reinforcing effects of different stimuli. Also, both the nonnutritive sucking and the synchronized reinforcement procedure have been used to compare the reinforcing effects of only one type of stimulation. A further limitation of the latter procedures is that stimuli are presented one at a time, so a comparison of several stimuli may be time consuming. A procedure that would allow the reinforcing effects of multiple stimuli to be compared in a relatively brief period of time would overcome these limitations and is described in what follows.

Stimulus Preference Assessment with Infants

A methodology to be used with infants for evaluating stimuli as potential reinforcers draws upon the research findings in the area of stimulus preference assessment with adults and children with disabilities. Certain variations of the stimulus preference model could be more easily adapted for use with infants. Although the multiple-stimulus method is less time consuming, the paired stimulus method is likely be more effective with infants, given their inability to attend to many stimuli at once. Even if infants were able to attend to and differentiate among

multiple stimuli, determining what behavior constitutes a "choice" would be difficult. Thus, a variation on the paired stimulus method seems more appropriate.

One way to determine preference would be to use a head-turn response in a variation of the synchronized reinforcement procedure. The infant being tested would have to be able physically to make the head turn response and to sit in an infant chair (e.g., a car seat). The infant would be placed on its back in an infant chair and a head turn in either direction would result in one of the two stimuli being presented. For example, if the two stimuli being compared were stroking the infants leg and providing an auditory stimulus, each time the infant turned its head to the left, the auditory stimulus would be provided continuously until the infant turned its head away. If the infant turned its head to the right, its leg would be stroked until it turned away. After a pre-determined period (e.g., 5 minutes), the amount of time spent with the head turned in each direction could be compared. The stimulus associated with the side where the infant's head was turned more would be considered the "chosen" stimulus. Each stimulus would be presented in random order with every other stimulus as described above. When all stimulus presentations were complete, the percentage of time each stimulus was chosen when it was available would be calculated. The stimuli would then be ranked according to this percentage score yielding a rank order of preference. The amount of time required for conducting the assessment could be reduced significantly by limiting the number of stimuli to 4 or 5, rather than the 12 to 16 used in assessments with older participants. Behaviors other than the head-turning response could also be used to indicate preference as long as they were easily observable and distinguishable one from the other.

To validate, experimentally, the results of the stimulus preference assessment, a reinforcer assessment would be conducted. Since infants are, for the most part, non-ambulatory, the concurrent operants procedure described previously would not be feasible. The reversal procedure, which serves the same purpose, would be much easier to perform. The reversal procedure could be conducted in the same manner as described previously. Each stimulus could be delivered contingent on a response (e.g., a leg kick) on some schedule (probably continuous) of reinforcement until a steady rate of responding is observed. Then the infant's rates of responding for each stimulus could be compared. If the results of the reinforcer assessment matched the results of the stimulus preference assessment, then the latter would be validated.

Conclusion

Knowledge about potential reinforcers would be of great value to practitioners who work with infants with disabilities. The proposed procedure would provide a systematic and efficient method of reinforcer identification. These reinforcers could then be used to increase desirable behaviors (e.g., positive interactions with caregivers, so-called "attachment behavior," vocalizations) and decrease maladaptive behaviors (e.g., food refusal, avoidant behavior, protesting behavior).

Stimulus preference assessment has many practical advantages which make it ideal for use in applied settings. First, its administration does not require a great deal of skill. Practically anyone can easily be trained to perform it. Second, it would not require much time. Four to five stimuli could likely be assessed in an hour or less. Third, it increases the likelihood of success. Interventions using reinforcers identified by the procedure would have a much higher probability of being successful than interventions using arbitrarily chosen stimuli.

Although operant procedures have been used to determine infant preferences among social stimuli (e.g., Peláez-Nogueras, et al., 1996; 1997) none have been designed specifically to identify nonsocial reinforcers. A procedure, stimulus preference assessment, has been developed to serve this purpose and has been demonstrated to be effective with adults and children with disabilities. An adaptation of this procedure for use with infants was proposed. If demonstrated effective through research, this procedure could have a substantial positive impact on applied interventions with at risk and infants with disabilities.

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Does Reinforcement Destroy Intrinsic Motivation?

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Despite the effectiveness of reinforcement procedures, there has been much controversy about their use. Critics contend that using reinforcement will undermine the subject's intrinsic motivation. They assert that a person whose behavior is reinforced will be less likely to perform that behavior when reinforcement is withdrawn and argue that the rate of behavior may even decrease below initial baseline levels. Consequently, the use of reinforcement procedures in the schools or workplace is strongly discouraged. This paper will examine the assertions made by several critics of reinforcement, specifically Edward L. Deci, Mark R. Lepper and Alfie Kohn. The aim of this paper is to demonstrate that their assertions are unfounded and based on conceptual misunderstandings. Methodological problems, alternate explanations and recent research findings will also be discussed.

The Case Against Reinforcement

Deci's Approach

Deci defined intrinsically motivated behaviors as "behaviors in which a person engages in to provide himself with a sense of competence and self-determination" (Deci, 1975). Based on the cognitive evaluation theory, Deci made various propositions about the effects of rewards on intrinsic motivation and supported his predictions with empirical evidence.

Deci's first proposition states that "one process by which intrinsic motivation can be affected is a change in perceived locus of control of causality from internal to external. This will cause a decrease in intrinsic motivation, and will occur...when someone receives extrinsic rewards for engaging in intrinsically motivated behavior". This proposition implies that if people perceive the locus of control outside themselves, they will behave in accord with this perception. Thus, if people believe that they engage in an activity because of an extrinsic reward, subsequently they will engage in that activity only when they think it will lead to the extrinsic reward (Deci, 1975). In support his first proposition, Deci cited the results of some of his earlier studies. In the first, (Deci 1971) college students were given 3 thirteen-minute sessions to solve a puzzle, which in pilot testing was found to be intrinsically motivating. The subjects were then observed for an 8-minute free-choice period during which they could engage in any activity. Deci found that those who had received money for solving the puzzle were less likely to engage in the puzzle activity during the free-choice period than those who were not paid. In a second study, Deci and Cascio (1972) found that threat of punishment for incorrect performance, which supposedly results in perceived external control, also decreased intrinsic motivation. Deci affirmed that the results of these studies support the assertion that perceived external control decreases intrinsic motivation (Deci, 1975).

Deci's second proposition states that "the second process by which intrinsic motivation can be affected is a change in feelings of competence and self-determination. If a person's feelings of competence and self-determination are enhanced, his intrinsic motivation will increase. If his feelings of competence and self-determination are diminished, his intrinsic motivation will decrease" (Deci, 1975).

His third proposition explains that "every reward (including feedback) has two aspects, a controlling aspect and an informational aspect which provides the recipient with information about his competence and self-determination. If the controlling aspect is more salient, it will initiate the change in perceived locus of causality process. If the informational aspect is more salient, the change in feelings of competence and self-determination process will be initiated" (Deci, 1975). Together, the two propositions predict that when the controlling aspect of rewards is salient, the person will perceive the locus of causality as external, and intrinsic motivation will decrease. If the control aspect is not salient, then the informational aspect of the reward will provide the person with feelings of competence and self-determination, and intrinsic motivation will increase. Again, Deci cites his own research to support these two propositions. The finding that

subjects who received positive verbal feedback showed increases in intrinsic motivation (Deci 1971) was cited as evidence that if the informational aspect of rewards caused feelings of competence, intrinsic motivation increased. Deci, Cascio and Krusell's (1973) finding that negative feedback (which provides information, but not feelings of competence), decreased intrinsic motivation was also interpreted as indicative of the effects of feelings of competence and self-determination on intrinsic motivation. Finally, he cited a (Deci 1972) study which found that subjects who were paid based on the quality of performance subsequently showed less intrinsic motivation than those who were paid regardless of how well they did. Deci asserted that this occurred because in the quality-based condition the controlling aspect was more salient.

Lepper's Perspective

M. R. Lepper conceived of intrinsic motivation as "a measure of task engagement in a situation in which salient extrinsic contingencies had been deliberately minimized"; while extrinsically motivated activities had "instrumental value in producing tangible or social rewards" (Lepper, 1978). Lepper interpreted the effects of extrinsic rewards on motivation based on ideas derived from cognitive-dissonance research on insufficient justification (Aronson, 1966). The research on insufficient justification revealed that individuals who were induced to engage in attitudinally inconsistent behavior and given little extrinsic justification for this behavior later reported that their actions had been intrinsically rather than externally motivated. Thus, when external contingencies were insufficient to account for their actions, people attributed the actions to their own internal dispositions.

Lepper (1978) proposed that the converse effect could explain the detrimental effects of extrinsic rewards, when used to induce a person to engage in an initially intrinsically interesting activity. He posited that when "extrinsic incentives are sufficiently salient and seemingly 'oversufficient', the individual will attribute his or her behavior to these compelling extrinsic contingencies rather that to an intrinsic interest in the task and would therefore be less likely to regard the activity as interesting in itself" (Lepper, 1978). This proposition was called the "overjustification hypothesis" and predicted decreases in task motivation when people were presented with initially intrinsically interesting activities under conditions that made salient the instrumentality of these activities "as a means to some ulterior end". The overjustification hypothesis also predicted that the more salient the external motivation, the greater the decline in intrinsic motivation (Lepper, 1978). Lepper supported his hypothesis by citing a study performed by Lepper, Greene, and Nisbett (1973). In this study, the initial level of intrinsic motivation was measured by the amount of time preschoolers spent on a drawing activity during free-play periods, when they were free to choose among many other alternatives. These children were then divided into 3 groups: expected reward, unexpected reward, and no reward. Lepper predicted that giving an unexpected reward would not produce a detrimental effect on intrinsic motivation because the instrumental aspect of the behavior was less salient. Results confirmed Lepper's predictions as only in the expected reward group showed a decrease in intrinsic motivation. Lepper interpreted this finding as supporting evidence for his overjustification hypothesis (Lepper, 1978).

Kohn's Views

Alfie Kohn asserted that, although rewards increase the probability that we do things, they change the way we do those things. Rewards cause people to do things only because of what they expect to get in return. In contrast, intrinsic motivation "means enjoying what one does for its own sake" (Kohn, 1993). Kohn cited Deci and Lepper's research findings as evidence of the detrimental effects of rewards on intrinsic motivation. He then offered two reasons why he believed these detrimental effects occurred. The first reason is that "anything presented as a prerequisite for something else--that is, as a means toward some other end--comes to be seen as less desirable" (Kohn, 1993). [This reason resembles Lepper's view of the effects of perceived task instrumentality on intrinsic motivation.] Kohn supports this assertion by citing two studies. One is Lepper's (1982) study which found that children

who were told a story in which a child had to try two new foods, but was required to finish one food before s/he was allowed to try the other, subsequently reported that they would prefer to eat the food that was set up at the end, not the means. The other study is the Freedman et al., (1992) study which found that the greater the incentive used to get someone to engage in an activity, the more negatively people would view the activity for which it was received.

Kohn's second reason is that "rewards are usually experienced as controlling and we tend to recoil from situations where our autonomy is challenged." Being told what to do and how or when to do it, interferes with our sense of self determination and produces undesirable consequences (Kohn, 1993). [This reason resembles Deci's predictions.] As you can see, Kohn's approach combines Deci's and Lepper's theories. In fact, he uses their findings support his assertions. Kohn's perspective is not very novel nor is it based on evidence yielded by his own research; rather it serves to integrate some aspects of Deci and Lepper's views.

Reinforcement Defense

This section will discuss the conceptual and methodological flaws of the assertions made by Deci, Lepper, and Kohn and present evidence that reinforcement does not necessarily lead to decreased intrinsic motivation. Since Kohn's view is based on Lepper's and Deci's work, any evidence that refutes Deci's or Lepper's assertions automatically refutes Kohn.

Conceptual Flaws

First, it is important to state that there is no concrete evidence that intrinsic motivation exists; therefore, it is dubious that it can be decreased by reinforcement. Researchers have inferred the existence of intrinsic motivation from the behaviors they observed, specifically time spend on a task when reinforcement contingencies were not *deliberately* applied. But, there may have been unnoticed contingencies of reinforcement maintaining the target behavior before the intervention began. Unfortunately, since the only thing observed during the baseline phases of both Deci's and Lepper's work was the time spent on the activity, and not the antecedents or consequences of the activity, functional contingencies were not detected. The fact that they were not detected does not mean that these contingencies did not exist, but rather that the experimenters did not bother to search for them. Scott's research lends support to the possibility that undetected contingencies were in fact responsible for maintaining the behaviors that Deci and Lepper posited as being intrinsically motivated. Scott et al. (1988) found that "when behavior was sustained in a task setting in the apparent absence of salient extrinsic reinforcers, subtle response-produced stimulus changes were found to be involved". He proposed that a wide variety of so-called intrinsic behaviors can be acquired and maintained by the stimulus changes they produced. In short, it is not certain that there was an intrinsic cause for the behaviors studied by Deci or Lepper. Intrinsic motivation was merely a label posited to explain behaviors for which no obvious external cause was identified. This label was used to avoid the arduous task of seeking a legitimate explanation for the observed decrements in performance, as no attempts were made to search for the real causes for the decline in behavior or to identify the contingencies that maintained the behavior in the first place.

The decrements in performance observed by Deci and Lepper may have been due to a temporary disruption of the target behavior caused by superimposing a new reinforcement contingency over the preexisting contingencies that operated on the behavior before intervention. Flora (1990) proposed that "reduced rates of behavior typically attributed to the undermining of intrinsic interest are more objectively accounted for by environmental stimuli functions, including instructional control". Scott (1975) suggested that reinforcing stimuli come to act as discriminatory stimuli "in the presence of which behavior incompatible with operants maintained by sensory stimuli has been reinforced". Thus, "the introduction of a reinforcing event, would be expected to disrupt ongoing operants until those incompatible behaviors were extinguished". Basically, Scott's (1975) position is that the undermining effect is temporary and is caused by introducing yet another reinforcer into a preexisting system of complex or multiple contingencies. Finally, Scott (1975) maintains that

any type of sensory stimulation has reinforcing properties which can be modified by satiation and deprivation procedures. Consequently, the decrements on the target behavior observed during the free-play periods may be caused by the fact that the subjects are satiated.

Other alternate explanations for the decrements in performance have been proposed. First, the competing response hypothesis stated that subjects were "less interested in the (intrinsic) target behavior to the extent that responses are elicited that interfere with the target activity prior to the termination of contingencies" (Reiss & Sushinsky 1975). Preexposing subjects to a rewarding stimulus, either verbally or visually, may elicit responses that interfere with the target behavior and, consequently, cause it to decrease. Elicited responses that disrupt the target behavior may include "perceptual distraction, cognitive distraction (e.g., thinking about reward), excitement, anticipation of reward (Miller & Estes, 1961; ShefBeld,1966), or frustration resulting from delay or withdrawal of reward (Barker, Dembo, & Lewin,1941; Perry, Bussey, & Redman, 1977)" (Reiss & Sushinsky,1975). Second, the frustration hypothesis (Perry et al., 1977) proposed that when the reward for an activity is withdrawn, the activity acquires aversive properties through arousal of "anticipatory frustration" and this causes decreased interest in the activity.

Procedural Flaws

The procedures used in many studies of intrinsic motivation were flawed because rewards were used instead of legitimate reinforcement procedures. Cameron and Pierce (1994) conducted a meta-analysis of 100 published studies on the effects of reinforcement on intrinsic motivation and found that only a few studies tested for reinforcement effects as demonstrated by systematic increases in behavior due to the consequences that followed it. Because there was no test for reinforcement in most of the experiments that yielded decreases in intrinsic motivation, Cameron suggested that those findings should discussed in terms of the effects of rewards, rather than of reinforcers. "A reward is defined as something satisfying (by the person who gives it), not by an increase in behavior" (Pierce & Epling, 1995). It appears that Deci, Lepper and Kohn were aware of the fact that they were not utilizing of true reinforcement procedures as they all tended to use the word "reward" in the writings instead of the word "reinforcement". Additionally, Cameron and Pierce (1994) found that in the those few studies that used legitimate reinforcement procedures (Davidson & Bucher, 1978; Feingold & Mahoney, 1975; Mawhinney, Dickinson & Taylor, 1989; Vasta, Andrews, McLaughlin, Stirpe & Comfort, 1978; Vasta & Stirpe, 1979), reinforcement did not decrease intrinsic motivation.

Research Evidence

The results of several empirical studies also refute Deci's and Lepper's predictions. Davidson & Bucher (1978) assessed the effects of a continuing token reinforcement program in repeated test sessions and found no evidence of decreased intrinsic interest in the rewarded activity. In Dukes (1983), kindergartners were chosen because of their initial interest in question asking and were assigned to either a self-administered reinforcement group, an experimenter-administered reinforcement group, or a no-reinforcement group. Following 6 days o training, a post-test (without reinforcement) was administered. This post-test revealed no significant differences between groups, indicatin that intrinsic interest was not affected by reward

Smith (1980) assessed for Lepper's overjustification effect in 4th and 5th graders. H found that reinforcement does not cause the overjustification effect. In fact, "the reinforcemer or reward value aspect, led to the opposite effect--an increase in interest and post-contingen performance". Scott et al. (1988) assigned university students tasks, with varied levels of sensory reinforcement and complexity, under tw conditions of monetary reinforcement: announc and unannounced. Results demonstrated that "when a signaled extrinsic reinforcement contingency was applied it produced a significa increase in task performance during the time th extrinsic reinforcement contingency prevailed a did not produce a decrement in self-reports of t attractiveness nor in performance when the contingency was withdrawn" (Scott, 1988).

Mawhinney et al. (1989) used concurrent schedules of reinforcement to determine the ext

to which behavior was controlled by the extrinsic versus intrinsic rewards and found that extrinsic rewards did not weaken the reinforcing value of the intrinsic rewards following reward termination. Mawhinney (1990) found that people who are most highly intrinsically motivated by a task are the least likely to exhibit any post-reinforcement decrements in intrinsic motivation. Skaggs et al. (1992) replicated the results of Mawhinney et al.(1989). Taken together, the results of the preceding studies serve as evidence that salient reinforcement contingencies do not necessarily lead to decreased intrinsic motivation as indicated by declines in performance.

Conclusion

Despite the attacks against reinforcement brought forth by Deci, Lepper and Kohn, there is no convincing evidence to indicate that properly implemented reinforcement procedures inevitably cause subsequent decreases in intrinsic motivation. The conclusions reached by critics of reinforcement are incorrect and based on their erroneous interpretations of the principles and methods of reinforcement. Further, more reasonable explanations, which do not rely on hypothetical, unverifiable entities like intrinsic motivation, can be advanced to account for the observed decrements in performance.

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Perspectives on the Development of Behavior Characteristic of Autism

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Abstract

Perspectives on the development of behavior characteristics of autism are reviewed. This paper presents an analysis of existing behavioral theories on autism and attempts to integrate various theories from a developmental perspective. Behavior changes from infancy to adulthood are examined and an attempt is made to explain these changes behaviorally. The paper concludes by highlighting the importance of function in describing such behavior changes across a life span.

Behavioral Theories of Autism

Several behavioral theories have attempted to explain behavior characteristics of autism (Ferster, 1961; Lovaas & Smith, 1989; Koegel, Valdez-Menchaca & Koegel; Bijou & Ghezzi). This paper discusses four existing behavioral deficit theories: (1) behavioral hypothesis by Ferster (1961), (2) Lovaas and Smith's (1989) behavioral theory, (3) the social communication theory by Koegel, Valdez-Menchaca and Koegel, and (4) Bijou and Ghezzi's (1997) behavior interference theory.

Ferster's (1961) theory claims that the maintaining variables of behavior characteristics of autism can be explained by parental environment. This notion assumes that the parents are responsible for creating an environment that maintains autistic behavior. His theory is not in conjunction to those who believe that maltreatment by parents may result are autistic tendencies, but rather he is concerned with the direct contingencies established by the parent. Although this theory is the first attempt at understanding autism behaviorally, it lacks the complete understanding of the wide range of existing behavior characteristics of autism.

Lovaas and Smith's (1989) suggest that the behavior characteristics of autism can be explained by the laws of learning. They also claim that children with autism are able to learn in special environments, and this ability to learn in special environments may suggest a deficiency in the nervous system. Children with autism, according to this theory, also exhibit many more specific deficits. For the most part, this theory encompasses a behavioral account of autistic behavior; however, Lovaas and Smith's biophysiological explanation steers away from a strictly behavior analytic perspective.

The social communication theory by Koegel, Valdez-Menchaca and Koegel's (1994) is in conjunction to Lovaas and Smith in that both theories emphasize the neurological or physiological processes responsible for behavior characteristics of autism. Koegel et al. (1994) claim that these biophysiological processes may contribute to the lack of social behavior in children with autism. However, it is difficult to observe such proposed processes. Behavior characteristics of autism, from this perspective, are not completely behavioral because they are not observable. In a sense, reducing the behavior characteristics of autism to the neurological or physiological level of analysis allows for little room for an explanation of behavior from an operant level. It is possible to explain these behavior characteristics strictly by the laws of learning. Although we have a few behavioral theories on autistic-like behavior, there is still a need for further investigation.

The behavior interference theory is a developmental theory proposed by Bijou and Ghezzi (1996). The theory describes five categories in order to understand behavior characteristics of autism: (1) children with autistic-like behavior have an innate tendency to escape and avoid cutaneous and auditory stimuli, (2) the above posit interferes with the normal development of social conditioned reinforcers, therefore interfering with attachment behavior early in development, (3) attachment behavior is an important prerequisite for developing more complex social behavior such as language-related behaviors and symbolic play, (4) stereotypy in children with autism is an automatically reinforcing operant behavior that can be compared to exploratory behavior in normally developing children, and (5) the characteristics of autistic behavior are interrelated among the traits and abilities of the child with autism. The behavior interference theory, unlike any other psychological theory, describes all aspects of autistic behavior

from a developmental and behavioral perspective. This theory is specific to young children with autism, but developmentally it may be important to look at behavior changes across a life span. The following sections address these changes.

Developmental Changes in Characteristics of Autism over a Life Span: Deficits and Excesses

Although autism is referred to as a global deficit, it is important to realize that individuals who engage in autistic-like behaviors vary in the level of functioning and severity (Rogers & Pennington, 1991). Autism, therefore, can be viewed as a developmental disorder in that particular behaviors develop over a period of time and that development may not be the same in all individuals. For example, all normally developing children learn to walk at the same age, usually within a range where variability is low. Although a range exists, walking may emerge at different times. From a developmental perspective we can analyze autistic-like behaviors in a similar manner. Rogers & Pennington (1991) suggest that specific deficits in young children with autism are not maintained throughout development, "rather, we expect to see some sign of deeper underlying deficit specific to autism stand out during a specific developmental stage, only to be accomplished to some degree at a later developmental stage and replaced by other symptoms" (p. 146). From this perspective, autism should not be viewed as a developmentally stagnant disorder, but rather it should focus on the developmental changes that occur over a life span.

Behavioral changes in individuals with autism can be explained developmentally. For example, a pre-verbal, young autistic child has deficits in joint-attention, but as the infant with autism becomes older and more verbal, this deficit is no longer identified (Stone & Caro-Martinez, 1990). It has been shown that young individuals with autism with lower IQs fail infant-level motor imitation tasks, while older individuals with autism with higher IQs show proficiency in imitation skills (Morgan, Curtrer, Coplin, & Rodrigue, 1989). These and other findings in the developmental literature suggest that age and functioning level contribute to the behavior change of individuals with autism. These changes can be attributed to age related changes, but also by environmental changes (Gewirtz & Peláez-Nogueras, 1996). That is, the primary deficits in autism will not be constant across developmental stages, but rather deficits will change with development and experience (Rogers and Pennington, 1991). Autistic-like behaviors are not constant, therefore we must analyze the changes that occur at different periods or phase shifts in an individual's life. Although behavior analysts are not concerned with an age related changes or age as a "psychological variable"; age may facilitate the understanding of behavior characteristic patterns of autism. However, we must emphasize that it is not age that contributes to changes in behavior over a life span, but it is the constant causal interaction between orgasmic and environmental variables that is responsible for such changes.

Infant Autism: Behavioral Characteristics

Autistic-like behaviors have been proposed to emerge at birth, (Ritvo, Freeman, Ornate, and Tanguay, 1976; Happen, 1995). No research to date, however, can confirm this notion. At birth, it is very difficult to detect the sodalities of behavior characteristics of autism. Although empirical evidence is not available for early detection, parent's reports have been useful in looking at behavior changes in infants. Parents have reported that their infant cried infrequently compared to normally developing infants and they do not respond to companionship. Early detection for deficits in social behavior is possible. This deficit is noted by the absence of social referencing in infants who are six to eight months old (Siegel, 1996). Parents have reported that their infant is rigid when he or she is being held, and appears to lack the need for any sort of stimulation. Also, retrospective reports from mothers have indicated a lack of social attachment early in infancy. Moreover, parents have reported that their infant is considerably irritable and overreactive to any form of external stimulation (Ritvo et al., 1976). These behavior patterns can be a result of an infant interacting with different stimuli in the environment and then modifying his or her behaviors according to the aversive properties associated with such patterns.

Another deficit observed in infancy is the lack of imitative behavior. Normally developing

children will begin copying the behaviors their parents engage in as early as ten months old, but a child with autism does not develop these imitation skills (Siegel, 1996). The idea of imitation, for some, is innate in that normally developing infants are not directly taught to imitate (Siegel, 1996). Although infants are not directly taught to imitate, this behavior may develop and sustain because the actual act of imitating may be reinforcing given that there is a social consequence for imitative behaviors. Imitation is a precursor to many more advanced social behaviors but it can also facilitate early language in infants. Normally developing infants may begin to communicate through nonverbal means such as gazing, facial expressions, sounds, and gestures. Some of these behavioral deficits can be further detected in childhood when many more behaviors seem to emerge due to more interactions with the environment.

Many behavioral excesses are precursors to more advanced topographies and functions of stereotypical and perseverative behaviors. Behavioral excesses are not common in infants, but parents have reported that their infant excessively scratched and rapped the cover of their pram for a long period of time and engaged in rocking and banging when left alone (Wing, 1972). Pinpoint specific autistic-like behaviors in infancy is very difficult because many normally developing children also engage in topographically similar behaviors. Often, these behaviors during infancy can only be described by structure, but as we move into childhood and adulthood the functions of autistic-like behaviors become more apparent. Given strong deficits in other developmental areas, the function of behavior changes with various interactions with the environment (Peláez-Nogueras & Gewirtz, 1997).

Childhood Autism

Autism is most often diagnosed around age three or four years, when behavioral deficits and excess are highly defined. Behavioral development in an autistic child can be divided into three subcategories: (1) Socialization, (2) Communication, (3) Play/Imagination. Early signs of social isolation are detected in one and two year olds, Normally developing eighteen month old children are usually very interested in engaging in social interactions, but toddlers with autism prefer isolation (Siegel, 1996).

Children with autism have been labeled as being distant or aloof because they behave as though others do not exist (Wing, 1972). This lack of interest in others have been notices as early as infancy, but is more apparent in early childhood. It is a type of social detachment that may result from a history of minimum conditioned social reinforcers (Bijou & Ghezzi, 1997). Detachment may be more than lack of conditioned reinforcers; rather it may result from the type of interactions the child experiences with the environment. For example, a child who is distant and shows little interest in others is probably not going to engage in many reinforcing interactions. At some point, according the author of this paper, the interactant will discontinue the attempts to interact with the interactee. That is, the child with autism may indirectly be reinforced for not engaging in social interaction. Although we are unclear on the actual variables that maintain such behavior, it is still important to examine the progression developmentally and the progression of changes in the controlling environment.

Children with autism, although very distant from others, do engage in some form of relating. These children are more likely to engage in instrumental, rather than expressive relating (Siegel, 1996). Most normally developing children are more interested in social expressive relating where the child is constantly interacting with others. This sort of interaction seems more active in that the child is trying to understand and explore his or her environment. On the other hand, an autistic child engages in more instrumental-type relating where he or she interacts with others only to fulfill a want or a need (Siegel, 1996).

Another social deficit that becomes more visible in childhood is the lack of generalized imitation. Children with autism have difficulty producing generalized imitation. It takes many more trials to produce generalized imitation in children with autism compared to normally developing children (Poulson & Kymissis, 1996). As mentioned above, deficits in imitation are apparent as early as infancy. However, these deficits become more noticeable in early childhood when the autistic child fails to develop basic

imitation such as waving "bye" At two years of age, normally developing children begin to engage in a lot of pretend play, a concept that is very abstract and complex for children with autism. Deficits in children with autism may be a result of lack of motivation (Siegel, 1996). In behavioral terms we can interpret this as a setting factor, such as deprived environment, and the lack of externally mediated reinforcement associated with engaging in behaviors that produce a social consequence. Essentially, if a behavior is not reinforcing than it should decrease and eventually disappear from a child's repertoire.

Social behavior is an essential part of development because it facilitates language development. Along with deficits in socialization, children with autism also have both, deficits and excesses in communication. Lack of communication begins in infancy when a baby does not engage in nonverbal communication. During childhood, verbal communication starts developing in normal children, but we observe a delay in language with children wit autism. Children with autism either have a language delay or are completely mute. Those children who have a verbal repertoire have difficulties with complex verbal behavior such as sentence structure, understanding pronouns, understanding idiosyncratic use of words, and they also have difficulties with pragmatics (Siegel, 1996). Children with autism who do have language have difficulty in prosody or what is known as melody speech (Schopler & Mesibov, 1985). Learning verbal behavior seems to be hierarchical in that complex language (i.e. conversational skills etc.) is a result of simplistic language skills. Children with autism need to be taught all the rules of language that appear to be innate to normally developing children. Autistic children also have language excesses where vocal behavior would not necessarily be termed verbal behavior. These children engage in what is known as echolalia and delayed echolalia (Siegel, 1996). Although verbalizations should be encouraged, these types of vocalizations are not functional ways of communication. To some degree these are not forms of communication because there is no reciprocal social contingencies associated with echolalia or delayed echolalia. Skinner (1957) describes the echoic repertoire being maintained by what he calls "educational" reinforcement. Children with autism have been reinforced for engaging in echoic behavior, but the persistence of such behavior is difficult to explain. This behavior is usually termed as being a form of self-stimulation, which is automatically reinforced, therefore no social mediation occurs in echoic behavior.

Echoic behavior represents a form of excess, but there are other excesses that are observed during early childhood as well. Since autistic children have not developed an interest in play and imagination they tend to engage in unusual activities. Many children with autism do not engage in appropriate play, but rather have perseverative interests, or preoccupation's with parts of objects (Siegel, 1996). These behaviors can be termed self-stimulatory especially if the behavior is automatically reinforcing. This type of information would be determined by a functional analysis. These excesses start as early as infancy and continue to persist into childhood, and adulthood.

Adulthood

Many of the behaviors observed in childhood do improve in later adulthood. The improvements are mostly visible in social and emotional problems. Wing (1972) has suggested that as children become older they become more affectionate and sociable. He claims that language deficits are also not as distinguishable in adulthood, but this varies according to the severity of the diagnosis. On the other hand, Siegel (1996) does claim that even in adulthood individuals with autism have difficulties conforming to social rules; autistic individuals do not understand why rules that are established by society are so important. She furthers by saying that since individuals with autism have difficulties understanding social norms they compensate by overgeneralizing rules for social behavior.

There is a lack of literature devoted to adulthood autism, but it is apparent that many deficits from childhood extend to adulthood such as language and social deficits, but as suggested they can be modified when the environment is changed. The excesses such as various forms of self-stimulatory behavior also continues through adulthood. Many improvements can be observed with age, but this is still very unclear. Can

behaviors improve without intervention? It will be important to see behavior change in adulthood after intervention has been implemented during childhood and maybe even infancy. There is need for more research in understanding behavior change across the life span, by constantly examining environmental influences.

In sum, behavior characteristics of autism can be viewed from a life span perspective, but age and time alone cannot explain development of such behavior. This paper attempted to explain behavior change from infancy to adulthood, but these changes were attributed to operant learning, from a contextualistic perspective. Autistic-like behaviors do not always change across the life span, but it could be the result of the following analysis: analyzing behavior changes in the controlling environment and analyzing the contextual determinants of behavioral development (Gewirtz & Peláez-Nogueras, 1996). Behavior change is not a direct result of the "empty variable", but is a result of many observable interacting variables. We cannot explain behavior by age, nor can we explain it by topography, but rather we must explain autistic behavior by environmental determinants and more importantly function.

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A Discussion of Contextual Variables and Related Terminology in Behavior Analysis

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Although Behavior Analysts have used the three-term contingency to analyze and describe behavior, they also discuss the importance of variables external to the three-term contingency. Many psychologists have addressed the important effect that external variables have on behavior (Bijou & Baer, 1961; Gewirtz, 1972; Goldiamond & Dyrund, 1968; Kantor, 1946, 1959; McPherson & Osborne, 1988; Michael, 1982, 1993; Morris, 1988, 1992; Peláez-Nogueras, 1994, 1996; Schlinger & Blakely, 1987; Skinner, 1931; Wahler & Fox, 1981). This reference list is by no means exhaustive indicating a great deal of attention to the concept of external variables. The underlying concept that each of these authors addresses is similar in nature. Similar enough to comprise a field of literature relevant to a central topic. However, minor differences emphasized by different psychologists have produced a plethora of terms. Undoubtedly, each author used terminology most appropriate to his or her argument and discussion, but the result over time has been unclarity about proper usage and necessity for the numerous terms. Throughout this paper, the term contextual variables will be used when referring to this class of terms. The intended meaning is simply, the encompassing external and internal variables that effect the relationship between a stimulus and a response.

Behavior analysts are not known for their clear communication and education with those outside the field. This may even extend to the education of students within the field. It has been argued that the slow acceptance of behavior analytic principles, as compared to the theories of other fields, may partly be due to this poor grasp of public relations (Maurice, 1997). When arguing about terminology, the ultimate goal of the psychologist must be considered. A distinction must be made between what is needed for the development of basic science and theory, and what is needed for effective application of the results of advancing theory and science. When we only examine the usage of terminology for our own scientific purposes, changes are unnecessary since anyone who is familiar enough with the field to be interested in what is going on, already knows the terminology. This is incredibly ineffective, however, when transferring to applied work or education.

When examined from this view, some consensus and clarification of terminology used for discussing external variables is helpful and necessary. This argument is bound to be met with opposition, since dropping a term already utilized by some would be objectionable. No suggestion will be made to discontinue the use of any term. Variety in terminology allows for the sometimes necessary scrutiny within the field. The terms that will be discussed all contain subtle differences, which no doubt, prompted the designation of a unique term in the first place. The intention is not to argue that these differences do not exist, or that they are not important. Rather, the intention is to outline some examples of how varied the terminology has actually become and suggest some consensus for the sake of parsimony.

Contextualism as a Frame of Reference

Peláez-Nogueras (1994) addresses the meta-models of mechanism and contextualism (Pepper, 1942) and suggests that behavior analysis has often been associated with the mechanistic models of explanation (see also, Reese & Overton, 1970; Overton & Reese, 1973). This may be due to the traditional behavior analytic focus on the environment for determining behavior and to the belief among some behavior analysts that mechanism is a sufficient model from which to explain behavior (e.g., Marr, 1992). The more recent trend in behavior analysis, however, has been toward contextualism (e.g., Peláez-Nogueras, 1994). In fact, contextualism has been suggested as the world view of behavior analysis (Morris, 1988; Hayes & Reese, 1988).

Although contextualism as a world view has vast implications spanning many fields and approaches, it is helpful as a frame of reference for viewing the complexities surrounding behavioral variables. Peláez-Nogueras (1994) points out, a theory based on contextualism would encompass a holistic view in which responses and stimuli have no psychological meaning apart form the interdependent relation

between their function and context (p. 11). Moreover, using contextualism as a reference suggests that the meaning of behavior emerges from its context (Morris, 1988). Morris and many other behavioral psychologists agree that a better understanding of the determinants of stimulus potency is needed (Bijou, 1996; Gewirtz, 1972; Peláez-Nogueras & Gewirtz, 1997; Wahler & Fox, 1981). To examine context more completely, Morris (1988, 1992) suggests that it be addressed as a conceptual category and as a subject matter of analysis, rather than as a source of variation to be held constant, as has been typical within behavior analysis.

The Conceptualization of Context in Behavior Analysis

Over the years, concerns about the function of context were evident in Skinner's (1931) "third variables, " Kantor's (1946, 1959) "setting factors," and Keller and Schoenfeld's (1950) "establishing operations". For a more complete list of terminology, please refer to Table I, which lists thirteen different terms across twenty different psychologists. The relationships to which these terms refer are not identical. For example, some of them refer to the effects of context on the eliciting function of stimuli, some to the effects on the discriminative function, and others to the effects on the reinforcing function. The commonality among all these terms is their reference to variables outside of the three-term contingency which have a great effect on the relationship between stimuli and responses. This common thread is what calls into question the need for such diversity among terms. Regardless of the actual term used, all of these authors in some way reference environmental factors and their effect upon behavior. Interpret "environment" broadly in this context as is can refer to events occurring both outside and within the individual. Some license to collapse terminology, with the understanding that the basic concept is being preserved, would be useful.

A Summary of Select Terms

Some of the terms listed in Table I are more common than others. Additional information on some of the more historical or well known terms may aid in giving the reader more structure. The following summaries by no means encompass the breath of theory proposed by Skinner, Kantor, Michael, and others included. They are intended rather to give support to the definition listed and explain in some part, how the term came to be established. Once again, a commonality is evident in the weight psychologists give to the study of contextual variables.

Skinner (1931) stated, "the question of third variables is of extreme importance in the description of the behavior of intact organisms" (p .455). Skinner (1931) originally used the term "third variables" to describe secondary laws which change the primary relationship between stimuli and responses. Skinner referred to biological variables but also included drive and emotion in his concept of "third variables" (for a full discussion of Skinner's "third variables," see Morris, 1996).

Kantor (1946), uses the term "setting factors," to refer to the immediate circumstances defining "which particular stimulus function-response function operates at that moment" (p. 261). Kantor (1959) further illustrated the different interactions of stimuli and responses by outlining four categories which include: (a) "different objects with the same stimulus function," (b) "the same objects with different stimulus functions," (c) "different acts which carry the same response function," and (d)"the same actions which carry different response function," a and d are examples of how history can change the function of stimuli and responses. By including history as a factor in the relationship between stimulus and response, Kantor expanded the concept of contextual variables in a significant aspect.

Since then, more contemporary researchers have expanded on the importance of historical context as a determinant. For instance, Morris's(1992) "unpacking" of the three-term contingency relates a taxonomy of current and historical contextual variables to the relationship between stimuli and response.

Gewirtz (1972) emphasized "contextual determinants" on stimulus functioning. The range of contextual variables discussed by Gewirtz is very broad; however, several distinct factors are identified that could potentially affect stimulus functions. First, the "attributes of the

source" of reinforcement, including gender, age, status, and other variables, affect the strength of the reinforcing stimuli. Second, the "ecology" denotes the gross conditions of an environment that determines which events and behaviors can occur in a particular situation.

Bijou (1996) classifies some of the same type of factors into different categories, the group of which he calls, "setting factors". The first category includes the operations or events concerning physiological states and includes the same conditions that Skinner referred to as third variables (organic needs like food, sleep, air), which can be affected by deprivation and satiation. Physical circumstances comprise the second category. This refers to the influence of background on a figure in reference to the senses (visual, auditory, olfactory, tactile, gustatory), and to the environmental conditions, such as temperature, that effect the entire interaction. The final category refers to sociocultural conditions, such as cultural institutions, the presence and actions of a person or group, and verbal stimuli in the form of spoken or written rules.

The broad categories illustrated by Bijou (1996), appear to offer a clear, complete framework for the study of contextual variables. Theses categories lend themselves well to the consideration of function, an important inclusion when analyzing a stimulus-response relationship. The above authors, joined by Morris (1988) and Peláez-Nogueras(1994), agree that however variables are classified, seldom does any class alone affect a stimulus-response relation. These variables work in conjunction and cannot be separated, other than for analytic purposes. Whereas multiple contextual variables are always present in a naturalistic setting, the division and classification of variables can be useful when studying possible interactions (Peláez-Nogueras, 1996).

Michael's concept of "establishing operations" differs significantly from that of other behavior analysts. This is most apparent in the terminology he uses. Keller and Schoenfeld (1950) were the first to use the term, "establishing operation," (EO) to describe a "motivational variable". Michael (1982) elaborated on the term by defining an "establishing operation" as an environmental event, operation, or stimulus condition that affects a behavior by momentarily altering the (a) reinforcing effectiveness of other events and (b) the frequency of occurrence of that part of the organism's repertoire relevant to those consequences. Michael makes a finer distinction with the subcategories of conditioned establishing operations and unconditioned establishing operations. Although Michael's model gave rise to a good deal of criticism (Catania, 1993; Hesse, 1993; McDevitt, 1993), the concepts presented are consistent with earlier models. The goal is still to categories factors for ease in analysis and discussion. Michael actually promotes the analysis of such events as is seen by the wide use his terminology in applied literature and settings.

Peláez-Nogueras (1994) proposes "contextual interactants" to encompass "fundamental classes of variables that interact with the behavior of the organism and with the operative contingencies", (1994, p. 9). (The term "interactants" is borrowed from Oyama, 1985). Contextual interactants can produce relatively stable changes as a result of their reciprocal interaction with the environmental contingencies affecting the organism.

Finally, Morris (1988) uses "contextual conditions" to denote emphasis on phylogenic, ontogenic, and current contexts. Although the term itself does not denote a significant difference, the definition does in that it recognizes biological background as an inseparable variable effecting the function and potency of stimuli.

Conclusion

All of the terms outlined above have a very significant common denominator; the classifications made aid in the study of how context influences behavior. However, one would have difficulty in making a broad statement that would address the concept of contextual determinants without having failed to address many terms and parts of definitions that were not included. The first sentence in this paragraph is an example of an unsuccessful attempt, as it did not address many of the components discussed by the authors above. The lack in ability to address the topic simply can become detrimental when the development of a technique or learning material is hindered rather than facilitated by a vast amount of terminology.

The level of analysis ultimately determines what terminology an experimenter may use. A broad level of analysis will call for a less precise term that a fine grained analysis. Although an advancing science benefits from precise and accurate terminology, researchers may have been zealots in the past with the development of terminology that was so specific, that it applied to only their work at the time. Some of the above definitions seem to apply this kind of focus. As Behavior Analysis continues to develop as a field of psychology, those who engage in teaching, consulting, applied work, and even those who primarily conduct research, would benefit from an examination of the vast amount of terminology in the field. One particular area has been outlined in the above paragraphs, however, this is by no means a problem limited to this topic. All scientists in all fields must share the results of their endeavors with those in other fields and those in need of their service. The suggestion is made here to be conservative with terminology. As stated earlier, the unique distinctions made by the terms outlines are not unimportant and should not be eliminated completely. Extending the understanding of contextual variables in Behavior Analysis will enable the further advance of knowledge of stimulus-response function, and ultimately, human behavior. Some conservation in terminology at the general level is an important facilitative step in recognizing the full potential of research in the field and full application of behavior analysis outside the field.

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Table 1
Brief history of terms:

Name/Year	Term	Definition
Skinner (1931)	third variables	drive and motivation, also physiological states
Keller & Schoenfeld (1950)	establishing operations	a motivational variable that could effect behavioral emissions
Skinner (1957)	motivational operations	conditions effecting stimuli and the whole interaction
Kantor (1959)	setting factors	circumstances that operate as inhibiting or facilitating conditions in a behavior unit
Bijou & Baer (1961, 1978)	setting events	the selective mechanism for as response in development
Brady (1968)	potentiating operations	conditions that determine the potency of the consequences that functionally define the behavioral process
Goldiamond & Dyrund (1968)	potentiating variables	procedures which potentate the consequence or make the reinforcing event effective
Michael (1982)	establishing operations	any change in the environment which alters the effectiveness of some object or event as reinforcement
Michael (1993)	establishing operations	elaborated previous definition by including unconditional and conditional establishing operations
Sidman (1986)	conditioned stimulus control	a general influencing condition in stimulus equivalence
Schlinger & Blakely (1987)	functional altering contingent-specifying stimuli	a prevailing influencing condition for rule-governed behavior
Gewirtz (1972)	contextual conditions	differing potencies of stimuli
Morris (1988)	contextual conditions	phylogenic and ontogenic context - refers to current and historical context
Peláez-Nogueras & Gewirtz (1997)	contextual interactants	contextual determinants refers to all developmentally relevant factors

Skinner's Behaviorism and the Nature-Nurture Dichotomy

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Nature and nurture are commonly regarded as fundamental determinants of behavior, with nature referring to heredity or evolution, and nurture to the environment or learning. Although nature and nurture are cast in terms of a dichotomy, we typically acknowledge both and recognize "that neither operates to the exclusion of the other" (Catania, 1998, p. 371). That is, we properly conceptualize the nature-nurture dichotomy as a continuum (e.g., Catania, 1998, p. 371; Fantino & Logan, 1979, pp. 475-476).

Critics of behavior analysis, however, have characterized it as falling exclusively to the nurture or environmental side of the dichotomy (e.g., Gould & Marler, 1987a, 1987b). Such characterizations are fundamentally flawed (Skinner, 1974, pp. 4, 243-244; Todd, 1987; Todd & Morris, 1992), for behavior analysis actually falls "on the middle ground" (Skinner, 1977, p. 1007), acknowledging both nature and nurture as determinants of behavior. We seek to clarify Skinner's position on nature and nurture.

In exploring Skinner on the nature-nurture dichotomy, we first discuss his ultimate explanations for innate and acquired behavior: phylogenic and ontogenic contingencies. Second, we explore the ways in which he distinguished between these two sets of contingencies, that is, in terms of temporal relations, consequences, and what is selected. Third, we consider the concepts he invoked when explaining the control of innate and acquired behavior by phylogenic and ontogenic contingencies: temporal gaps, changed organisms, and causal chains. Throughout, we use the term "innate" broadly, referring to everything that, from Skinner's perspective, is considered inborn, for instance, respondent and operant conditionability, unconditioned eliciting stimuli and elicited responses, releasers and released behavior, and primary positive and negative reinforcers (see, e.g., Michael, 1985, pp. 101-102; Skinner, 1969, pp. 201-202).

Explaining Innate and Acquired Behavior

As already pointed out, Skinner acknowledged both innate and acquired behavior (e.g., Skinner, 1966, 1975a, 1981, 1984; see Michael, 1985). What he rejected were their explanations cast in terms of a hypothetical "inner causal agent" (Skinner, 1953, p. 116; see Skinner, 1953, pp. 27-31), in particular, instincts and habits. About these, Skinner (1966) commented:

> Until we have identified the variables of which an event is a function, we tend to invent causes. Learned behavior was once commonly attributed to "habit,".... "Instinct," as a hypothetical cause of phylogenic [i.e., innate] behavior, has had a longer life. We no longer say that our rat possesses a marble-dropping habit, but we are still likely to say that our spider has a web-spinning instinct. (p. 1208)

Instead of instincts and habits, Skinner accounted for innate and acquired behavior by appealing to contingencies of selection (see Skinner, 1981). In his words:

> I do not believe in a strict dichotomy between "ontogenic behavior" and "phylogenic behavior," if by behavior one means a stored habit or an instinct, but I think it is quite easy to distinguish between ontogenic phylogenic contingencies of selection, and that was one of the points of "Phylogeny" [i.e., "The Phylogeny and Ontogeny of Behavior," 1966]. (Skinner, in Catania & Harnad, 1988, p. 420)

Phylogenic contingencies or "contingencies of survival" refer to natural selection and explain how organismic characteristics such as innate behavior are selected, which are then transmitted to subsequent members of a species (Skinner, 1966, 1974). Similarly, ontogenic contingencies or "contingencies of reinforcement" refer to selection in the behavioral domain and explain how acquired behavior becomes part of a repertoire during an organism's individual behavioral history (Skinner, 1966, 1974). Phylogenic and ontogenic contingencies, then, not instincts and habits, are the variables of which innate and acquired behavior are respectively and ultimately a function.

Phylogenic and Ontogenic Contingencies

With innate and acquired behavior accounted for in terms of phylogenic and ontogenic contingencies, we turn to the defining characteristics of these contingencies to clarify further Skinner's version of the nature-nurture dichotomy. Skinner distinguished between these contingencies in at least three ways: (a) their temporal relation to behavior, (b) their consequences, and (c) what they select.

Temporal Relations

First, according to Skinner (1966), "the contingencies responsible for unlearned behavior acted a very long time ago" in the evolutionary history of a species (p. 1208), whereas ontogenic contingencies operate during the lifespan of individual organisms and are responsible for acquired behavior. Thus, whereas phylogenic contingencies are relatively remote from future instantiations of the selected innate behavior, ontogenic contingencies are relatively near and determine the selected acquired behavior.

Consequences

The second way in which phylogenic and ontogenic contingencies are distinguished lies in their consequences. As Skinner (1966) said of phylogenic contingencies:

> A given response is in a sense strengthened by consequences which have to do with the survival of the individual and species. A given form of behavior leads not to reinforcement [as in operant ontogenic contingencies] but to procreation. (p. 1206)

In other words, survival and the production of offspring are the functional consequences of innate behavior, which is therefore more likely to occur in future members of a species. In contrast, reinforcement is the functional consequence of acquired (i.e., operant) behavior, which is therefore more likely to occur during the remaining lifespan of an individual (Glenn & Madden, 1995; Skinner, in Catania & Harnad, 1988, p. 76; Smith, 1986).

Selection

The third way in which phylogenic and ontogenic contingencies are distinguished lies in what they select. As Skinner argued:

> [Phylogenic] contingencies select variations in genes which contribute to the "innate" behavior of a species,[ontogenic]... contingencies contribute to the selection of variations which compose "learned" behavior. (Skinner, in Catania & Harnad, 1988, p. 405)

Here, Skinner seems to have distinguished between two domains-- behavioral and biological. In the behavioral domain, phylogenic and ontogenic contingencies differ in what they select--innate and acquired behavior, respectively. In the biological domain, phylogenic contingencies also select genes, whereas what ontogenic contingencies select or how they operate on the organism was left unspecified by Skinner, at least in the passage above. Nonetheless, we tentatively conclude (and later, try to argue) that, for Skinner, ontogenic contingencies operate on the organism biologically, for example, neurologically (e.g., Skinner, in Catania & Harnad, 1988, p. 422). Discussing the role of the biological organism in the analysis of behavior may further clarify Skinner's version of the nature-nurture dichotomy, to which we now turn.

Temporal Gaps, Changed Organisms, and Causal Chains

To understand the processes involved in the selection of innate and acquired behavior, we turn to three other concepts in Skinner's system: temporal gaps, changed organisms, and causal chains.

Temporal Gaps

Both innate and acquired behavior occur after the contingencies that selected them are no longer present. Skinner referred to the intervals between past contingencies (phylogenic and ontogenic) and present or future behavior (innate and acquired) as "temporal gaps" (e.g.,

Skinner, 1953, p. 54; 1974, p. 236; 1975b, p. 43; see Skinner, 1978, p. 49; 1989, p. 18). For Skinner, these gaps presented a problem: How can we account for the control of current or future behavior by past contingencies? Skinner's solution: Something bridges the temporal gap, in particular, a changed organism (e.g., Skinner, 1971, pp. 195-196; 1974, p. 237; Skinner, in Catania & Harnad, 1988, pp. 409, 422).

Changed Organisms

In general, the changed organism that Skinner emphasized refers to a behaviorally changed organism, that is, to change in an organism's response repertoire and the variables of which it is a function. In the context of phylogenic and ontogenic contingencies, though, change also involves biological change (see Delprato & Midgley, 1992; Hayes, 1992; Lee, 1988, pp. 162-163; Parrott, 1983; cf. Branch, 1977; Glenn & Madden, 1995). For instance, in replying to a critic, Skinner noted that:

> Eibl-Eibesfeldt raises a question about the product [of phylogenic and ontogenic contingencies]. Both kinds of contingencies change the organism--"the wiring of the neuronal networks." Phylogenic contingencies do so in a way involving the genome, ontogenic contingencies in a different way, individual organism. (Skinner, in Catania & Harnad, 1988, p. 422)

In other words, Skinner identified the changed organism as the link bridging the temporal gap between historic contingencies-- either phylogenic or ontogenic--and current or future behavior. In general, the sequence from (a) contingencies to (b) biological organism to (c) behavior constitutes a three-link "causal chain" (cf. Skinner, 1953, pp. 34-35).

Causal Chains

The preceding discussion suggests that Skinner saw the concept of the "causal chain" (e.g., Skinner, 1953, pp. 34-35, 160, 279; 1956, p. 92; 1974, p. 231) as useful in explaining both innate and acquired behavior (see Skinner, 1974, pp. 236-237; 1975b, pp. 42-43; 1978, p. 49). We describe these chains in what follows, beginning with their initial links--phylogenic and ontogenic contingencies, respectively.

Phylogenic contingencies

Remote phylogenic contingencies are linked to current or future innate behavior by causal chains. The chains consist of a sequence of events occurring over a species' evolutionary history: Organisms are exposed to phylogenic contingencies; phylogenic contingencies select innate behavior and genes; genes are replicated, leading to the development of biological organisms that, as current members of a species, are biologically different from other, past members; and the current biological organisms are more likely than their predecessors to engage in certain innate behaviors under particular conditions. The replicated genes and the biological organisms are the middle links in a causal chain. That is, replicated genes and the biological organisms to which they give rise (i.e., the organisms' biological structures and functions) bridge the temporal gap between (a) phylogenic contingencies, which operate in the evolutionary history of the species, and (b) the current and future innate behavioral repertoire of the members of the species.

Ontogenic contingencies

Likewise, ontogenic contingencies are linked to current or future acquired behavior by causal chains. These chains, however, consist of a sequence of events occurring within an individual's behavioral history: An organism is exposed to ontogenic contingencies, ontogenic contingencies select acquired behavior and change the organism biologically (e.g., neurologically), and the biologically changed organism is therefore more likely than its earlier self to engage in certain acquired behaviors under particular conditions. The changed organism is the middle link in a causal chain. That is, the biological organism bridges the temporal gap between (a) ontogenic contingencies, which operate in the behavioral history of the individual, and (b) the current or future acquired behavioral repertoire of the individual.

Conclusion

Behavior analysis has long been characterized as falling exclusively on the nurture side of the nature-nurture dichotomy. To be sure, Skinner was critical of "genetic explanations" for what are more likely instances of acquired behavior (e.g., Skinner, 1974, p. 49) and, while he acknowledged biological factors in the analysis of behavior, he conducted almost no empirical research on them (but see, e.g., Skinner & Heron, 1937). Skinner, however, recognized both nature and nurture as determinants of behavior. Phylogenic and ontogenic contingencies are his version of the nature-nurture dichotomy (cf. Catania, 1998, p. 371).

In presenting Skinner's position, we are not unaware of the criticism and debate that the nature-nurture dichotomy has evoked. Our purpose, however, has been other than evaluative. Nonetheless, if behavior analysis decides to reconsider the nature-nurture dichotomy, it might turn to alternative conceptualizations that are in keeping with a natural science perspective. One alternative is the developmental systems perspective, wherein "nature and nurture are not alternative causes but product and process," respectively (Oyama, 1985, p. 131; see Midgley & Morris, 1992).

Authors' Note

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