EXPERIMENTAL ANALYSIS OF HUMAN BEHAVIOR BULLETIN

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STUDENT PAPER COMPETITION

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THE EXPERIMENTAL ANALYSIS OF HUMAN BEHAVIOR BULLETIN

The *EAHB Bulletin* is published twice yearly, in the Spring and Fall, by the Experimental Analysis of Human Behavior Special Interest Group (EAHB SIG), a group organized under the auspices of the Association for Behavior Analysis (ABA). Articles in the *Bulletin* represent the views of the authors. They are not intended to represent the approved policies of the SIG or ABA, or the opinions of the membership of the SIG or ABA. The inside back cover has information about joining the SIG. Publication costs are paid by the dues of the SIG members and by the Parsons Research Center of the University of Kansas.

We would like to thank Donna Dutcher and Mark Johnston for help with this issue.

Guidelines for Submissions

Please send three copies of brief reports and one copy of other materials. In addition, send one clearly labeled reproduction quality copy of each figure or table. For general information on preparing materials for publication in the *Bulletin*, we encourage authors to consult the author guidelines in the January issue of the *Journal of the Experimental Analysis of Behavior*. If possible, send text and figures of final versions on disk.

Brief Reports and *Technical Information* should be no longer than 2,000 words. They can be written in APA style (without an abstract) or in summary form. Please prepare figures and tables to fit the column or page width of the *Bulletin*. Incorporate information typically included in figure captions in the text.

Research in Progress may be up to 1,000 words long.

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Please submit brief reports, technical information, and laboratory descriptions to Tom Critchfield (Department of Psychology, Auburn University, Auburn, AL 36849-5214); submit research in progress, abstracts, and news to Dean Williams (Parsons Research Center, P.O. Box 738, Parsons, KS 67357).

Submit brief reports and technical information by February 15 and all other materials by March 15 for the Spring 1996 issue.

1995 OUTSTANDING GRADUATE STUDENT PAPER AWARDS

The EAHB-SIG congratulates the recipients of Outstanding Paper Awards in its 12th Annual Student Paper Competition. The competition solicited student submissions addressing any topic relevant to the experimental analysis of human behavior. Established members of the SIG and selected guest experts served as peer reviewers on the manuscripts. On the basis of reviewer recommendations, this year's winners, and the titles of their papers are:

Scott Lane, Auburn University, Equivalence Class Formation and Complex Stimuli: Emergent Arbitrary Match to Sample via Identity Matching to Complex Samples. (Thomas S. Critchfield, sponsor)

Julie McEntee, University of Kansas, Parsons Research Center, Response Allocation to Stereotypy: Systematic Replication of Green and Striefel (1988) with Students with Mental Retardation. (Richard R. Saunders, sponsor)

Andrea Peuster, University of North Texas, The Effects of a Point Loss Contingency on Equivalence. (Sigrid S. Glenn, sponsor)

The winners will be honored at an awards symposium at the 1996 ABA Convention in San Francisco where they have been invited to present a summary of their work. Watch the Spring edition of the Bulletin for summaries of the winning papers. For information about the 1996-1997 competition (submission deadline: September 19, 1996), write: Dr. Barbara J. Kaminski, 1024 Charles Ave., Morgantown, WV 26505, Telephone: 304-291-3682.

Thanks to all members of the SIG who reviewed papers. Special thanks to Barbara Kaminski, the competition coordinator, and the reviewers for this year's competition:

Charles Cantania
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Call for Nominations for Board of Student Editors

Because graduate students are an important part of the *Bulletin's* audience, and because an important part of the *Bulletin's* mission is to nurture graduate students, it is now *Bulletin* policy to include a graduate student referee in the peer review process for most submissions. Nominations for members of a Board of Student Editors are being sought until February 15, 1996. Desired qualifications include interest and experience in the experimental analysis of human behavior and good writing skills at both the conceptual and mechanical levels. The term of a student editor will end upon graduation or upon completion of additional training (e.g., postdoctoral fellowship). Send nominations, including the students' curriculum vitae, to Tom Critchfield, Department of Psychology, Auburn University, Auburn, AL 36849. A list of board members will appear in the Bulletin beginning with the Spring, 1996, issue.

BRIEF REPORTS FOCUS ON CLASSICAL CONDITIONING

TECHNICAL INFORMATION: THE ESTABLISHMENT AND ELECTRODERMAL ASSESSMENT OF CONDITIONED SEXUAL RESPONSES

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Recent research has suggested that respondent eliciting functions may be transferred through derived relations. For example, Dougher, Augustson, Markham, Greenway, and Wulfert (1994) trained subjects on a series of related conditional discrimination tasks that led to the emergence of 2-4 member equivalence relations (A1-B1-C1-D1 and A2-B2-C2-D2). A mild electric shock applied to the subjects' forearms then served as an unconditioned stimulus (US) that followed presentations of B1 (i.e., respondent conditioning). B2 was also presented but in the absence of the US. Conditioned emotional responses (CERs) to B1 and B2 were measured as skin conductance responses (SCRs). Subjects were then presented with each of the remaining members of either equivalence relation to test for a transfer of respondent functions. Five of the 8 subjects produced evidence of respondent conditioning and transfer of respondent functions.

A recent article by Augustson, Markham, and Dougher (1994) reviewed some of the methodological issues that arise when mild electric shocks are used to establish CERs in human subjects during transfer of function studies. The present article responds to some of the issues raised by Augustson et al. and also addresses a series of additional methodological and technical problems that arise during the respondent conditioning and electrodermal measurement of responses elicited by sexual stimuli.

In our laboratory, subjects are seated comfortably before a microcomputer on which a series of related conditional discrimination tasks are presented. Training on these tasks often leads to the emergence of the following equivalence relations: A1-B1-C1, A2-B2-C2, and A3-B3-C3 (where all stimuli are nonsense syllables). Using a respondent conditioning procedure, sexual and nonsexual functions are then established for the C1 and C3 stimuli, respectively (C1 and C3 are presented to subjects in a quasi-random order). A short sexually explicit film taken from a popular sex instruction video follows C1 on 80% of trials whereas a short nonsexual film depicting scenic landscapes follows C3, again on 80% of trials. This 80+/20- reinforcement schedule was employed in order to enhance resistance to extinction, thereby allowing for the repeated presentation of test trials on which no US is presented. A 45-60 s interval separates the conditioning trials.

We probe for respondent conditioning by measuring skin resistance responses (SRRs) during the CS-US intervals on the 12 final conditioning trials. For this reason, we have extended the CS-US interval to 5 s. The extended interval has not been found to affect response acquisition adversely (Lockhart & Grings, 1964) and affords the advantage of facilitating non-disruptive measurement of responses (i.e., SRRs can be measured at any stage during training). Following approximately 18 conditioning trials, our subjects generally show differential conditioning (i.e., C1 produces significantly greater SRRs than C3). Subsequently, these differential respondent conditioning functions transfer through equivalence relations to the A1 and A3 stimuli, respectively. That is, most subjects showing greater SRRs to C1 over C3 have shown a transfer of this response differential to the A1 and A3 stimuli.

THE PROBLEM OF RESPONSE QUANTIFICATION

We use skin resistance responses (SRRs) as opposed to skin conductance responses (SCRs) to measure classical conditioning and transfer of functions (the latter is simply the reciprocal of the former, but see subsequent commentaries). As phasic SRRs correlate highly with tonic measures of skin resistance (up to 0.998; see Lykken & Venables, 1971),

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Detailed information regarding the video material we have produced may be obtained by writing to either author at the Department of Applied Psychology, University College Cork, Ireland.

We hope that this information is helpful to other researchers and we would welcome any remarks or comments on the issues we have raised.

we do not record tonic levels of skin resistance as an additional measure of response strength. Responses are recorded on a Grass® polygraph (model 7PI) and are measured in Ohms. Electrodes are prepared with a dilute NaCl solution (Lykken & Venables, 1971) and placed on the volar surfaces of the distal phalanges of the index and middle finger (Dawson, Schell, & Filion, 1990).

Although the procedure for recording electrodermal responses is relatively standardized, there is little agreement in the psychophysiological literature regarding the correct method for the quantification of these responses. One dimension of electrodermal activity that appears to be particularly ambiguous is the baseline level of arousal from which deviations in skin resistance/conductance are measured. Buresova and Bures (1976), for example, advised that baselines be calculated by averaging all of the nonspecific SRRs over the 30-m period prior to response measurement. In contrast, Grossman (1967) recommended the use of a 2 to 5 s measurement period. Which of these definitions is adopted will depend on the specific goals of research (e.g., the former baseline measure may be suitable for the assessment of diurnal changes in electrodermal activity, whereas the latter may be more appropriate for the assessment of transitory fluctuations). In effect, definitions of baseline arousal appear to be formulated on the basis of immediate scientific goals rather than universal convention.

As a solution to the problem of baseline calculation, Dawson et al. (1990) noted that many researchers use the skin resistance/conductance level at the time of response onset, as a "floating" baseline measure. However, this baseline criterion is no less ambiguous than those offered above, in that a standard definition of *response onset* also appears to be absent from the psychophysiological literature. As skin resistance levels are constantly changing, a visual inspection of response onset (e.g., from a graph) will inevitably suffer from subjective bias.

To circumvent confusion, we have chosen the level of skin resistance at the time of *stimulus presentation*, as our baseline. In effect, we measure each SRR with respect to a floating baseline that is determined over zero time (i.e., at the point of stimulus presentation). Although spontaneous changes in electrodermal activity may enhance or depress particular measures of electrodermal change, the accumulative total of such effects should approach zero when calculated across an entire experimental session.

Further difficulties have arisen in determining the duration over which an electrodermal response should be measured. Perhaps a standard measurement period has not evolved because electrodermal responses have varying "rise times," depending on the nature of the stimulus (Davis, 1930). After extensive pilot testing, however, we have settled on a 5-s measurement period. Skin resistance response-peaks within this period appear to be contingent upon the delivery of both our CS+ *and* our CS-. Furthermore, this measure is in agreement with research showing that phasic skin responses generally begin within 3 s (Levinson, Edelberg, & Bridger, 1984) and peak within 5 s (Dawson et al., 1990; Levis & Smith, 1987) of the onset of a discrete stimulus.

Finally, during the course of our research we have questioned the behavioral significance of response magnitude (both positive and negative responses) as a measure of autonomic arousal. Specifically, we do not agree that negative values, obtained from negative electrodermal responses (i.e., indicating relaxation), should be included in statistical analyses of response strength. Thus, in our research, negative responses are read as zero responses. This procedure has internal validity insofar as our research compares responses to various stimuli within individual subjects.

We now define an SRR as: *The maximum absolute decrease in (ohmic) skin resistance from the skin resistance level, taken at the time of stimulus onset, recorded within 5 s of stimulus onset.* For statistical purposes, we transform this measure according to the function: Log (SRR + 1) (Venables & Christie, 1980). This transformation reduces the large standard deviation commonly observed within sequences of electrodermal responses, thereby facilitating statistical analyses of multiple response measures. In addition, this formula allows for the inclusion of zero data, as the log of zero is undefined.

ALTERNATIVE FORMS OF STIMULUS CONTROL

Augustson et al. (1994) noted that when mild electric shocks were used to establish conditioned emotional responses, the functions of the CS+ sometimes transferred to the CS- when the CS+ was presented in the absence of a US (e.g., on a probe trial or during a partial reinforcement schedule). These researchers suggested that the delivery of explicit verbal instructions to subjects may serve to reduce this "reversal effect." Some researchers, however, may not wish to confound the nonverbal control of emotional responses with verbal instructions, particularly where stimulus control has been derived

through arbitrary stimulus relations (Green, Sigurdardottir, & Saunders, 1991).

Another solution to the reversal effect problem is to eliminate partial reinforcement or disruptive probe trials during training so that a US follows every CS presentation. If this route is taken, however, conditioned responses will be less resistant to extinction and thus repeated testing for classical conditioning and a transfer of functions (with no US) will not be possible.

We appear to have avoided the reversal effect in our research by explicitly establishing functions in both the CS+ *and* the CS- (i.e., sexual and nonsexual, respectively). In contrast, Augustson et al. (1994) did not explicitly establish a function in their CS- and consequently it may have acquired one via fortuitous stimulus sequence. In effect, researchers employing electric shock as a US might avoid the reversal effect by attaching strong and mild response functions to the CS+ and CS-, respectively. Of course, this procedure may reduce the functional distinction between the CS+ and the CS- and thus additional training trials may be required to produce robust responses.

UNCONVENTIONAL STIMULI

Peculiar methodological issues arise when visual sexual stimuli are used as CSs. First, the intensity of a sexual stimulus evades uniform manipulation (i.e., the potency of a sexual stimulus depends on the unique personal history of each subject). The intensity of an electric shock, in contrast, can be more readily enhanced simply by increasing amperage.

Second, it is customary to extend the sexual US to 21.6 s or more to facilitate a full sexual response (Bancroft, 1974). This procedure departs from traditional conditioning procedures and we have noticed that it also diminishes the salience of CS-US contiguity (i.e., subjects are more likely to ignore the CS and simply wait for the US). For example, even after 12 conditioning trials, some of our subjects have not been able to verbalize the CS-US relation. To increase the salience of the CS-US contiguity, we now also use a simultaneous conditioning procedure in which the CS is flashed periodically in the top right corner of the screen, during the presentation of the US. In effect, the conditioning procedure employed in our research consists of a combination of trace and simultaneous respondent conditioning. This procedure, at least in the context of the current research, produces more robust responses with fewer conditioning trials and utilizes a combination of two standard respondent conditioning procedures (see Chance, 1988, p. 52).

Finally, although skin response magnitude decreases rapidly with successive exposures to stimuli of constant potency (Davis, 1930), this problem appears to be exacerbated with sexual stimuli. We have had to remove several subjects from our research program because of rapid habituation and unresponsiveness to the US. Thus, researchers attempting to establish conditioned sexual responses should employ stimuli that produce large electrodermal changes across subjects.

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COMMENTS ON ELECTRODERMAL ASSESSMENT AS A MEASURE OF CLASSICAL CONDITIONING IN HUMANS

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Research on classical conditioning is important to our understanding of complex human behavior, especially in light of the demonstration that classical conditioning effects can spontaneously transfer among members of equivalence classes (Dougher, Augustson, Markham, Greenway, & Wulfert, 1994). Roche and Barnes (1995), in describing techniques for using skin resistance (SR) as a measure of conditioning to sexual stimuli in a classical conditioning paradigm, make an important contribution. They describe some of the technical problems that arise when classical conditioning in humans is measured via electrodermal activity, and propose some creative solutions.

Nevertheless, it is possible to underestimate the complexity of human classical conditioning research. A variety of factors complicate classical conditioning with humans in laboratory settings (Augustson, Markham, & Dougher, 1994), and extensive research has not produced standardized procedures for using electrodermal activity (EDA) as a measure of conditioning (Dawson, Schell, & Filion, 1990; Lykken & Venables, 1971; Peek, 1987; Venables & Christie, 1980). This note identifies several issues worth considering in the design of research incorporating EDA.

One issue concerns the choice between skin resistance and skin conductance (SC) as a measure of EDA. Although SR is the reciprocal of SC, some potentially important differences do exist between the measures (Lykken & Venables, 1971; Peek, 1987; Venables & Christie, 1980). SC is used more often because it produces a linear relationship between conductance increases and the number of active sweat glands. SR decreases in a nonlinear fashion as the number of active sweat glands increases. SC therefore is preferred for scaling and quantification of responses in many settings (Peek, 1987). Additionally, SC may allow for more straightforward interpretation of the data and provide a clearer basis for distinguishing among responses in contexts that involve high EDA levels.

Another issue concerns the distinction between tonic and phasic (i.e., response) measures. Roche and Barnes (1995) argue convincingly for the use of a floating baseline with phasic measures, but their assumption that EDA rises and falls randomly between conditioning trials may be optimistic, especially in paradigms designed to condition anxiety. Floating baselines also may reduce the ability to differentiate between responses to CS+ and those to CS-. As preresponse baseline levels rise, a ceiling effect can occur if subjects are not given sufficient time during the intertrial interval for EDA to restabilize. Measures of nonaroused baseline levels permit the estimation of appropriate stable states, which in turn can guide the selection of inter-trial intervals and aid in data interpretation. Moreover, a floating baseline for phasic measures is more clearly justified with SC than with SR, because SC responses are more easily compared across the range of measurement.

One of the most troublesome issues in classical conditioning with humans is the ability of subjects to engage in verbal behavior regarding what is happening in the experiment (Augustson et al., 1994). This can lead to a variety of difficulties including superstitious behavior, unexpected forms of stimulus control, and "reversal effects." Reversal effects sometimes occur during sequences of probe trials in which a stimulus is presented in the absence of the US

to assess conditioned responding. In some subjects, the presentation of a CS-, following the initial presentation of the CS+ in the absence of the US, elicits a large SC change (Augustson et al., 1994). Practical constraints of laboratory settings (e.g., limitations on US intensity levels and the number of conditioning trials) can exacerbate these problems. Here Roche and Barnes (1995) offer some particularly promising suggestions, especially in terms of a design in which both CS+ and CS- receive specific conditioning; an analogous approach has proven useful in research employing increased task difficulty as the US (Hackbert, Markham, Dougher & Augustson, 1994).

Roche and Barnes (1995) also suggest pairing the CS+ exclusively with the US, that is, never presenting probe trials. The cost of this approach—loss of probe data—may outweigh its advantages. A value of the probe trial is that it permits the assessment of conditioned responses at CS offset and during the interval in which the US would have occurred. In several of the studies performed recently at the University of New Mexico, the response during these intervals proved to be quite informative. Although probe trials introduce their own special methodological considerations (see Augustson et al., 1994), I recommend their continued use, especially when only limited conditioning trials can be conducted.

A final point concerns Roche and Barnes' (1995) recommendation that only positive responses be considered while interpreting the data. This issue remains unresolved in the psychophysiology literature (Peek, 1987; Venables & Christie, 1980), but I concur with Roche and Barnes. Because response decrements do not provide a clear-cut measure of counter-conditioning or conditioned inhibition, one is on solid ground only when interpreting increases in responding or positive changes from baseline.

In sum, research on classical conditioning in humans can be difficult and frustrating. It often forces methodological compromises that produce a mixture of advantages and disadvantages. Continued development of method is essential to further progress, and Roche and Barnes' (1995) efforts represent a step in the right direction, as does work in progress by M. R. Markham (personal communication, January 15, 1995) at Florida International University on the use of eyeblink conditioning paradigms in transfer of function studies. The present comments are offered in the same spirit. Remarks and suggestions are welcome.

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MEASURING ILL-DEFINED EVENTS AND OTHER PROBLEMS: A REPLY TO AUGUSTSON

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In our original paper, we outlined some of the technical and methodological problems that arise during the conditioning and electrodermal assessment of conditioned emotional responses (CERs) in humans. Augustson provides an insightful analysis of our discussion, and wisely highlights some of the pitfalls into which researchers might fall were they to follow our suggestions to the full. Circumventing methodological problems in psychophysiological research, however, almost invariably invites new difficulties. It is important, therefore, that the reader be aware of the complexity of some of the issues raised by Augustson.

All of the basic constituents of the electrodermal response are not yet fully understood and many may not yet have been identified (see Dawson, Schell, & Filion, 1990; Fowles, 1986). It is with this in mind that we address the following issue raised by Augustson.

Augustson is correct in pointing out that skin conductance (SC), rather than skin resistance (SR), is the more popular measure of electrodermal activity. As he and others have argued (e.g., Fowles, 1986), this is because SC measures are linearly related to the number of active sweat glands (sudomotor activity) at the electrode placement sites (whereas SR measures are not). Because it is widely believed that sudomotor activity is the basic constituent of the electrodermal response, it is (rather reasonably) assumed that SC is more reliable than SR as an index of autonomic arousal.

However, the idea that SC is linearly related to sudomotor activity and therefore autonomic arousal, may be misleading. Specifically, sudomotor activity is in fact composed of eccrine and apocrine sweat gland activity. Although SC measures are indeed linearly related to eccrine sweat gland activity, the relation between SC and apocrine sweat gland activity remains unclear (Dawson et al., 1990; Shields, MacDowell, Fairchild, & Campbell, 1987). Relatively recent research, however, has indicated that apocrine activity may be related to the presentation of emotional stressors in a somewhat different manner than eccrine activity (Jakubovic & Ackerman, 1985). Future research, therefore, may find that SR correlates more highly with apocrine activity than SC does with eccrine activity. Psychophysiologists would then be in a quandary as to which measure (SR or SC) represents the more valid index of electrodermal activity and/or autonomic arousal. In effect, because the "galvanic reflex mechanism" has yet to be unequivocally identified, treating SC as the more valid index of electrodermal activity and autonomic arousal is, at present, merely a matter of mathematical convenience.

Augustson wisely questions our use of a floating baseline level. As Augustson suggested, this procedure rests upon the assumption that the prestimulus SR level fluctuates randomly. Using a floating baseline, however, is one of the few procedures within psychophysiology that appears to be widely accepted; in fact, the most commonly employed experimental paradigm often requires a floating baseline (see Dawson et al., 1990, p. 308). As Augustson suggests, however, interpretive problems may arise when baselines are not recorded across time; under these conditions it is not possible to identify ceiling effects in a post-hoc analysis. We would argue, however, that although prestimulus baselines may not fluctuate completely randomly, the problem of ceiling effects applies only to the analysis of individual responses. When experimental paradigms employ multiple response measures across a range of stimuli with distinct behavioral functions, the ceiling effect problem would appear to be greatly diminished. Indeed, where a significant difference in response strength to stimuli is obtained across multiple measures, ceiling effects are, ipso facto, of no concern. However, one route by which researchers can circumvent effects produced by nonrandomly fluctuating baselines, is to use response frequency as the measure of response strength. This measure is not uncommon amongst psychophysiologists and is the measure best equipped to disentangle responses that are superimposed upon one another (i.e., when stimuli are presented at intervals that are shorter than response recovery time).

Finally, we would like to clarify our procedure for the omission of negative data. Although we read all negative responses as zero responses, we include these zero data points in all statistical analyses. In effect, our measure of response strength can be considered neither one of magnitude (all responses)

nor amplitude (positive responses only). The significance of negative responses is decidedly unclear and recording them as zero responses has not lead to any discernible problems in our research. Furthermore, it should be noted that recording positive responses only (i.e., amplitude) carries with it certain complications. Firstly, recording only response amplitudes can leave the researcher with little or no data to analyze (Dawson et al., 1990). Secondly, the exclusion of nonpositive data often leads to paradoxical statistical outcomes. Consider, for example, a subject that produces a positive skin resistance response of 1,000 ohms to each of six presentations of a stimulus 'A.' Now suppose that this subject is also exposed to six presentations of a second stimulus 'B.' Upon the first five presentations of stimulus 'B,' this subject either fails to respond or produces a negative response (i.e., relaxes), but on the final presentation produces a positive response of 1,000 ohms. Now, when the five nonpositive responses to stimulus 'B' are omitted, the average response to both stimuli becomes 1,000 ohms (i.e., they are equal). Thus, it would be difficult to accept response amplitude as a valid measure of the stimulus control observed in this hypothetical study. In fact, the omission of nonpositive data from statistical analyses in our research has led to precisely this type of paradoxical outcome and also to a substantial loss of data.

Research conducted by Augustson and his colleagues has proven to be invaluable to us at the Cork laboratory, and we are very grateful to him for reinforcing our contribution with his erudite reply. We look forward to seeing yet more important and ground breaking research from Augustson and his colleagues in the not too distant future.

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*RECENT PUBLICATIONS OF EAHB SIG MEMBERS**

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*Excludes *JEAB*, *JABA*, and *The Behavioral Analyst*.

CONFERENCE PRESENTATION ABSTRACTS

Measures of Aggression, Impulsivity and CNS Serotonergic Activity in Male Parolees

D. R. Cherek, F. G. Moeller, W. Schnapp, and D. M. Dougherty
The University of Texas at Houston

Thirty males on parole participated after giving their informed consent. Subjects were divided into a violent (n=9) and nonviolent group (n=21) based upon their criminal history. Subjects were excluded if screening indicated any history of medical or psychiatric illness, or recent drug use detected by urine drug screen analysis. Subjects participated for four days. Day 1 consisted of six 25-m sessions during which aggressive and escape responding were measured using the Point Subtraction Aggression Paradigm. Day 2 consisted of up to 10 sessions which employed an adjusting self-control procedure to measure impulsivity. Days 3 and 4 involved two neuroendocrine challenge tests conducted in the University's CRC. One day subjects were administered placebo and on the other day, buspirone 0.4 mg/kg. To assess CNS serotonergic activity in these subjects serial measures of prolactin were taken to determine the response to the challenge agent, buspirone. The violent and nonviolent groups differed significantly on measures of aggressive responding, impulsivity and prolactin response, as well as psychometric measures of aggression. The violent parolees emitted more aggressive responses, made more impulsive choices, and had a lower CNS serotonergic response to buspirone. These data support the external validity of measures of human aggression obtained under controlled laboratory conditions, and they also suggest behavioral tendencies and biological conditions which may result in increased probabilities of violence, impulsivity, and risks for other antisocial behavior such as drug dependence.

Meeting of the College on Problems of Drug Dependence, Scottsdale, AZ, 1995.

Marijuana's Effect on Humans' Choices in Situations of Diminishing Returns

D. M. Dougherty and D. R. Cherek
The University of Texas at Houston

The effects of smoked marijuana on choices to switch from a progressive-ratio (PR) schedule to a fixed-time (FT) schedule of point presentation were studied. A paradigm was used where subjects could either respond to earn points or accumulate points on an alternative schedule requiring no responses. During experimental sessions, subjects began in the PR schedule where the number of responses required on one button to earn a point began at 50 responses and increased by 10% on successive ratios. The subject could terminate the PR schedule at anytime by making ten responses on another button. Once the PR schedule was terminated, points were presented on a 200 s FT schedule, requiring no responses. The monetary value of the points was manipulated (5, 10, and 20 cents). Using the paradigm, the effects of smoking placebo or three potencies of marijuana cigarettes on the time spent in the PR and FT schedules were examined. Marijuana smoking reduced the proportion of time spent in PR schedule and produced an earlier escape to the FT schedule. Marijuana's effects were attenuated by increasing the point value. These results are consistent with many subjective clinical observations suggesting that marijuana produces amotivational effects.

Meeting of the Association of Behavior Analysis, Washington, DC, May, 1995.

Behavior Analysis, Developmental Language Research, and Comparative Psychology: A Case Study in Discipline Isolation

W. V. Dube, K. Wilkinson, and W. J. McIlvane
E. K. Shriver Center and Northeastern University

Researchers from behavior-analytic, developmental, and comparative perspectives have all investigated the conditions under which new arbitrary (symbolic) relations are acquired. For example, young children, people with severe mental retardation, and several species of nonhuman mammals all exhibit *exclusion* in the context of a well-established matching-to-sample baseline: When presented with an undefined sample stimulus and a comparison array that includes one undefined comparison and one or more baseline comparisons, subjects select the undefined comparison. Further, subsequent testing may show a *learning outcome*: Exposure to exclusion trials results

in the acquisition of stimulus control by a new relation between the undefined stimuli. Between 1974 and the late 1980s, exclusion and learning outcomes were described independently in three research literatures: Behavior analysis, child language research, and animal language research. More recently, however, crossdisciplinary citations have begun to appear. This presentation briefly reviews the history of exclusion research, with emphasis on the independent development of research programs, methods, and terminology in the three disciplines. We then identify several research areas where a multidisciplinary approach may be mutually beneficial.

American Psychological Association 102nd Annual Convention, Los Angeles, CA, August, 1994.

More Evidence for Increased Aggression in Women after Alcohol Consumption

D. M. Dougherty, D. R. Cherek, and R. H. Bennett
The University of Texas at Houston

The purpose of this study was to determine the effects of a range of alcohol doses on the aggressive responding of females. The Point Subtraction Aggression Paradigm was used which has two response options available to the subject: (a) point-maintained responding, emitting 100 responses on one button earned the subject 10 cents; and (b) aggressive responding, emitting 10 responses on an alternative button ostensibly subtracted 10 cents from another person also working to earn money. Aggressive responses were engendered by a random-time schedule of point loss (every 6 s to 120 s), and instructions attributed these point losses to button presses made by another subject. Ten female subjects participated, and each experienced placebos and three alcohol doses, 0.25, 0.50, and 1.00 g of 95% alcohol/kg body weight. The most important finding was that the 1.00 g/kg alcohol dose produced statistically significant increases in aggressive responding relative to placebo. There was, however, a small subset of individuals whose aggressive responding increased the most after consuming the 0.25 g/kg alcohol dose. Rates of point-maintained responding were unaffected by the 0.25 and 0.50 g/kg alcohol doses and slightly suppressed by the 1.00 g/kg alcohol dose. These findings are inconsistent with the results from a handful of previous studies indicating that the probability of aggression is not increased by alcohol in females. These inconsistencies between the few studies in this area may be attributable to procedural differences, which have varied considerably across studies.

Research Society on Alcoholism, Steamboat, CO, June, 1995.

Measures of Aggression in Recent Cocaine Abusers

D. M. Dougherty, F. G. Moeller, D. R. Cherek, and T. A. Rustin
The University of Texas at Houston

As part of a continuing effort to determine the effects of cocaine on aggression, we are studying hospital inpatients admitted for cocaine treatment. In the past, in our laboratory, we have found no evidence for increased aggression after either a single dose or repeated intranasal doses of cocaine. As a result, we are now looking at the possibility that chronic abuse of cocaine and the subsequent withdrawal may elevate aggressive responding. To do this, the Point Subtraction Aggression Paradigm is being used with three response options available to the subject: (a) point-maintained responding (earning points exchangeable for money); (b) aggressive responding, subtracting points from another fictitious other subject; and (c) escape, avoiding point subtractions. Aggressive responses are engendered by periodic point loss attributed to the fictitious subject. Measurements of aggression are being taken upon admission and then when possible again one week later. Twelve subjects have been tested thus far and there are two important trends in the data. One, subjects reporting recent cocaine use emit fewer aggressive responses than subjects not reporting recent cocaine use. Two, antisocial personality disorder appears to be more predictive of aggressive responding than recency of cocaine use. These findings are consistent with our hypothesis that cocaine does not appear to induce aggression, but rather the more important factor are the characteristics of the person using cocaine.

Supported by NIDA Grant DA 03166-10

Problems of Drug Dependence, Scottsdale, AZ, June, 1995.

Self-Control and Impulsiveness in Adult Human Females: Effects of Food Preferences

L. B. Forzano
State University of New York College at Brockport

Self-control can be defined as the choice of a more delayed, larger amount reinforcer over a less delayed, smaller amount reinforcer, and impulsiveness as the opposite. Several experiments have found that a number of factors can affect the degree of self-control demonstrated by adult humans. However, with only one exception, previous experiments have used the same type of reinforcer for both response alternatives. This is despite the fact that reinforcer quality preference has been shown in a variety of experiments to significantly influence the choice behavior of nonhumans and humans. The current experiment used 13 adult human females to explore the effects of reinforcer preference, in particular, food preference on choice behavior in a self-control paradigm. Self-control was estimated using juice delivered during the session as the reinforcer. Subjects demonstrated significantly less self-control in conditions in which subjects had a higher preference for the juice received as the less delayed, smaller amount reinforcer than for the juice received as the more delayed, larger amount reinforcer. The results demonstrate that subjects' food preferences can influence self-control for food reinforcers.

Association for Behavior Analysis, Washington, DC, May, 1995.

Self-Control and Impulsiveness in Adult Human Females: Effects of Visual Food Cues and Dieting Status

L. B. Forzano
State University of New York College at Brockport

This experiment examined the effects of visual food cues and dieting status on adult human females' choice behavior in a self-control paradigm. No significant difference in self-control was demonstrated as a function of the presence or absence of visual food cues. However, self-reported dieting subjects demonstrated significantly more self-control over all conditions. In addition, the results suggest that level of deprivation may influence adult human females' self-control for food reinforcers.

Eastern Psychological Association, Boston, MA, March, 1995.

Stimulus Equivalence in Nonvocal Communication

G. Green, K. Chellquist, C. Johnson, S. Ross, S. Krendel-Ames, B. Bellone, and J. Jeffrey
The New England Center for Autism

Skills necessary for effective nonvocal communication were analyzed within the conceptual and methodological framework of stimulus equivalence. Five students with severe learning difficulties and limited communication repertoires served as subjects. Match-to-sample and picture-exchange procedures were used to assess their skills in relating communication symbols (various types of photos, line drawings, miniature objects) to corresponding words and objects. The resulting individual skill profiles were not entirely consistent with informal assessments by teachers, nor with the hierarchy of symbol discriminability and symbol-referent matching predicted by previous research with this population. Results also suggested that analyzing all relevant stimulus-stimulus relations can enhance the effectiveness of instruction in nonvocal communication for students with severe learning difficulties.

Association for Behavior Analysis, Washington, DC, May, 1995.

Prerequisites for Simple Discrimination and Conditional Identity Matching Performances

C. Johnson and D. White
The New England Center for Autism

A multiple-baseline-across-subjects design was used to evaluate the relation between "session skills" (sitting, waiting, looking at the stimuli, scanning the stimulus array, and pointing to a stimulus) and simple and conditional discrimination performances. Three students with severe to profound mental retardation participated. Baseline assessments identified a profile for each subject that indicated inconsistent performances on simple discrimination, conditional

identity matching, and one or more sessions skills. Session skills were taught in a simple discrimination context with prompt fading and positive reinforcement procedures. Then simple discrimination and conditional identity matching posttests were given without prompts or reinforcement for session skills. Simple discrimination performances were maintained with high accuracy, but identity matching performances improved only slightly from baseline. These results have implications for teaching students with severe special needs in self-contained and inclusive classrooms.

Association for Behavior Analysis, Washington, DC, May, 1995.

Verbal Processes in Relational Matching to Sample

B. Lowenkron
California State University, Los Angeles

How do some stimuli come to control the selection of other stimuli when there is a consistent relation between them? Current conceptions of conditional discrimination control, wherein the probability of a selection response to one stimulus (the comparison) is heightened by the presence of another (the sample), seem limited because they treat all stimuli as if they were arbitrarily paired. As a result, this approach cannot provide an explicit description of the nature of generalization based on consistent relations (such as identity). This paper treats the comparison-selection response as an autoclitic report of the occurrence of joint control by two other verbal relations--one a self-echoic repetition of the subject's tact for the sample, and one a tact of the comparison. Such a notion specifically appreciates consistent relations between stimuli, and as the data illustrate, specifies training procedures that produce generalized delayed matching performances across a wide variety of relations between stimuli--including identical/different, before/after, further/nearer, and greater/lesser.

Association for Behavior Analysis, Washington, DC, May, 1995.

Antisocial Personality Disorder and Alcohol Induced Aggression

F. G. Moeller, D. M. Dougherty, and D. R. Cherek
University of Texas at Houston

Epidemiologic studies of human aggression consistently find a link between alcohol and violence. Within the population, individuals with Antisocial Personality Disorder (ASP) are more likely to begin alcohol use at an early age and have problems with violence. The purpose of this study was to determine the effects of alcohol consumption on aggressive responding in subjects with ASP under controlled laboratory conditions. We administered three doses of alcohol (0.25, 0.5, and 1.0 g/kg) and placebos to subjects with ASP before and after testing using the Point Subtraction Aggression Paradigm. This paradigm ostensibly pairs the subject with another individual who can take points earned away from the subject. Subjects can either earn points which are exchanged for money, or take points away from the fictitious subject with which they are paired. Subjects are provoked by a random schedule of point losses and are free to respond to point losses by taking points away from the other subject (defined as the aggressive response) or continue to earn points themselves. In the two subjects with ASP tested thus far, both subjects have shown a dramatic increase in aggressive responding on the Point Subtraction Aggression Paradigm after alcohol consumption. These preliminary results lend experimental support for the relationship between ASP and alcohol induced aggressive responding with ASP subjects.

Research Society on Alcoholism, Steamboat, CO, June, 1995.

Tryptophan Depletion and Aggressive Responding in Healthy Males

F. G. Moeller, D. M. Dougherty, A. C. Swann, D. Spence, C. M. Davis, and D. R. Cherek
University of Texas at Houston

In order to study the effect of decreasing plasma tryptophan levels on aggressive responding in a controlled laboratory setting, we administered two doses (25 g and 100 g) of a tryptophan-free amino acid mixture to 10 healthy male subjects after 24

hours of a low tryptophan diet. Subjects were screened for current or past psychiatric, or nonpsychiatric medical illness. Aggressive responding on a free-operant laboratory measure of aggression, the Point Subtraction Aggression Paradigm, and plasma tryptophan levels were measured before and after drinking the amino acid mixture. There was a significant increase in aggressive responding after the 100 g mixture and a nonsignificant increase in aggressive responding after the 25 g mixture. There was also a significant decrease in plasma tryptophan at 5 hours after ingestion compared to baseline for both doses of the amino acid mixture. This study supports the hypothesis that tryptophan depletion increases aggressive responding in healthy males in a laboratory setting, probably by decreasing brain serotonin.

Society for Neuroscience, San Diego, CA, May, 1995.

Visual vs. Motor Sample Stimuli in the Conditional Discrimination Performance of Adults with Severe Mental Retardation

K. Saunders, M. Johnston, B. Tompkins, and D. Williams
University of Kansas - Parsons Research Center

Two nonverbal men showed chance accuracy on a fixed-ratio discrimination task when the two "samples" were randomly presented. Trials began when a box appeared in the upper middle of a computer screen. Touching it produced two identical boxes, one on either side of the lower screen. Either a single response or many responses (8 responses for one subject; 16 for the other) was required (the sample box was always the same). A reinforcer was presented for touching the right-hand box after many touches and for touching the left box after a single touch. When the procedure was changed so that the same "sample" was required for blocks of five trials, performance stabilized with near-perfect accuracy, except that "errors" were invariably made on the first trial of a block. Thus, there was no conditional control by the number of touches (the sample). When the procedure was again changed such that the sample was a circle when one press was required and a cross when many presses were required, both subjects demonstrated conditional control. A replication of the original condition again showed no evidence of control by the motor samples. Both subjects ultimately showed perfect conditional control by visual samples presented randomly (one touch regardless of sample), but no control by the FR samples. Thus control by their own motor behavior was less readily established than control by visual stimuli for these subjects.

Gatlinburg Conference on Research and Theory in Mental Retardation and Developmental Disabilities, Gatlinburg, TN, March, 1995.

Regional Cerebral Blood Flow During Repeated Exposure to a Vigilance Task in Adults with Attention Deficit Hyperactivity Disorder

J. B. Schweitzer, T. Faber, C. D. Kilts, J. Votaw, J. M. Hoffman, and L. Tune
Emory University, Atlanta, GA

There is increasing evidence that Attention Deficit Hyperactivity Disorder (ADHD) has a neurobiologic basis. Behaviorally these symptoms increase with repeated exposure to a task. Using the Paced Auditory Serial Addition Task (PASAT), an auditory vigilance task, we examined changes in regional Cerebral Blood Flow (rCBF) in 4 adult right-handed males with ADHD and 5 normal right-handed male controls. Subjects were scanned on two consecutive days with 2 resting state, 2 control and 2 PASAT conditions per day, each associated with [^{15}O] water administration. In this ongoing study, different task related increases and decreases in rCBF between the groups emerged. ADHD subjects showed significant activations in the primary visual cortex and visual association cortex during the PASAT compared to the control task ($p<.01$). Control subjects showed activations in the right parietal and left inferior frontal regions during PASAT ($p<.01$). Changes in rCBF with repeated task exposure, were assessed by subtracting images acquired on Day 1 during the PASAT from Day 2. In ADHD subjects there were increases in rCBF in the left, superior temporal lobe from Day 1 to Day 2 ($p<.01$); however there were no significant decreases in rCBF from Day 1 to Day 2 ($p<.01$). Control subjects showed activations in the inferior frontal lobe, the superior parietal lobes, and the left gyrus rectus from Day 1 to Day 2 ($p<.01$). Control subjects also showed decreases in rCBF from Day 1 to Day 2 in the left temporal lobe and the cerebellum ($p<.01$). These

results suggest that different brain regions, and perhaps behavioral strategies, are used by ADHD adults to perform vigilance tasks than adults without ADHD. Furthermore, the lack of decreases in rCBF seen in ADHD subjects with repeated PASAT exposure suggests a sustained processing demand, that is diminished with practice in control subjects.

Society for Neuroscience, San Diego, CA, May, 1995.

Transfer of Computer-Based Spelling and Matching-to-Sample Performances to Tabletop Tasks

R. Stromer, H. A. Mackay, A. A. McVay, and D. Flusser
E. K. Shriver Center

Teaching procedures that establish computer-based spelling may yield written spelling and the functional use of that writing repertoire. An illustrative case is reported involving a student with moderate mental retardation and a profound hearing loss. Pretests showed that the student matched pictures and printed words to one another but did not spell the words to picture samples. The student was then taught to spell the words using a computerized word-construction procedure. As the accuracy of computer spelling increased, written spelling to the computer pictures also improved. A similar improvement occurred during a tabletop task and when objects instead of pictures served as samples. Moreover, accuracy scores were high when the student was required to write a "list" of the names of objects displayed on the tabletop, then retrieve identical objects from a shelf nearby. Further analyses suggested that (a) the availability of the list at the shelf (as compared to the tabletop display alone) was a crucial component of the retrieval task, and (b) the transfer of stimulus control of computer-based teaching to tabletop tasks may have been attributable to the existence of stimulus classes involving pictures, objects, and printed words.

Association for Behavior Analysis, Washington, DC, May, 1995.

Fixed Ratio Discrimination Learning and Level of Mental Retardation

D. Williams, M. Johnston, B. Tompkins, K. Saunders, & R. Tessel
University of Kansas - Parsons Research Center

The FR discrimination task may be useful for cross-species comparisons of factors affecting discrimination learning. We measured the performance of persons with profound to mild mental retardation to determine whether this task was differentially sensitive to level of disability. Subjects were 13 adults with MAs from 2.2 to 6.9 years. Stimuli were 2 inch black squares presented on a touch-sensitive computer monitor. After the required number of touches to a square in the center of the screen, the square disappeared and identical squares were presented in the left and right halves of the screen. Following 16 responses, a touch to the left square was correct and after 1 (Condition 1) then 4 (Condition 2) responses, the right square was correct. Subjects who learned the FR16 vs FR4 discrimination were trained on the reverse contingency (Condition 3). The number of trials to criterion for each condition was negatively correlated with MA, and the highest condition completed was positively correlated with MA ($r = .84$). Of the subjects that learned the 4-16 reversal, those with MAs of 5.0 or greater learned the reversal as fast as the original 4-16 discrimination, but the subjects with MAs of 4.0-4.9 required more sessions to acquire the reversed discrimination. These results show that the FR discrimination task is differentially sensitive to severity of MR, and that these results may be compared to those from animal models of retardation.

Gatlinburg Conference on Research and Theory in Mental Retardation and Developmental Disabilities, Gatlinburg, TN, March, 1995.

GRANTS AWARDED TO EAHB SIG MEMBERS

Grant Title: Aggressive Behavior: Alcohol and Menstrual Cycle Effects
Principal Investigator: Donald M. Dougherty
Affiliation: The University of Texas at Houston
Agency: National Institute of Alcohol Abuse and Alcoholism
Dates: 07/01/95 - 06/30/00
Amount: $347,853

With this grant, we will study the effects of alcohol on aggressive responding using both female and male subjects under controlled laboratory conditions. In the past, researchers have avoided female subjects in pharmacological studies because of the unknown interactions between experimental drugs and the changes accompanying the female's menstrual cycle. In the few studies that have used females, some aggression researchers have suggested that males and females may differ in both their response to provocation and to the effects of alcohol. This research will systematically investigate the effects of menstrual cycle phases, dose of alcohol, and possible interactions between these two variables on aggressive responding in females. The proposed studies will also allow some comparisons to be made between female and male aggression. Specifically, these studies will help identify some of the environmental factors responsible for precipitating aggressive responding in both female and male subjects. The specific aims of these laboratory studies are to: (1) examine the effects of menstrual cycle phase on aggressive responding; (2) examine the effects of different doses of alcohol on aggressive responding in females; (3) examine interaction effects between menstrual cycle and alcohol dose on aggression; (4) examine differences between females reporting either severe or mild menstrual symptoms on aggressive responding; and (5) examine gender differences in both the frequency of aggressive and escape responding. The results from these studies will aid in the future development of other laboratory paradigms and procedures for testing female subjects.

Grant Title: Learning Disabilities: Symptom Permanence and Consequences
Principal Investigator: Lewis P. Lipsitt
Affiliation: Brown University, Providence, Rhode Island
Agency: National Institute of Neurological Disorders and Stroke
Dates: 07/01/95 - 06/30/99
Amount: $1,202,220

Little information exists regarding long-term behavioral, social, and cognitive outcomes of children diagnosed with specific learning disabilities (LD). We will do a 25-year follow-up study of participants, now 28-34 years of age, in the National Collaborative Perinatal Project. These individuals were studied intensively from birth to 7 years of age. Procedures to be used on follow-up include a battery of neuropsychological measures of verbal functions, abstraction, memory, visual perceptual function, and motor abilities. Aspects of social functioning including anti-social behavior and substance abuse will be assessed. Questions addressed: Does childhood LD persist into adulthood? How does childhood LD impact social, behavioral, and emotional functioning? Does outcome vary with type of LD? Are academic and behavioral/learning remediation processes effective?

Grant Title: Generalization and Transfer in Mental Retardation
Principal Investigator: Robert Stromer
Affiliation: E. K. Shriver Center
Agency: National Institute of Child Health/Human Development,
Dates: 1995-2000
Amount:: $833,484

This project examines problems of generalization and transfer in the context of a program that seeks to apply computer technology to teach rudimentary communication skills to individuals with developmental disabilities. In research already accomplished, we have developed methods for establishing complex, integrated networks of matching, naming, and writing skills. Our research program and its general methodology provide a framework within which to study a novel stimulus class approach to problems of generality. That approach involves analyses of the formation of feature stimulus classes and arbitrary stimulus classes, the former involving stimuli with common physical attributes, the latter not. Resembling prior conceptual analyses, we suggest that the formation of feature classes constitutes an important basis for cross-situational transfer and generalization. Unique to our analysis is an emphasis on relationships between feature classes and arbitrary classes which foster the transfer of stimulus control across situations. The studies explore implications and parameters of the stimulus class analysis, including classes under higher-order contextual control, and classes derived from incidental learning, observational learning, and differential consequences.

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