BRIEF REPORT

CONDITIONAL DISCRIMINATION AND STIMULUS EQUIVALENCE IN YOUNG CHILDREN FOLLOWING THREE DIFFERENT BASELINE TRAINING PROCEDURES

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It is widely recognized that subjects with developmental disabilities often encounter difficulties in learning arbitrary conditional discriminations (e.g., Eikeseth & Smith, 1992; McIlvane, Dube, Kledaras, Ienacco & Stoddard, 1990; Saunders & Spradlin, 1989, 1990, 1993). However, similar difficulties have been reported for young, normally-developing children (e.g., Augustson & Dougher, 1991; Pilgrim, Jackson & Galizio, 2000; Schilmoeller, Schilmoeller, Etzel & LeBlanc, 1979; Zygmont, Lazar, Dube & McIlvane, 1992). For example, in the Pilgrim et al. study, normally developing children (ages 3-6) failed to master an arbitrary match-to-sample (MTS) task under conditions of differential reinforcement, but acquisition was observed when specific instructions or sample-naming procedures were used. Unfortunately, the use of explicitly verbal procedures may be problematic when the experimental question involves emergent relations because of the theoretical controversy over the role of verbal processes in such relations (see for example, Horne & Lowe, 1996, and commentaries). In an attempt to develop a training procedure that required no verbal interaction with subjects, Pilgrim et al. also explored the effects of pretraining a conditional discrimination with thematically related stimuli (e.g., given a picture of a flower as a sample stimulus, choosing a picture of a vase, and not a cake was reinforced). This thematic MTS pretraining was effective in facilitating acquisition of an arbitrary conditional discrimination problem for most children.

This work was supported by NICHD grant HD34265. This study formed part of Christy Jordan's Master's Thesis. The authors gratefully acknowledge the help of a number of graduate and undergraduate students who assisted in the time-consuming data collection required in this project, especially Heidi Morgan, Tracy Pena and Robyn Stout. Address correspondence to Mark Galizio, Department of Psychology, UNC at Wilmington, Wilmington, NC, 28403. E-mail: galizio@uncwil.edu.

Although thematic MTS training contributed to acquisition in the absence of explicitly verbal interactions, Pilgrim et al. noted that the effectiveness of thematic training depended on children's pre-experimental histories with the thematic stimuli, and that these were likely to have involved verbal processes. In contrast, wholely non-verbal training procedures have been developed in other laboratories for teaching arbitrary MTS to children. For example, in sample stimulus-control shaping procedures (Etzel, Milla, & Nicholas, 1996; Zygmont et al., 1992) the sample stimuli in identity-matching relations are gradually changed until they are physically different from the reinforced comparison choice, thus establishing arbitrary relations. In sum, several different techniques are now available to facilitate the acquisition of arbitrary MTS in children. Little is known however about how these techniques compare in terms of speed of acquisition and number of errors, or with respect to the emergence of equivalence relations. The present study provides for preliminary consideration of specific instructions, thematic pretraining, and stimulus-control shaping with respect to these dimensions.

METHOD

Subjects and Apparatus

Nineteen children (ages 2 to 4) were studied in a quiet area in their preschool. A Macintosh computer was used for stimulus presentation and data recording using software designed by Dube (1991). Responses were made by touching an Edmark touchscreen or by moving and clicking a mouse.

Procedure

Each trial began with the presentation of a black and white stimulus in the center of the screen. A response to the sample stimulus produced three comparison stimuli displayed 7.5 cm from the sample, each in one of the four quadrants of the monitor. A response to the

comparison designated as correct produced a fanfare and animated stars while errors resulted in a buzzer. A 1.5 s intertrial interval separated the comparison choice from the presentation of the next trial's sample. Sessions consisted of 24 or 36 trials (depending on the training phase) and lasted approximately 15 min. Edible reinforcers (fruit, candy) were provided at the end of each session. Mastery criterion for each training phase was set at 90% correct for 2 consecutive sessions. For each training phase, sample stimuli appeared equally often, and the position of comparison stimuli varied unsystematically.

All children were initially pretrained with an identity matching task involving familiar and then abstract figures used only during pretraining. After meeting criterion, subjects were unsystematically assigned to one of three training conditions (with the three exceptions noted below) designed to facilitate acquisition of an arbitrary conditional discrimination with abstract stimuli (A1 B1, A2 B2, A3 B3). For children assigned to the Instruction Condition, the experimenter presented cards depicting A1, A2, B1 and B2 and told the child how to make correct responses: "When this object (A1 or A2) comes up in the middle of the screen, I want you to find this one (B1 or B2, respectively)." Children then began training in which A1 or A2 was presented as the sample, and B1 and B2 were the comparisons. The instructions were repeated prior to each of the first five trials of each session, and again following errors. After achieving the mastery criterion, subjects were exposed to the full AB baseline (as above but with B3 presented as a third comparison on all trials and A3 presented as a sample on 1/3 of the trials) without instructions.

Children assigned to the Thematic Condition received conditional discrimination training in which the sample and correct comparison stimulus were familiar members of a common category. Figure 1 shows the three thematic sets that were available including animals, body parts, and vehicles (Set 1), faces and trees (Set 2) and fruits and flowers (Set 3). During Thematic training, if, say, a picture of a cat was presented as a sample, then choosing a cow (rather than an airplane or a hand) was reinforced. After mastering one of the Thematic sets, subjects were presented with the arbitrary AB task (A1B1, A2B2, A3B3). If a subject showed no trend toward mastery of one of the Thematic sets within 10 sessions, a different set was introduced.

Figure 1

Finally, children in the Sample Stimulus-Control Shaping (SSCS) condition were initially exposed to identity matching with two stimuli, B1 and B2. Following mastery, sample stimulus B1 was gradually changed in shape through 18 successive steps progressively approximating, and finally becoming, stimulus A1. Training began with Step 1 (Identity matching) and following 5 consecutive correct responses moved to Step 2, and so on. Each new session began one shaping step lower than the highest one mastered on the preceding session. After Step 18 the arbitrary AB task with all six stimuli (A1B1, A2B2, A3B3) was introduced. Figure 2 shows the stimulus variations at each step of the shaping sequence.

After meeting criterion on AB, children in all conditions were trained on a second 3-choice conditional discrimination, AC, with trial and error conditions. When the AC discrimination was mastered, AB and AC trials were randomly mixed. When the mastery criterion was met, reinforcement density was reduced to 75% of the trials, and then to 50%. Probe trials were then interspersed with baseline trials on each subsequent session. Each subsequent session assessed only one equivalence property (i.e., reflexivity, AA, BB, CC; symmetry, BA, CA; or equivalence, BC, CB) with 6 or 9 probe trials per session, and probe testing was conducted for a minimum of 18 sessions in order to observe stable probe performances.

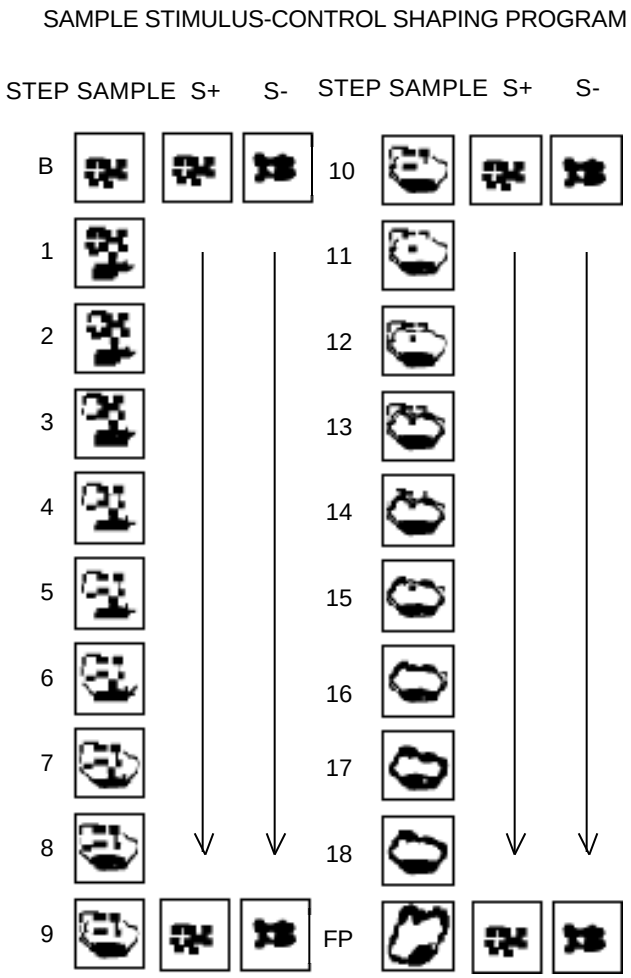

Figure 2

RESULTS

Five children were originally assigned to the Instructions condition (Mean age = 40.5 months), but one subject (TK) failed to acquire the discrimination with instructions and after 14 sessions was re-assigned to the SSCS condition. Twelve children were initially assigned to the Thematic condition (Mean age = 43.5 months), but two of these subjects failed to acquire the AB discrimination and after 14 (Subject CM) or 16 sessions (Subject JD) were re-assigned to the SSCS condition. Five subjects were studied in the SSCS condition (Mean age = 41.0 months) including the three children originally assigned to other conditions.

In order to assess the effectiveness of the three procedures, we determined the total number of sessions completed from the first session following pretraining to mastery of the initial AB conditional discrimination, as well as the total number of errors made during this period. These data are presented for each subject in Figure 3. The four children who completed Instructions training showed the most rapid acquisition (top panel) and the fewest errors (bottom panel; but note that Subject TK, who failed to meet the training criterion is not included with the other four Instructions children in Figure 3). Acquisition was slower and more variable with SSCS and Thematic training. Two of the Thematic children (ST and AC) showed rapid acquisition (10 sessions or fewer) comparable to those trained with Instructions but several required nearly 40 total sessions (note JA, CW and TR), and two children never met criterion (CM and JD - not included with the other Thematic group children in Figure 3). Subjects in the SCSS conditions required an intermediate number of sessions (15-29), but tended to make fewer errors overall than children receiving Thematic training. (Note that data in Figure 3 from subject TK exclude sessions with instructions, and that data for CM and JD exclude sessions in Thematic training.) These differences were evaluated statistically through Median Tests which confirmed that fewer sessions to criterion were required with Instructions training than with either Thematic subjects ($p<.01$) or SCSS ($p<.05$), but that these latter groups did not differ ($p>.05$). Instructions subjects made significantly fewer errors than Thematic ($p<.05$), but the differences between Instructions and SCSS and between Thematic and SCSS were not significant.

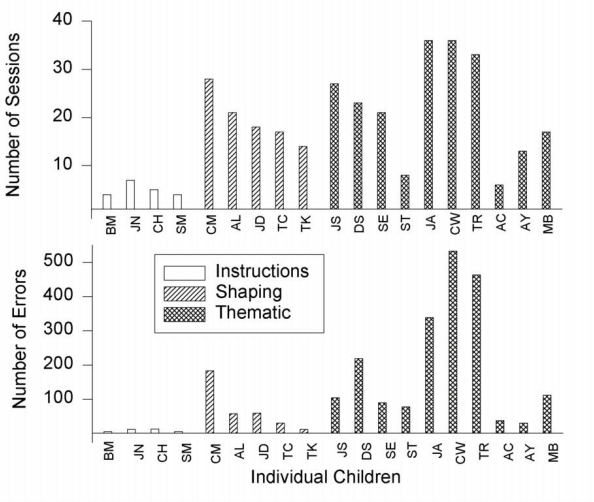

Figure 3

Figure 4 shows number of sessions (top panel) and number of errors (bottom panel) to reach

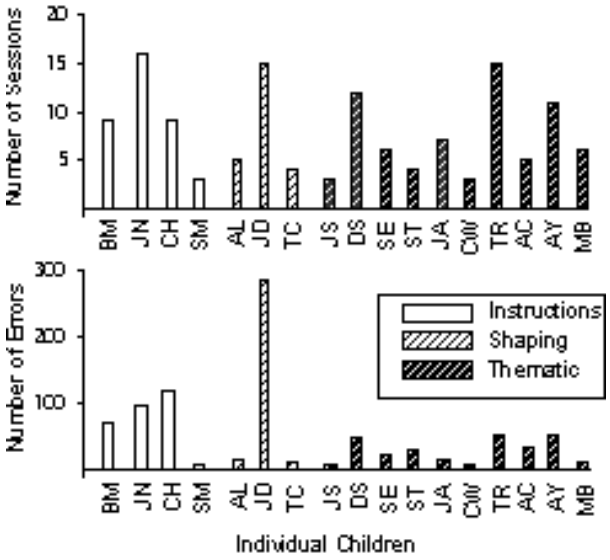

Figure 4

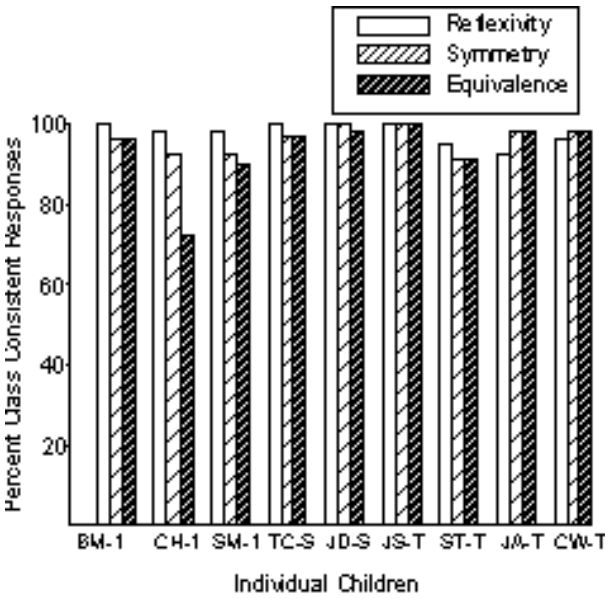

Figure 5

mastery criterion on the second conditional discrimination. Note that two subjects from the SCSS group (TK and CM) were not included in Figure 4 because they left the experiment during this phase. Although considerable variability is evident with both measures, there appears to be little evidence of any differences between training conditions and indeed, Median tests on sessions and errors were non-significant ($p>.05$).

Finally, Figure 5 shows performances on reflexivity, symmetry and equivalence probe trials during the final five sessions of probe testing. Eight of the nine subjects who reached this stage performed at criterion level (90% or higher) on each probe type, consistent with the formation of stimulus-equivalence classes. Subject CH, in the Instructions condition, reached criterion for reflexivity and symmetry, but after more than 60 total probe sessions had not met criterion on equivalence trials.

DISCUSSION

All three of the training methods used were effective in promoting the acquisition of an arbitrary conditional discrimination for most children. This is a valuable finding in that most children in the age group studied would not be expected to master this type of problem through trial and error (Augustson & Dougher, 1991; Pilgrim et al., 2000). Although all training procedures were effective, differences between procedures were noted. These differences must be interpreted with caution because of questions regarding the comparability of the groups prior to training. For example, children in the Thematic training condition were, on the average, slightly older than those in the other two groups, and of course, three of the SCSS children were placed in that training condition only after failing in one of the other conditions. Nonetheless, it was interesting to note that instructions resulted in the most rapid acquisition with the fewest errors for the four subjects who completed the Instructions training. That one subject (TK) failed to reach mastery with instructions, however, indicates a limitation of this procedure. Subject TK appeared to have very low-level verbal abilities - most of her verbal interactions with the experimenters were characterized as echolalic in nature. Her failure to benefit from instructions illustrated that their effectiveness is limited to children with adequate verbal skills.

Thematic and SSCS training appeared to be about equally efficient in terms of sessions and errors to mastery of the initial conditional discrimination. The advantage of these techniques was that they did not explicitly require verbal skills on the part of the subject. Thematic training was effective in 10 of the 12 children tested and, given the ease with which it was programmed, has much to commend it. SSCS was effective in all five children tested. This success rate is particularly impressive given that three of these children had failed previously with Instructions (TK) or Thematic (CM & JD) training. One limitation of SSCS is the relative

response cost required to develop the graded stimulus sequences.

It is also worth noting that there were no differences in performance between subjects from the various training conditions with respect to acquisition of a second conditional discrimination. Finally nine of the 10 subjects tested showed emergent probe performances indicative of equivalence-class formation. Equivalence thus emerged whether or not the baseline training involved verbal manipulations. This seems an important finding given the procedural differences that characterize the literature on equivalence performances in young children.

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BRIEF REPORT

THE NEXT GENERATION: AUTHORSHIP TRENDS IN THE EXPERIMENTAL ANALYSIS OF HUMAN BEHAVIOR (1980 - 1999)

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The Experimental Analysis of Human Behavior (EAHB) Special Interest Group has accomplished a great deal in its 22 or so years in operation (see Johnston, 1983). Analyses of publication trends document some of those accomplishments and provide an occasion to reflect on the accomplishments of the EAHB research community (e.g., Buskist & Miller, 1982; Hyten & Reilly, 1992). Recently, Dymond and Critchfield updated and extended existing analyses of EAHB research. Their data show that, despite some variability across years, EAHB continues to be well represented in the *Journal of the Experimental Analysis of Behavior* (*JEAB*; Dymond & Critchfield, 2001). Additionally, EAHB research has been appearing in *The Psychological Record* (*TPR*) with increasing frequency, to the point where more EAHB articles appeared in *TPR* than in *JEAB* in recent years (Dymond & Critchfield, 2002). Our analyses, like previous ones (e.g., Dougherty, 1994) also show a robust tradition of investigation of some topics (e.g., stimulus control) but not of others (e.g., choice and preference). Overall, however, we have concluded that EAHB as a sub-discipline is in relatively good health based on the number and variety of research articles published in key journals.

There are, of course, other objective indices of a field's health and status. For example, one may assess the citation impact of a field's research articles (e.g., Critchfield, Buskist, Saville, Crockett, Sherburne, & Keel, 2000). In addition, consistent with the spirit of formal bibliometric techniques (e.g., Glanzel, Schubert, & Czerwon, 1999), one may attempt to examine who, precisely, is contributing to a field's published works. This was the objective of the present article: to focus on authorship trends in key EAHB journals, *JEAB* and *TPR*. First, the proportion of articles published by new and frequent authors during the years 1980 to 1999 was recorded. This interval was selected because previous surveys of EAHB in *JEAB* indicate that (a) little EAHB research was published before 1980; (b) growth in EAHB was evident during the late 1980s to early 1990s; and (c) EAHB publication rates have not changed systematically since the mid-1990s (Buskist & Miller, 1982; Dymond & Critchfield, 2001; Kollins, Newland, & Critchfield, 1999). Using a similar twenty-year review period, Dymond, Clarke, Dunlap, and Steiner (2000) found declining trends in the number of papers by new authors and an increase in the publications of frequent contributors to the *Journal of Applied Behavior Analysis* (*JABA*). Data such as these suggest that a relatively small number of repeat contributors account for the majority of *JABA's* pages, which should lead to concerns about content and diversity. Analogous concerns might be especially acute in an area like EAHB, which generates fewer empirical reports each year than does applied behavior analysis. Second, the present article determined the most prolific authors in the EAHB and assessed the extent to which their research contributions have been specialized.

METHOD

Article Selection: All data-based EAHB articles (excluding review, theoretical, and technical articles) published between 1980 and 1999 in *JEAB* and *TPR* were examined (cf. Buskist, Sherburne, &

Preparation of this article was supported by an APU School of Applied Sciences Research Sabbatical. Many thanks to Tom Critchfield for assistance with data collection and for his enthusiastic support of the project. Address correspondence to the author at, Department of Psychology, APU, East Road, Cambridge, CB1 1PT, UK (e-mail: s.dymond@apu.ac.uk).

Received January, 2001; revised January, 2002; accepted March, 2002.

Table 1

Description of the categories into which articles were assigned.

Content Areas	
Behavioral Pharmacology	"Behavioral action of drugs" (Branch, 1991, p. 21) including pharmacologically-mediated effects on operant behavior, and the role of drugs as reinforcers and as discriminative stimuli
Choice and Preference	"Manipulation of reinforcer frequency, magnitude, or, in general, reinforcer value in concurrent operant procedures" (Buskist & Miller, 1982, p. 140) including research on self-control
Reinforcement & Punishment	"Parametric investigations of human performance on various schedules of reinforcement" (Buskist & Miller, 1982, p. 140) including studies examining conditioned reinforcement, reinforcer type, and reinforcement theory; also analogous investigations of punishment and conditioned suppression; primary focus on illuminating fundamental principles of operant consequences, rather than applying these principles to shed light on other processes.
Social and Verbal Behavior	Empirical studies of social behaviors such as competition, cooperation, and aggression, and studies which involve "the acquisition and maintenance of conversation and vocalization" (Buskist & Miller, 1982, p. 140) including research on instructions, self instructions, rule-governance, and self-reports
Stimulus Control	"Studies dealing with the aspects of generalization and discrimination" (Buskist & Miller, 1982, p. 140), including research on derived stimulus relations; primary focus on illuminating fundamental principles of stimulus control, rather than applying these principles to shed light on other processes.

Critchfield, 1996). Although previous surveys of publication trends in the area have focused exclusively on *JEAB*, the present study also examined EAHB trends in *TPR*. *The Psychological Record* was included in the analysis because it has been receptive to EAHB research historically (Buskist, 1983), often publishes more EAHB articles per issue than *JEAB* (Buskist et al., 1996; Dymond & Critchfield, 2002), and has published several special issues on the EAHB (e.g., Vol. 33, Winter; Vol. 43, Fall) and one of the area's most-cited sources (Baron & Galizio, 1983; see Critchfield et al., 2000). To determine the types of research questions that EAHB studies have addressed most often, the articles were assigned to content categories (Table 1) derived from those of Buskist and Miller (1982; see Dymond and Critchfield, 2001, for rationale).

Author Categories: For *JEAB* and *TPR*, the present analysis sought to evaluate the contributions of veteran investigators, as a measure of stability in the field, and of new investigators, as a measure of renewal in the field. A new investigator was operationally defined as a first author who had not appeared in a same-journal EAHB article during the preceding 5 years. A veteran investigator was defined as any author of an article who appeared in at least 5 same-journal EAHB articles in the previous 10 years. Using these definitions, the proportion of articles in which a new first author and a veteran author appeared, respectively, was determined.

Observer Training, Article Coding, and Reliability Assessment: Observer training took place in two phases. In the first phase of training, two observers independently applied the region of origin and content categories to EAHB articles in six volumes of *JEAB* and compared their ratings on an article-by-article basis. No disagreement occurred for region of origin categories. Content disagreements prompted the re-coding of the relevant articles, with results compared as before. Remaining discrepancies were discussed until the observers agreed on category assignments,

definitions, and interpretations. In the second phase of training, the same two observers independently applied the article selection criteria to all articles in six volumes of *TPR.*

Each observer then applied the training experience to the coding of all relevant articles in one of the journals. At least one week later, the observers repeated their evaluations for the years 1993 to 1999. Intraobserver agreement was assessed for each journal by comparing total counts, from the first and second evaluations, for each of the content and region of origin categories. Across categories, mean percent agreement (100 X [lower count / higher count]) was 95% for *TPR* and 92% for *JEAB,* with agreement scores for individual categories within a journal ranging from 85% to 100%. Because the first and second evaluations produced similar results, the second one was arbitrarily chosen for use in the final data set.

RESULTS & DISCUSSION

New and veteran authors. Figure 1 summarizes the contributions of new and veteran authors in *JEAB* (filled circles) and *TPR* (open circles), from 1980 to 1999 in five-year intervals. The left panel shows that, for *JEAB,* the proportion of EAHB articles contributed by new first authors has held steady across the sampling period at around .50. For *TPR,* the proportion of articles contributed by new first authors has remained at or above *JEAB* levels. Overall, the data suggest that EAHB benefits from a steady infusion of new talent. The right panel of Figure 1 shows that, in both *JEAB* and *TPR,* the proportion of articles contributed by veteran authors has increased since 1985, although the trend is more pronounced in *JEAB.*

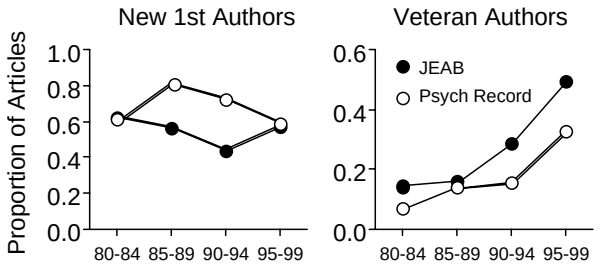

Figure 1

The distribution of new and veteran authors may vary across different research areas, however. A similar trend was found in a recent analysis of the sources cited most frequently in the EAHB, with the majority of the sources addressing issues in (derived) stimulus control (Critchfield, et al., 2000). To address this issue, Table 2 shows the numbers of new first authors and veteran authors from each of the EAHB research content areas listed in Table 1 in *JEAB* and *TPR,* respectively. For content categories, BP = Behavioral Pharmacology, CP = Choice and Preference, SC = Stimulus Control, RP = Reinforcement and Punishment, SV = Social and Verbal Behavior. Research on basic Reinforcement and Punishment and Stimulus Control processes account for the majority of new first authors in both journals, with the biggest increase in new contributors being evident in Stimulus Control articles published in *TPR.* Interestingly, Stimulus Control articles published in *JEAB* account for the highest number of veteran authors across all research categories.

Table 2

The numbers of new first authors and veteran authors from each of the EAHB research content areas listed in Table 1 in *JEAB* and *TPR,* respectively. BP = Behavioral Pharmacology, CP = Choice and Preference, SC = Stimulus Control, RP = Reinforcement and Punishment, SV = Social and Verbal Behavior.

	BP	CP	SC	RP	SV
JEAB					
New First Authors	13	27	60	71	46
Veteran Authors	4	4	18	8	4
TPR					
New First Authors	5	9	79	63	47
Veteran Authors	0	0	7	7	4

Most prolific authors. To provide a more detailed estimate of who has contributed what to EAHB, a list was compiled of the investigators (*N* = 42) who have contributed the most EAHB articles in *JEAB* and *TPR* combined, during the sampling period (see Table 3). The only criteria for inclusion in this list was the publication in either journal of at least 5 articles in which an individual was named as an author. Content categories checked in Table 3 are those to which an author contributed at least one article during the census period. As an aside, only 7 of the authors - 5 from Europe, 1 from Australia, and 1

author who listed, at different times, affiliations in both Australia and North America - had affiliations outside the North America, although 4 of these were among the 20 most prolific authors.

Because the content categories employed are not mutually exclusive, authors could contribute to multiple categories with each article. The topical interests of EAHB's most prolific investigators are addressed in Figure 2, which shows the proportion of the 42 most prolific individuals listed in Table 3 who contributed to each of the five article content categories defined in Table 1. The research categories of Stimulus

Table 3

Most prolific EAHB authors (1980 - 1999)

Author	Content Categories					# Articles		
	BP	CP	SC	RP	SV	*JEAB*	*TPR*	Total
Barnes-Holmes D.			√	√	√	6	16	22
Fields L.			√			6	11	17
Buskist W. F.		√	√	√	√	3	11	14
Adams B. J.			√			5	8	13
Hayes S. C.			√	√	√	9	3	12
McIlvane W. J.			√	√	√	7	5	12
Bickel W. K.	√	√	√	√	√	9	2	11
Critchfield T. S.	√		√		√	8	3	11
Dube W. V.			√	√		7	4	11
Cherek D. R	√	√		√	√	4	6	10
Smeets P. M.			√	√	√	1	9	10
Bennett R. H.	√	√	√	√	√	2	7	9
Higgins S. T.	√	√	√	√	√	7	2	9
Spradlin J. E.			√			7	2	9
Verhave T.			√			3	6	9
Hayes L. J.		√	√	√	√	3	9	9
Crosbie J.			√	√	√	2	5	7
Green G.			√			6	1	7
Keenan M.			√	√	√	2	5	7
Perone M.		√	√	√	√	6	1	7
Reeve K. F.			√			5	2	7
Saunders K. J.			√			5	2	7
Saunders R. R.			√			5	2	7
Sidman M.			√			6	1	7
Bentall R. P.			√	√	√	3	3	6
DeGrandpre R. J.	√	√	√	√	√	4	2	6
Dougherty D. M.	√	√	√	√	√	2	4	6
Griffiths R. R.	√	√	√	√	√	5	1	6
Hughes J. R.	√	√	√	√		5	1	6
Lane S. D.		√	√	√	√	3	3	6
Miller H. L.		√	√	√	√	1	5	6
Stromer R.			√			3	3	6
Wulfert E.			√			3	2	5
Baron A.			√	√	√	4	1	5
Chase P. N.			√	√	√	5	0	5
Dougher M. J.			√	√	√	3	2	5
Fantino E.		√	√	√		5	0	5
Holborn S. W.			√	√	√	2	3	5
Kelly T. H.	√		√	√	√	4	1	5
Lee V. L.				√	√	2	3	5
McDowell J. J.		√		√	√	5	0	5
Roche B.			√		√	2	3	5

Table 4

Most prolific EAHB authors in each of the research content areas, and number of articles published in *JEAB* and *TPR* combined during the 1980s, the 1990s, and the overall census period.

Behavioral Pharmacology	80s	90s	Σ
Bickel W.K.	2	8	10
Higgins S.T.	3	5	8
Griffiths R.R.	3	3	6
DeGrandpre R.J.		4	4
Foltin R.W.		4	4
Kelly T.H.		3	3
Bennett R.H.		2	2
Cherek D.R.		2	2
Rush C.R.		2	2
Silverman K.		2	2

Choice & Preference	80s	90s	Σ
Logue A.W.	2	2	4
Navarick D.L.	2	2	4
Flora S.R.		3	3
Hackenberg T.D.		3	3
Madden G.J.		3	3
Bickel W.K.		2	2
Buskist W.F.	2		2
Darcheville J.C.		2	2
DeGrandpre R.J.		2	2
Leung J.P.	1	1	2
McDowell J.J.	1	1	2
Rachlin H.	1	1	2
Silberberg A.	1	1	2
Sonuga-Barke E.		2	2

Stimulus Control	80s	90s	Σ
Barnes-Holmes D.		19	19
Fields L.	1	16	17
McIlvane W.J.	6	6	12
Adams B.J.		11	11
Critchfield T.S.		11	11
Dube W.V.	4	7	11
Smeets P.M.	2	8	10
Hayes S.C.	4	5	9
Hayes L.J.	2	5	7
Sidman M.	5	2	7
Saunders K.J.	3	4	7
Saunders R.R.	2	5	7
Stromer R.	2	4	6
Dougher M.J.		5	5
Perone M.	2	3	5
Roche B.		5	5
Stoddard L.T.	4	1	5
Wulfert E.	1	4	5
Baron A.	3	1	4
Bickel W.K.	1	3	4
Dymond S.		4	4
Fantino E.	2	2	4
Galizio M.	1	3	4
Griffiths R.R.	1	3	4
Lane S.D.		4	4
Lazar R.M.	2	2	4

Reinforcement & Punishment	80s	90s	Σ
Buskist W.F.	10	3	13
Cherek D.R.		10	10
Bennett R.H.	5	3	8
Barnes-Holmes D.	1	6	7
Crosbie J.		7	7
Higgins S.T.	3	4	7
Bickel W.K.	1	5	6
Dougherty D.M.		5	5
Catania A.C.	4		4
DeGrandpre R.		4	4
Fantino E.	2	2	4
Johnston J.M	3	1	4
Lowe C.F	3	1	4
Matthews B.A.	4		4
McDowell J.J.	4		4
Ninness H.A.C.		4	4
Perone M.	2	2	4
Shimoff E.	4		4
Spiga R.		4	4
Wearden J.	1	3	4
Zeiler M.D.	3	1	4
Baron A.	3		3
Bentall R.P.	3		3
Case D.	2	1	3
Flora S.R.		3	3
Hackenberg T.		3	3
Hayes S.C.	3		3
Joyce J.H.	1	2	3
Lee V.L.		3	3
Madden G.J.		3	3
Morgan D.L.	2	1	3
Navarick D.	2	1	3

Social & Verbal Behavior	80s	90s	Σ
Cherek D.R.		8	8
Critchfield T.S.		8	8
Buskist W.F.	4	3	7
Barnes-Holmes D.		6	6
Catania A.C.	4		4
Chase P.N.	2	2	4
Dougherty D.M.		4	4
Hayes L.J.	1	3	4
Hayes S.C.	4		4
Matthews B.A.	4		4
Shimoff E.	4		4
Spiga R.		4	4
Bernstein D.J.		3	3
Hake D.	3		3
Joyce J.H.	1	2	3
Kelly T.H.		3	3
Ninness H.A.C.		3	3
Rosenfarb I.	2	1	3
Schmitt D.R.	1	2	3
Bentall R.P.	1	1	2
Cerutti D.T.	0	2	2
DeGrandpre R.J.	0	2	2
Foltin R.W.	0	2	2
Lane S.D.	0	2	2
Martinez H.	0	2	2
Michael R.L.	0	2	2
Roche B.	0	2	2
Schmid T.	2	0	2
Torgrud L.J.	0	2	2
Vyse S.A.	0	2	2
Wulfert E.	1	1	2

Control, Reinforcement and Punishment, and Social and Verbal Behavior were addressed more often than Behavioral Pharmacology or Choice and Preference (left panel). The right panel of Figure 2 shows the primary topical emphasis of the most prolific authors, defined as the content category in which each author was most often represented. Consistent with historical trends in EAHB topical coverage, Stimulus Control and Reinforcement and Punishment were the most common major emphases. Interestingly, Social and Verbal Behavior, although frequently addressed in EAHB articles was the primary emphasis for only 2 of the 42 most frequent contributors, suggesting that social and verbal processes are often a tangential consideration in contemporary EAHB research (e.g., Critchfield, Tucker, & Vuchinich, 1998). Choice and Preference was the area of primary emphasis for none of the 42 most prolific authors.

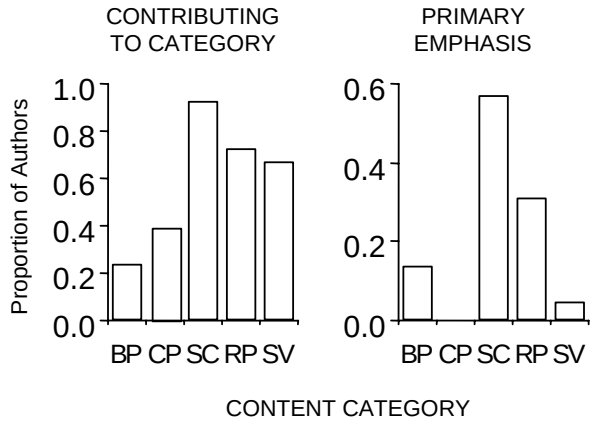

Figure 2

To evaluate content-area specialization more precisely, the most prolific authors, operationally defined as those with the most articles in a content category in *JEAB* and *TPR* during the census period, including at least one first-author publication, in each of five content areas, were determined. Table 4 lists approximately the 25 most prolific authors per content area (less for low-frequency content areas, more in the case of ties). Table 5 provides an estimate of the extent to which these authors have been specialized in their interests. The table shows the probability of an author in one content area also contributing to the other content areas. Several patterns are evident. First, the proportions shown in Table 5 all exceed the base rate with which the content categories were represented in the sample of articles. This outcome is not surprising given that the authors involved, by definition, contributed more often than the typical author. Nevertheless, the base rates serve as a reminder that the content areas were addressed unequally in the sample of articles, and thus serve as a useful point of comparison for the other data in the table. Second, the most prolific authors in Behavioral Pharmacology exhibited a remarkable range in topical emphasis, with at least four-fifths of these authors contributing to each of the other four content areas. This may be a characteristic of human Behavioral Pharmacology, which, in the abstract, considers drugs in the context of the major operant phenomena (Higgins & Hughes, 1998), or it may simply reflect the interests of the relatively few authors involved in our sample (Table 2). Third, authors with a Stimulus Control emphasis tended to contribute least frequently to each of the other four categories than colleagues with other topical emphases. But whether the apparent specialization of Stimulus Control researchers reflects a worrisome narrowness, or a valuable focusing of perspective in a rapidly maturing research area, cannot be ascertained from the data.

Table 5

Proportion of the most prolific EAHB authors in each content area that also contributed to other content areas.

Author's	Other Content Areas of Contribution				
Content Area	BP	CP	SC	RP	SV
BP	--	.80	.80	.80	1.00
CP	.14	--	.43	.71	.39
SC	.15	.27	--	.53	.58
RP	.25	.50	.59	--	.75
SV	.27	.27	.87	.73	--

CONCLUSIONS

Overall, the present data suggest that the EAHB benefits from a moderate but steady infusion of new talent which is balanced by the contributions of veteran investigators. Whether the next generation of investigators can sustain the field's momentum of the past twenty years remains to be seen. There is cause for optimism, however, in the observation that several of the most prolific authors in each of the five content areas examined contributed exclusively in the 1990s.

The present findings mirror those of Critchfield et al. (2000) and Dymond and

Critchfield (2001, 2002) to the extent that over the past two decades research in Stimulus Control has supplanted that of other areas. To evaluate whether or not this represents a threat to the diversity of the EAHB, consider the following points. First, the increase in attention to Stimulus Control appears to be at the detriment of research on Choice and Preference and Behavioral Pharmacology. While the appearance of Choice and Preference studies with humans in *JEAB* and *TPR* may have already peaked, at least using existing preparations, research on human Behavioral Pharmacology is regularly published in mainstream psychopharmacology journals. This suggests a wider audience for both Behavioral Pharmacology and the EAHB discipline than is revealed by the present analysis. For instance, journals such as *Pharmacology, Biochemistry and Behavior, Learning and Motivation, the Journal of Experimental Child Psychology, the Quarterly Journal of Experimental Psychology, the American Journal on Mental Retardation, and Brain Injury,* among others have contained EAHB publications in recent years. While trends such as these bode well for the field in general, additional factors such as the pressure on faculty to publish high-quality articles in high-impact journals (see Garfield, 1989), suggest that EAHB research may have to continue broadening its publication base.

Second, practical considerations and the relative ease of conducting research on Stimulus Control topics may partly explain content trends. As others have noted, stimulus control studies often require subjects to participate for only a few hours compared to the parametric and otherwise complex designs often employed in research on choice that often require the extended participation of individual subjects (Schmitt, 1995). Similarly, a range of readily available experimental software (e.g., Dube, 1991; Roche, Stewart, & Barnes-Holmes, 1999) and replicable experimental procedures now make it possible for isolated researchers to initiate and maintain a research program with few resources.

Third, the continued growth in Stimulus Control research reflects recent theoretical and empirical developments in the analysis of human verbal behavior. For many researchers, the generative, bidirectional nature of derived stimulus relations provides an empirical approach to, and working model of, verbal behavior itself (e.g., Hayes, Barnes-Holmes, & Roche, 2001). Given that understanding the complexity of human behavior directly has been the objective of behavior analysis from the outset, it is perhaps not surprising that human verbal behavior is now the subject of such research attention. Indeed, the experimental analyses of complex behavior such as cognition, emotion, and rule-following are still being developed and are being aided by the explanatory power of derived stimulus relations and the array of unique preparations now available to study human behavior directly. It seems, then, that research on derived stimulus relations is set to be a predominant feature of future publication trends. Finally, as theoretical and empirical advances continue areas such as stimulus control may command more funding opportunities and attract more graduate students and hence potentially more EAHB publications than other areas.

In conclusion, almost twenty years ago, Miller (1983) speculated on the factors behind a small human operant data base and asked whether the EAHB was "just dormant or … in the final abortive phases of demise" (p. 552). The present report, as well as other surveys of publication trends that are now available, clearly show that the EAHB is far from in demise. In fact, it continues to grow at a healthy and steady rate into a distinct, viable sub-discipline directly addressing the complexity of human behavior.

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