Letter Recognition by Mentally Retarded Adults: Improving Performance through Differential Outcomes

Paul R. Malanga
Western Michigan University

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LETTER RECOGNITION BY MENTALLY RETARDED ADULTS: IMPROVING PERFORMANCE THROUGH DIFFERENTIAL OUTCOMES

by

Paul R. Malanga

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Submitted to the
Faculty of The Graduate College
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requirements for the
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LETTER RECOGNITION BY MENTALLY RETARDED ADULTS: IMPROVING PERFORMANCE THROUGH DIFFERENTIAL OUTCOMES

Paul R. Malanga, M.A.
Western Michigan University, 1992

Four mentally retarded adults were taught to recognize (i.e., discriminate) finger spelling letters when presented as members of unchanging pairs (e.g., A and E, G and H). Correct responses were followed by food or verbal praise. On average, terminal accuracy was significantly greater when a correct response to a given letter was consistently followed by a particular outcome (e.g., food followed correct responses to A and praise followed correct responses to E) than when nondifferential outcomes were arranged (e.g., food followed 50% of all correct responses and praise followed the remaining 50%, regardless of whether the responses were to A or E). These findings suggest that the differential outcomes effect, which has been repeatedly demonstrated in nonhumans, can be established when teaching meaningful discriminations to mentally retarded people.
ACKNOWLEDGMENTS

The present manuscript is the result of a long and arduous process entailing many hours of laborious work. I wish to express sincere appreciation to Michael Mack and Mark LeSage who provided valuable input regarding the details of the construction of the experimental setting in addition to giving valuable input regarding the content of the text. In addition, I would like to thank my advisor, Dr. Alan Poling, for providing invaluable assistance and direction which helped improve the quality of this thesis. Without Dr. Poling's assistance, the timely completion of this thesis would not have been possible. Dr. Jack Michael and Dr. Wayne Fuqua also provided valuable suggestions contributing to the quality of the manuscript.

Appreciation is also expressed to the staff members of the Douglas Community Center (Kalamazoo, MI), whose cooperation and understanding helped minimize the possible adverse effects of extraneous events unrelated to this study.

The following individuals made substantial contributions to this study and without their help the completion of this thesis would have been impossible. Sue Schultz expended considerable time and effort assisting with the collection of interobserver agreement data, in addition
to making valuable comments regarding the analysis. Cindy Price also made substantial contributions with data collection as well as providing much needed emotional support. She also helped develop and implement performance management contingencies to facilitate my writing behavior.

Finally, I would like to acknowledge my parents, Mona and Paul; and my sister, Lynn, who provided unyielding support and encouragement throughout this project. Joseph Awad also provided support by demonstrating an unyielding amount of consideration when my production level was at its peak.

Paul R. Malanga
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Letter recognition by mentally retarded adults: Improving performance through differential outcomes

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CHAPTER I

INTRODUCTION

Stimulus control is evident when the frequency of occurrence of a particular response is different in the presence of a particular stimulus than in its absence. If, for instance, a child is more likely to cross a street in the presence of a green pedestrian signal than in its absence, the response of crossing is controlled by the signal light. Many important human behaviors are stimulus-controlled and the development of appropriate stimulus control is central to the educational process. Considerable effort has been expended in basic research designed to disclose the variables that affect stimulus control (e.g., Mackintosh, 1974; Rilling, 1977) and in applied research designed to develop appropriate stimulus-response relations in mentally retarded people (e.g., Rusch, Rose, & Greenwood, 1988; Sulzer-Azaroff & Mayer, 1991).

An important recent finding in the area of stimulus control is the differential outcomes effect (DOE), which refers to the increase in speed of acquisition or terminal accuracy that occurs in discrimination training when each of two or more discriminative stimuli are correlated with a
particular outcome (e.g., type of reinforcer). Trapold (1970) provided an early demonstration of this phenomenon. He exposed rats to a discrimination problem that required a response to one lever (R1) in the presence of one stimulus (S1), and a response to a second lever (R2) in the presence of another stimulus (S2). Acquisition was faster and greater accuracy occurred when correct R1s produced food pellets and correct R2s produced a sucrose solution than when both R1s and R2s produced the same kind of reinforcer.

Given that differential outcomes using different types of reinforcers with no delay can facilitate discriminative responding, what about differential delays using the same reinforcer? Carlson and Wielkiewicz (1972) used different delays of reinforcement as outcomes with food being the reinforcer. In the differential outcomes group, a 5-s delay of reinforcement consistently followed a response to one lever (R1) in the presence of one stimulus (S1) and no delay consistently followed the alternative response to a second lever (R2) in the presence of another stimulus (S2). The random-delay group consisted of each of the two stimulus-response sequences being followed, on a random half of the trials, by a delay of reinforcement while the all-delay group experienced a delay of reinforcement for all correct responses. The no-delay group received the reinforcer immediately for all correct responses. The
differential outcomes group reached a higher level of terminal accuracy in a shorter period of time than the remaining three groups.

Demonstrating the DOE using conditional discrimination procedures has applied significance since many important discriminations, especially with developmentally delayed individuals, involve these types of discriminations. Given that differential delays can be used to facilitate discriminative responding using only one reinforcer, what about qualitatively different reinforcers across different delays? Peterson, Wheeler and Armstrong (1978) assessed this possibility by employing a two-choice delayed conditional discrimination task with qualitatively different reinforcers. In the differential outcomes condition, food was correlated with correct responses following one sample stimulus and water with another. Alternatively, in the nondifferential outcomes condition, food and water were arranged with equal probability for all correct responses. Delays of 0, 2, and 3 seconds were inserted between the offset of the sample stimulus and the onset of comparison stimuli. Results indicated that performance was superior in the differential outcomes condition.

In the studies reviewed thus far, the reinforcers used have been biologically relevant. However, unconditioned reinforcers are not always available nor are they always
desirable. One of the disadvantages with unconditioned reinforcers is that they are often inconvenient from an applied standpoint. In most, if not all cases, it is more convenient and pragmatic to use conditioned reinforcers. This being the case, it would be advantageous if the DOE could be obtained using conditioned reinforcers. Peterson and Trapold (1982) used qualitatively different reinforcers in differential and nondifferential outcomes arrangements with pigeons. Unlike Peterson et al. (1978), who used two biologically relevant reinforcers (food and water), Peterson and Trapold used a biologically relevant reinforcer (food) and a biologically neutral outcome (tone). In the differential outcomes group, following the presentation of red samples, correct responses resulted in 3-sec access to grain. Alternatively, following the presentation of green samples, correct responses resulted in 0.75-sec 1-kHz tone. The arrangement was the same for the nondifferential outcomes group with the exception that there was no correlation between sample color and the outcome of correct responses, which was 50% food and 50% tone in all cases. Not surprisingly, the differential outcomes group performed significantly better than the nondifferential outcomes group.

Similarly, Peterson (1984) assessed the effects of food and tone as outcomes in a differential and
nondifferential paradigm using a delayed-matching-to-sample discrimination procedure with delays of 0 and 1-sec with pigeons. In the differential outcomes condition, responses to a vertical line pattern (R1) contingent on the presentation of a red sample (S1) resulted in 3-sec access to grain (O1) while responses to a horizontal line pattern (R2) contingent on the presentation of a green sample (S2) resulted in a 0.75-sec 1-kHz tone (O2). The nondifferential outcomes group was exposed to the same conditional discrimination task as the differential outcomes group with the exception that O1 and O2 followed each stimulus-response sequence equally often. The differential outcomes group performed better than the nondifferential outcomes group across all delays.

Many other studies of the DOE have appeared. Most of them involved nonhuman subjects (rats or pigeons) and used delayed-matching-to-sample (e.g., Peterson, Linwick, & Overmier, 1987; Edwards, Jagielo, Zentall, & Hogan, 1982; Urcuioli, 1990) or two-choice successive discrimination procedures (e.g., Carlson & Wielkiewicz, 1972; Fedorchak & Bolles, 1986; Papini & Silingardi, 1989). The DOE has been demonstrated with a variety of outcomes, including different probabilities of reinforcement (DeLong & Wasserman, 1981), quantitatively different reinforcers (Carlson & Wielkiewicz, 1976), qualitatively different reinforcers.
(Peterson et al., 1978), and food versus a tone (Peterson & Trapold, 1980).

With one exception (Santi & Savich, 1985), in every study with nonhumans there was evidence that subjects exposed to differential outcomes learned the discrimination tasks faster or exhibited greater steady-state accuracy than subjects exposed to nondifferential outcomes. In most studies, the DOE was impressive in magnitude. For example, in a study that employed a delayed-matching-to-sample procedure and a crossover design with pigeons, at an 8-s delay subjects were correct on 96% of trials under the differential outcomes condition and on 73% of trials under the nondifferential outcomes condition (Alling, Nickel, & Poling, 1991). These results are not exceptional in the magnitude of the DOE observed.

Findings with nonhumans suggest that the use of differential outcomes might prove useful in teaching difficult discriminations to humans. Surprisingly few published studies have explored this possibility. The DOE clearly was evident in one of these investigations (Saunders & Sailor, 1979), which used severely mentally retarded children as subjects. The task performed was a two-choice successive discrimination. Across the first four conditions of the study, one subject was exposed, in order, to differential outcomes, nondifferential outcomes,
differential outcomes, and nondifferential outcomes. The median percent correct responses across these conditions for that subject were 74%, 49%, 63%, and 52%. For the other subject, exposed to nondifferential, differential, nondifferential, and differential outcomes, the median percent correct responses were 52%, 60%, 46%, 64%. For a third subject, who was exposed in order to differential and nondifferential outcomes, median accuracy levels were 53% and 46%, respectively.

The DOE also was evident in a study that examined acquisition of a three-choice successive discrimination by three moderately and severely mentally retarded children (Janssen & Guess, 1978) and in a study examining two-choice successive discrimination by five autistic children (Litt & Schreibman, 1981). Two methodologically weak clinical reports also provide a suggestion of the effect (Hewett, 1965; Stark, Giddan, & Meisel, 1968). Each of these clinical reports involved a single autistic child performing a two-choice successive discrimination.

In contrast to these findings, Dube, Rocco, and McIlvane (1989) failed to observe the DOE in four mentally retarded adults. Interestingly, they employed delayed-matching-to-sample procedures similar to those used in studies of the DOE with nonhumans. At delays ranging from 0 to 5 s in three subjects, and from 0 to 7 s in one
subject, percent correct responses did not differ appreciably when differential and nondifferential outcomes were arranged. The variables responsible for the failure of Dube et al. to produce the DOE are unknown, although those authors discussed several possibilities.

The findings of Dube et al. notwithstanding, it appears that differential outcomes can in some cases be used to facilitate the acquisition of appropriate stimulus-controlled behavior in developmentally delayed people. The purpose of the present study was to examine whether the use of differential outcomes facilitated in moderately and severely mentally retarded adults the acquisition of a functional skill, recognizing sign language letters.
CHAPTER II

METHOD

Participants

Four mentally retarded adults, three men and one woman (Participant 2), served as participants in the present study. The ages of Participants 1, 2, 3, and 4 were 57, 29, 33, and 38 years, respectively. Participants 2 and 3 were moderately mentally retarded. Participants 1 and 4 were severely mentally retarded. Three of the participants lived in adult community living situations; Participant 2 lived at home with her mother. Participant 1 received thioridazine five days per week for behavior control. Participants 2, 3, and 4 received anticonvulsant medications (carbamazepine, phenytoin and valproic acid, and phenytoin, respectively) each day.

Participants 3 and 4 were able to carry on a simple conversation. Participant 2 had a more limited verbal repertoire. Her expressive language skills were limited to one- and two-word utterances. Participant 1 emitted grunts and hand gestures but no words could be readily distinguished.

These individuals were chosen for inclusion in the study based on their known limited history with the class
of stimuli used in this study (sign language letters). Informed consent and assent were secured and Human Subjects Institutional Review Board approval was obtained before the experiment began (see Appendix A).

Setting and Materials

The setting was a day treatment program for developmentally disabled adults. The study was conducted in a room measuring approximately 7 by 20 meters. During all experimental sessions the room contained a table, three chairs and a file board partial partition positioned to the right of the experimenter. The chairs were arranged in a semi-triangular form with one chair on one side of the table and two chairs divided with the file board partial partition on the other side. The purpose of the partition was to prevent the experimenter and independent observer from seeing one another. The experimenter (author) and the participant sat facing each other across the table. During sessions when interobserver agreement was calculated, the observer sat in the third chair to the right of the file board partition.
Figure 1. Sample Data Sheet.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Response +/-</th>
<th>CORR Stimulus</th>
<th>Position</th>
<th>SR+/Sr+</th>
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<td>20</td>
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The only materials used were 7 cm by 9 cm black and white pictures of finger spelling letters and a data collection sheet developed by the experimenter displayed in Figure 1. The pictures were copied from Riekehof (1978) and were enlarged to the desired size.

Procedure

Participants were taught to identify finger spelling letters when presented as members of unchanging pairs in a two-choice discrimination task. Six pairs of letters were used in the study: A and E, G and H, I and J, U and R, P and Q, and M and N. These pairs were chosen because the sign for both letters in each pair are topographically similar, which should make it relatively difficult to discriminate between them. Prior research indicated that the DOE is most readily observed when the task being learned is relatively difficult (Goeters et al., in press).

Each session consisted of 20 trials. A trial began when the experimenter placed cards representing the pair of letters (signs) under consideration face up before the participant and prompted, "Touch the sign _____" (one of the letters from the pair being taught, e.g., A or E). Each participant had previously learned to respond appropriately to the touch command, thus no other instruction was necessary to produce a response.
If the participant touched the appropriate letter within 10 s of the prompt, a correct response was recorded by the experimenter and a reinforcer (food or verbal praise) was delivered immediately. If no response occurred within 10 s (which very rarely occurred), or if the participant touched the letter not named by the experimenter, an incorrect response was recorded and neither food nor verbal praise was forthcoming. The trial ended when a correct or incorrect response occurred. At that time, the pictures of signed letters were removed from the table and a 10-s intertrial interval, timed with a digital wristwatch, began.

All trials were similar to the one just described. Across each session, each letter was presented to the participant's left on 10 trials and to the participant's right on 10 trials. The location of a particular letter across trials varied across sessions and was random. On 10 trials, selected at random with the exception that no one letter was designated as correct on more than three consecutive occasions, the experimenter asked the participant to touch one of the letters (e.g., A). On the remaining trials, he asked the participant to touch the other letter (e.g., E). Training with a given pair of letters continued until there was no visually evident trend in percent correct responses across five consecutive sessions. Sessions
generally were conducted each weekday, at about the same
time each day.

Two experimental conditions were compared. In one
(D), outcomes were differential. When outcomes were
differential, correct responses to one letter (e.g., A)
were followed by food (one piece of Kix cereal, General
Mills, Minneapolis) and correct responses to the other
letter (e.g., E) were followed by verbal praise (e.g.,
"Well done," "Good work," "Excellent job"). In the other
experimental condition (N), outcomes were nondifferential.
Here, 50 percent of correct responses to both letters
(e.g., A and E) were followed by food and the remaining 50% of
correct responses were followed by verbal praise. The
type of consequence arranged across successive correct
responses was selected at random, with the exception that a
particular outcome was not delivered for more than three
consecutive correct responses.

Participant 1 was exposed, in order, to D-N-D-N
conditions, with correlated letter pairs of P and Q, M and
N, R and U, and G and H. Participant 2 was exposed to
differential and nondifferential outcomes in the sequence
N-D-N-D-N. Letter pairs for this participant, in order of
presentation, were A and E, G and H, I and J, M and N, and
R and U. Participant 3 also was exposed to an N-D-N-D-N
sequence. The letter pairs correlated with these condi-
tions were P and Q, M and N, R and U, G and H, and A and E, respectively. The sequence of conditions for Participant 4 was D-N-D-N, with the correlated letter pairs of A and E, G and H, I and J, and M and N. On average, 14 sessions were required for responding to stabilize under the differential outcomes condition; the range was 5 to 21 sessions. A mean of 13 sessions, with a range of 6 to 32, was required for stability under the nondifferential outcomes condition.
CHAPTER III

RESULTS

The experimenter recorded percent correct responses during each session. On 130 of the 253 total sessions (51%), and at least 50% of the total sessions for each participant, an independent observer also recorded data. Interobserver agreement was determined by comparing those data to data recorded by the experimenter. Overall interobserver agreement, calculated by the point-by-point method (Kazdin, 1982), was 97%, with a range across sessions of 75 to 100%. Because interobserver agreement was high, only data recorded by the experimenter will be considered here.

Figure 2 summarizes results for the entire experiment. This figure presents mean group percent correct responses for all subjects when exposed to differential and nondifferential outcomes. These data represent the last five sessions of exposure to each condition, during which performance stabilized.

When data are combined across subjects and exposures, mean percent correct responses was 84 under the differential outcomes condition and 57 under the nondifferential outcomes condition. This difference in means is substantial, and a paired t-test indicated that it is significant.
Figure 2. Mean Percent Correct Responses by Each Participant During the Last Five Sessions of exposure to Each Experimental Condition.

Vertical lines represent plus and minus one standard error.

at the .001 level ($t = 4.18$, $df = 29$, $p < .001$).

Although overall accuracy was much greater under the differential outcomes condition, the accuracy of individual participants varied considerably across conditions and was not always higher when differential outcomes were arranged.

Table 1 shows for each participant mean percent correct responses during the final five sessions of exposure to all experimental conditions. It is of interest that many errors appeared to be the result of position preferences, which were especially common under the nondifferential condition.
Table 1

Mean Percent Correct Responses by Each Participant During the Last Five Sessions of Exposure to Each Experimental Condition

<table>
<thead>
<tr>
<th>Participant</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 D N D N</td>
<td>57</td>
<td>67</td>
<td>51</td>
<td>45</td>
<td>-</td>
</tr>
<tr>
<td>2 N D N D N</td>
<td>50</td>
<td>77</td>
<td>71</td>
<td>96</td>
<td>52</td>
</tr>
<tr>
<td>3 N D N D N</td>
<td>100</td>
<td>97</td>
<td>2</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>4 D N D N</td>
<td>98</td>
<td>50</td>
<td>90</td>
<td>51</td>
<td>-</td>
</tr>
</tbody>
</table>

*Conditions are listed in the order arranged for each participant. Conditions with differential outcomes are designated by "D," those with nondifferential outcomes by "N."

Table 2 provides a summary of errors per side for each participant under all experimental conditions. The data reported in Table 2 are not unique. Peterson, Wheeler and Armstrong (1978) have also reported position preference responding in nondifferential outcomes conditions.

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Table 2
Mean Percent of Total Errors by Each Participant When the Correct Stimulus was Presented on the Right

<table>
<thead>
<tr>
<th>Condition* and Percent of Error Responding</th>
<th>Participant</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td>D</td>
<td>N</td>
<td>D</td>
<td>N</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>42</td>
<td>48</td>
<td>47</td>
<td>47</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Participant 2</td>
<td>N</td>
<td>D</td>
<td>N</td>
<td>D</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>49</td>
<td>78</td>
<td>71</td>
<td>10</td>
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<tr>
<td>Participant 3</td>
<td>N</td>
<td>D</td>
<td>N</td>
<td>D</td>
<td>N</td>
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<tr>
<td></td>
<td>0</td>
<td>58</td>
<td>50</td>
<td>63</td>
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<tr>
<td>Participant 4</td>
<td>D</td>
<td>N</td>
<td>D</td>
<td>N</td>
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<tr>
<td></td>
<td>50</td>
<td>81</td>
<td>73</td>
<td>98</td>
<td>-</td>
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</table>

*Conditions are listed in the order arranged for each participant. Conditions with differential outcomes are designated by "D," those with nondifferential outcomes by "N."

Participants 1 and 3 showed the least amount of position preference across all experimental conditions. The data for participant 1 indicates no position preference across all experimental conditions. The main reason for this is that he responded in a left-right-left alternate fashion regardless of the condition. This clearly indicates that the consequences were not controlling his
behavior. Therefore, no consequences were delivered during the last N condition. The rationale for this experimental manipulation was to assess what influence this may have on his choice behavior. This had no effect on his choice behavior.

Position preference is indicated for participant 3 in the third N condition and second D condition. However, in the second D condition, there were only 24 incorrect responses across nine sessions for an average of 2.6 errors per session. All the errors occurred in the first four sessions of this condition, however, which results in an average of six errors per session for the first four sessions. Responding was perfect for the last five sessions.

Participants 2 and 4 exhibited the greatest degree of position preference across all experimental conditions. For Participant 2, the greatest degree of position preference occurred during the second and third N conditions respectively. The second D condition indicates a large amount of position preference. Thirty-eight incorrect responses occurred across 17 sessions; 23 of the 38 incorrect responses (60%) occurred during the first five sessions. The remaining sessions, with the exception of one, included no more than two errors per session and no session consisted of more than five errors.
During the nondifferential outcomes conditions, Participant 4 responded almost exclusively to his left. Position preference responding did not occur during the D conditions. The error analysis for the second D condition indicates biased responding. However, only two sessions resulted in 11 or more errors. The greatest number of errors in the remaining sessions was four. A high degree of accurate responding was obtained during both D conditions.
CHAPTER IV

DISCUSSION

According to Urcuioli (1990), "One of the most consistent and powerful effects on the learning and retention of conditional discriminations is the enhancement of performance by differential outcomes" (p. 410). Over thirty studies with nonhumans, reviewed elsewhere (Goeters et al., in press), support his contention. So, too, do the results of the present study. These data provide clear evidence of the DOE in that mean steady-state accuracy in a two-choice discrimination task was appreciably higher with differential outcomes than with nondifferential outcomes.

The DOE has not been intensively studied in humans. Three studies (Janssen & Guess, 1978; Litt & Schreibman, 1981; Saunders & Sailor, 1979) and two case reports (Hewett, 1965; Stark et al., 1968) provide evidence that the DOE occurs in autistically impaired and mentally retarded children. In contrast, no evidence of the DOE was apparent in the single study that compared the effects of differential and nondifferential outcomes in adult humans (Dube et al., 1989). Thus the present study provides the only published demonstration of the DOE in adult humans.
There is no obvious reason why the DOE was apparent in the present experiment, but not in the Dube et al. (1989) study. Dube et al., who used various edibles and money as consequences, noted that the subjects in nonhuman demonstrations of the DOE were food deprived, whereas their participants were not. They suggested, "Perhaps deprivation is necessary to produce specific-outcome effects in delayed matching" (Dube et al., 1989, p. 489). The present findings do not bear directly on this suggestion, but they do indicate that deprivation is not necessary to produce specific-outcome effects (i.e., the DOE) under all procedures.

Dube et al. (1989) also pointed out that their participants entered the study with generalized identity matching already established. This may have interfered with the development of sample-specific behaviors which play a role in producing the DOE. Understanding how this might occur requires consideration of the mechanism responsible for the DOE.

Although there is no consensus as to how the DOE is best explained, several authors have offered a similar account (Alling et al., 1991; Dube et al., 1989; Goeters et al., in press; Peterson, 1984; Peterson & Trapold, 1980, 1982), as follows: Because a specific discriminative stimulus (e.g., "Touch the sign A" in the present study) is
reliably followed by a particular outcome (e.g., food), whereas another discriminative stimulus (e.g., "Touch the sign E") is reliably followed by a different outcome (e.g., verbal praise), those stimuli come (probably through respondent conditioning) to control different "expectancies." These expectancies may, but do not necessarily, involve overt behaviors (i.e., public conditioned responses). As Peterson, Wheeler, and Trapold (1980) noted, regardless of their form, "expectancies have stimulus properties which enable them to play all of the same behavior-controlling functions that exteroceptive stimuli can play [including] the acquisition of direct stimulus control over overt behaviors" (p. 269).

The DOE occurs because stimulus-specific expectancies act in conjunction with the physical features of particular discriminative stimuli to control choice behavior. In essence, two potential sources of stimulus control, expectancies and physical features, are present when differential outcomes are arranged, but only the latter source is present with nondifferential outcomes. The added source of stimulus control improves accuracy.

Dube et al. (1989) posited that the existence of a generalized identity matching repertoire in their participants may have interfered with the development of sample-specific responding ("expectancies" in the analysis above),
which is necessary for the DOE to occur. This is surely plausible.

In contrast to the Dube et al. (1989) study, the present investigation included no delays. Future research efforts might use a two-choice discrimination task employing differing amounts of delays, since this procedure has resulted in the DOE being observed with mentally retarded adults.

At present, the conditions under which the DOE can be produced in humans are unknown. That notwithstanding, it does appear reasonable to consider the use of differential outcomes as a technique for facilitating the development of appropriate stimulus-controlled responding in mentally retarded (and other) people. Put simply, the DOE potentially is of applied significance and merits further investigation in educational settings.
Appendix A

Approval Letter From the Human Subjects Institutional Review Board
Date: August 23, 1990
To: Paul R. Malanga
From: Mary Anne Bunda, Chair
Re: HSIRB Project Number 90-07-23

We have received the second revisions to your research protocol, and we find these revisions to be satisfactory. Therefore, this letter will serve as confirmation that your research protocol, “Establishing Discriminations with the Mentally Retarded using the Differential Outcomes Procedure,” has been approved, as revised, after full review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any change in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

xc: Alan Poling, Psychology

Approval Termination: August 23, 1991

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Appendix B

Approval Letter From the Kalamazoo County Human Services Department
TO: David Sluyter, Director
     Center for DD Adults
FROM: Patricia Davis Baker
DATE: April 10, 1991
RE: Research Review Proposal
     Paul Malanga

This is to notify you that our office has received the revisions suggested for Mr. Paul Malanga's research protocol. I have asked John Chamberlin to review recommendations and revisions to see if the revisions adequately address recommendations. Mr. Chamberlin has advised me that changes do address recommendations. I have verbally advised Mr. Malanga of the above and that he is able to commence his proposal.

PDB/cd

cc: Paul Malanga
BIBLIOGRAPHY


