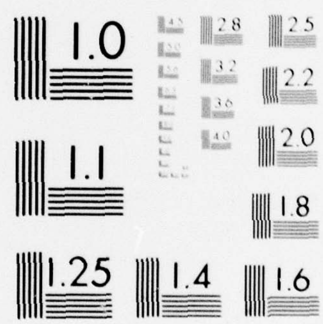
AD-A074 167 WASHINGTON SCHOOL OF PSYCHIATRY D C F/G 5/10
PROGRAMMED ALTERATION OF PERCEPTUAL AND CONCEPTUAL CONTROL OVER--ETC(U)
FEB 64 I GOLDIAMOND DA-49-193-MD-2448

UNCLASSIFIED NL

| OF |

AD
A074167

END
DATE
FILMED
10-79
DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

05G

LEVEL II

PROGRAMMED ALTERATION OF PERCEPTUAL AND CONCEPTUAL CONTROL OVER BEHAVIOR: TWO PAPERS

ISRAEL GOLDIAMOND
INSTITUTE FOR BEHAVIORAL RESEARCH

Performed under contract between
THE WASHINGTON SCHOOL OF PSYCHIATRY and
THE OFFICE OF THE SURGEON GENERAL,
U. S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
Contract No. DA-49-193-MD-2448

and ARIZONA STATE UNIVERSITY
and the ELECTRONIC SYSTEMS DIVISION,
U. S. AIR FORCE SYSTEMS COMMAND

February 1964

17p.

Accepted for publication in the Journal of the experimental Analysis of Behavior.

369650

79 09 24 361

DEPARTMENT OF THE ARMY
ARI FIELD UNIT, BENNING
U. S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES
P.O. BOX 2086, FORT BENNING, GEORGIA 31905

PERI-IJ

8 August 1979

SUBJECT: Shipment of Documents

Defense Documentation Center
Cameron Station
Alexandria, VA 22314
ATTN: Selection & Cataloging

The Documents in these shipments are approved for public release. The distribution is unlimited.

FOR THE CHIEF:

ALEXANDER NICOLINI
Major, Infantry
R&D Coordinator

ABSTRACT

Starting out with a task involving simple discrimination of forms or concepts, a human subject winds up discriminating on an entirely different and more complex basis, the transfer of control being accomplished almost without error, and as a result of a built-in feature of the sequence of behaviors or stimuli programmed.

Two papers are presented. In the first, discrimination of differing triangles, perceptual stimuli, is established errorlessly in preschool children, where, without the sequence, such discrimination is extremely difficult. In the second paper, the sequence is used to establish conceptual control over behavior.

The papers exemplify the "fading" method, adapted from programmed instruction and derived from animal research. This involves programming the establishment of discrimination without error. The papers also indicate the behavioral similarity between discrimination, perception, and conceptualization. Uses of the procedure for research and training in these areas are suggested.

Errorless establishment of visual discrimination using fading procedures[1]

Robert Moore and Israel Goldiamond[2]

Arizona State University[3]

A visual discrimination task involved presenting a triangle briefly as a sample; when it was withdrawn, this triangle and two others differing slightly in degree of rotation were presented in different positions, with S required to locate the sample that had been presented. Discrimination proved difficult for preschool children. When only the correct triangle was illuminated, discrimination was readily established. The brightness difference between correct and incorrect matches was gradually faded out by increasing the intensity of the incorrect matches, until they were equal in brightness to the correct match. The discrimination established by brightness difference was maintained in its absence, thereby transferring stimulus control from brightness to form, in an almost errorless sequence.

In laboratory discrimination experiments, the establishment of discrimination often requires numerous extinction trials. In programmed instruction (Holland, 1960), on the other hand, the experimental aim is to program the presentations so as to preclude such trials, which are considered to be "errors." In the present investigation, such "errorless" procedures were applied to a laboratory situation to minimize S^{Δ} responding, using preschool children as Ss, in a task involving form discrimination.

The procedure is adapted from an experiment by Terrace (1963), who minimized the considerable S^{Δ} responding previously associated with the establishment of responding to vertical rather than horizontal stripes by pigeons. The easier discrimination between red and green was first established. Each stripe was then embedded in a color, and the colors were then gradually faded out. The discrimination was transferred to the stripes alone almost without error.

Method and procedures

Six children attending private day nursery schools[4] served as Ss, with ages (to the nearest year), and sexes as follows: S-1, 3F; S-2, 5M; S-3, 4F; S-4, 5F; S-5, 4M; S-6, 4M. They were children of working mothers, engaged mainly in clerical tasks (with one nurse and one teacher); the fathers included clerical, maintenance, and skilled industrial workers. The experiment was conducted in a special room at the nursery schools set aside for that purpose.

The S faced a masonite panel, about 24 in. square, containing four small windows, each of milk plastic, 2 in. wide by 3 in. high. The sample window was centered toward the top of the panel, with the other three windows symmetrically arranged in an arc below it, so that the center of each was 4 in. from the center of the sample window. Arranged in an arc beneath each of the matching windows were three small buttons, the manipulanda, with a pilot light above each. This light went on when the correct button was pressed.

Two types of series were run, full presentations and fading series, for the same or different Ss. In the full presentations, the sample window at the top went on, projecting a triangle at full 110 v. intensity. The sample window then went off, and simultaneously, the current was switched to the three matching windows below, each of which contained a triangle presented at full 110 v. intensity. One of these was matched in degree of rotation with the sample triangle, and the other two differed. The S was required to select the one that matched the withdrawn sample, a delayed matching to sample task (Ferster and Appel, 1961). In the fading series, the sample window was presented and withdrawn, as in the full series, but of the three windows, only the correct match was presented at full 110 v. intensity, the two incorrect matches being presented at a lower intensity, ranging from 0 and up. This distinction between correct and incorrect was enhanced by a marked phi-phenomenon effect as the current was switched from the sample to the correct matching window. This series began with three presentations of the incorrect windows at 0, then one presentation each at settings .35, .40, .50, .60, .65, .70, .75, .80, .83 (or .82), .86, .88, .90, .92, .94, .96, .98 of full voltage. There were then at least seven presentations at 1.00 (110 v.) in this series. It will be noted that at this final level, the settings are identical to those of the full series, and that the gradual increase in voltage whereby this identify is produced represents a gradual fading of the brightness difference between incorrect and correct, since the latter is always presented at full intensity. A correct response advanced the presentation to the next in this series; an incorrect response resulted in a repetition of the step (with a new slide). Two errors in a row resulted in a regression to a previous step.[5]

Three triangles differing in angle of rotation were used as stimuli (Reynolds, 1961). They were inverted isosceles skeleton triangles, altitude 1.75 in., base 1.25 in. centered in each window. The apex was either straight down (D), rotated 25° to the left (L), or to the right (R). All three appeared in the matching windows, in varied positions; the sample was also varied. The order of sample presentations (with match presentations in parentheses) was: L (LDR), D (RLD), R (LRD), L (RDL), D (DRL), R (DRL), R (RDL), L(DLR), D(LDR), recycle. Nine sheets of acetate formed the slides, which incorporated these presentations, and which were inserted into position before each presentation, with all lights off.

The S faced the panel, with E visible at the side, with controls behind the panel. The sample was illuminated for approximately 4 sec. as S was told: "Look at the picture in the top window. See which way it's pointing." It was then turned off, illuminating the matching windows, and E said: "Find another pointing the same way; touch it and push the button underneath it." If a correct response was made, the pilot light above the button illuminated immediately, and S was handed a small consumable or trinket, which he had previously been instructed to put into a small plastic bag. If an incorrect response was made, nothing was said by E. Recording was manual.

Results

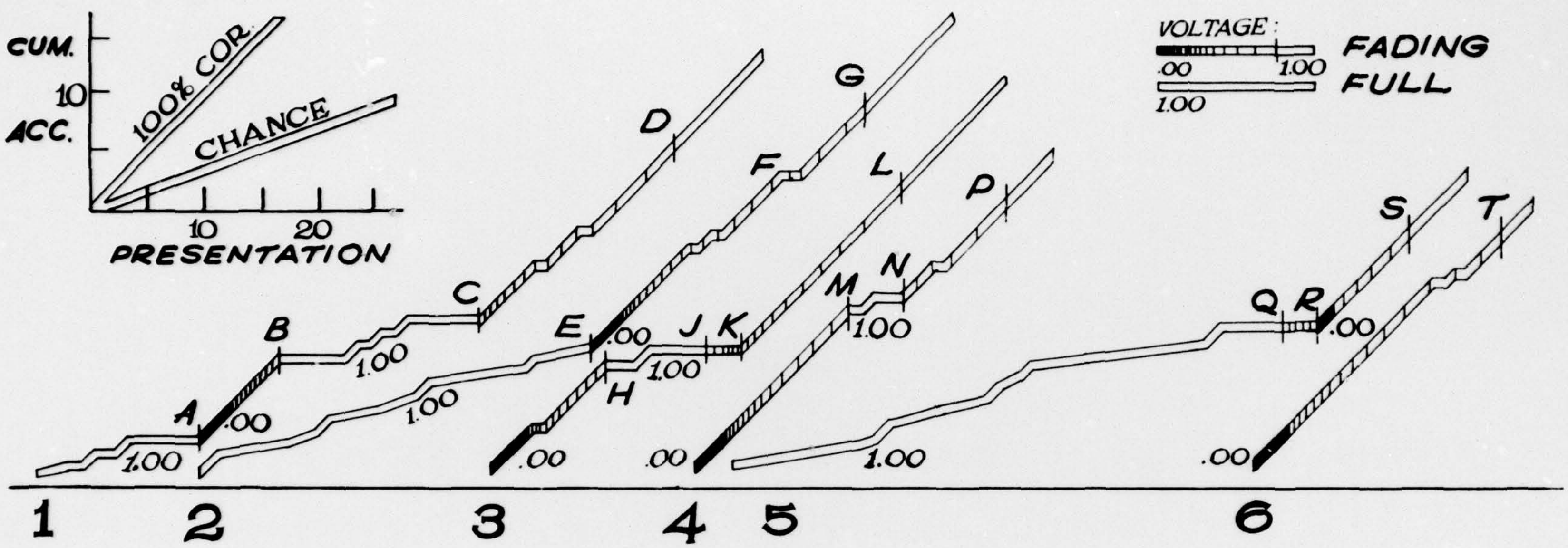
Results are presented in Fig. 1. The ordinate is cumulative correct responses, and the abscissa is number of presentations. Establishment of discrimination by the fading schedule is most clearly demonstrated by the

---

Fig. 1 about here

---

curve for S-1, who was begun on the full series, with incorrect windows at voltage setting 1.00. Accuracy was no better than chance. At A, fading was introduced, with the incorrect windows set at 0. These were then increased in voltage to .60, at B. All responses in this series were accurate. The brightness differences between correct and incorrect were then eliminated, with the full series replacing the fading series, from B to C, during which the settings of the incorrect windows were 1.00. Accuracy immediately deteriorated to chance values. At C, fading procedures were reintroduced, with the



CUM.
10
ACC.
100% COR.
CHANCE
10
20
PRESENTATION
VOLTAGE:
.00
1.00
FADING
1.00
FULL
A
B
C
D
E
F
G
H
J
K
L
M
N
P
Q
R
S
T
1.00
.00
1
2
3
4
5
6

voltage setting at .60, where it had been before the total elimination of differences between the windows. Accuracy immediately returned, with only two errors occurring during the ascending voltage (but decreasing brightness difference) series. At D, the voltages of all three matching windows were the same, and it will be noted that accuracy was maintained under conditions where previously (the full series) it had been no better than chance. Stimulus control had been transferred from brightness to rotation.

Contrasting effects upon the establishment of discrimination using full and fading series are also demonstrated by S-2, who was begun on the full series, with accuracy no better than chance. At E, fading was introduced, with the incorrect windows set at 0. Discrimination immediately became errorless. At F, there were two errors in a row, and the voltage was lowered one step. Accuracy returned, and the progression was reinstated, culminating in 1.00 at G, when the incorrect and correct windows were equal in brightness, the condition prior to E. In contrast to the latter period, which was under the full series, discrimination was now maintained without error.

The fading procedure initiated the sessions of S-3 and S-4, who accordingly began with errorless discrimination trials. For S-3, at H, the setting was .75, and the next settings were at 1.00, the full series, instead of .80 of the fading series. There was an immediate deterioration in accuracy. At J, the .75 setting was reintroduced, with no appreciable effect upon accuracy. The settings were then progressively reduced to .70, .65, and .60, at which point accuracy was reinstated (K), and the progression was then reestablished, with accuracy continuing thereafter through L, at the final setting of 1.00. For S-4, setting .82 was followed by full voltage at M, with breakdown to chance performance. Reinstatement of the fading procedure at N, when the setting was returned to .82, was followed by recovery of accuracy, which continued with one error into P, at the final setting of 1.00.

For S-5, the series was begun at full setting, with the chance performance characteristic of this procedure evident. At Q, the incorrect windows were lowered to .60 rather than 0, with no appreciable effect upon accuracy. At R, accordingly, fading was introduced by setting the incorrect windows at 0, with the complete instatement of accuracy which characterized this procedure. For this S, however, the fading series comprised three presentations at 0, four at .60, and six at 1.00. Errorless behavior was maintained during transitions whose abruptness disrupted discrimination in the other Ss. Whether such behavior was a function of the individual S, or of the long standard discrimination training period prior to Q, which characterized this record, and during which some discrimination may have been established, cannot be answered from these data. The record certainly contrasts, however, with the of S-6, who was begun using the fading procedure, and was continued on it without interruption. By T, the progression had reached 1.00 and was maintained without error. Discrimination was established with only two errors, and in the minimal time. His condensed performance contrasts sharply with that of the other Ss, and the similarities of his record to those of other Ss during fading series, suggests that it was the fading procedures themselves that were involved in the rapid establishment of discrimination.

Discussion

These results indicate that fading procedures may be extended to the errorless establishment of discrimination in matching to sample procedures.[6] Errors produce extinction trials which may make it more difficult to maintain the behavior being studied and serve to prolong the series, and the economy of procedures which minimize error was depicted in the last S presented, whose learning was the most "perfect" -- with the least practice. Control of errorless behaviors by the procedures themselves was evident throughout the experiments by the reversibility and reinstatement obtained when the fading procedures were systematically dropped or instated. The results also reiterate that a major variable in the establishment of behavior is the sequence (or program) of procedures utilized. On the response side, attention to sequence characterizes shaping, which can be considered a program of reinforcement of successive response ensembles, the succession being dictated by increasing presence of behavior along a criterion dimension. Thereby, novel response patterns are established, either for their own sake, or for use in other research. Analogously, in fading, E reinforces responses to stimulus differences successively approaching a criterion stimulus dimension, and it is suggested that such procedures may be useful in the establishment of novel discriminations and others required in psychophysical or other perceptual (cf. Goldiamond, 1962) or conceptual research (Goldiamond, in press).

References Cited

Ferster, C. B., & Appel, J. B. Punishment of S^{Δ} responding in matching to sample by time out from positive reinforcement. J. exper. Anal. Behavior, 1961, 4, 45-56.

Goldiamond, I. Perception. In Bachrach, A. J. (ed) The experimental foundations of clinical psychology. New York: Basic Books, 1962, pp. 280-340.

Goldiamond, I. A research and demonstration procedure in stimulus control, abstraction, and environmental programming. J. exper. Anal. Behavior (in press).

Holland, J. G. Teaching machines: an application of principles from the laboratory, J. exper. Anal. Behavior, 1960, 3, 275-287.

Reynolds, G. S. Contrast, generalization, and the process of discrimination. J. exper. Anal. Behavior, 1961, 4, 289-294.

Terrace, H. S. Discrimination learning with and without "errors". J. exper. Anal. Behavior, 1963, 6, 1-27.

November 21, 1963

Footnotes

[1]Performed under contract with the Operational Applications Laboratory, Electronic Systems Defense, Air Force Cambridge Research Center. L. G. Hanscom Field, Bedford, Massachusetts.

[2]Based on a master's thesis in the Department of Psychology, Arizona State University, Tempe, by the senior author, under supervision of the junior author.

[3]Present address of the junior author, from whom reprints are available: Institute for Behavioral Research, Forest Glen Laboratory, 2426 Linden Lane, Silver Spring, Maryland. Concurrently on appointment as Professor of Psychology, Arizona State University.

[4]The authors wish to express their appreciation to the Little Papoose Nursery School and to Collier's Nursery School, Scottsdale, Arizona, for making their resources available.

[5]In four Ss, the fading series was extended between two and four presentations by unsystematic errors by E, which seemed to have no effect upon the data. These errors included repeating the voltage of the preceding presentation, and increasing by steps of .05 where .10 was scheduled.

[6]Discrimination of selected letters of the alphabet, using parallel fading procedures, was also established without error with other children from the same nursery schools.

Captions for illustrations

Fig. 1. Accuracy rates as functions of differential reinforcement of correct and incorrect matches of triangles when presented at full intensity during training (Full), as compared to initial presentation at differing intensities for correct and incorrect matches, with the difference gradually faded out (Fading), by increasing the intensity of the incorrect matches until they were as full as the correct matches.

A research and demonstration procedure in stimulus control, abstraction, and environmental programming[1]

Israel Goldiamond[2]

Institute for Behavioral Research[3]

Explaining the experimental analysis of behavior to groups or individuals is often facilitated by an example. A pigeon and relay rack can be carried around, but the author has found the following example, which requires only chalk and blackboard (or mimeographed handouts) to be singularly effective. It may be used to exemplify differential reinforcement, controlled alteration of stimulus control, errorless programming of the environment, and the relationship between stimulus discrimination, abstraction, and conceptualization, among others.

The speaker says he is going to write pairs on the board, the audience is to read both members, and then when he points left or right, they are to indicate which is correct. They can do so by raising their hands as he points alternatively, or in some other way, depending on the situation. He says: "Very good" for the correct choice, or "That was wrong." The pairs are written below each other in succession on the board (or read out in succession for a handout.) The sequence follows (Right is correct on 1; the arrow is presented):

1.	A	B	11.	ROBERT	MAY
2.	B	D	12.	ANNETTE	BOB
3.	B	Q	13.	BOY	GIRL
4.	O	B	14.	SONNY BOY	BETTY ANN
5.	JB	AQ	15.	BRUCE	BETSY
6.	URB	VOX	16.	EDNA	WILLIAM
7.*	BULL	COW	17.	LOUISE	GEORGE
8.	SOW	BOAR	18.	EDWARD	RACHEL
9.	BUSTER	NANCY	19.	JOHN	ROBERTA
10.	DAISY MAE	LI'L ABNER			

* The S is instructed to read from here on in.

By Presentation 16, none of the elements of the original pair are present, and stimulus control has been transferred, almost without error, from the letter B to the conceptual abstraction male. At Presentation 19, the originally controlling stimulus is rejected. The progression may be used to elucidate the relations mentioned previously, and to go on to other points. The procedure also lends itself to such areas of research in verbal behavior as properties of a stimulus class, effects of context, sequential positioning and order effects, and the like. It can be used for long term investigations with single organisms, with alterations in the behavior being controlled (or in error) as the major dependent variable.

Substituting 14 BILL-ALICE for the presented 14, 15 produces considerable latency and error at the WILLIAM-EDNA choice. Restructuring the sequence so that WILLIAM-EDNA are presented after shifting control from B by presenting it in both members (SONNY BOY-BETTY ANN, BRUCE-BETSY) eliminates the error, and this point may also be used for demonstration.

Footnotes

[1]Written under contract between the Office of the Surgeon General, U. S. Army Medical Research and Development Command, and the Washington School of Psychiatry, DA-49-193-MD-2448.

[2]Research Career Development Award, N.I.M.H., at I.B.R. Also on appointment as professor of psychology, Arizona State University, Tempe.

[3]Address: Forest Glen Laboratory, 2426 Linden Lane, Silver Spring, Maryland.