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ABSTRACT

Articles resulting from studies conducted by college undergraduates in all areas of experimental psychology are provided, together with abstracts of other papers authored by students in the field of study. The articles are: The Influence of SET on Solving Hidden-Word Problems by Lana I. Boutacoff; Violation of Personal Space in Deviant Adolescents by Robert J. Hodges: Three Mnemonics: Pegword, Progressive Elaboration, and Narrative Chains Compared for Effectiveness by Barbara Manlove; The Effect of REM Sleep Deprivation on a DRL Schedule--A Male Albino Rat by Alan Rowland and Jean Enero; and The Effects of Extraneous Stimuli on the Learning Rates and Performance Levels of an Autistic Child by Dan J. Rybicki, Dean Alexander, Cory Shulman, Laura B. Schreibman, and David Rosenzweig. The abstracts are of the following papers: The Good Behavior Game: Its Application in Reducing Disruptive Behavior in a Problem Classroom by Laurel A. Bartlett; Cutaneous Perception of Color--Yes or No? by Dietra Brown; Content Analysis: History, Methodology, and Research Applications in Psychology by Alice King; The Effect of Alpha and Beta Activity on Recall of Low and High Association CVC Trigrams by Margret L. Marsden and Thomas A. Petite; and Modification of Disruptive Classroom Behavior by a Response Cost Token System by Bliss Rodriguez. This journal represents an innovative junior college project. (DB)

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The editors recognize that studies herein represent a learning process, involving experimental design, statistical analysis, interpretation of results, and introduction to APA format. This learning process often results in scholarly and creative research. However, publication in a traditional journal may be restricted due to the author's undergraduate status. The Journal of Undergraduate Psychological Research aims to review and publish selected studies conducted by undergraduates in all areas of experimental psychology.

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JOURNAL OF UNDERGRADUATE PSYCHOLOGICAL RESEARCH

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THE INFLUENCE OF SET ON SOLVING HIDDEN-WORD PROBLEMS

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The influence of set on problem solving behavior is well recognized. Most research in this field, however, has primarily utilized either water-jet or anagram problems; the use of hidden-word problems has been negligible. This study evaluated the influence of hidden-word problems on establishing and retaining set. From the 12 confounding variables recognized as possibly influencing hidden-word tasks, letter-order and word-frequency were chosen to be the dependent variables.
One hundred-eight college students were asked to solve one of four group-administered tests containing hidden word problems. The solution-sets were either: (1) a word having a close or far letter-order; or (2) a word of high or low Thorndike-Lorge frequency. The results indicated that: (1) words of both close and far letter-orders significantly established set, while retention of set was more significant for close-lettered words than for far-lettered words; and (2) high frequency words significantly established and retained set, while low frequency words were not significant.
The relevance of this study to problem solving research was to support Lunchins' contention that understanding the influence of set comes from "studying the characteristics of situations in which set comes about" (1942, p. 28). This study concluded that one such situational characteristic is the intrinsic quality of the stimulus (viz., letter-order and word-frequency).

In Berlin, 1927, Karl Zener and Kor Duncker designed the initial Water-Jar Einstellung experiment (Maier, 1930; Lunchins, 1942). In 1942, Lunchins introduced this experiment to America, supplementing the original water-jar problems with three additional problem-solving tasks: hidden-word tasks, mazes, and geometry experiments. The results, which were based primarily on the water-jar data, proved the mechanization-of-set hypothesis:

> If a response is made several times in succession to a number of similar situations, there is a strong general tendency to repeat this response again in a succeeding similar situation (Luchins, 1942, p. 28).

This "strong general tendency" was identified as <u>set</u> or <u>Einstellung</u>; it referred to a predisposed readiness for a particular response which was established through past experience.

Questioning whether or not factors other than the mechanization process also influenced set-behavior, Luchins speculated a second hypothesis:

> The blind, repetitive activity is not the result of a general, fundamental tendency but is created by special factors in the situation (1942, p. 28).

The situational factors to which Luchins made reference focused on extrinsic factors (those relating to the <u>S</u>) and intrinsic factors (those relating to the stimulus). In his original study and again primarily using the water-jar problem, Luchins (1942) measured how set was influenced by such situational factors as: age, sex, general intelligence and attitude; speed, the number of practice problems needed to induce set, and the retention of set over time.

Many subsequent studies replicated Luchins' (1942) experimental design in order to evaluate how to decrease set (Luchins & Luchins, 1950), and to investigate how set was influenced by sex (Guetzkow, 1951), response time (Gardner, 1958), effort (Knight, 1963), direct manipulation of the water-jars (Luchins & Luchins, 1950; Tresselt & Leeds, 1953a), and the number of problems needed to induce set (Maltzman & Morrisett, 1952; Tresselt & Leeds, 1953b; Schulz, 1960).

The influence of set in problem solving behavior is well recognized; however, it is interesting to note that the relevant research has primarily focused on water-jar (e.g., Luchins, 1942) and anagram tasks (e.g., Rees & Israel, 1935; Maltzman & Morrisett, 1952). The reasons for this are clear. The mechanization of set elicited from water-jar problems has been reliably proven (e.g., Luchins, 1942; Guetzkow, 1951, Maruszewski; 1970). Water-jar tasks have been easily administered, and simple arithmetic problems, with respect to word problems, have relatively few confounding variables. Finally, "studies employing anagrams as a problem solving task so closely parallel the work on water-jars" that analysis of water-jar problems may be directly applied to that of anagram problems (Schulz, 1960, pp. 72-3).

Besides the hidden-word tasks supplementing Luchins' (1942) classic experiment, only one other study addressed hidden-words (Schmeck & Ribich, 1969). Because hidden-words research has essentially been neglected, since Luchins (1942) utilized the hidden-words data in support of the mechanization hypothesis, and in light of speculating a situational hypothesis (Luchins, 1942), this study proposes to re-evaluate the influence of set on solving hidden-word problems.

Current Status

The current status of hidden-word problems is unclear. (1) The reliability of previous hidden-words research is questionable; Luchins' (1942) hidden-words experiment consisted of only four experimental groups (total N=15). (2) The two terms, hidden-words and anagrams, have been confused in both hidden-words studies (i.e., Luchins, 1942; Schmeck & Ribich, 1969). A hidden-word refers to a cluster of letters within which an embedded word can be found without transposing any of its letters. An anagram is a cluster of letters from which a word can be assembled by transposing and incorporating all of its letters. (3) Hidden-word tasks have been little researched; therefore, it is difficult to construe the variables which confound the problem-solving behavior of these tasks. Results from research on anagrams, word-recognition, and letter-order have subsequently been recognized as suggesting 12 potential variables which might confound the problem-solving process of hidden-words. An explanation of these 12 intrinsic variables follows.

Potential Variables

1. Word frequency. Word frequency refers to how often a word occurs in the English language. Marbe's Law states that there is a positive correlation between word frequency and recognition time (Woodworth, 1938, p. 361; Bruner & Postman, 1947, p. 75).

2. Letter frequency. Letter frequency refers to how often each letter occurs in the written language. Anagram studies reported that letter frequency and solution time were positively related (Cohen, 1968).

3. Letter order. The first letter of the word has been shown to influence word recognition tasks (Huey, 1968, p. 97). Anagram studies reported that meaningfully-grouped letters were more difficult to solve than meaninglessly-grouped letters (Devnich, 1937; Beilin & Horn, 1962; Estrand, 1965; Rosen, 1971).

4. Transition probability. Transition probability, or the number of letter-movements needed to solve an anagram, was positively related to solution time (Mayzner & Tresselt, 1958; Warren & Thomson, 1969).

5. In word frequency studies, monosyllabic words occurred more frequently than polysyllabic words (Zipf, 1935), and words of 2-4 letters occurred more frequently than words of 5+ letters (Miller, et al., 1958).

6. Problem length. Schmeck and Ribich (1969) measured the influence of problem length on the establishment of set. Using 4-letter hidden-words, they found that 7-letter problems elicited a stronger set than 10-letter problems.

7. Inimical vs. neutral words. Jung (1918) discerned the relationship between emotionality and word association time. Subsequent research concluded that recognition thresholds were influenced by emotion-laden words (Bruner & Postman, 1947; McGinnies, 1951), taboo words (Whittaker, et al., 1952), need-relevant words (Milburn & Bell, 1972), and value-laden words (Postman, et al., 1948; Solomon & Howes, 1951; Gilchrist, et al., 1954).

8. Effort. The amount of effort expended on the initial problems of a problem-solving task positively correlated with the strength of set (Luchins & Luchins, 1954; Knight, 1963).

9. Multiple solutions. Success in decomposing long words into shorter words was more dependent upon the number of possible solutions than upon the word length (Winthrop, 1956). Solution-choice in a multiple-solution problem was influenced by word frequency (Mayzner & Tresselt, 1966) and by particular letter combinations (Silvestri & Gavurin, 1972).

10. Number of set-inducing tasks. Set was most effectively established when six to eight set-inducing problems were used (Luchins, 1942; Tresselt & Leeds, 1953b).

11. Speed. The time allotted to complete a set of tasks was inversely proportional to the strength of set (Luchins, 1942). Although the introduction of speed did not guarantee the establishment of set, it did "create conditions which hindered careful thinking and favored mechanization" (Luchins, 1942, p. 56).

12. Time interval. The retention of the set-pattern was evident after a period of seven days (Tresselt & Leeds, 1953b) and, for some, after one month (Luchins, 1942).

The Hypotheses

This study proposes that the two intrinsic variables of letter-order and word-frequency influence the establishment and retention of set in hidden-word problems for American-born, English-speaking college students. It hypothesizes that: (1) a solution-word embedded in a close letter-order pattern (CLO) will establish and retain a stronger set than a solution-word embedded in a far letter-order pattern (FLO); and (2) a high frequency solution-word (HFW) will establish and retain a stronger set than a low frequency solution-word (LFW).

METHOD

Subjects

The Ss were 53 male and 55 female college students (N=108) who were recruited from psychology classes, dorms, and fraternities from four San Francisco Bay Area college .

All Ss were American-born. Their first-spoken language was English. The Ss' ages ranged from 17-56 years, with a median age of 20 years. The Ss' general intelligence was average to above-average: their cumulative college grade-point-average (G.P.A.) ranged from 2.0 (C) to 3.93 (A); the mean G.P.A. was 2.99. The Ss represented all year-levels in college, with freshmen representing 43% of the Ss; and all fields of study, with 44% of the Ss being social science majors.

Apparatus

The apparatus consisted of three-page booklets for each of four tests. Page 1 of the booklet served three purposes: (1) it was a coversheet for the test problems; (2) it asked for characteristics of the S; and (3) it explained the test's instructions. Page 2 listed problems 1-5, and Page 3 listed problems 6-11.

The problems were typed on an Olivetti typewriter using Prestige Elite type. Each problem was horizontally centered on the paper and consisted of: (1) the problem number, (2) nine lower-case letters which were each separated by two blank spaces, and (3) a 2½ inch line on which the S was to write his solution-word.

The Four Tests

Two tests were constructed for each of the two dependent variables. (1) The letter-order variable was measured by Tests 1 and 2. The set-solution for Test 1 was a word embedded in a "far letter-order" (FLO) or a 1-3-5-7-9 letter pattern; that for Test 2 was a word embedded in a "close letter-order" (CLO) or a 3-4-5-6-8 letter pattern. In these two tests, word-frequency was controlled: all set-solutions were high-frequency words. (2) The word-frequency variable was measured by Tests 3 and 4. The set-solution for Test 3 was a high-frequency word (HFW); that for Test 4 was a low-frequency word (LFW). In these two tests, letter-order was controlled: all set-solution words were embedded in a 1-3-4-6-8 letter pattern.

An example-problem in the instructions of Page 1 reflected that test's set-solution pattern. Except for this example-problem, the first page for all tests were identical.

Solution-Words

Table 1 lists the solution-words, their word-frequency ratings, and their mean letter-frequencies for each of the four tests. Controls for the variables influencing these solution-words were as follows.

1. Word frequency. Word frequency ratings were taken from the Thorndike-Lorge (T-L) Word Count (Thorndike & Lorge, 1944). The basic T-L word frequencies were used. (1) High frequency words (HFW) were those which occurred 100 or more times per million and had a frequency rating of approximately the first thousand. (2) Low frequency words (LFW) were those which occurred between 11 to 29 times per million and had a frequency rating of approximately the fourth-to-fifth thousand.

2. Letter frequency. Using the U-count (Underwood & Schulz, 1960) as the letter-frequency index, words having high letter-frequencies were selected. The rank-ordered letter frequencies ranged from 1 to 22; the median was 7; the mode was 8.

TABLE 1

Solution-Words,
Their Word-Frequency Ratings and Mean Letter-Frequencies

TEST #1: set = far letter-order

Solution-Word	Word-Freq.*	$\bar{X}$ Letter Freq.
1. store (S)		4.2
2. short (S)		6.0
3. reach (S)		6.8
4. third (S)		7.0
5. cause (S)		7.2
6. chair (S)		7.6
7. plain (S)		8.6
learn (A)		5.6
8. stand (S)		5.8
trade (A)		5.0
9. sound (A)		8.0
10. drive (S)		9.2
raise (A)		4.8
11. serve (S)		4.6
earth (A)		7.6

TEST #2: set = close letter order

Solution-Word	Word-Freq.*	$\bar{X}$ Letter Freq.
1. store (S)		4.2
2. short (S)		6.0
3. reach (S)		6.8
4. third (S)		7.0
5. cause (S)		7.2
6. chair (S)		7.6
7. learn (S)		5.6
plain (A)		8.6
8. trade (S)		5.0
stand (A)		5.8
9. sound (A)		8.0
10. raise (S)		4.8
drive (A)		9.2
11. earth (S)		7.6
serve (A)		4.6

*Word frequency is constant--all high frequency words.

(S) = set-solution word
(A) = alternate-solution word

TEST #4: set-low-frequency words**

Solution-Word	Word-Freq.	$\bar{X}$ Letter Freq.
1. trend (S)	LF(26)	5.0
2. moist (S)	LF(14)	6.4
3. notch (S)	LF(11)	6.8
4. stake (S)	LF(29)	7.0
5. sauce (S)	LF(27)	7.2
6. ranch (S)	LF([illegible])	7.6
7. split (S)	LF(26)	8.6
serve (A)	HF	4.6
8. crust (S)	LF(22)	8.4
chair (A)	HF	7.6
9. heard (A)	HF	6.4
10. craft (S)	LF(21)	8.2
close (A)	HF	7.0
11. scarf (S)	LF(14)	9.2
sight (A)	HF	7.8

TEST #3: set = high frequency words **

Solution-Word	Word-Freq.	$\bar{X}$ Letter Freq.
1. raise (S)	HF	4.8
2. short (S)	HF	6.0
3. reach (S)	HF	6.8
4. third (S)	HF	7.0
5. cause (S)	HF	7.2
6. chair (S)	HF	7.6
7. thing (S)	HF	7.6
torch (A)	LF(17)	7.2
8. white (S)	HF	6.8
width (A)	LF(28)	8.8
9. ounce (A)	LF(26)	7.2
10. count (S)	HF	7.5
craft (A)	LF(21)	8.2
11. right (S)	HF	6.0
ranch (A)	LF(20)	7.6

**Letter-order is held constant--all solutions are placed in a 1-3-4-6-8 letter pattern.

(S) = set-solution word (A) = alternate-solution word

HF = high frequency word, all of which occurred 100 or more times per million.
LF = low frequency word. The number in the parentheses indicate the frequency rating in terms of # of times per million.

3. Letter order. For all tests but Test 2, the solution words began with the first letter of the problem. In Test 2, CLO condition, the first letter of the solution-word began with the third letter of the problem.

4. Effort. High-effort was elicited by selecting words with high letter-frequencies. Moreover, the solution-words of each test were organized in descending order, whereby the word with the highest mean letter-frequency became problem 1, the next highest became problem 2, and so forth to problem 6. Between-test controls for effort were also considered: the mean letter frequencies for the solution-words of problems 1-6 in Test 3 were respectively proportional to those in Test 4. In Tests 1 and 2, the solution-words of problems 1-6 were identical (see Table 1).

Effort was further controlled by letter order as measured by Underwood and Schulz (1960, pp. 374-428). In order to elicit high-effort, letter order was manipulated in two ways: (1) uncommon letter sequences were used to separate the letters of the solution-words, while (2) common letter sequences were used to encourage the grouping of certain letters away from those of the solution-word. For example, in t a r e s a l d n, the solution word was trend. The uncommon letter sequence was ldn, while the common letter sequences were tar, are, res, and sal.

5. Word and problem length. This study used only monosyllabic, 5-letter words which were embedded in 9-letter problems.

6. Inimical vs. neutral words. A pilot study was conducted in order to control for inimical words. Given 100 3 x 5 cards on which 5-letter words were typed, twenty Mills College students were asked to check those words which connote or suggest anything positive or negative. Those words having three or less checks were considered neutral words for this study.

Order of Problems

The form of this study was adapted from Luchins' (1942) experimental design. Examples of the four types of problems used in each test and their solution-formulas was presented in Table 2.

TABLE 2

Examples of the Four Problem-Types From Each Test

Problem-Types	Problem	Solution Word	Solution-Formula
Test 1: FLO Condition			
Set-Inducing (#1-6)	c e h l a u i s r	chair	1-3-5-7-9 (set solution)
Establishers (#7-8)	e o t r a d n e d	stand	1-3-5-7-9
Evaluators (#10-11)		trade	3-4-5-6-8 (alternate sol.)
Breaker (#9)	l a s o u n a d e	sound	3-4-5-6-8
Test 2: CLO Condition			
Set-Inducing (#1-6)	n o c h a i a r f	chair	3-4-5-6-8 (set solution)
Establishers (#7-8)	s o t r a d n e d	trade	3-4-5-6-8
Evaluators (#10-11)		stand	1-3-5-7-9 (alternate sol.)
Breaker (#9)	s l o i u m n a d	sound	1-3-5-7-9
Test 3: HFW Condition			
Set-Inducing (#1-6)	c o h a d i a r b	chair	1-3-4-6-8 (set solution)
Establishers (#7-8)	r a i g n h e t h	right	1-3-4-6-8
Evaluators (#10-11)		ranch	1-2-5-7-9 (alternate sol.)
Breaker (#9)	o u i t n a c f e	ounce	1-2-5-7-9
Test 4: LFW Condition			
Set-Inducing (#1-6)	t a r e s a l d n	trend	1-3-4-6-8 (set solution)
Establishers (#7-8)	s i c a g r h f t	scarf	1-3-4-6-8
Evaluators (#10-11)		sight	1-2-5-7-9 (alternate sol.)
Breaker (#9)	h e u s a l r i d	heard	1-2-5-7-9

For each test, problems 1-6 were the set-inducing problems which proposedly led the S into an Einstellung- or E-effect. The first six problems were solved only by the set-solution which was illustrated in the example problem for that test.

Problems 7 and 8 were the Establishers, or problems which determined whether or not the E-effect had been developed. The Establishers could be solved by one of two methods: by the previously used set-solution, or by an alternate-solution. The alternate-solution was the set-solution of that variable's opposite test (e.g., in Test 3, the set-solution was a high-frequency word, and the alternate-solution was a low-frequency word; in Test 4, the set-solution was a low-frequency word, and the alternate-solution was a high-frequency word). Choosing the set-solution method would indicate that set was established, while choosing the alternate-solution method would indicate that set was not established.

Problem 9 was the Breaker; it was solvable by only the alternate-solution method. By forcing the S to use the alternate-solution, the Breaker attempted to interrupt the E-effect and S's subsequent retention of set.

Problems 10 and 11 were the Evaluators, or problems which assessed the retention of set. Each of these problems could be solved by either the set-solution or the alternate-solution methods. Choosing the set-solution would indicate that set was retained, while choosing the alternate-solution would indicate that set was not retained.

Procedure

The 40 booklets for each of the four tests were pre-arranged in an A-B-C-D order. For each experimental session, the appropriate number of tests for that group was taken from the top of the pre-arranged booklets and randomly distributed among the Ss. The distribution of the different Ss for each test is given in Table 3.

TABLE 3

Distribution of Ss Among Four Tests

	Test #1	Test #2	Test #3	Test #4	Totals
Men	14	17	12	10	53
Women	12	14	15	14	55
Totals	26	31	27	28	N=108

As the booklets were being distributed, the Ss were asked to complete the questions at the top of the coversheet which asked for S's characteristics and to read the subsequent instructions. When this was done, E reiterated the instructions. The Ss were asked to find a 5-letter embedded word in each of the 11 problems and to draw a slash through each letter of the solution-word. The purpose behind instructing the Ss to use slashes was to help them more readily see the repetition of the set-solution between problems and to subsequently encourage the establishment of set. The Ss were asked to solve each problem in sequence. Ss were asked to work as quickly as possible. After answering any questions, E told the Ss to begin and started a stopwatch. After 20 minutes, the booklets were collected and the Ss were debriefed.

Having the tests timed for each S accounted for the variable of speed in Einstellung-tasks. A "speed-test" atmosphere, however, was avoided during the experimental session by not over-emphasizing the timed aspect of the test. The Ss did not become anxious or careless in their work; instead, they moved steadily through each problem, thus encouraging the establishment of set. The mean time taken to complete each test was also used as an indicator of the four tests' relative degree of difficulty.

RESULTS

The criterion for establishing set was measured by computing a chi-square (X^2) value between the response frequencies of each test's Establishers and its respective Breaker. The criterion for retaining set was measured in similar fashion: a X^2 test was run between the response frequencies of each test's Breaker and its respective Evaluators. Finally, to ascertain the strength of set in the four test conditions, a X^2 test was run between the response frequencies of each tests' Establishers and their respective Evaluators. The three X^2 values for each of the four tests are presented in Table 4.

TABLE 4

Chi-Square Values for the Four Tests

	SET ESTABLISHED	SET RETAINED	SET STRENGTH
LETTER-ORDER			
Test #1 set = FLO	8.33***	6.56*	0.18
Test #2 set = CLO	20.86***	16.62***	0.0002
WORD-FREQUENCY			
Test #3 set = HFW	9.47***	6.81**	0.31
Test #4 set = LFW	3.56	3.26	4.17*

*$p < .05$
**$p < .01$
***$p < .005$

The mean time taken to complete each test is listed in Table 5.

TABLE 5

Mean Time For The Four Tests

	Mean	Range
LETTER-ORDER		
Test #1	8'34"	2'20" - 20'
Test #2	5'93"	2'10" - 12'45"
WORD-FREQUENCY		
Test #3	10'13"	2'10" - 20'
Test #4	15'02"	9'20" - 20'

Responses were recorded as being one of three solution-choices: set-solution, alternate-solution, and zero-or-wrong solution. Response percentages were computed for each set-inducing problem, the Establishers, Breaker, and Evaluators. These response percentages for Tests 1 and 2 are given in Table 6; those for Tests 3 and 4 are given in Table 7.

TABLE 6

Response Percentages for the Two Letter-Order Tests

	% Set-Solution		% Alternate - Sol.		% Zero-or-Wrong Sol.	
	#1 (FLO)	#2 (CLO)	#1 (CLO)	#2 (FLO)	#1	#2
1	73	97			27	3
2	77	90			23	10
3	69	77			31	23
4	69	65			31	35
5	69	97			31	3
6	81	84			19	16
7+8	67	87	25	6.5	8	6.5
9	0	0	77	10	23	90
10+11	54	79	40	8	6	13

TABLE 7

Response Percentages For The Two Word-Frequency Tests

	% Set - Solution		% Alternate - Sol.		% Zero - or - Wrong Sol.	
	#3 (HFW)	#4 (LFW)	#3 (LFW)	#4 (HFW)	#3	#4
1	100	46			0	54
2	78	54			22	46
3	96	54			4	46
4	67	75			33	25
5	81	46			19	54
6	78	92			22	8
7+8	65	40	30	33	5	27
9	0	0	37	42	63	58
10 + 11	54	38	35	33	11	29

The criterion for evaluating the influence of letter-order and word-frequency on set involved comparing the two tests of each experimental condition in terms of: (1) the differential percentages for each solution-choice in the Establishers; (2) the differential percentages for each solution-choice in the Evaluators.

Letter-Order: Tests 1 and 2

Set was significantly established in both the FLO and CLO conditions (Tests 1: $X^2 = 8.33$, df=1, $p < .005$; Test 2: $X^2 = 20.86$, df=1, $p < .005$). The retention of set, however, was slightly more significant in the CLO condition ($X^2 = 16.62$, df=1, $p < .005$) than in the FLO condition ($X^2 = 6.56$, df=1, $p < .025$). Both tests also established a strong set: the response frequencies of the Establishers and Evaluators were not significantly different in either test (Test 1: $X^2 = 0.18$, df=1, n.s.; Test 2: $X^2 = 0.0002$, df=1, n.s.).

The time taken to complete each test varied with the test condition: Ss needed more time for the FLO problems ($\bar{X}$ time = 8.34 min.), than for the CLO problems ($\bar{X}$ time = 5.93 min.).

In Test 1, response- percentages for the Establishers were: 67% set-response; 25% alternate, or CLO response; 8% zero-or-wrong response. For the Breaker, 77% of the responses were the alternate, CLO solution; only 23% were the zero-or-wrong solution. Finally, for the Evaluators, 54% of the responses were set-solutions; 40% were CLO, alternate solutions; and only 6% were zero-or-wrong solutions.

In Test 2, response-percentages for the Establishers were: 87% set-response; 6.5% alternate, or FLO response; 6.5% zero-or-wrong response. For the Breaker, 90% of the responses were the zero-or-wrong solutions; only 10% were the alternate, FLO solution. For the Evaluators, 79% of the responses were set-solutions; 13% were zero-or-wrong solutions; and only 8% were FLO, alternate solutions.

For the letter-order tasks, the percent of failure in all problems, except for problems 4, 8, 10, and 11, was larger in the FLO problems than in the CLO problems.

Word-Frequency: Tests 3 and 4

In Test 3, HFW condition, set was significantly established ($X^2 = 9.47$, df=1, $p < .005$) and retained ($X^2 = 6.81$, df=1, $p < .01$). Test 3 also had a strong set: a X^2 test between the response frequencies of the Establishers and Evaluators indicated no significant difference between the two groups ($X^2 = 0.31$, n.s.).

Only in Test 4, LFW condition, was set not established; there was no significant difference between the response frequencies of the Establishers and Breaker ($X^2 = 3.56$, n.s.). There was also no significant difference between the response frequencies of the Breaker and the Evaluators ($X^2 = 3.26$, n.s.). A significant difference between the Establishers and Evaluators ($X^2 = 4.17$, df=1, $p < .05$), confirmed that a strong set was not established.

The time needed to complete the word-frequency tests also varied with the test condition: the LFW problems took longer to complete ($\bar{X}$ time = 15.02) than the HFW problems ($\bar{X}$ time = 10.13).

In Test 3, response-percentages for the Establishers were: 65% set-response; 30% alternate, LFW response; 5% zero-or-wrong response. For the Breaker, 63% of the responses were zero-or-wrong solutions; 37% were LFW, alternate solutions. Finally, for the Evaluators, 54% of tne response were set-solutions; 35% were LFW, alternate solutions; and 11% were zero-or-wrong solutions.

In Test 4, response-percentages for the Establishers were: 40% set-response; 33% HFW, alternate response; 27% zero-or-wrong response. For the Breaker, Ss did not express a significant preference for the HFW alternate-solution method: only 42% of the responses were HFW, alternate solutions; while as many as 58% were zero-or-wrong solutions. Finally, for the Evaluators, only 38% of the responses were set-solutions; 33% were alternate, HFW solutions; and 29% were zero-or-wrong solutions.

For the word-frequency tests, the percent of failure for all problems, except for problems 4 and 6, was greater for the LFW problems than for the HFW problems.

DISCUSSION

The Hypotheses

Letter-order. The hypothesis for the letter-order variable was partially confirmed. Unexpectedly, the FLO test as well as the CLO test established a strong set; while, as predicted, the CLO test retained a stronger set than the FLO test. These results suggest that set was established independent of the problems' letter-order, thus supporting the contention that set is a mechanical process.

The intrinsic factor of letter-order, however, did influence the solution-process of hidden-word problems. This was evident in: (a) the weaker retention of set for the FLO test; and (b) the Ss' preference for the CLO solutions over the FLO solutions. This preference was expressed in two ways: (1) The CLO problems required less time to complete--the time-differential being smaller for Test 2 than for Test 1. (2) Consider the non-set solutions in problems 7-11 for both tests: when the alternate-solution was a CLO solution (i.e., Test 1), the percent-response differential was greater for the alternate-solution than for the zero-or-wrong solution; however, when the alternate-solution was a FLO solution (i.e., Test 2), the percent-response differential was greater for the zero-or-wrong solution than for the alternate-solution. The higher percentage of failure (i.e., of zero-or-wrong solutions) in problems 8, 10, and 11 of Test 2, therefore, was due to the Ss' preference for a zero-or-wrong solution over a FLO solution. These results consequently indicate that the situational factors of letter-order in hidden-word problems influenced the mechanization process of set.

To infer that these situational factors resulted from figure-ground configurations of the Gestalt school would be erroneous. If this were true, Test 1 would not have established set, since the Gestalt laws of proximity and familiarity would have forced a larger percentage of Ss to respond in the Establishers and Evaluators with the CLO, alternate-solution, rather than with the FLO, set-solution.

To conclude that letter-order was the sole situational factor influencing the problem solving process of hidden-word problems would also be erroneous. A minimum of two other variables might be influencing this process and should be considered in subsequent studies of similar word problems. These two variables are effort and the influence of the first letter on the solution-word.

In designing the experiment, effort was considered in terms of letter sequences common to the English language and letter frequency. Effort, however, was not considered in terms of a CLO problem being easier to solve than a FLO problem. Since high-effort encourages the Einstellung-effect, the FLO test might have produced a strongly-established and less strongly-retained set because of the relatively high-effort involved in solving its initial problems. Similarly, because the CLO set-solutions (Test 2) required less effort than the FLO set-solutions (Test 1), the Test 2 Ss were probably not as persistent in solving problems 7-11 as were the Test 1 Ss. Consequently, if a Test 2 S was not able to quickly solve a problem, S would probably pass over it. This strategy would explain not only the time-differential between Test 1 and 2, but it would also explain the preference in Test 2 for the zero-or-wrong solution over the alternate, FLO solution.

The variable of the first-letter in word problems should also be recognized. In Test 1, FLO condition, the first letter of the solution-word was also the first letter of the word problem. In Test 2, CLO condition, the first letter of the solution-word was the third letter of the word-problem. Since the first letter is a significant influence in solving word problems, this problem-design might have facilitated the establishment and retention of set in the FLO test. Further research into the covariant influences of effort and letter-sequence on letter-order is suggested.

Word frequency. The hypothesis for the word-frequency variable was confirmed: the HFW test both established and retained a strong set, while the LFW test neither established nor retained set.

The influence of word-frequency on solving hidden-word problems was clearly expressed. It was evident not only in the absence of set in the LFW test, but also in the preference for the HFW problems over the LFW problems. This preference was expressed in two ways: (1) the HFW problems required less time to complete--the time-differential being smaller for Test 3 than for Test 4; and (2) although the response patterns for Test 3 and 4 did not resemble that explicit patterns of Tests 1 and 2, they did show that Test 3 Ss tended to persist until they found some solution, while Test 4 Ss tended to respond with a zero-or-wrong solution. The persistent lack of positive reinforcement by the discovery of some solution in the LFW problems probably facilitated the discouragement of set in Test 4. These results consequently indicate that the situational factors of the problems must first be in the realm of the S's competence before set can become a recognized factor in the problem-solving process. Further research into the degree and type of competence needed in order for set to become an influential factor in problem solving behavior is suggested.

The limitations of this study should also be considered.

The variables. The influence of all variables, except for problem length, on hidden-words had been inferred from research on anagrams,word-recognition or letter-order. Empirical evidence of their influences on hidden-words is needed.

Multiple-solutions. Although this study conducted two pilot studies (total N=42) in order to control for multiple-solutions, Ss still found some unintentional solutions in one or two problems of each test. The degree to which these extraneous solutions influenced set was not ascertained.

Inimical words. It is probably presumtious to assume that the pilot study (N=20) effectively rid this study of inimical words. A case in point was a problem in Tests 1 and 2, where the unintended response of suave was given by two of the 57 Ss. According to these two male Ss, suave was a joke-word which was often spoken in their fraternity. Since suave was an unintentional solution, its occurrence and inimical meaning was readily identified; the response to an intended solution whose meaning was inimical for some Ss would be less readily identified.

Means of measuring set. It is difficult to evaluate the validity of Luchins' (1942) experimental design as a measurement of set in hidden-word problems. Others have also questioned its validity (see e.g., Luchins, 1942, pp. 87-9; Krech, et al., 1969, p. 266). Instances such as the confounding influence of effort and letter-sequence in Tests 1 and 2, and the weak positive reinforcement in Test 4 possibly altered the set-process. These instances, in addition to the Ss' qualitative reports that they were "looking for some pattern" as they always did in solving a word problem, and they "didn't bother to stop and look for alternate solutions" additionally indicate the factors inherent to this study's experimental design, rather than to the set-process, might have influenced this study's results.

SUMMARY

A strong set was established in both letter-order tests, while a stronger set was retained by the CLO test than by the FLO test. The influence of letter-order on set was evident in the smaller time-differential and the greater percent-response differential found in the CLO solutions relative to the FLO solutions.

A strong set was established and retained in the HFW test; no set was established in the LFW test. The influence of word-frequency on set was evident in the smaller time-differential and the greater percentages of some kind of solution-response, as opposed to no response, for the HFW problems relative to the LFW problems.

These results indicate that immediate prior experience or mechanical repetition does not solely influence the mechanization process of set in hidden-word problems. Situational characteristics are prevalent as well.

REFERENCES

Beilin, H. & Horn, R. Transition probability effects in anagram problem solving. Journal of Experimental Psychology, 1962, 63, 514-8.

Bruner, J.S. & Postman, L. Emotional selectivity in perception and reaction. Journal of Personality, 1947, 16, 69-77.

Cohen, J.L. The effect of letter frequency on anagram solution times. Psychonomic Science, 1968, 11, 79-80.

Devnich, G.E. Words as "Gestalten." Journal of Experimental Psychology, 1937, 20, 297-300.

Ekstrand, B.R. & Dominowski, R.L. Solving words as anagrams. Psychonomic Science, 1965, 2, 239-40.

Gardner, R.A. & Runquist, W.N. Acquisition and extinction of problem-solving set. Journal of Experimental Psychology, 1958, 55, 274-7.

Gilchrist, J.C., Ludeman, J.F., & Lysak, W. Values as determinants of word recognition thresholds. Journal of Abnormal and Social Psychology, 1954, 49, 423-6.

Guetzkow, H. An analysis of the operation of set in problem-solving behavior. Journal of General Psychology, 1951, 45, 219-44.

Huey, E.B. The Psychology and Pedagogy of Reading. Cambridge: M.I.T. Press, 1968, 71-116.

Jung, C.G. Studies in Word Association. London: W. Heinemann, Ltd., 1918, 234-65.

Knight, K.E. Effect of effort on behavioral rigidity in a Luchins water jar task. Journal of Abnormal and Social Psychology, 1963, 66, 190-2.

Krech, D., Crutchfield, R.S., & Livson, N. Elements of Psychology: A Briefer Course. New York: Alfred A. Knopf, 1969, 241-83.

Luchins, A.S. Mechanization in problem solving: the effect of Einstellung. Psychological Monographs, 1942, 54, Whole #248.

Luchins, A.S. & Luchins, E.H. New experimental attempts at preventing mechanization in problem solving. Journal of General Psychology, 1950, 42, 279-97.

Luchins, A.S. & Luchins, E.H. The Einstellung phenomenon and effortlessness of task. Journal of General Psychology, 1954, 50, 15-27.

Maier, N.R.F. Reasoning in humans. I: On direction. Journal of Comparative Psychology, 1930, 10, 115-43.

Maltzman, I. & Morrisett, L. Different strengths of set in the solution of anagrams. Journal of Experimental Psychology, 1952, 44, 242-6.

Maruszewski, Mariusz. Mechanizacja w rozwiazywaniu problemow: Wyniki pewnej modyfikacji eksperymentu A.S. Luchinsa (Mechanization of problem solving: A modification of A.S. Luchins' experiment). Studia Psychologiczne, 1970, 10, 81-6. (Psychological Abstracts, 1972, 48, No. 2264.)

Mayzner, M.S. & Tresselt, M.E. Anagram solution times: A function of letter order and word frequency. Journal of Experimental Psychology, 1958, 56, 376-9.

Mayzner, M.S. & Tresselt, M.E. Anagram solution times: A function of multiple solution anagrams. Journal of Experimental Psychology, 1966, 71, 66-73.

McGinnies, E. Emotionality and perceptual defense. Journal of Experimental Psychology, 1951, 41, 401-10.

Milburn, T.W & Bell, N. Values and estimation of word frequencies. Psychological Reports, 1972, 31, 47-56.

Miller, Newman, & Friedman. Length-frequency statistics of written English. Information and Control, 1958, 1, 370-89.

Postman, L., Bruner, J., & McGinnis, E. Personal Values as selective factors in perception. Journal of Abnormal and Social Psychology, 1948, 43, 142-54.

Rees, H.V. & Israel, H.C. An investigation of the establishment and operation of mental sets. Psychological Monographs, 1935, 46, #6, 1-26.

Rosen, S.M. Solution difficulty and perseveration as functions of anagram type. Psychological Record, 1971, 21, 401-8.

Schmeck, R.R. & Ribich, F. Rigidity as a function of task complexity. Psychonomic Science, 1969, 17, 323.

Schulz, R.W. Problem solving behavior and transfer. Harvard Educational Review, 1960, 30, 61-77.

Silvestri, P.J. & Gavurin, E.I. Anagram solving and solution-word transition probability. Perceptual and Motor Skills, 1972, 35, 338.

Solomon, R.L. & Howes, D.H. Word frequency, personal values, and visual duration thresholds. Psychological Review, 1951, 58, 256-70.

Thorndike, E.L. & Lorge, I. The Teacher's Word Book of 30,000 Words. New York: Teachers College, Columbia University, 1944.

Tresselt, M.E. & Leeds, D.S. The effect of concretizing the mental set experiment. Journal of General Psychology, 1953a, 48, 51-5.

Tresselt, M.E. & Leeds, D.S. The Einstellung effect in immediate and delayed problem-solving. Journal of General Psychology, 1953b, 49, 87-95.

Underwood, B.J. & Schulz, R.W. Meaningfulness and Verbal Learning. Philadelphia: Lippincott, 1960.

Warren, M.W. & Thomson, W.J. Anagram solution as a function of transition probabilities and solution word frequency. Psychonomic Science, 1969, 17, 333-4.

Whittaker, E.M., Gilchrist, J.C., & Fischer, J.W. Perceptual defense or response suppression? Journal of Abnormal and Psychology, 1952, 47, 732-3.

Winthrop, H. Factors in perceptual reorganization of words. Psychological Reports, 1956, 2, 499-500.

Woodworth, R.S. Experimental Psychology. New York: Henry Holt & Co., 1938.

Zipf, G.K. The Psychology of Language. Boston: Houghton, Mifflin, 1935.

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VIOLATION OF PERSONAL SPACE IN DEVIANT ADOLESCENTS

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This study dealt with the consequences of the violation of personal space with adolescents who were defined as deviant as a result of their academic underachievement. It was hypothesized that a violation of personal space would be more detrimental to the performance of a light discrimination task and would bring about more anxiety (as measured by galvanic skin response) in these deviant adolescents than in normal adolescents. Violation of personal space was also examined in terms of the components of the sociofugal-sociopetal axis and the kinesthetic factors discussed by Hall (1963). It was expected that the sociopetal orientations and the smaller proxemic distances would show the greater task detriment and higher levels of anxiety. Although an unexpected differential effect with the difficulty of the discrimination task somewhat confounded the findings, some support was shown for the hypotheses. The inconclusive nature of the results are discussed, and some improvements for future experimental designs are suggested.

Sommer (1969) referred to personal space as "an area with invisible boundaries surrounding a person's body into which intruders may not come." The idea of intrusion is central to the concept of personal space. The behavioral consequences of the violation of an individual's personal space requirements can be seen to be a meaningful aspect of any interpersonal situation.

This study delt with the consequences of such an intrusion with a particular group of subjects. These subjects were a group of adolescents whose behavior had been defined as deviant as a result of their inability to perform in a normal educational environment. A previous study (Newman, 1963) showed that the personal space requirement for a similar group of adolescents was significantly greater than was that of a group of normal adolescents of the same age. It was suggested that a greater level of anxiety might account for this difference. In this study, it was suspected that factors accounting for the personal space requirements of deviant adolescents might be related in some way to their behavior. An experimental situation was devised to examine the differences in the personal space requirements the group of deviant adolescents and a group of normal adolescents. It was hypothesized that a violation of personal space would be more detrimental to performance of a discrimination task and bring about more anxiety in deviant adolescents than normal adolescents.

The personal space requirements were measured by the stated preferences of the subject, a procedure used in previous studies (Pederson, 1972; Haase, 1973; Newman, 1973). The level of anxiety was indicated by obtaining a measure of galvanic skin response (GSR) for each subject. This was seen as an appropriate means of obtaining an autonomous measure of anxiety as McBride (1965) found a significant relationship between proximity and GSR in adult humans.

One other consideration was dealt with in this study. Hall (1963) used the term "Proxemics" to describe the study of the spatial and distal components of the microspace unconsciously structured between individuals. In this study, violation of personal space was examined in both terms of the distance between the subject and the experimenter and the orientation of the experimenter to the subject. Hall (1963) discusses proxemic distances as a function of certain kinesthetic factors related to man's phylogenetic past. The factors are delineated by the body's ability to caress, hold, strike, etc. Thus, four interpersonal distances are defined by these factors: 1) within body distance; 2) within touching distance with only the forearm extended; 3) within touching distance with arms fully extended; and 4) within reaching distance (Hall, 1963). One additional distance is that which would not allow any contact without the movement of the organism. The orientations of the bodies is described by Hall (1963) as components of the sociofugal-sociopetal (SFP) axis. This axis is used to describe spatial, rather than distal, arrangements between two bodies. In this study, four components of the SFP axis were used: two sociofugal orientations, that is, spatial arrangements that would characterize a minimum interaction situation; and two sociopetal orientations, providing for maximum interaction. These factors were examined within the experimental context. It was predicted that the sociopetal orientations and the smaller proxemic distances, expressed in terms of the kinesthetic factors, would show the greatest detriment to discrimination task performance and higher levels of anxiety in both groups of adolescents than the sociofugal orientations and the larger proxemic distances.

METHOD

Subjects

All subjects were seventh grade students at Cupertino Junior High School in Cupertino, California. The seven deviant subjects, five males and two females, were enrolled in a special class for academic underachievers. Their behavior was characterized as deviant and hostile, although not always aggresively so. Although they fell within the normal range of intelligence, their academic performance was well under the expectancies for a normal seventh grade student at the school. The seven normal subjects, five males and one female, were students randomly selected from a group of 120 volunteers. The normal subjects were all enrolled in the regular school curriculum and were behaviorally normal.

Apparatus and Materials

The discrimination task device (Lafayette Instruments) was a simple apparatus that displayed two lights mounted flush on the front of the device. The lights could be adjusted so that either would be brighter. The GSR was recorded for each subject using a polygraph (Lafayette Instruments). The trial intervals and latency times were timed by stopwatch, and a set of standard data sheets were used.

Procedure

The experiment was conducted in two parts: the discriminination task and the personal space task. Each subject was tested individually. The subject was conducted into a classroom and seated in a central position in the room. As blinds were drawn and the room was somewhat isolated, distractions from the experimental tasks were held at a minimum. After the subject was seated, the electrodes from the polygraph were attached to the first and third fingers of the subject's left hand. As the electrode cord was better than four feet in length, it was possible to position the polygraph and its operator to the back and the left, well away from the subject. With the electrodes thus attached, a base line was established before the following instructions were read to the subject.

> This is a kind of eye test. We want to see how well you can tell things apart. In front of you is a box with two lights. Your job will be to tell me which light is brighter. Each time the lights come on, look closely at them. After the lights go off, tell me which one was brighter. If you think

> the one on your left was brighter, say "number one " If you think the one on your right was brighter, say "number two." We will give you two practice tries before we start the test.

The discrimination task device was located at eye level ten feet in front of the subject. On each trial (including the practice trials), the lights were exposed for five seconds. Both the subject's response and the latency of responding was recorded for each trial. The trial interval was the five seconds of the light exposure plus the latency of the response from the subject. Intertrial intervals were not constant and were not recorded. After the completion of the two practice trials, these instructions were read.

> You must not say anything during the test except to tell which light is brighter, so if you have any questions, ask them now. The machine you are connected to tells us how hard you are concentrating on the test. So watch the lights carefully and remember not to give the answer until <u>after</u> the lights go off.

The discrimination task consisted of twenty trials. On each trial, the position of the experimenter was varied in his orientation and proximity to the subject. As four different orientations and five distances were used, each of the twenty trials was unique in terms of the proximal and distal relationship of the experimenter to the subject. The sequence of these twenty different arrangements was randomly assigned. The five distances between the experimenter and the subject were three, 15, 22, 40, and 60 inches. The four orientations can be best described as angles formed by imaginary lines extending through the shoulders of both the experimenter and the subject. The juncture of these two lines forms this body angle. The angles formed by the position of the experimenter to the subject were 45, 90, 180, and 270 degrees. The last angle was 270 instead of 90 degrees in that the experimenter was positioned at the back (past the 180-degree mark) rather than at the front of the subject's body. The relative positions of the experimenter to the subject is illustrated in Figure 1.

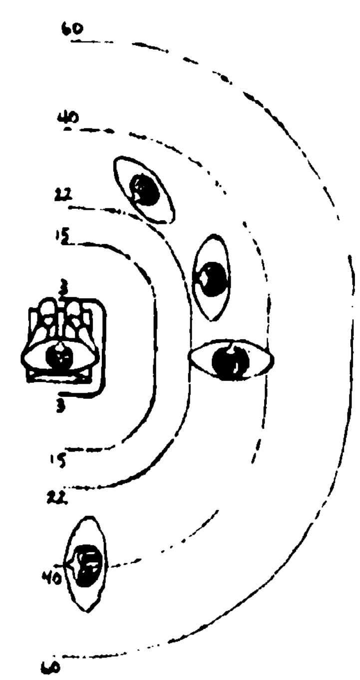

FIG. 1. Area around subject (seated) occupied by experimenter during discrimination task. (The experimenter positions shown here represent the four SFP axis components at the mean critical proxemic distance for all subjects.)

After the final trial of the discrimination task, the polygraph electrodes were removed and the personal space task was conducted. The subject was asked to remain seated and the following instructions were read.

> This is another test to see how well you can tell things apart. This time your job will be to tell how far we are apart. As I walk towards you, tell me to stop when you feel I am too close to you. In other words, as soon as you feel uncomfortable because I am too close, say "stop."

From a distance of approximately eight feet, the experimenter approached the subject a small step at a time, pausing briefly with each step. When told to stop by the subject, the experimenter halted, and the distance from the experimenter's closest foot (the left foot for the first three orientations and the right foot for the last) to the nearest point on a square formed by the four legs of the subject's chair. The distance from the subject to the experimenter was the critical proxemic distance, and this procedure was used to determine the critical proxemic distance for each orientation.

RESULTS

Two measures were used in analyzing the results: a performance score and a measure of GSR. The performance score was a measure of task detriment. For a correct response, the performance score for that response equalled the response latency in seconds. For an incorrect response, the performance score equalled the response latency plus one. The GSR measure was an increase in skin resistance in thousands of ohms, as indicated by the needle deflections of the polygraph. Only the highest point of deflection for each trial was used in computing the GSR, even if more than one deflections occurred during a single trial.

One unexpected differential effect was that of the difficulty of the discrimination task. The discrimination task when light number one was brighter (task 1) was markedly more difficult than was the task when light number two was brighter (task 2). And, although the trials were randomly ordered, seven of the discrimination trials with light number one occurred at the 40- and 60-inch distances as opposed to only three at the three-, 15-, and 22-inch distances. A $\underline{t}$-test computed for the performance scores for task 1 and task 2 was extremely significant ($\underline{t}=7.00$, df=278, $p < .05$). However, a $\underline{t}$-test comparing the GSR scores for task 1 with those of task 2 did not show that task difficulty had affected GSR in a similar manner. In fact, the results this $\underline{t}$-test were significant in the opposite direction ($\underline{t}=-2.719$, df=278, $p < .05$), a fact that might be attributable to the effect of the independent variable rather than the differential effect of task difficulty.

Two sets of $\underline{t}$-tests were computed to test the first hypothesis, the values of which are shown in table 1. The inter-group series of $\underline{t}$-tests compared the scores of the deviant adolescents with the scores of the normal adolescents. The inter-group series compared the scores inside the CPD with those outside the CPD.

Two 4 x 5 mixed design analyses of variance were computed to examine the second hypothesis. The values of $\underline{F}$ are given in Table 2. As can be seen in Table 2, proxemic distance seemed to have a significant effect on performance. To determine if this effect was due to the effect of the independent variable or the differential effect of the task difficulty, a series of $\underline{t}$-tests were computed using the performance scores at each of the five proxemic distances

TABLE 1

Values of *t*: Hypothesis I

Scores	*t*-values			
	Galvanic Skin Response Trials with light 1	Galvanic Skin Response Trials with light 2	Discrimination Task Performance Trials with light 1	Discrimination Task Performance Trials with light 2
Inter-Groups [b]				
Inside CPD[a]	-1.061	-1.575	2.110 *	1.930 *
Outside CPD[a]	- .682	- .309	-1.538	.062
Intra-Group [c]				
Deviants	1.060	.958	2.167 *	1.739 *
Normals	1.762 *	.811	-1.667 *	.118

[a] critical proxemic distance (CPD) determined for each subject and used to derive scores

[b] comparing scores of deviant group with those of normal group

[c] comparing scores inside CPD with those outside CPD

* $p < .05$

for each of the two degrees of task difficulty. When light one was brighter, no significant difference ($p > .05$) could be found among the performance scores at any of the proxemic distances. When light two was brighter, only the performance

TABLE 2

Analysis of Variance:

Hypothesis II

Source	df	MS	F
Performance Scores			
SFP axis component (A)	3	.77	1.07
E-S distance (B)	4	2.63	3.66*
A x B	12	2.08	2.89*
Galvanic Skin Response			
SFP axis component (A)	3	4.10	3.13*
E-S distance (B)	4	2.95	2.25
A x B	12	1.00	.76

Note.--Data used from all subjects.

* $p < .05$

scores at the three-inch distance (t=2.222, df=82, $p < .05$) and the 15-inch distance (t-2.158, df=82, $p < .05$) were found to be significantly greater than those scores at the 22-inch distance.

Another t-test was computed to examine the difference in the GSR for the sociopetal and the sociofugal orientations. GSR scores were found to be significantly higher for the sociopetal than for sociofugal orientations (t-2.391, df=278, $p < .05$). Finally, as supplementary analysis, a series of t-tests were computed using the GSR scores at each of the five proxemic distances. The t-values are presented in Table 3.

TABLE 3

Values of t: Hypothesis II

Distance [a]	t-values				
	3	15	22	40	60
3	---	1.293	1.074	2.431*	1.818*
15		---	.250	1.564	.670
22			---	1.737*	.909
40				---	-.958
60					---

Note.--Galvanic skin response for all subjects was used to derive data.

[a]distance from experimenter to subject in inches.

*$p < .05$

One other result is worthy of note. There was no significant difference ($p > .05$) between the CPD's for the deviant adolescents and those of the normal adolescents. The mean CPD's are shown in Table 4.

TABLE 4

Mean Critical Proxemic Distances

SFP Axis Component	Group	
	Deviant	Normal
45°	24"	24"
90°	24"	23"
180°	21"	23"
270°	29"	30"

DISCUSSION

In spite of the confounding effect of the extraneous variable of task difficulty for the small and large proxemic distances, some support can be shown for the first hypothesis. The deviant adolescents showed a greater degree of performance detriment inside personal space boundaries than did the normal adolescents, while there was no difference in performance outside the personal space boundaries. In fact, only the deviant adolescents showed poorer performance inside the personal space boundaries than outside.

It would follow, however, that this detriment would be associated with an increase in anxiety, as was hypothesized in this study. This was not the case. There was little indication of greater levels of anxiety inside the personal space boundaries than outside in either group. And there was certainly no difference between the two groups that would parallel their differences in performance.

The results also lend only inconclusive support for the second hypothesis. The difference in performance found for each of the proxemic distances was attributable only to the nature of the discrimination task. There was, however, a greater level of anxiety for the sociopetal orientations than for the sociofugal orientations, as well as greater anxiety for some small proxemic distances than for the larger distances. The fact that these differences are evident only in the extremes and that there is no interaction between the two sets of factors would indicate that these effects are extremely subtle and that this experimental design did not allow for fine distinctions to be made. The SFP axis component and the kinesthetic factors that delineate any proxemic relationship between two individuals are not likely to be mutually exclusive variables as would be suggested by the results of this study.

Therefore, further testing would be necessary before these hypotheses could be readily accepted. This same, or a similar, experimental design could be used to test the effects of violation of personal space on some task that allows more possible variance in performance, thus allowing a finer measure of these effects. Also, a more controlled setting could be used to test the second hypothesis of this study. It is not necessary, and may in fact be a hindrance in testing, to examine the more subtle aspects of personal space while the subject is active in the performance of a task. Spatial and distal relationships could be manipulated while monitoring a number of physiological effects on a passive subject.

REFERENCES

Guardo, C.J. Personal space in children. Child Development, 1969, 40, 143-151.

Haase, R.F., & Markey, M.J. A methodological note on the study of personal space. Journal of Consulting and Clinical Psychology, 1973, 40, 6-8.

Hall, E.T. A system for the notation of proxemic behavior. American Anthropologist, 1963, 65, 1003-1026.

Hall, E.T. The Hidden Dimension. Garden City, New York: Doubleday and Company.

McBride, G., King, M.G., & James, J.W. Social proximity effects on galvanic skin response in adult humans. Journal of Psychology, 1965, 61, 153-157.

Neisels, M., & Guardo, C.J. Development of personal space schemata. Child Development, 1969, 40, 1167-1178.

Newman, R.C., & Pollack, D. Proxemics in deviant adolescents. Journal of Consulting and Clinical Psychology, 1973, 40, 122-125.

Pederson, D.M., & Heaston, A.B. The effects of sex of subject, sex of approaching person, and angle of approach upon personal space. Journal of Psychology, 1972, 82, 277-286.

Rodgers, J.A. Relationship between sociability and personal space preference at two different times of day. Perceptual and Motor Skills, 1972, 35, 519-526.

Sommer, R. Personal space: the behavioral basis of design. Englewood Cliffs, New Jersey: Prentice-Hall.

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THREE MNEMONICS: PEGWORD, PROGRESSIVE ELABORATION, AND NARRATIVE CHAINS COMPARED FOR EFFECTIVENESS

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The present study compared three mnemonics: 1) pegword; 2) pegword plus progressive elaboration; and 3) narrative chains, with each other and with rote learning. The following experimental hypothesis were advanced: performance, to be measured by the number of items correctly recalled, will be lowest for the rote learning situation (control); the next highest performance level will be for the pegword mnemonic; the third highest level will be obtained by using the progressive elaboration mnemonic; and the highest performance is predicted for narrative chaining. The results have been interpreted to mean that both the progressive elaboration and narrative chain mnemonics work significantly better than the pegword mnemonic, supporting one experimental hypothesis. The remaining hypotheses that performance for the pegword would be greater than for rote learning (control), and that narrative chain performance would be greater than that for progressive elaboration did not achieve statistical significance.

Several recent studies have demonstrated the utility of "mnemonics" (a system of precepts and rules to assist or improve the memory) as a strategy for remembering lists of items, numbers, or nonsense syllables (Bower, 1973; Bower and Reitman, 1972; Bower and Winsez, 1970; Bower and Clark, 1969). Based on paired-associate learning (Bower and Winsez, 1970), the mnemonic facilitates memorization by serving as a cue or "peg" for the item to be recalled. Mnemonic strategies date back as far as Greek times (Yates, 1966), "and there is little advice on remembering that a modern researcher can give that was not available from Simonides of Ceos or Quintillian" (Lesgold and Goldman, 1973).

Ebbinghaus' studies of forgetting demonstrated that forgetting occurred in a "reliable, orderly fashion" (Bower, 1973). Ebbinghaus' forgetting curve showed a functional relationship between the amount of material forgotten and the passage of time since learning had taken place. His research suggested several questions, including can forgetting be prevented or slowed down, and is memorizing a skill which can be taught and/or improved? Research suggests that memorizing is a skill (Bower and Reitman, 1972; Bower and Winsez, 1970; Bower and Clark, 1969; Lesgold and Goldman, 1973), one which can be learned and improved by special means.

Neisser (1967) theorized that memory works in a series of steps. In the first step, stimulus information is coded by mentally visualizing the stimulus. Neisser coined the term "iconic memory" to describe "the persistence of visual impressions (that) makes them available for processing even after the stimulus is terminated." The second stage in memory processing is the transformation of the iconic information into words. The verbal description is then available for permanent storage.

Neisser pointed out, however, that storing visual information by semantic coding is at times unreliable: the verbal description may err in that the person may report a word which sounds like the correct one, but does not look like it.

Sperling (1963) provides a similar account of memory processing: the subject sees the stimulus material for a short time, scans it, selecting certain information to rehearse verbally, then later repeats what he has rehearsed.

Neisser (1967) suggests that coding by semantic rehearsal is the process most often used, but it is not the only coding method. Learning from visual experience definitely takes place in young children and animals, yet without verbalization. It appears that some non-verbal storage medium must be available.

Rote memorization refers to the encoding process described by Neisser and Sperling; rote memorization consists of verbally repeating the items to be recalled as often as possible in the time allotted (Bower, 1973). Rote memorization works well enough if only a few items are to be remembered or only a short retention interval is required, but is less effective if either the number of items or time interval is extended. Mnemonic strategies have proven effective in situations involving extensive items or recention times.

The present study compared three mnemonics: 1) pegword; 2) pegword plus progressive elaboration; and 3) narrative chains, with each other and with rote learning. Several studies have been done comparing one of the above mnemonics with rote learning (Bower and Reitman, 1972; Bower and Winsez, 1970; Bower and Clark, 1969), but no study has yet been published which compares the three mnemonic methods with each other.

The pegword mnemonic uses a series of rhymes corresponding to the integers from one to ten (Table 1) which are easily recalled because of the rhyme scheme. To use the pegword, an individual creates a bizarre image linking the vision called up by the numbered peg (i.e., "gun" in the case of "one is a gun") with the word to be remembered. As with all the mnemonic methods discussed in this study, mentally visualizing a bizarre interaction between the peg and the item to be recalled appears to be very important (Bower, 1973; Lesgold and Goldman, 1973). Yates (1966) determined that the superiority of mnemonic principles depends on visual impressions. Neisser (1967) adds that, "...to construct something attentively is to see it clearly. Such objects can then be remembered; that is they can be reconstructed as visual images."

The necessity for uniqueness of the associative images as investigated by Lesgold and Goldman (1973), who found a high correlation ($r = 0.89$) between uniqueness of the imagined relationship and memory performance. The advantage of the pegword mnemonic, then, lies in the visual representation of the item to be recalled in a bizarre link with the peg. For this reason, the peglist (and the other "visual" mnemonics to be discussed) have been shown to facilitate memorization and prolong recall.

The inherent disadvantage of the peglist was also demonstrated by Bower and Reitman (1972). Bower and Reitman found that using the same peglist to learn several sets of items creates retroactive interference for recall of earlier items, similar to the A-B A-C paradigm for negative transfer. The A-B A-C paradigm assumes that A-C will not cause unlearning of A-B if A is encoded differently for the two instances. With the peglist mnemonic, as an individual memorizes several sets of items, all using the same pegwords, confusion arises as to which word belongs to which set, reducing the effectiveness of the pegword mnemonic.

In an attempt to eliminate or reduce retroactive interference arising from multiple use ("overloading") of the same peglist, Bower and Reitman (1972) developed the technique of progressive elaboration. Like the pegword, progressive elaboration begins with the rhyming integer mnemonic. The elaboration technique resembles progressive addition of new objects to a mental picture; for each peg, the subject visualizes an active relation between each new word and the objects already in the image. The advantage of the pegword plus progressive elaboration mnemonic is that it is effective in eliminating retroactive interference. No disadvantage of progressive elaboration were demonstrated.

The narrative chain is another "visual" mnemonic. With this method, the subject invents a story which weaves together a list of items to be remembered, while visualizing a unique relationship connecting each of these elements (Bower, 1973; Waters, 1971). Bower and Clark (1969) demonstrated the superiority of recall with narrative chains over rote learning and over memorization of word pairs constructed by the experimenter.

One advantage of the narrative chain appears to be the thematic construction, which links the elements together in a logical fashion (Bower, 1973; Bower and Clark, 1969). Another advantage is that since the invention of the narrative is determined by the sequence of the items to be learned, correct order of the items is preserved in the story.

Conceptually, the prediction was made that each of the mnemonic strategies in the present study would be more effective than rote learning. It was also predicted that the pegword plus progressive elaboration mnemonic would be more effective than the pegword alone, supporting Bower and Reitman's (1972) study. Since narrative chaining had been shown to be highly effective due to thematic linkage and sequential construction (Bower and Clark, 1969), the prediction was made that the narrative chain mnemonic would prove more effective than progressive elaboration.

The following experimental hypothesis was advanced: performance, to be measured by the number of items correctly recalled, will be lowest for the rote learning situation (control); the next highest performance level will be for the pegword mnemonic; the third highest level will be obtained by using the progressive elaboration mnemonic; and the highest performance is predicted for narrative chaining.

METHOD

Subjects

Twenty-eight college undergraduate students volunteered to participate in the study. The students were randomly assigned to one of the four test situations on the basis of matched scores obtained from the Verbal segment of the Scholastic Aptitude Test. The resulting Randomized Block Design was instituted to control for homogeneity of between-group and within-group variance. Subjects were classified as being "high," "average," or "low" scoring in terms of their verbal SAT scores, and were distributed so that each test situation contained two "high," three "average," and two "low" scoring subjects, for a total of seven subjects per group.

Procedure

The experimental design was multilevel, consisting of four independent groups of seven subjects each. Three of the four experimental groups were trained to use one mnemonic (pegword, progressive elaboration, or narrative chain) prior to testing; the fourth group (control) received no training prior to testing. The control group was designated as Group I, subjects taught to use the pegword mnemonic comprised experimental Group II, the progressive elaboration method was used by subjects of Group III, and Group IV subjects learned to use narrative chaining.

Paivio, Yuille, and Madigan's (1968) list of 925 nouns scored for concreteness and imagery was obtained and from their findings a list of the 100 words with the highest scores for concreteness was compiled. The 100 nouns were then assigned randomly to one of ten lists. "Double-functioning" nouns - those appearing in the peglist (i.e. "two is a shoe" or "eight is a plate") were not included, even though interference from this type of double function was shown to be insignificant when only one double functioning word was included per list (Bower and Winsez, 1970).

Prior to testing, Group II subjects memorized the list of pegwords given in Table 1, and were instructed to use the ten mnemonic pegs when learning each list of concrete nouns. Subjects were asked to form a visual association between the mnemonic peg and the corresponding word to be learned, so that a distinct image linking the noun with the peg was obtained. For example, if the first word on list one were "coffee," Group II subjects would use the peg "one is a gun" and might mentally picture a gun pouring out coffee. Subjects were informed that the more bizarre the image, the more likely they would be to recall it. It was stressed that subjects actually picture the association mentally and not attempt to use rote learning.

Training for Group III included memorization of the peglist in Table 1 and instructions for its use as with Group II. Once the image linking the noun with the peg had been formed, subjects were instructed that all subsequent items associated with that peg were to be progressively added to their mental picture. By the end of the testing session, all ten nouns associated with "one is a gun" would be combined into one complex image. The example of progressive elaboration, provided by Bower and Clark (1969) was given to Group III subjects in written form.

TABLE 1

Pegword Mnemonic

one is a gun	six is sticks
two is a shoe	seven is heaven
three is a tree	eight is a plate
four is a dour	nine is wine
five is knives	ten is a hen

Group IV subjects were instructed to learn each of the ten test lists by constructing a narrative linking the test items in the order presented. Again, subjects were requested to mentally visualize the narrative while creating it, and to "see" the words interacting in some way. By the end of the test session, each subject would have composed ten stories, with each story composed of the ten concrete nouns for that list. An example in written form, taken from Bower and Clark (1969) was presented to Group IV subjects as an illustration of the narrative chain mnemonic.

Each experimental group was tested separately. Testing procedure was indentical for all groups: subjects had ten minutes in which to learn each list of ten nouns according to the method of instruction specified. After a particular list of words had been memorized, the group was tested for immediate recall of that list by asking subjects to write the ten words in the order in which they had been presented. Time between completion of one test and presentation of he next word list was two minutes. At the end of all ten trials, subjects were as :ed to reproduce all ten word lists (100 words) in the order in which they had been presented. Items for each list had to be in correct order, and all ten lists had to be correctly ordered.

Subjects who were unsure of the position of any word or list were instructed to guess at its correct position. Twenty-five minutes were allocated for completion of the comprehensive (100 word) test. All lists were presented and all tests taken in written form to preclude the possibility of secondary variance arising from intermodal (visual as well as aural) stimuli and responses.

Two methods of scoring were used, a "strict" and a "lenient" scoring. The strict scoring method required that the order of the items in each list be exact, and that the order of the lists themselves be exact. Lenient scoring differed from strict scoring in that lenient scoring did not require that lists be in the proper order, but items within each list had to be accurately placed.

RESULTS

Data obtained by both the strict and lenient method of scoring were analyzed by an analysis of variance. A significant difference ($p < .05$) was obtained for between-group variance with the strict scoring condition only. Tukey's HSD (Honest Significant Difference) statistic (Kirk, 1968) was then computed to make all pairwise comparisons among means. Significant differences among means ($p < .05$) were obtained between Groups II and III, and II and IV. No HSD was computed for the data obtained by lenient scoring since the F statistic for lenient comparisons was not significant.

TABLE 2

Analysis of Variance: Strict Scoring

	SS	df	MS	F
Between-group	13688.42	3	4562.81	6.99 *
Within-group	3916.22	6	652.70	1.33
Residual	8826.08	18	490.34	

*$p < .05$

DISCUSSION

The significant F ratio obtained under strict scoring indicated a significant difference existed between at least two of the means, and the location of this difference was pinpointed by the HSD statistic as being between Groups II - III, and II - IV. This difference is reflected in the graph, Fig. 1.

The results have been interpreted to mean that both the progressive elaboration and narrative chain mnemonics work significantly better than the pegword mnemonic, supporting the experimental hypothesis. Since no significant difference was obtained between Groups I and II or between Groups II and IV, the experimental hypothesis that performance for the pegword would be greater than for rote learning (control), and the hypothesis that narrative chain performance would be greater than that for progressive elaboration, have been rejected. Non-significant differences between means for Group I - I and III - IV has been attributed to secondary (error) variance.

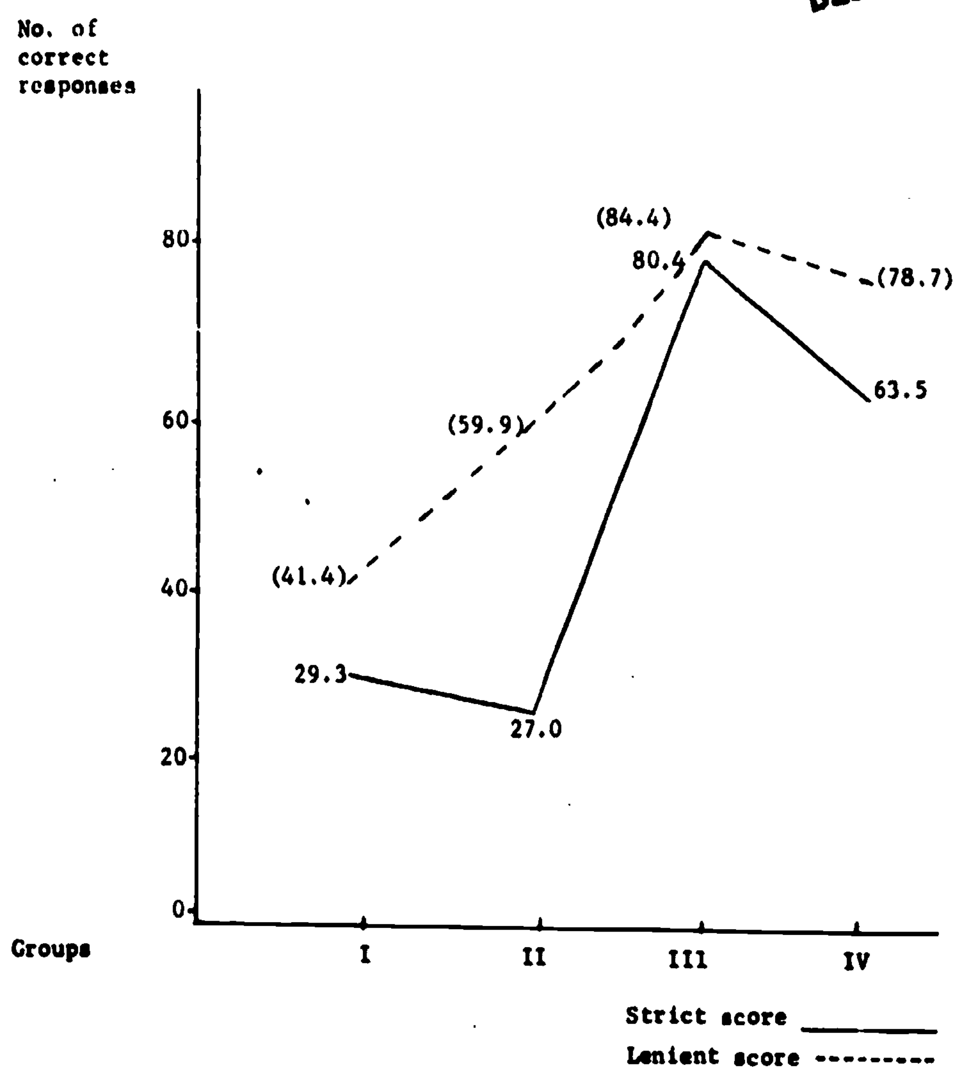

FIG. 1. Means for strict and lenient scoring.

For Group I (control), error variance is presumed to be due to sampling error; three of the control subjects were found to have devised and used a mnemonic rather than rote learning, causing the distribution to be kurtiod. The mean of 29.28 is not an accurate measure of central tendency since scores ranged from 2 to 71. The three subjects found to have used a mnemonic scored 44, 56, and 71. As their mnemonic, the subjects used item grouping, rhythm, imagery, and rhymes; the subject who scored 71 was found to have used narrative chaining, the mnemonic Group IV subjects had been instructed to use. The extraneous variable, use of mnemonics in the rote learning condition, was not apparent to the experimenter until testing had been completed, and could probably have been eliminated had all subjects been screened more carefully. Further screening would include a description by each subject of the method he would use to memorize ten lists of ten words and those subjects whose learning strategy did not conform to the experimenter's definition of rote learning would be eliminated.

The comparatively low mean score (27) for Group II under strict scoring is best explained by the prediction of the experimental hypothesis: that subjects using the pegword mnemonic would correctly recall the order of the items for each list, since each noun and peg were paired with an integer, but subjects would not recall the order in which the lists had appeared, due to retroactive interference. Evidence in support of this theory is provided by data obtained with lenient scoring; when the requirement for exact list order was disregarded, the Group II mean more than doubled.

The mean of Group III was highest for all groups, which did not support the experimental hypothesis that Group IV would perform better than Group III. Four of the seven subjects in Group III received perfect scores (100 correct) under the strict scoring condition. The subjects who did not score highly (lowest score = 47) were influenced by the extraneous variable of attention. These subjects expressed difficulty constructing composite images of more than six associated objects. In two instances, subjects admitted they had "given up" using the progressive elaboration mnemonic before all ten lists had been learned. Instruction in the mnemonic's use and practice over time should have improved the subjects' ability to use progressive elaboration. Lenient scoring did not improve scores for Group III, indicating that the progressive elaboration mnemonic is maximally efficient.

The major difficulty encountered by Group IV subjects using the narrative chain mnemonic was remembering the first word of each list. The first word was an essential element in recalling the list, since it served as a cue for the narrative. Lower scores were obtained by Group IV subjects as compared with Group III because the progressive elaboration mnemonic used by Group III provided a method for recalling the first item of each list. When Bower and Clark (1969) obtained superior results for narrative chaining over rote learning, they provided a first-word cue for each list. A cue was not provided in the present study because it was considered to weigh the outcome in favor of Group IV.

Not only did Group IV subjects experience difficulty recalling the first item of each list, but those subjects who did remember the first word encountered difficulty recalling which list came first, second, and so on. The difference in mean scores between the strict and lenient conditions is due solely to list reversal; when subjects were not penalized for incorrect list sequence, their scores increased by an average of 15 points.

Another factor believed to have made the progressive elaboration mnemonic more efficient than narrative chaining, was that the narrative chain required semantic rehearsal. Group IV subjects described the task of weaving a story from physical images alone to be difficult or impossible, and six of the seven subjects used verbal aids. When verbal links were used, the narratives could only be learned by rote, reducing the effectiveness of the imagery. Had the narratives been constructed entirely with images, as the subject who successfully recalled all 100 nouns discovered, the sequence of images was extremely similar to the composite mental picture formed by using the progressive elaboration mnemonic.

REFERENCES

Bower, G. and M. Clark, Narrative stories as mediators for serial learning, Psychonomic Science, 1969, 14 (4), 81-82.

Bower, G. and D. Winsez, Comparison of associative learning strategies, Psychonomic Science, 1970, 20 (2), 119-120.

Bower, G. and J. Reitman, Mnemonic elaboration in multilist learning, Journal of Verbal Learning and Verbal Behavior, 1972, 11 (40), 478-485.

Kirk, R., Experimental Design: Procedures for the Behavioral Sciences, Belmont, California, Brooks-Cole Publishing Company, 1968.

Lesgold, A. and S. Goldman, Encoding uniqueness and the imagery mnemonic in associative learning, Journal of Verbal Learning and Verbal Behavior, 1973, 12 (2), 193-202.

Matheson, D., Bruce, R., and K. Beauchamp, Introduction to Experimental Psychology, San Francisco, Holt, Rinehart, and Winston, Inc., 1970.

McNemar, Q., Psychological Statistics, New York, John Wiley and Sons, Inc., 1962.

Neisser, U., Cognitive Psychology, New York, Appleton-Century-Crofts, 1967.

Paivio, A., J. Yuille, and S. Madigan, Concreteness, imagery, and meaningfulness values for 925 nouns, Journal of Experimental Psychology Monograph Supplement, 1968, 76 (1, part 2).

Sperling, G., A model for visual memory tasks, Human Factors, 1963, 5, 19-31.

Waters, T., Psychologistics: An Operating Manual for the Mind, New York, Random House, 1971.

Yates, F., The Art of Memory, Chicago, University of Chicago Press, 1966.

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THE EFFECT OF REM SLEEP DEPRIVATION ON A DRL SCHEDULE--A MALE ALBINO RAT

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The purpose of this study was to explore the relationship between REM deprivation and temporal orientation. One male albino rat, subjected to REM deprivation, was trained on a DRL schedule with reinforcement contingent upon bar pressing after a thirty second interval. Graphs indicate higher bar presses and decreased reinforcement rates over hours of deprivation. Statistical data was not reported.

The role of REM sleep in "normal" psychological functioning has been well substantiated by studies in REM sleep deprivation (Dement, Greenburg, and Kline, 1966). The behavioral effects of REM-deprivation include increased motor activity and hyperexploratory behavior (Boyaner, 1970; Albert et al, 1971), hypersexuality (Dement, 1969), irritability (Dement, 1966), increased oral behavior (Fisher, 1965), and increased appetite (Dement and Fisher, 1963). Empson and Clark (1970) have implicated REM sleep as being necessary for optimal memory consolidation, and the deprivation of REM sleep has been shown to adversely effect conditioned avoidance response retention (Fishbein, 1970, 1971; Leconte and Bloch, 1970).

One of the physiological changes which marks the transition from non REM to REM sleep in mammals is a decrease in the muscle tonus of the posterior neck muscles. Animals placed on small pedestals or platforms surrounded by water are able to achieve non REM sleep, but are awakened by their snouts falling into the water each time they enter the REM state. This method has been used widely to deprive animals of REM sleep (Mordin et al, 1968; Dement _et al_, 1968).

DRL (differential reinforcement of low rates) is a time-contingent operant reinforcement schedule which is mastered only by the organism responding beyond a pre-defined temporal limit. Success under DRL is thus contingent upon the temporal factor and the bar press response, and requires greater discriminative behavior than the bar press alone (Skinner and Fester, 1957). Deprivation of the total sleep state has been shown to cause disorientation in time (Ross, 1965; Kollar, 1968); the influences of REM deprivation upon temporal orientation remains to be investigated, however. The purpose of this paper was to establish the relationship between REM deprivation and temporal orientation, operationally defined as success under the DRL schedule.

METHOD

Subjects

The subject for our experiment was an adult male albino rat deprived to eighty percent of its normal body weight. The rat had previous history with DRL, reinforcement being contingent on bar pressing after a thirty second interval had elapsed from the time of the last bar press. The rat was food-deprived for twenty-two hours prior to experimentation.

Apparatus

The REM deprivation chamber contained inner dimensions of 11.5" x 8.0" x 12.0" and was constructed of 0.25" thickness plexiglass panels. A 4.0" x 1.5" stand (platform A) was positioned 5.0" from the bottom of the chamber for REM deprivation conditions and replaced with a 5.0" x 7.0" stand (platform B) for the post-deprivation conditions. The chamber was filled with water to the level of the platform. The Scientific Prototype test cage was constructed of two aluminum end panels, two plexiglass side panels, a plexiglass top panel with air holes, containing a feeding tray, response bar, and water receptacle 1.0" above a grid floor. A Scientific Prototype (Model D700) pellet feeder was connected to the chamber and regulated by a Lehigh Valley Electronics (Model 511-10) control unit which was utilized with a LVE universal timer in a modular control system wired for DRL.

Procedure

The rat was placed on a DRL schedule with reinforcement contingent upon bar pressing after a thirty second interval had elapsed. The subject received spaced practice over a period of twelve days, until the criteria of one reinforcement per five responses was met over a one hour period of time. The rat was then deprived of food for twenty-two hours, after which time he was placed in the test cage for one hour and allowed to bar press for food reinforcement under the DRL schedule mentioned above. Responses and reinforcements were recorded on a cumulative recorder. After sixty minutes in the test cage the subject was removed and placed in the REM deprivation chamber upon platform A for twenty-three hours under conditions of constant illumination and temperature, after which time the subject was again placed in the test cage for sixty minutes under DRL. The animal was then weighed and placed in the chamber on platform A for an additional twenty-three hours. This procedure was repeated for three days or a total of seventy-two hours, after which time platform A was replaced with B. Identical procedure was repeated for an additional fourty-eight hours.

RESULTS

Bar pressing as a function of time is represented in Figure 1. It was noted that bar pressing generally increased as REM deprivation time increased. This trend was noted to extend twenty-four hours after REM deprivation was terminated, at which time a sharp drop in the number of bar presses was noted.

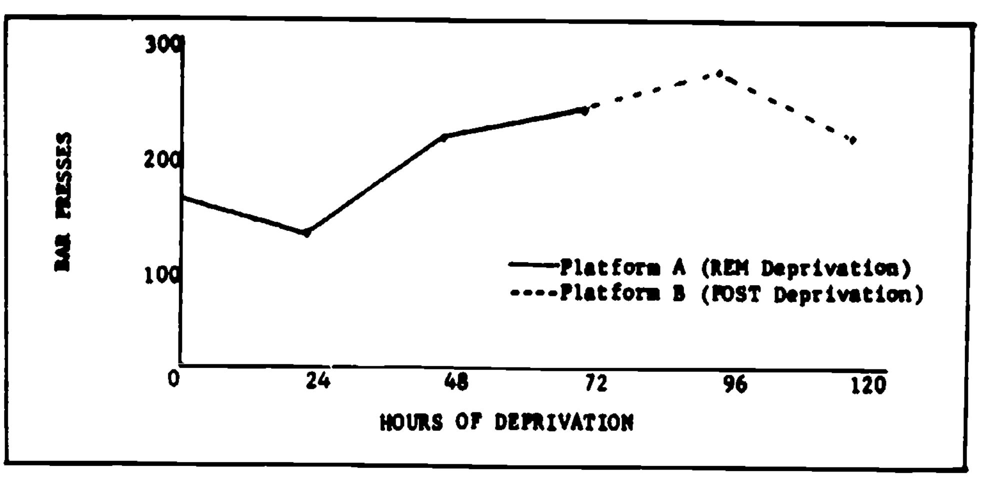

FIG. 1. Bar presses as a function of hours of deprivation.

Figure 2 shows the number of reinforcements received by the subject as a function of REM deprivation time. An immediate decrease in reinforcements received is noted, with the subject receiving only one-third of the total baseline reinforcements after seventy-two hours of deprivation. Termination of the REM deprivation was accompanied by an immediate increase in the number of reinforcements attained by the rat, with complete return to baseline values after forty-eight hours.

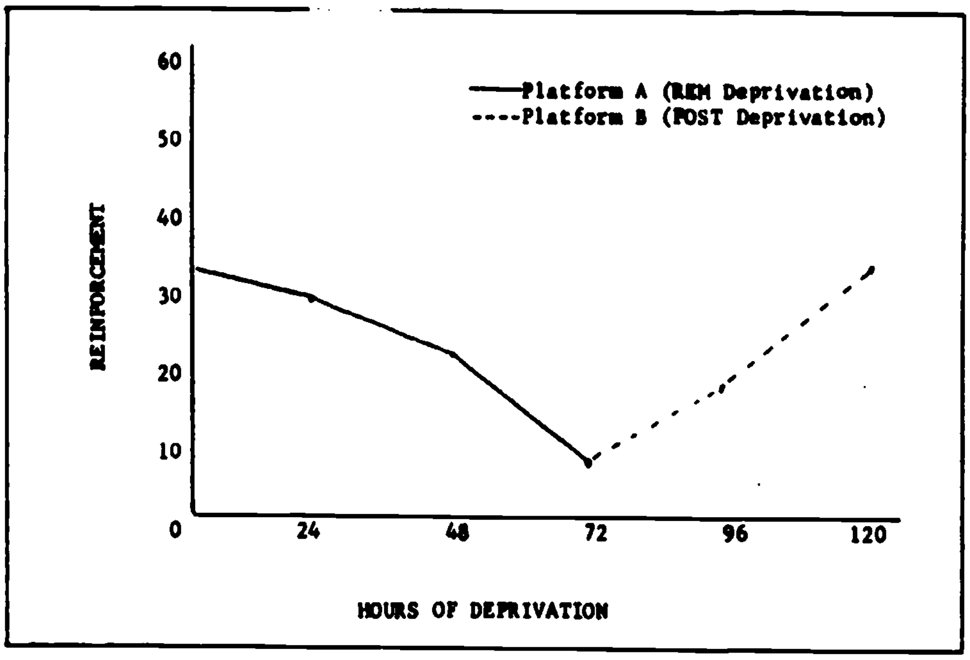

FIG. 2. Reinforcement as a fuction of hours of deprivation.

Figure 3 expresses the ratio between bar presses and reinforcements as a function of REM deprivation. A steep increase in the ratio of responses to reinforcements is noted after twenty-four hours of deprivation, with a ratio of one reinforcement per 18 responses noted after seventy-two hours of deprivation. When platform B was instituted, a sharp decrease in the ratio was noted with almost complete return to baseline values after forty-eight hours.

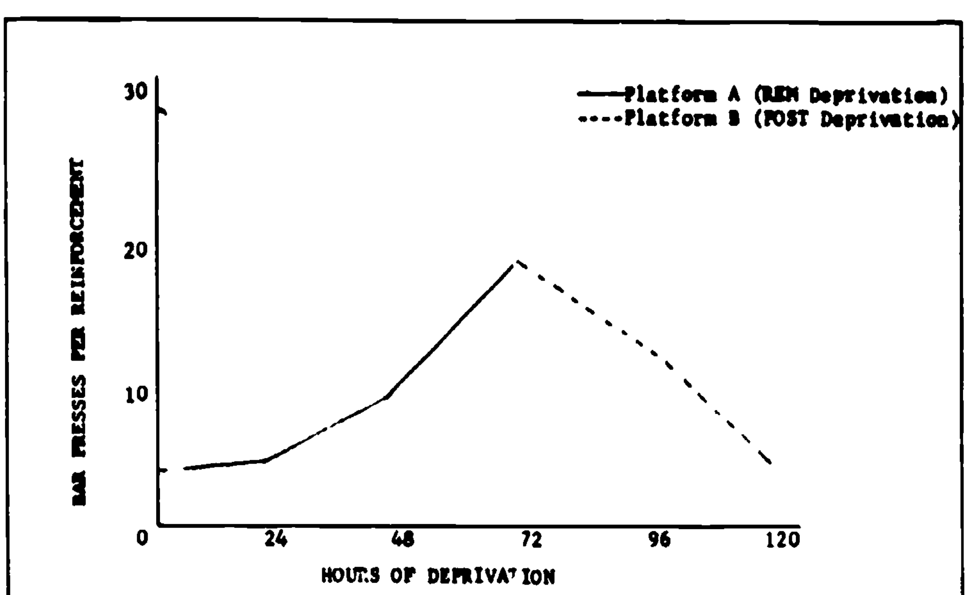

FIG. 3. Bar presses per reinforcement as a function of hours or deprivation.

DISCUSSION

Data indicate that REM deprivation effects temporal orientation adversely. To the seventy-two hour REM deprivation limit of this study, it appears that temporal impairment is progressive; reducing the number of reinforcements received by the rat, and increasing the total number of responses. The exchange of platform A for B, which allowed REM sleep to be achieved, is marked by an increase in the number of reinforcements attained by the rat, and a decrease in the ratio between responses and reinforcements. A return to pre-experimental values for both are observed after forty-eight hours.

Although it is concluded from this study that REM sleep deprivation does affect temporal orientation, the specific reason remains obscure. Further experimentation is warranted, as disruption of the DRL schedule could have resulted as a consequence of the hyperactivity or the increase in appetite associated with REM sleep deprivation. Chemically-induced control of activity would be useful in ruling out hyperactivity as the cause if it is not, and using reinforcements other than food as the incentive for DRL mastery could investigate the role appetite increase played in these results.

REFERENCES

Albert. et al., "The behavioral effects of REM sleep deprivation in rats." Psychophysiology, 1970, 6, 550-560.

Boyaner, H.G. "Effects of REM sleep deprivation on exploration in rats." Psychological Reports, 1970, 27, 918.

Dement, W.C. & Fisher, C. "Experimental interference with the sleep cycle." J. of Canadian Psychiatric Assn., 1963, 8, 400-404.

Dement, Greenburg, & Kline. "The effect of partial REM sleep deprivation and delayed recovery." EEG and Clinical Neurophysiology, 1966, 9, 673-690.

Dement, W.C. et al., "The effects of DAS on REM-deprived rats." Physiology and Pathology, Philadelphia, Lippincott, 1969, 245-65.

Empson, H., & Clark, P.R. "Rapid eye movements and remembering." Science, 1970, 165, 1643-46.

Fester, C.B. & Skinner, B.F. "Schedules of Reinforcement." New York, Appleton-Century Croft Inc., 1957, 459-502.

Fishbein, W. "Interference with conversion of memory from short-term to long-term storage by partial sleep deprivation." Comm. Beh. Biol., 1970, 5, 171-75.

Fishbein, W. "Disruptive effects of REM deprivation on memory storage." Physiological Behavior, 1971, 6, 279-82.

Fisher, C. "Sleep: preliminary report; cycle of penile erections synchronous with dreaming (REM) sleep." Arch. of Gen. Psychiatry, 1965, 12, 29-54.

Kollar, E.J. et al., "Neurological findings during prolonged sleep deprivation." Neurology, 1968, 18, 836-40.

Leconte, P., & Bloch, V. "Deficit in the retention of the conditioned avoidance response after REM deprivation." Comp. Rend. Arch. Science, 1970, 271, 226-29.

Mordin, Bruce. et al., "The effects of REM sleep deprivation on fighting." Physiol. and Behavior, 1968, 3(3), 425-32.

Ross, J.J. "Neurological findings during sleep deprivation." Arch. of Neurol., 1965, 12, 399-403.

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THE EFFECTS OF EXTRANEOUS STIMULI ON THE LEARNING RATES AND PERFORMANCE LEVELS OF AN AUTISTIC CHILD

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Studies of autistic children commonly cite examples of poor attention, self-stimulatory behavior, and slow learning rates. In an effort to examine the environment determinants of these behaviors, a single-subject, A-B-A reversal design study was carried out with a four-year old autistic girl. Two conditions were tested: an extraneous stimulus condition in which extra people were present and engaged in conversation during a trial and error learning situation; and a minimal stimulus condition which differed from the first in that only the child and therapist were present. The order of presentation of conditions was varied to examine interactions between condition complexity and sequence of presentation. Dependent measures were taken on performance, attention, and self-stimulation. The results indicate that impaired performance and behavior occur most predominantly when the extraneous stimulus condition is presented in the latter half-hour of the therapy session. The implications of this finding for optimal therapy and parent training programs is discussed.

Early infantile autism is classified as a form of childhood psychosis characterized by extreme social withdrawal. Yet this is only one of the bizzare behaviors evident in autistic children. Studies of these children commonly cite examples of self-stimulatory behavior, poor visual and auditory attention, and excessive tantrumming, self-destructive behavior, and demands for situation sameness (e.g. Kanner, 1943; Rimland, 1964; Young, 1969; Lovaas, Schreibman, Koegel, and Rehm, 1971). Researchers have postulated theories of perceptual and physiological dysfunction to account for autistic behavior. Three major theories of this sort have been devised: the underarousal theory proposed by Rimland (1964), the overarousal theory of Hutt and his colleagues (Hutt and Hutt, 1956, 1969; Hutt, Hutt, Lee, and Ounsted, 1965; and Hutt and Ounsted, 1966), and the overselectivity theory of Lovaas and colleagues (Lovaas, Schreibman, Koegel, and Rehm, 1971; Lovaas and Schreibman, 1971; Koegel, 1971; Koegel and Wilhelm, 1973; and Schreibman, 1972). Experimental validation of these conflicting theories is essential to the selection of an optimal therapy program for autistic children. At present, the latter two theories hold the predominance of empirical support.

Rimland claims that the autistic child does not have sufficient sensory input due to a dysfunction in the reticular activating system (RAS) of the mesencephalon. It is through this brainstem formation that most of the afferent impulses from the sensory receptors enter the brain for further processing. Proper functioning of the RAS is essential to the integration of sensory input making discrimination

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and meaningful action possible. Rimland believes that the RAS blocks sensory input and therefore the child responds by creating his own stimulation of the brain via self-stimulatory behavior. This behavior is to protect the brain from atrophy. Without this stimulation, the brain would be in a state of underarousal. Yet this is only conjecture, for there is no evidence from EEG studies to show that autistic children are centrally underaroused. Indeed, the evidence is contrary to this notion. Nevertheless, some therapists adhere to Rimland's underarousal theory and have developed environments which exhaust the range of possible sensory stimulation. However, no empirical support for the efficacy of this treatment is yet available.

On the other hand, an alternative explanation might be that offered by Hutt and colleagues. These researchers have proposed a theory which attributes autistic behavior to a malfunction of either the RAS or sensory receptors producing a sustained state of high central arousal. The have measured EEG and behavioral responses of autistic children to changes in environment stimuli and have found significant correlations of self-stimulation behaviors as well as desynchronized, arousal EEG's with more sensory complex situations. These authors infer that such behavior as self-stimulation may act as a perceptual defense mechanism against further sensory input. If overarousal in the case, as the waking EEG records indicate, then the tendency to demand situation sameness may be further attempts by the child to safeguard against overstimulation from novel stimuli. Research by Ney, Palvesky, and Markley (1971) lends support to the hypothesis that these children are hypersensitive to stimuli and may have developed a broad range of defenses (self-stimulation, social withdrawal, demands for sameness, etc.) to cope with the masses of sensory stimuli surrounding them. The overarousal theory is complemented by the overselectivity theory.

Research into selective attention and perceptual deficits by Lovaas and his colleagues has pointed to a tendency for autistic children to selectively attend to a single stimulus when presented with a multiple stimulus input. This difficulty in dealing with incoming stimuli may be physiologically caused, yet despite this, these researchers have produced significant improvement in the conditions of autistic children by relying on a behavior modification therapy which employs simple, direct discriminative stimuli (S^D's). The therapy situation is kept free from distracting, non-essential stimuli to provide for optimal attention to that stimuli which is present. The therapist is thus able to increase the probability that the child will attend to the relevant stimuli associated with the learning task presented. This method has been shown effective in facilitating rapid acquisition of a task (Sailor and Taman, 1972). It also supports the overarousal theory since reduction of stimuli appears to be necessary for cortical associations to be formed.

There appears to be a relationship between the amount of environment stimulation and the behavior of autistic children. How does the level of ambient stimuli effect such behaviors as self-stimulation and attention? What consequences do these effects have upon the training and performance of autistic children? If extraneous stimuli must be present in the therapy environment of the autistic child, what is the least harmful manner in which this may be accomplished? These questions prompted the present study which has been designed to analyze the effect of environmental complexity, condition sequence, and task difficulty upon the discrimination performance of a single autistic child in a therapy situation. The effect of these factors upon self-stimulation and attention was also noted. It was hypothesized that the addition of extraneous irrelevant stimuli to the therapy environment would impair the performance and behavior of the child.

METHOD

Subject

The subject was a four-year-old girl diagnosed as autistic by agencies unaffiliated with this study. At intake she displayed selectivity and resistance in her responsiveness, yet appeared normal on tests of her sensory modalities. Observations of finger "wiggling" pointed to occurences of self-stimulation. Intake notes showed marked signs of classical autism: demands for situation sameness, wild temper tantrums, and self-abusive behavior. She lacked appropriate affect and avoided social interaction. Furthermore, speech was delayed and, for the most part, functionally mute. She had undergone three months of therapy at the Claremont Autism Project when the study was executed.

Apparatus

Equipment for the study consisted of an Esterline Angus continuous event recorder equipped with two pens to score the dependent variables of self-stimulation and attention for both frequency and duration. Two observers took recordings from an observation booth behind a one-way glass. The observation room was equipped with an audio monitor and intercom system. The experimental room was the usual location for the subject's therapy. It contained a small table, three small chairs, two large chairs, and a shelf of toys. The room was otherwise devoid of distracting objects or sounds. A script based on Margery Willams' story A Velveteen Rabbit was used by confederates during the extraneous stimulus condition.

Procedure

A single-subject, A-B-A reversal design with two tasks was employed in an effort to assess the environmental determinants of the dependent measures. Two non-verbal discrimination tasks were devised, one at pre-criterion level and one at post-criterion level. Criterion was set at a level of 85% correct responses for a given task. Above this level, a task was considered mastered by the subject. The experimental tasks were assessed during a 30 trial baseline period to fulfill the requirements of the design. The pre-criterion task was a discrimination of two nonsense syllable, nonsense shape objects named "mib" and "dak." The post criterion discrimination task was of two common objects, "ball" and "car."

Two conditions were manipulated as independent variables. A minimal stimulus condition consisted of the subject and therapist seated at the small table, engaged in training on the discrimination tasks. Communication between the experimental room and observation room was conducted through the bug-in-th-ear intercom. No auditory stimuli were present other than that from the E and S. An extraneous stimulus condition differed from the above by adding the presence and conversation of two confederates familiar to the S. These confederates were seated 3 feet to the right and equal-distant within the visual field of the subject, and were engaged in conversation between themselves. All other aspects of the situation were held constant including the order and position of S^D items, time and frequency of rest periods, schedules of reinforcement, and task difficulty.

A second independent variable was the condition sequence. As the experimental sessions were an hour in length, comparable to the normal therapy sessions, the order of presentation of conditions was systematically varied to assess the interaction of time and fatigue with condition complexity upon the S's behavior. Thus, the order of presentation for the three day study was 1) minimal stimulus followed by extraneous stimulus; 2) extraneous stimulus followed by minimal stimulus; and 3) minimal stimulus followed by extraneous stimulus.

The third independent variable was task complexity. The two tasks listed above were chosen to operationally represent a simple task (post-criterion) and a more difficult task (pre-criterion). These tasks were held constant in order of presentation, position of S^D items on the table, and number of discrete trails. The position of the items was determined by a random number list, selecting 25 positions, near to the S and far from the S, for the stimulus object to occupy.

Dependent variables were performance, defined as percent correct on the discrimination tasks; attention, scored as the number of attention-calling S^D's "Look at me," given by the experimenter; and self-stimulation. As a method of artifact control, a trial and error learning situation was employed, devoid of prompts or shaping to hold constant these variables. A response was scored as correct if the subject correctly handed the discrimination item to the experimenter-therapist within five seconds following the E's request. If no response occurred prior to this time or if an incorrect choice was made, the observers recorded the response as wrong. Attention levels were inferred from the number of "Look at me" commands given during a condition. These S^D's were delivered by the E contingent upon a three second lapse in visual contact between the E and S. The frequency of these S^D's were recorded by the two independent observers. Self-stimulation consisted of the following, narrowly defined behaviors, scored for both frequency and duration:

Finger manipulation: extending and contracting fingers in an opening and closing motion; crossing fingers in a "good luck" fashion; and a picking motion, especially near legs.

Body movements: rocking forward and back, or side to side; swinging legs back and forth, side to side; knocking knees together in repetition.

Observers were pretrained for reliability on the above measures.

Experimental sessions consisted of the presentation of blocks of 25 discrete trails for each task totaling 50 S^D's for a given condition on any one day. The same number and order of S^D's were presented during the alternate condition for a total of 100 discreate trials for the entire session. In order to avoid monotony and to resemble a typical therapy session most closely, the groups of 25 discrete trials for each task were presented in groups of 10 S^D's each, varied from to pre- to post-criterion tasks.

Reinforcement was administered on a CRF (continuous reinforcement schedule) for social reinforcement and a flexible VR (variable ratio schedule) for primary reinforcement. The primary reinforcer, peanut butter or candy, was given contingent upon a correct response, 3-5 times for each block of 10 trials. Thus, if no correct responses occurred, the S received no reinforcement. However, if 3 or more were correct responses, the S received social reinforcement for each and the possibility of at least 3 or at most 5 primary reinforcers. This flexibility allowed the experimenter to determine whether or not to reinforce the response without binding him to a more rigid schedule which might necessitate administration of a primary reinforcer during some inappropriate behavior following a correct response. Incorrect responses were followed by a mild "no" by the E. Inappropriate reaching was followed by the command "hands down." All other behaviors were neither reinforced nor punished by the E. Following groups of 20 S^D's and/or completion of a condition segment, the subject was allowed a five minute break to rest and play with the experimenter, consistent with the routine therapy program.

RESULTS

Performance measures showed a definite drop in percent correct scores for the post-criterion task on days 1 and 3 (days on which the extraneous stimulation condition was presented in the latter half-hour). See figure 1.

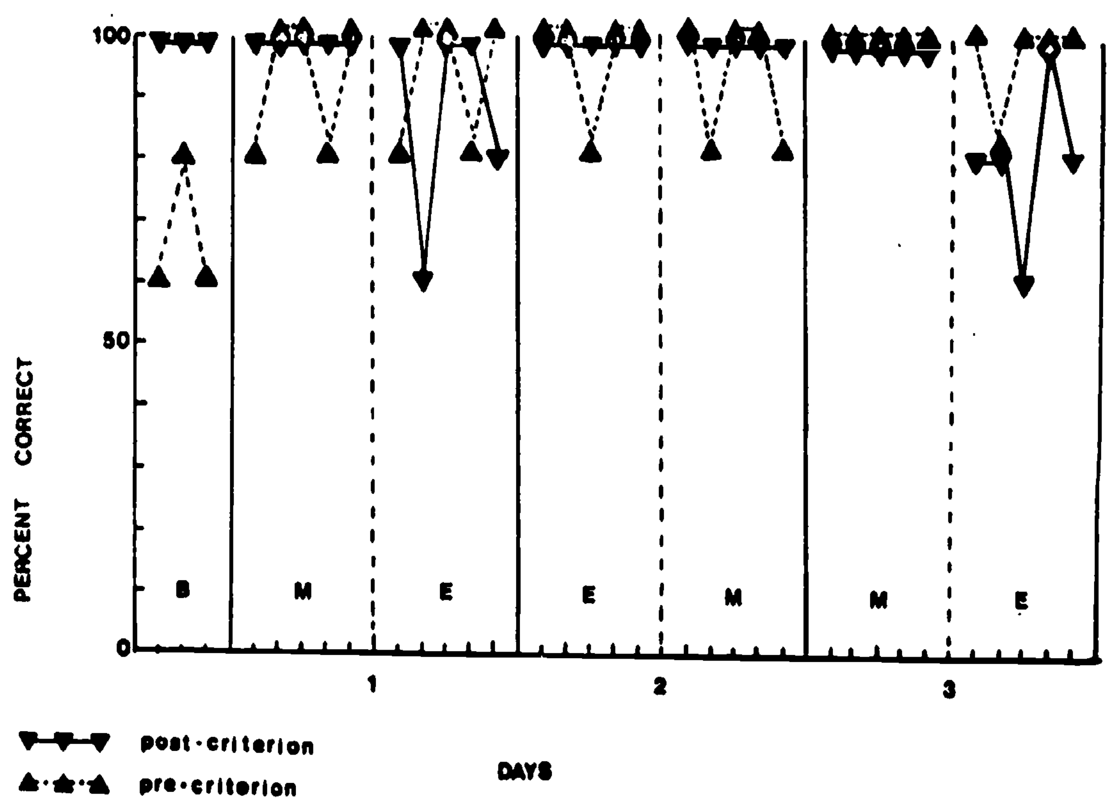

FIGURE 1. Performance on Discrimination Task. Performance was scored for percent correct from blocks of 25 trials. These groups of trials were graphed in segments of five trials. Hence, for a given condition, there appear five points as percent correct scores for a given task. The downward facing triangles, connected by the solid lines represent the scores for the post-criterion task, while the upward facing triangles joined by the dashed line represent the scores for the pre-criterion task.

The lower percent correct scores for this task did not appear on day two when the order of conditions was reversed. Performance on the pre-criterion task was initially low, but quickly reached a high level of correct responses, although this was subject to a small degree of variability. Reliability for performance observations was established at 100% agreement.

Scores for attention were initially high, indicative of poor attention. By the second day, however, these scores had dropped to a much lower level and remained at about this level for the third day. Each day, the larger of the two scores appeared during the latter condition. However, the greatest of such differences occurred on days one and three between shifts from minimal stimulation to extraneous stimulation conditions. Reliability varied from a low of 86% to 100% agreement for this measure.

Self-stimulation was scored for both frequency and duration. The greatest frequency occurred on day one in the extraneous stimulation condition, while the lowest frequency of self-stimulation occurred during baseline and day three, minimal stimulation condition. These frequency scores varied from a low of 0 occurences of self-stimulation to a high of 4 occurences, while the score for duration was more widely distributed and more clearly skewed.

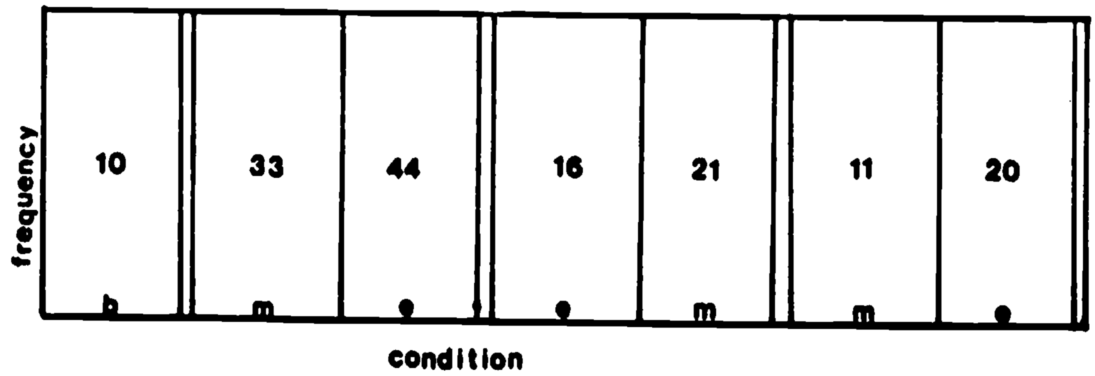

FIGURE 2. Attention Measured by Number of Look at Me Commands Administered. Larger scores represent a greater number of Look at Me commands administered contingent upon lapses in eye contact. These larger scores indicate poorer attention, operationally defined as eye contact.

b -- baseline condition
m -- minimal stimulation condition
e -- extraneous stimulation condition

Self-stimulation ranged from 0 seconds to 55 seconds per half-hour. The highest of these scores for both frequency and duration occurred on days one and three during the extraneous stimulation conditions. No differences in scores for either measure were observed on day two. Reliability was established at 100% agreement.

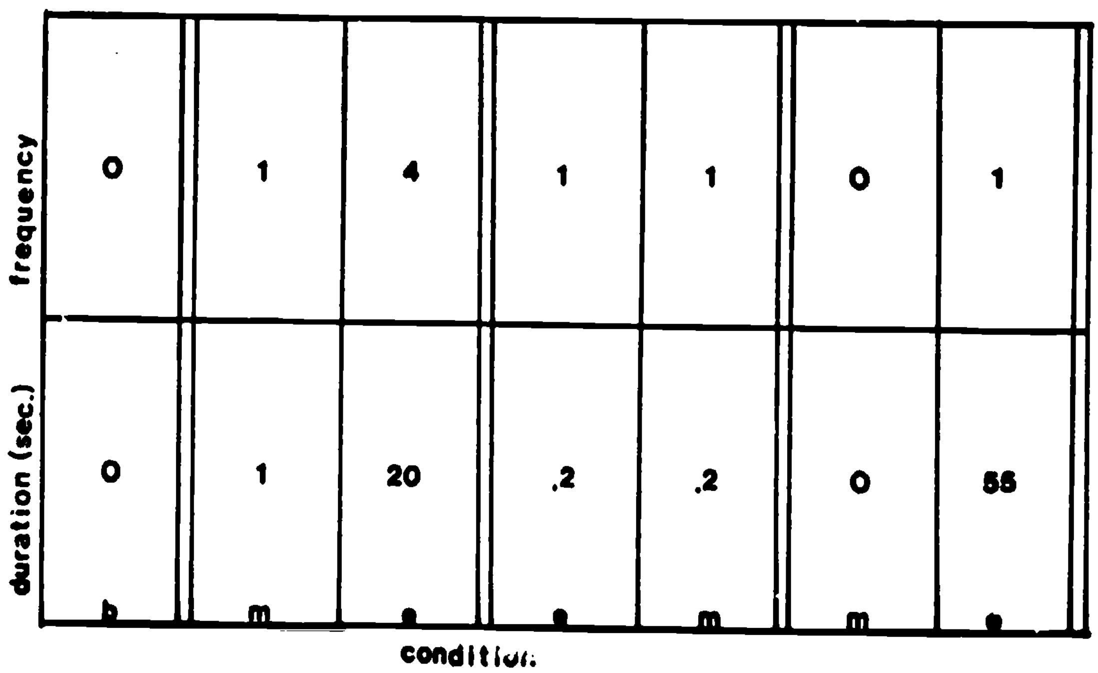

FIGURE 3. Self-Stimulation Frequency and Duration. The frequency and duration of self-stimulatory behaviors was measured for each of the half-hour conditions.

b -- baseline condition
m -- minimal stimulation condition
e -- extraneous stimulation condition

DISCUSSION

It was originally hypothesized that increased amounts of environmental stimuli would lead to decreased levels of performance and concomittant increases in inattention and self-stimulation. It was further proposed that the major decline in percent correct scores would occur with the pre-criterion task. However, the results failed to directly support either of these hypotheses. Instead, the suspected behavioral consequences of environmental conditions appeared predominantly in the post-criterion task on days one and three. This suggests an interaction between condition and order of presentation. The significance of this relationship upon therapy designs will be discussed later.

A detailed examination of the data lends support to the overarousal theory and the overselectivity theory. On the basis of the overarousal theory, one would expect to observe increased levels of self-stimulation and inattention to some forms of stimuli in an extraneous stimulation condition. Hutt and his colleagues propose that the self-stimulation may act to flood the neural circuitry and thereby effectively block incoming stimuli. If the ambient level of environmental stimuli were raised beyond some threshold level, then the child would respond with this self-stimulation defense mechanism. The overarousal theory would suggest that the results of increased stimulation would be situation specific; however, the present data tends to qualify this statement since condition alone was not a sufficient single cause of increased levels of self-stimulation. It would be worthwhile to replicate Hutt, Hutt, Lee, and Ounsted (1965) in light of the current findings to assess the extent to which fatigue and sequence of condition influenced their results.

The overselectivity theory offers an explanation for the low performance levels for the extraneous stimulation condition. If this theory is correct, one would expect impaired performance on learning tasks under such conditions due to the flooding of the learning situation with irrelevant stimuli, thereby lowering the probability of the child attending to the stimuli relevant to the task. This would appear as lowered scores for percent correct. Again, this would be suspected to be situation specific, regardless of order. However, the decline in performance appeared primarily in conditions of extraneous stimulation which occurred in the second half of a session. Nevertheless, the results lend partial support to the theory insofar as decreased performance for both tasks did occur in the extraneous stimulation conditions.

The post-criterion task showed the greatest decline in percent correct scores. These declines occurred solely in the extraneous stimulation conditions, and then, only when that condition was presented in the latter half of a session. Although the task was well established above the 85% correct criterion level, marked declines in performance were evident when the levels of environmental stimulation were increased in the second half-hour. These drops in performance accompanied lowered levels of attention and increased levels of self-stimulation. General performance diminished during this condition. To assess the effects of the environmental stimulation upon learning rates, the pre-criterion task was studied.

During both conditions, the pre-criterion task varied in percent correct. This variability was identical for both conditions on day one, indicating that for such a task, the environmental complexity did not influence the level of performance. Days two and three showed decreases for this task in the latter half of the session with the greatest difference occurring on day three. However, the persistent variability of this task limits the extent of possible conclusions. At best, they suggest a trend of comparatively lower levels of performance during the latter half-hour of a therapy session. When combined with the differences noted in attention, self-stimulation, and post-criterion performance, it appears that the latter half of a therapy session is necessarily poorer in quality than the first. This conclusion has ramifications for the design of therapy sessions, subject to further experimental support.

Behavior modification studies with exceptional children ranging from disruptive, pre-delinquent children (Johnson and Brown, 1969) to autistic children (Lovaas, Koegel, Simmons, and Long, 1973) point to the necessity of parental training in operant techniques. Afterall, they are the ones most closely involved with the children on a daily basis. The results from any intervention program are only as effective as generalization outside the clinic can be maintained. Therefore, it is necessary to train the parents to be effective therapists. Often this training necessitates the addition of extra persons to the therapy situation who interact and converse with the parents in training as they practice their therapy skills. This situation is roughly comparable to the extraneous stimulation condition of the present study. Although a more direct test using the actual parents in training is necessary, the current findings suggest that parental training would optimally be conducted during the first half-hour of a therapy session.

The results reported here should be understood as preliminary findings. The stimulus control variables identified here may be solely specific to this particular child and circumstances. Replication is needed to assess the general applicability of these findings. Especially useful would be multiple replications across subjects, tasks, therapists, and level and types of extraneous stimulations. Nevertheless, some tendencies relevant to parent training and the design of therapy for autistic children have been observed.

REFERENCES

Hutt, C., and Hutt, S.J. Effects of environmental complexity on stereotyped behaviors of children. Animal Behavior, 1956, 13, 1-4.

Hutt, S.J., Hutt, C., Lee, D., and Ounsted, C. A behavioral and electroencephalographic study of autistic children. Journal of Psychiatric Research, 1965, 3(3), 181.

Hutt, C., and Ounsted, C. The biological significance of gaze aversion with particular reference to the syndrome of autism. Behavioral Science, 1966, 11, 346-356.

Hutt, C. and Hutt, S.J. Biological studies of autism. Journal of Special Education, 1969, 3(1), 3.

Johnson, S.M., and Brown, R.A. Producing behavior change in parents of disturbed children. Journal of Child Psychology and Psychiatry, 1969, 10, 107-121.

Kanner, L. Autistic disturbances of affective contact. Nervous Child, 1943, 2, 217.

Kanner, L. Follow-up study of eleven autistic children originally reported in 1943. Journal of Autism and Child Schizophrenia, 1971, 1(2), 19.

Koegel, R. Selective attention to prompt stimuli by autistic and normal children. Unpublished doctoral dissertation, University of California, Los Angeles, 1971.

Koegel, R., and Wilhelm, H. Selective responding to multiple visual cues by autistic children. Journal of Experimental Child Psychology, 1973, in press.

Lovaas, O.I., and Schreibman, L. Stimulus overselectivity of autistic children in a two stimulus situation. Behavior Research and Therapy, 1971, 2, 305-310.

Lovaas, O.I., Schreibman, L., Koegel, R., and Rehm, R. Selective responding by autistic children to multiple sensory input. Journal of Abnormal Psychology, 1971, 77, 211-222.

Lovaas, O.I., Koegel, R., Simmons, J.Q., and Long, J.S. Some generalization and follow-up measures on autistic children in behavior therapy. Journal of Applied Behavior Analysis, 1973, 6(1), 131-166.

Ney, P.G., Palveshy, A.E., and Markley, J. Relative effectiveness of operant conditioning and play therapy in childhood schizophrenia. Journal of Autism and Child Schizophrenia, 1971, 1, 161.

Rimland, B. Early Infantile Autism. New York: Appleton, Century, Crofts, 1964.

Sailor, W., and Taman, T. Stimulus factors in the training of prepositional usage in three autistic children. Journal of Applied Behavior Analysis, 1972, 5(2), 183-190.

Schreibman, L. Within-stimulus versus extra-stimulus prompting procedures in discriminations with autistic children. Unpublished doctoral dissertation, University of California, Los Angeles, 1972.

Young, S.T. Visual attention in autistic children and normal children--effects of stimulus novelty, human attributes, and complexity. Unpublished doctoral dissertation, University of California, Los Angeles, 1969.

(Received June 25, 1974)

1. Bartlett, Laurel A. (Occidental College) The good behavior game: its application in reducing disruptive behavior in a problem classroom.

The effects of controlling group contingencies for disruptive behavior was studied through implementation of the "Good Behavior Game" in a combination fifth and sixth grade classroom. The class, consisting of multi-racial, multi-ethnic, multi-ability level children, was divided into four groups. The rate of talking out and disruptive physical behaviors was recorded for each morning period before recess. Groups went to recess five minutes early, on time, or five minutes late depending on the number of undesirable behaviors they had accumulated. Disruptive behavior was significantly reduced during on contingency conditions.

2. Brown, Dietra. (Mills College) Cutaneous perception of color -- yes or no?

In an attempt to test the hypothesis that human skin in some people may be able to discriminate different colors in the visible range of the electromagnetic spectrum, 25 women taking courses in Psychology at Mills College were asked to distinguish, with their fingers, between red and light blue papers covered with plastic wrap and concealed from vision. Each of the 60 stimulus plates contained three colored squares, two of which were identical and one different. In addition, 10 control plates were prepared in which all the colors were identical. These 70 plates were assembled in random order and presented to the Subjects in a loose-leaf notebook. The notebook was placed inside a cardboard box, illuminated by 2 100-watt light bulbs and kept at temperatures ranging from 70° to 90° F. A large bib-like piece of cloth tied around the S's neck and covering both the box and the arms of the S was used to prevent Ss from seeing the stimuli. In addition, the S's were blindfolded. The experiment was a double-blind one in which neither E nor S knew the order of presentation of stimuli. E recorded Ss response for later scoring. Since there were 3 colored squares on a stimulus plate, S would have been able to score correctly on 1/3 of the trials by simple guessing. No S received a score of more than 1/3 correct, thus obtaining scores equivalent to those received by chance guessing. The results of this experiment would seem to negate the hypothesis that some people possess the ability to discriminate different colors in the visible range of the electromagnetic spectrum. They do not agree with results obtained by Youtz (1968) who has found people with this ability. Research indicates that experimental design could account for this discrepancy. Therefore, despite failure to obtain significant results, proof of the DOP phenomenon rests on experimental design and skill of the Experimenter.

3. King, Alice. (Scripps College) Content analysis: history, methodology, and research applications in psychology.

The development of content analysis, a powerful research tool, was traced. The author's program for content analysis of written materials was described. A study, based on readability research, was performed on ten student papers, testing for development of writing complexity. Hypotheses concerning sentence structure and vocabulary load did not prove significant according to the correlated t-test. The vocabulary load hypothesis, however, was significant according to the sign test. The inconclusive results were explained on the basis of the possible difference between reading and writing skills. The author concluded that standardized measurement techniques for writing skills must be developed.

4. Marsden, Margret L. & Petite, Thomas A. (West Valley College) The effect of alpha and beta activity on recall of low and high association CVC trigrams.

To investigate the relationship between alpha and beta EEG activity and recall of low and high association CVC trigrams, four female and four male college students were verbally given lists of low and high association CVC trigrams in both alpha and beta activity. The Ss were asked to recall the trigrams in order presented in each activity. To validate Archer's (1960) study of low and high association CVC trigrams a sample of 100 low and high association CVC trigrams were randomly selected from that study and presented to 180 college students. Of the 100 trigrams selected 32 were used for this study. An intra-subject design was used. The hypothesis that Ss will recall more low and high association CVC trigrams in alpha activity than beta activity was not confirmed.

5. Rodriguez, Bliss. (Occidental College) Modification of disruptive classroom behavior by a response cost token system.

To five, fourth and fifth grade boys, sent to an opportunity room for disruptive behavior in their normal classrooms, a response-cost token system was introduced. The behavior this system was to modify was their talking out without permission, for this was very disruptive in their normal classrooms. From the first week until the last in which the token system was in operation, it was quite evident that the token system reduced their talking-out behavior greatly. After the system was removed, the talking-out behavior was still reduced approximately 53% in relationship to the first week's baseline. The results indicated that a token response-cost system provided a practical means of effectively modifying disruptive, talking-out behavior in the classroom.