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The effects of five types of verbalization on acquisition of discriminative motor responses.

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THE EFFECTS OF FIVE TYPES OF VERBALIZATION ON ACQUISITION OF DISCRIMINATIVE MOTOR RESPONSES

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THE EFFECTS OF FIVE TYPES OF VERBALIZATION ON ACQUISITION OF DISCRIMINATIVE MOTOR RESPONSES

By

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INTRODUCTION

Theoretical and Experimental Background

The mechanism of acquired distinctiveness of cues which is among the more important concepts used in Miller and Dollard's (1) analyses of the roles of verbal responses in complex behavior has been described as follows:

> "According to stimulus-response theory, learning to respond with highly distinctive names to similar stimulus situations should tend to lessen the generalization of other responses from one of these situations to another since the stimuli produced by responding with the distinctive name will tend to increase the difference in the stimulus pattern of the two situations. Increased differentiation based on this mechanism has been called acquired distinctiveness of cues." (7, p. 174)

Several investigators have reported data which are consistent with the suggestion, based on the concept of acquired distinctiveness, that learning to give a different name to each of several similar stimuli will lead to positive transfer to a motor discrimination task. Eighty nursery school, kindergarten, and first grade children were used in Pyles' (9) assessment of the effect of verbal labelling of three-dimensional nonsense figures on rate of learning of motor choice responses to the same figures. In addition to the nonsense figures, a set of five familiar animal figures was employed. The two conditions, one of naming and the other of not naming the nonsense figures, plus a third condition in which the familiar figures served as the stimuli, were given

to all Ss in counterbalanced orders. With prior practice equated, choice responses to the more readily labelled familiar figures were acquired most rapidly. The condition in which names for the nonsense figures were acquired led to faster learning of appropriate choices than did the no naming condition.

Gagné and Baker (3) divided 150 college undergraduates into four groups which, prior to undertaking a discriminative motor task, were given 0, 8, 16, or 32 trials to learn different letter labels for the color-position stimuli of the motor task. The results indicated that, in terms of both error and time measures, 32 verbal learning trials led to significant positive transfer to the motor task. The motor performance levels of the 8 and 16 verbal trial groups did not differ significantly from the achievement of the group which had had no verbal labelling experience.

Rossman and Goss (10) divided college sophomores into three groups of 15 Ss each. Two groups were given 1 and 4 verbal trials to learn different nonsense syllable labels for each member of six pairs of Gibson's standard and first degree similarity figures. A third group learned the same responses to mastery. When the three groups were given 20 trials on a motor task which required different responses to the members of each stimulus pair it was observed that mastery of the verbal responses led to more rapid discrimi-

native motor learning than did 1 or 4 verbal learning trials.

Other investigators, however, have not confirmed the notion of acquired distinctiveness or have obtained results which indicated that pre-motor experiences involved uncontrolled variables in addition to the experimentally introduced verbal learning task.

Thompson (12) failed to obtain significant positive transfer from experience in learning nonsense syllable names for puzzle pieces to rate of learning to actually assemble the puzzle. She suggested, however, that insufficient verbal training may have accounted for the lack of positive transfer effects. Also, Lawshe and Cary (6) have reported that one trial of naming the pieces of a motor skills test did not aid subsequent assembly rates. Because one trial was probably not sufficient for activating verbal discriminations, their procedure did not provide a crucial test of the Miller-Dollard hypothesis.

Smith and Goss (11) and Goss (4) criticized the preceding experiments on the grounds that explicit controls for the possible effects of warm-up and/or of the activation of pre-experimentally acquired names had not been introduced. Therefore, Smith used nursery school children to ascertain whether learning different names for four white squares with areas of 2, 8, 32, and 128 square inches would facilitate the acquisition of motor responses to the same stimuli, over and above

positive transfer attributable to warm-up or to the activation of pre-experimentally acquired verbal discriminations. Both verbal training and the activation of verbal labels led to more rapid motor learning than did warm-up in the form of seeing the stimuli alone. In fact, warm-up was no more effective than the control condition of no prior exposure to the stimuli. Motor learning performances of the verbal learning and verbal activation groups did not differ significantly.

Prior to learning a discriminative motor task, three groups of college undergraduates learned different nonsense syllable names for four different intensities of white light to three different levels of mastery. (4) Three groups were given corresponding amounts of experience designed to arouse pre-experimentally acquired verbal discriminations and three additional groups were given equivalent amounts of warm-up. A tenth group which had had no experiences with the lights before undertaking the motor task served as a control. Motor task performances of all groups given pre-motor experiences were superior to the achievement of the controls. While the group with greatest mastery of the verbal responses learned the motor task most rapidly, differences among the remaining verbal, the prior habit arousal, and the warm-up groups were not significant. Thus, since both warm-up and activation of pre-experimentally learned names led to positive transfer

effects which were exceeded only by facilitation based on considerable mastery of nonsense syllable names, criticism of previous studies for failure to control these factors would seem to be justified.

Statement of the Problem

Both arousal of previously learned labels and warm-up probably involved using different names for similar stimuli. Therefore, findings of motor learning facilitation stemming from these pre-motor experiences do not contradict the concept of acquired distinctiveness. They also suggest, however, that pre-experimentally acquired bases of acquired distinctiveness should receive additional experimental attention. To this end the present study investigated rate of acquisition of discriminative motor responses as a function of pre-motor learning mastery of experimentally introduced names or as related to experiences with four conditions of activation of pre-experimentally acquired labels.

Two of the conditions of arousal of previously learned names were induced by instructions to look at similar stimuli, to discriminate among them, and to give them different names. In order to determine whether a different name was given to each of the different stimuli in a consistent fashion, Ss in one of these conditions were further instructed to say the names out loud.

Neither of these seeing, discriminating, naming con-

ditions, however, involved differential reinforcement of naming responses, that is, one response to each stimulus was not consistently reinforced and other responses non-reinforced. Further, Ss might not have discriminated the number of different stimuli presented correctly and/or might have failed to make different responses to each different stimulus. Therefore, two experimental conditions which assured the reinforcement of a different response to each different stimulus were also introduced. In one of these conditions, Ss were instructed to supply different names for different stimuli and when sufficient trials had been given to elicit some discriminative names these responses were differentially reinforced. The stimulus labels of the second condition were obtained by means of a preliminary determination of names which Ss frequently used to discriminate among similar stimuli. Thus, while supplied by E, it was expected that some, if not all, of these names would be in each S's pre-experimentally acquired repertory of stimulus labels.

Three degrees of pre-motor experiences under each of these four activation conditions and two levels of mastery of the fifth condition, learning experimentally introduced names, were administered. Thus positive transfer effects based on both type and amount of pre-motor learning conditions could be assessed.

EXPERIMENTAL METHOD

Subjects

One hundred and fifty undergraduates from the introductory psychology course at the University of Massachusetts were randomly assigned to 15 groups of 10 Ss each. All were naive with respect to the purpose and procedures of the experiment. There were slight group-to-group variations in the proportions of men and women in each group.

Apparatus and Stimuli

The verbal-motor discrimination device described in detail by Goss (4) and represented diagrammatically in Figure 1 was utilized. The four different but similar intensities of white light stimuli for both the verbal and motor discrimination tasks were presented in the lower circular aperture. Intensities of the four stimuli as measured on a Weston Photronic foot-candle Meter at a point selected as representative of the location of the typical S's eyes, 18 inches out from and 10 inches above the light source, were 1.2, 1.8, 2.4, and 3.5 apparent foot-candles. The upper aperture was used to present the two sets of word stimuli which elicited verbal responses for paired associate verbal learning. One set consisted of four consonant nonsense syllables of 80% association value drawn from Glaze's (5)

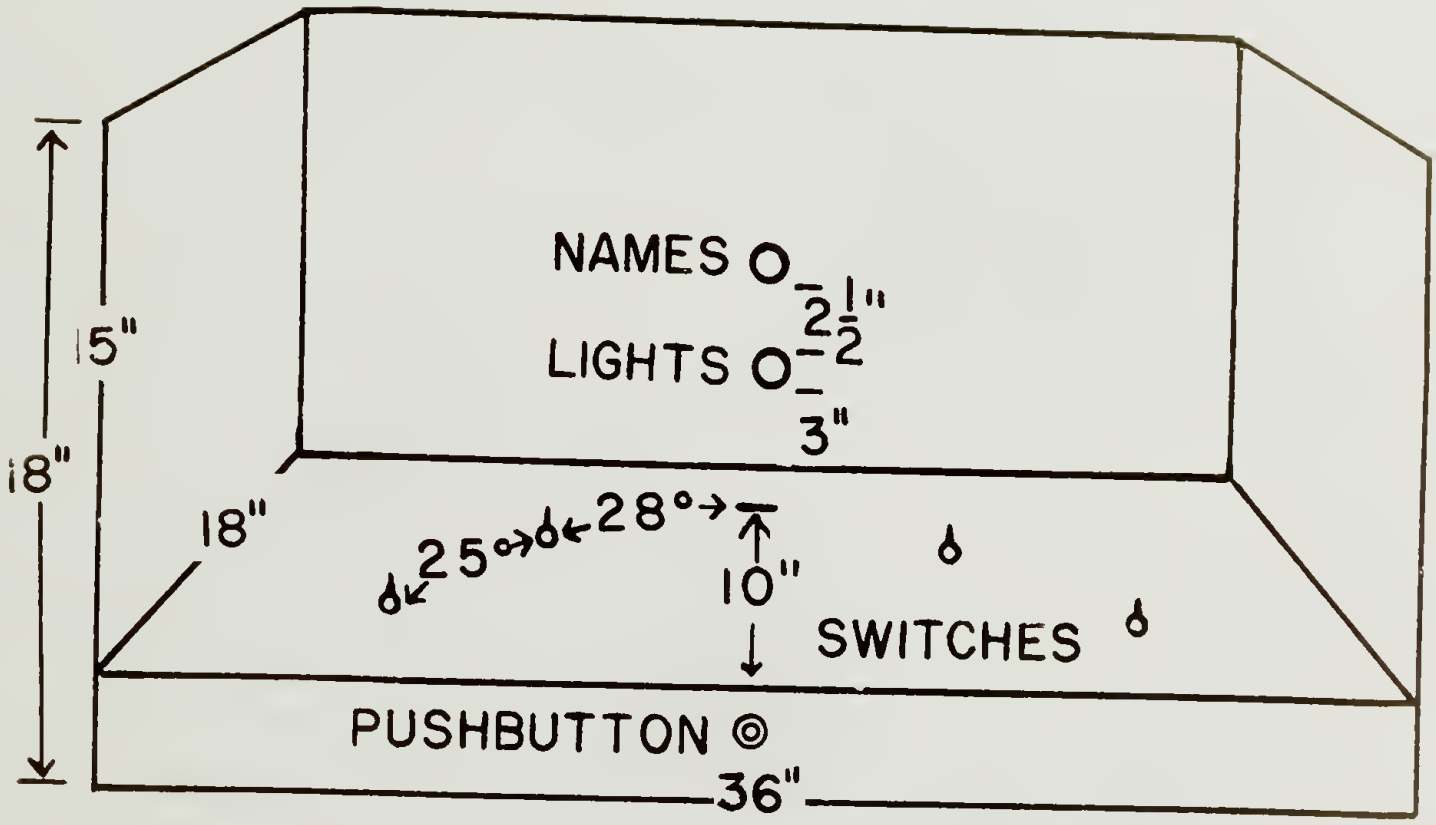

Figure 1

Diagram of the front or Ss' view of the experimental apparatus

list. These were vol, nig, cuf, and jer. The other set was constructed primarily on the basis of results of a preliminary investigation in which nine undergraduate Ss, comparable to those used in the experimental groups, were shown the four different intensities of light randomly presented for 75 trials with instructions to overtly name or label each different light. Inspection of the responses of this preliminary group indicated that the names given most frequently were "Very bright", "Brighter", "Bright", and "Dull." Further analysis, however, revealed that the Ss had tended to use the term "Brighter" in a relative sense rather than as a label for any one specific light. That is, any of the three higher intensity lights following the light of lowest intensity tended to be labelled as "Brighter." It was decided, therefore, not to use the label "Brighter" as one of the stimuli to elicit pre-experimentally acquired names. The name "Very dull" was added to the experimenter-supplied names to make a fourth term. This term was selected because it had been chosen by some of the Ss in the preliminary investigation and because it meant an equal number of bright and dull labels.

Light-word pairs of the verbal task, and the light stimuli alone of the motor task were presented in a randomly determined order of blocks of four trials each, with no pair or light alone appearing more than once within each block.

Procedure for Pre-motor Experiences

Table 1 summarizes the experimental design. Five types of pre-motor experiences were administered to two or three different criterion levels. Groups NS-11 and NS-0 were required to learn nonsense syllable lavels for the four different intensities to two levels of mastery. Specifically, NS-11 reached a criterion of 11 of 12 correct anticipations for three successive four trial blocks while NS-0 was given 100% overlearning based on the 11 of 12 criterion.

Familiar words, supplied by E, that is, words which on the basis of the preliminary experiment could be expected to be in Ss repertoire to some degree, were the stimuli for the verbal responses of the ES groups. ES-11 and ES-0 reached the same criteria of mastery as NS-11 and NS-0 respectively. Since NS-0 required about 48 more trials to reach criterion than ES-0, the ES-0-48 group which was to be matched with NS-0 with respect to number of trials was also introduced.

The Ss in the groups whose self-supplied familiar names were differentially reinforced were instructed to begin to guess a different name for each different light until they found a name which E designated as "right." They were then to continue to label each light with that "right" response. Since Ss usually labelled the same stimulus with several different names, E selected one of these names for each

Table 1

Summary of Types and Levels of Pre-Motor Experiences
(N in each group = 10)

Group	Type (Condition) of Pre-Motor Experience	Level (Degree) of Pre-Motor Experience
NS-11 NS-O	Learn different nonsense syllable (NS) responses to similar intensities.	11 of 12 correct 100% overlearning
ES-11 ES-O	Activation of previously acquired names for intensities by means of experimenter-supplied (ES) familiar names.	11 of 12 correct 100% overlearning 100% overlearning + 4s[1]
SS-11 SS-O SS-O-2s	Activation of previously acquired names for intensities by means of subject-supplied (SS) familiar names.	11 of 12 correct 100% overlearning 100% overlearning + 2s[1]
SDNO-64 SDNO-92 SDNO-108	Instructed to see (S) or look at, discriminate (D) among, and give different names (N) to the stimuli overtly (O).	64 trials[2] 92 trials[3] 108 trials[3]
SDNC-64 SDNC-92 SDNC-108	Instructed to see (S) or look at, discriminate (D) among, and give different names (N) to stimuli covertly (C).	64 trials[2] 92 trials[3] 108 trials[3]
C	Control: no pre-motor experiences with lights.	----------

1. To match NS-O with respect to trials to criterion.
2. Number of trials an approximate match for NS-11, ES-11, ES-O, SS-11, and SS-O.
3. Number of trials to bracket the number of trials given to NS-O, ES-O-4s, SS-O-2s.

stimulus as "right". The criterion of selection was that the name for a given intensity fit in with the names for other intensities so that there was a sequence of four "words" whose "logical" order paralleled the gradations of light intensities.[1] Because the four words selected were supplied by each S there were inter-individual differences in the sets of four differentially reinforced responses. In order for S to produce sufficient different responses for E to decide which name for each intensity was to be designated as "right" no responses were reinforced during the first 12 trials, after which the E-selected appropriate response to a given intensity was reinforced. SS-11 and SS-0 learned their activated pre-experimentally acquired labels to the 11 of 12 and overlearning criteria respectively. SS-O-28 was given 28 trials beyond the overlearning criterion in order to approximate the number of trials to criterion for NS-O.

Instructions to see or look at the lights, to try to discriminate among them by noticing differences, and to give each different light a different name introduced Ss of the SDNO and SDNC conditions to their pre-motor experiences. The former group was further instructed to say the names out loud

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1. A few Ss gave color names or responses like fish, bird, pond, river, etc. which had no logical order matching the gradations of light intensities. These responses were then reinforced.

(overtly) while Ss in the latter group were told that they "need not say the names out loud." The 64 trials administered to all Ss in SDNO-64 and SDNC-64 were about halfway between the extremes of from 48 to 75 pre-motor experiences for NS-11, ES-11, and ES-0, and SS-11 and SS-0. The 92 and 108 trials for SDNO-92 and -108 and for SDNC-92 and -108 approximated the smallest (94.4) and largest (107.6) numbers of trials for NS-0, ES-0-48, and SS-0-28.

E read the instructions for each condition aloud as each S read the same instructions to himself. These instructions are reproduced in Appendix A.

The 64 and 92 trials administered to the SDNO-64 and -92, and the SDNC-64 and -92 groups were specified on the basis of the performances of the first five Ss in the two NS, and in the ES-11, ES-0, SS-11, and SS-0 groups. Blocks of five Ss in these four SDNC and SDNC groups were then used. Subsequently the remaining five Ss in each of these ten groups were called. The number of trials to be given to ES-0-48, SS-0-28, SDNO-108, and SDNC-108 were then based on the mean of total verbal learning trials for NS-0. All Ss in each of these four conditions served in succession.

Procedure for Motor Learning

Immediately after completing their pre-motor experiences the above groups were introduced to the discriminative motor

task by means of appropriate instructions (Appendix A). The motor task required learning to select one of the four spatially distinct toggle switches for each of the four intensities. The correct switch for each light was designated as the switch which turned off the light. The control group was introduced to the motor learning task with no previous experimental experiences with the lights.

All groups had 48 motor learning trials. On each trial Ss were permitted to choose switches until the correct one had been selected. Because this correction procedure was employed, motor learning could be measured in terms of both errorless trials and errors.

RESULTS

Verbal Learning

The means of all or total trials administered to Ss in the 14 pre-motor experience groups are summarized in Table 2. These means are based on trials up to and including the 11 of 12 and overlearning criteria and in the case of groups ES-O-48 and SS-O-28, also include the 48 or 28 additional trials. It will be noted that the verbal learning groups differed with respect to total trials (up to and including the criterion trials) with ranges of from 48.0 to 62.4 trials for the 11 of 12 groups and of from 48.4 to 97.6 trials for the overlearning conditions. Due to one S in ES-11 who required 130 trials and to two Ss in ES-O who took less than 30 trials to reach criterion, these groups had almost equal numbers of pre-motor trials. The ES-O group, however, with more experiences at the 11 of 12 criterion, presumably had greater mastery of the verbal discriminations.

Groups ES-O and SS-O had only one-half and three-fourths of NS-O's 97.6 trials to the overlearning criterion. The possibility that number of pre-motor trials rather than level of mastery might have led to differences in motor learning performances was controlled by the introduction of groups ES-O-48 and SS-O-28 which were given 48 and 28 trials beyond the overlearning criterion respectively in order to approxi-

Table 2

Means and Standard Deviations of All or Total Pre-motor Experiences

Group	All or Total Trials	
	M	SD
NS-11	57.2	22.3
NS-0	97.6	19.6
ES-11	48.0	30.5
ES-0	48.4	13.4
ES-0-48	107.6	22.76
SS-11	62.4	27.5
SS-0	75.2	34.0
SS-0-28	94.4	19.8
SDNO-64	64.0	--
SDNO-92	92.0	--
SDNO-108	108.0	--
SDNC-64	64.0	--
SDNC-92	92.0	--
SDNC-108	108.0	--
Control	--	--

mate the 97.6 trials of NS-O.

The 64 and 92 seeing, discriminating, and naming trials were based on the performances of the first five Ss run in each of the six NS, ES, and SS 11 of 12 and overlearning groups. The 64 trials were selected as the best approximate match for total trials of all groups but NS-O. The 92 trials represented a slight underestimate of the 97.6 mean for all 10 Ss of NS-O. Therefore, the 108 trial groups were added in order to weight total number of trials slightly in favor of the SDNO and SDNC conditions as well as to assure totals which would exceed anticipated totals for ES-O-48 and SS-O-28.

Upon completion of their seeing, discriminating, and naming experiences, Ss in these conditions were asked how the lights differed and how many different ones they had seen. Fifty-two recognized that intensity was the dimension of variation and four of the remaining Ss made approximately correct designations. Thirty said that they had seen four different lights and 18 additional Ss saw either 3 or 5 lights. One thought there were two different lights and 11 saw from six to "seven or eight" lights. Thus most Ss in these conditions learned how the lights varied and approximately how many different ones they had seen.

Most Ss in the SDNO groups named the different intensities as very bright, bright, brighter, white, dull, or very dull. A few used arbitrary order systems such as 1, 2, 3, 4,

or A, A^+, AA, and AAA. Names for colors (e.g. yellow, grey, tan) as well as responses like fish, bird, snow also occurred.

In order to ascertain whether the 30 Ss of the three SDNO groups made the same different response to each different intensity in a consistent fashion, it was necessary to set some criterion for consistent responses. This criterion was specified as the use of the same distinctive name for each intensity on 50% or more of the occurrences of that intensity. By this criterion, 5 Ss made consistent responses to all four intensities, 15 labelled at least three intensities consistently, four Ss made consistent responses to two intensities. Only 2 of the remaining six Ss failed to make a consistent response to at least one of the intensities. Thus, since two-thirds of the Ss labelled three or more intensities in a consistent fashion, it seems tenable to conclude that pre-experimental experiences of Ss had provided labels which could serve as bases for acquired distinctiveness.

Motor Learning

Table 3 summarizes the means and standard deviations of errorless trial and error measures for the 48 motor learning trials.

Analysis of variance (2) was used to test null hypotheses with respect to differences in errorless trial and error means among all 15 groups, between the control group and all pre-motor experience groups combined, and among the 14 pre-

Table 3

Means and Standard Deviations of Errorless Trials and Errors During 48 Motor Learning Trials

Group	Errorless Trials		Errors	
	M	SD	M	SD
NS-11	32.0	4.06	19.1	6.1
NS-0	32.8	5.4	20.2	11.5
ES-11	31.3	5.9	23.5	12.3
ES-0	33.3	4.1	18.5	6.6
ES-0-48	34.4	3.8	18.4	6.1
SS-11	28.5	7.5	28.5	16.7
SS-0	30.8	6.1	23.6	5.4
SS-0-28	34.0	4.0	17.4	5.4
SDNO-64	31.7	7.5	23.6	16.1
SDNO-92	29.0	9.2	29.1	20.2
SDNO-108	32.9	4.5	20.9	7.6
SDNC-64	27.1	7.8	32.5	16.6
SDNC-92	33.3	3.9	18.7	5.9
SDNC-108	32.7	6.5	21.9	11.9
Control	21.8	10.3	45.8	22.9

motor experience groups. (Tables 4, 5). The differences among the 15 errorless trial and error means yielded Fs of 2.42 and 2.96 respectively, both of which were significant at beyond the 1% level of confidence. The Fs of 20.32 and 26.76 for comparisons of errorless trial and error means of the control group with those for the combined pre-motor experience groups were also significant at beyond the 1% level. The F-ratio of 1.04 and 1.03 for differences among the two response measures for the 14 pre-motor experience groups, however, were not significant at the 5% level. The t-test was then used to compare errorless trial and error means of the controls with those of SDNC-64, the pre-motor experience group with the smallest number of errorless trials and the most errors. Both one-tail ts of 1.77 and 2.17 for errorless trials and errors respectively were significant at the 5% level for 135 df.[2]

Statistical analysis, therefore, indicates that any one of the 14 combinations of type and amount of pre-motor verbalization experiences leads to significant positive transfer to the motor discrimination task. The non-significant Fs for errorless trial and error means of the 14 pre-motor experience groups suggest, however, that any differ-

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2. Within groups variances for errorless trials and errors based on 135 df were used to compute error variances for these t-tests (2).

Table 4

Summary of Analysis of Variance for Errorless Trials

Source of Variation	df	Sum of Squares	Mean Squares	F
Between 15 groups	14	1525.76	108.98	2.42*
Between controls and 14 pre-motor experiences combined	1	914.76	914.76	20.32*
Between 14 pre-motor experiences	13	611.00	47.00	1.04
Within groups	135	6076.00	45.01	
Total	149	7601.76		

* Significant at the 1% level for appropriate df.

Table 5

Summary of Analysis of Variance for Errors

Source of Variation	df	Sum of Squares	Mean Squares	F
Between 15 groups	14	7798.57	557.04	2.96*
Between controls and 14 pre-motor experiences combined	1	5039.05	5039.05	26.76*
Between 14 pre-motor experiences	13	2759.52	212.27	1.13
Within groups	135	25422.50	188.31	
Total	14	33221.07		

* Significant at the 1% level for appropriate df.

ences among either of these measures might be attributed to chance. Since these Fs were not significant, further analysis of the between 14 groups sums of squares for error-less trials and errors into sources of variation based on types, amounts, and interaction of type and amounts of experiences did not seem necessary.

DISCUSSION

Verbal Learning

The SDNO and SDNC groups were introduced to ascertain whether pre-experimentally acquired names for intensities could serve as the basis for acquired distinctiveness. Relevant to this question was the finding that most Ss in these groups were aware that the lights differed with respect to intensity. More importantly, half of the Ss guessed the number of different lights correctly and an additional 18 who thought they had seen three or five lights were only one light off. Analysis of the overt responses of the SDNO groups disclosed that more than two-thirds of the 30 Ss gave the same label to two or more of the four intensities on 50% or more of the occurrences of those intensities. Thus, not only was there recognition of how the lights differed and of how many there were, but also different pre-experimentally acquired labels were given to different intensities in a consistent fashion. On this basis, it appears tenable to conclude that acquired distinctiveness can arise from activation of pre-experimentally acquired names by means of instructions to see, discriminate, and name.

Motor Learning

The motor learning superiority of all pre-motor experi-

ence groups was consistent with Goss' (4) observations. The failure to obtain significant differences among the 14 combinations of type and amount of pre-motor experiences, however, requires explanation.

Three questions arise in considering why type of pre-motor experience did not affect degree of motor learning. One concerns the apparent discrepancy between the present findings of little difference between NS conditions and SDNO and SDNC groups and Goss' report that learning nonsense syllables led to significantly greater facilitation than seeing or seeing and discriminating. Pertinent to the explanation of this discrepancy is the fact that the seeing and seeing and discriminating instructions did not explicitly call for giving different names to the different intensities as did the instructions of the present study. The addition of the naming requirement probably occasioned somewhat greater activation and perhaps more consistent use of pre-experimentally acquired labels. Therefore, the SDNO and SDNC groups could have been expected to reach a higher motor learning level than seeing and discriminating Ss and thus to approximate the performance of the NS groups more closely. Also relevant is the finding that while Goss' NS-O group was significantly superior to the other pre-motor experience conditions, Ss in this condition in this investigation did not

perform as well. Several factors such as different Es, different orders of stimuli, slight differences in intensities, or sampling fluctuations may have contributed to this observed difference in performance levels.

The question of why NS experiences did not lead to different effects than ES or SS conditions might also be raised. To explain this finding consideration should be given to the possibility that some differential reinforcement of pre-experimentally acquired names took place during the acquisition of the nonsense syllable responses. Specifically, Ss might have first labelled intensities with different familiar names in order to provide greater distinctiveness for nonsense syllable responses. Since differential reinforcement could have then occurred for both familiar and nonsense syllable names, actual differences between the NS groups and the E-supplied and S-supplied familiar names conditions might have been negligible.

The third question stems from the failure of differential reinforcement of familiar names for the ES, SS, and as hypothesized above, the NS groups to lead to greater positive transfer than activation of previously learned names. At the present time, however, no satisfactory explanation of this finding can be advanced.

Amount of pre-motor experience was also unrelated to

motor learning performance. In the case of the NS, ES, and SS conditions, the 11 of 12 criterion may have brought the strengths of the differentially reinforced responses relatively close to asymptotic values. Therefore, additional increments in strength brought about by overlearning trials may have been too small to lead to statistically significant differences among small groups of highly variable Ss. The labels employed by most Ss in the SDNO and SDNC conditions were probably those in each Ss repertoire with greatest initial strength. Since these responses were not differentially reinforced, little change in strength as a function of trials would have been anticipated.

In conclusion, the results of this study suggest that the presence of different labels for each of several similar stimuli served to facilitate discriminative motor learning. No combination of type and amount of pre-motor naming experiences, however, appeared to be significantly superior.

SUMMARY

The present study stemmed from previous investigation of Miller and Dollard's concept of the acquired distinctiveness of cues. Of specific concern were the effects of varying amounts of five types of pre-motor verbal labelling experiences upon the subsequent acquisition of a discriminative motor task.

One hundred and fifty undergraduates were randomly assigned to 15 groups of 10 Ss each. Four different but similar light intensities were the stimuli for paired associate verbal learning as well as for the motor task. Sets of four nonsense syllables and of four familiar words were the stimuli for the paired associate responses.

Three of the five types of labelling experiences involved differential reinforcement of a different name for each intensity. Two groups of Ss learned nonsense syllable names to criteria of 11 of 12 correct anticipations and 100% overlearning. Two additional groups of Ss learned E-supplied familiar names for the intensities to the same criteria and an additional group was given 48 trials beyond the overlearning criterion. The Ss of three other groups supplied their own labels which 2 groups learned to the 11 of 12 and overlearning criteria and a third group to the overlearning cri-

terion plus 28 trials.

The Ss in the two remaining types of pre-motor experiences were instructed to see, discriminate among, and name the intensities. Three groups were given 64, 92, and 108 trials and three other groups which had additional instructions to name the stimuli out loud or overtly were given corresponding numbers of trials. After completion of pre-motor experiences, these 14 groups plus a control group which had had no previous naming experiences, had 48 trials to learn to discriminate among the light intensities by means of the selection of a different toggle-switch for each intensity.

Most of the seeing, discriminating, and naming Ss recognized how the lights differed and 30 of the 60 guessed the number of intensities correctly. Analysis of the responses of the groups which named overtly, indicated that Ss were able to give different labels to each intensity in a consistent manner. It was concluded, therefore, that instructions to see, discriminate, and name activated acquired distinctiveness in the form of pre-experimentally acquired distinctive names for similar stimuli.

Errorless trial and error measures were used to score motor learning performances. In terms of both measures, all pre-motor experience groups were significantly superior to the controls. The differences among the 14 combinations

of type and amount of labelling, however, were not statistically significant. Thus, while activation of different names for similar stimuli facilitated the acquisition of discriminative motor responses, the type and/or amount of such activation had no differential effects.

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APPENDIX

Appendix A. Instructions for Pre-motor Experiences and Motor Learning

Nonsense syllables

SIT HERE. Try to sit up straight and don't lean over this panel (point to panel with switches.)

THIS IS an experiment in the effects of seeing stimuli and not a psychological test. We are interested in certain complex relationships of the perceptual processes common to all people and not concerned with your personal reactions.

WHEN THE task begins you will see a light in this lower round hole or window. (Point.) Shortly after the light has appeared this upper window will open and you will see a nonsense syllable. This is the name for that light. After both light and name have been exposed for a short while both windows will close and another light will appear. After a short while this light will be accompanied by a different nonsense syllable.

YOUR TASK will be to learn the name which is paired with each different light. To do this you are to try to guess or anticipate the name of the light when the light alone is on and before the nonsense syllable is exposed. You should guess by pronouncing the nonsense syllable out loud as distinctly as possible. If you guessed wrong correct your guess by saying the syllable out loud when the syllable is exposed. The task will end when you have learned to label each light with the nonsense syllable which has been paired with that light.

DO NOT try to set patterns of response. The only way you can learn is to pay attention to each light as it appears and to learn the name which goes with that light. If you don't know the name of the light always guess. Wrong guesses won't be counted against you and you may guess correctly.

REMEMBER that you will see a series of lights each of which is paired with a different nonsense syllable. You are to learn to say the nonsense syllable for each light when the light alone is on before the nonsense syllable is exposed.

Familiar names supplied by E

SIT HERE. Try to sit up straight and don't lean over this panel (point to panel with switches).

THIS IS an experiment in the effects of seeing stimuli and not a psychological test. We are interested in certain complex relationships of the perceptual processes common to all people and not concerned with your personal reactions.

WHEN THE task begins you will see a light in this lower round hole or window (point). Shortly after the light has appeared this upper window will open and you will see a name. This is the name for that light. After both light and name have been exposed for a short while both windows will close and another light will appear. After a short while this light will be accompanied by a different name.

YOUR TASK will be to learn the name which is paired with each different light. To do this you are to try to guess or anticipate the name of the light when the light alone is on and before the name is exposed. You should guess by pronouncing the name out loud as distinctly as possible. If you guessed wrong correct your guess by saying the name out loud when the name is exposed. If your guess was correct you should also say the name out loud when the name is exposed. The task will end when you have learned to label each light with the name which has been paired with that light.

DO NOT try any set patterns of response. The only way you can learn is to pay attention to each light as it appears and to learn the name which goes with that light. If you don't know the name of the light always guess. Wrong guesses won't be counted against you and you may guess correctly.

REMEMBER that you will see a series of lights each of which is paired with a different name. You are to learn to say the name for each light when the light alone is on before the name is exposed.

Familiar names supplied by S

SIT HERE. Try to sit up straight and don't lean over this panel (point to panel with switches).

THIS IS an experiment in the effects of seeing stimuli and not a psychological test. We are interested in certain com-

plex relationships of the perceptual processes common to all people and not concerned with your personal reactions.

WHEN THE task begins you will see a light in this lower round hole or window (point). After the light has been on for a short time it will go off and a short period later another light will appear.

IT WILL be your task to learn a different name for each different light. To do this, as each light appears you are to guess the name of that light. If you guess the name of a particular light incorrectly, I will say nothing and when that same light appears again, you should change your guess to another name. When you guess the name for a particular light correctly, I will tell you "right". Whenever that light appears again, you are to use this "right" name for that light. There will be only one "right" name for each light and you are to learn to use that name only for that light and not for any of the other lights.

IN ORDER that you may get used to the task, I will give you a number of trials in naming the lights before I start telling you if your guess is right. When I think you are familiar enough with the task, I will tell you, and for the rest of the trials, I will say "right" for a correct guess, and nothing for an incorrect guess.

REMEMBER that you will see a series of lights. As you see each light you are to guess the correct name for that light. After some practice trials, I will tell you when you have guessed the right name for a particular light. When you have once guessed the right name for a particular light always use that name for that light.

ANY QUESTIONS?

Seeing, discriminating, and naming overtly

SIT HERE. Try to sit up straight, and don't lean over this panel (point to panel with switches).

THIS IS an experiment in how well you can judge how stimuli differ and not a psychological test. The experiment is also concerned with how well you can determine how many different stimuli you have seen. We are interested in certain complex relationships of the perceptual processes common to all people and not concerned with your personal reactions.

WHEN THE task begins you will see a light in this lower round hole or window (point). After the light has been on for a short while it will go off and a short period later another light will appear. The lights will not follow each other in any regular order but each of the different lights will be repeated. As each light appears you are to give a name or label to that light. Each light should have one and only one name and that name is to be used only for that light. Thus there will be as many different names as different lights. Your task will be finished when you have learned to always give a different name to each different light. As each light is presented you are to say its name out loud. Try to speak as distinctly as possible.

AFTER YOU have finished the task I will ask you two questions which you are to answer as well as you can. These questions will be: How did the lights differ?
How many different lights did you see?

REMEMBER YOU will see a series of lights and you are to try to learn to always give each different light a different name. You are to say the name for each light out loud.

DO YOU have any questions?

Seeing, discriminating, and naming covertly

SIT HERE. Try to sit up straight and don't lean over this panel (point to panel with switches).

THIS IS an experiment in how well you can judge how stimuli differ and not a psychological test. The experiment is also concerned with how well you can determine how many different stimuli you have seen. We are interested in certain complex relationships of the perceptual processes common to all people and not concerned with your personal reactions.

WHEN THE task begins you will see a light in this lower round hole or window (point). After the light has been on for a short while it will go off and a short period later another light will appear.

THERE WILL BE several lights. The lights will not follow each other in any regular order but each of the different lights will be repeated. As each light appears you are to give a name or label to that light. Each light should have one and only one name and that name is to be used only for

that light. Thus there will be as many different names as different lights. Your task will continue until I think you have had sufficient trials to learn the names. You need not say the names out loud but as each light appears you should always say the name for that light to yourself.

AFTER YOU have finished the task I will ask you two questions which you are to answer as well as you can. These questions will be: How did the lights differ?
How many different lights did you see?

REMEMBER YOU will see a series of lights and you are to try to learn to always give each different light a different name. Don't bother to say the names out loud.

DO YOU have any questions?

Motor Learning

NOW WE will try another task; one which is designed to measure your reaction time.

USING YOUR preferred hand, always start with your thumb pressing on the button and with the rest of your hand flat like this (demonstrate). Keep your other hand in your lap or at your side. As in the previous task sit up straight, and don't lean over the switch panel.

WHEN THE test begins you will see a light in the round hole (point). You are to try to learn which one of the four switches goes with that light. To learn this you will have to select switches until you find the one which turns off the light - that is the correct switch. When you find the switch which turns off the light hold it briefly like this (demonstrate), then release it and return your hand to the starting position.

THERE WILL be several different lights and you are to select a different switch for each light. Always, the switch which turns out the light is the one you should have selected. The lights will be in random order. Therefore, don't try to use any set pattern of switches since to do so will only hurt your score. You must respond to each light separately by selecting a different switch.

TRY TO respond as accurately, but as quickly, as possible. Don't forget to hold the correct switch, i.e., the switch which turns off the light briefly.

DO YOU have any questions?

Appendix B

Sets of Four Differentially Reinforced Names Supplied by Each S of the SS Groups

Subject	Names for intensities: Bright	Next bright	Next dull	Dull
Group SS-11				
1. F.G.	Bright	Light	Lighter	Dark
2. P.S.	Intense	Bright	Medium	Dull
3. R.T.	Very bright	Bright	Moderately bright	Dim
4. W.C.	Brighter	Bright	Medium	Dim
5. M.U.	Very bright	Bright	Medium	Dull
6. M.G.	Sunlight	Bright yellow	Yellow	Greenish
7. S.R.	Bright	Dim	Yellow	Pink
8. A.B.	Extra bright	Bright	Medium	Shady
9. H.S.	Bright	Not as bright	Half dim	Dim
10. E.B.	1	2	3	4
Group SS-0				
1. P.P.	Bright	Next bright	Dim	Dull
2. A.K.	Jim	John	Stanley	Jack
3. A.P.	Brightest	Bright	Lighter	Dim
4. S.D.	Bright	Pretty bright	Glaze	Dull
5. P.B.	Bright	Medium	Dim	Low
6. B.B.	Very bright	Bright	Dim	Very dim
7. M.G.	Bright	Medium	Faint	Dim
8. C.C.	1	2	3	4
9. J.H.	Brightest	Bright	Dim	Dimmer
10. P.H.	Bright	Medium	Medium bright	Dull
Group SS-0-28				
1. D.M.	Bright	Light	Dim	Dimmest
2. R.C.	Bright	Not so bright	Medium	Dim
3. L.M.	1	2	3	4
4. J.M.	Bright	Not so bright	Less bright	Very much lighter
5. B.S.	Brighter	Bright	Less bright	Medium
6. B.D.	Very bright	Semi-bright	Semi-dull	Very dull
7. S.B.	State	Town	Country	River
8. D.E.	Bright	Medium	Joe	Dull
9. A.J.	Very bright	Medium bright	Fairly dim	Dim
10. C.W.	Very bright	Bright	Dim	Very dim

Appendix C. Data for Individual Ss in Pre-motor and Motor learning Conditions

Table C1

Data for group NS-11

Subject	Sex	Number of pre-motor experiences (including 12 criterion trials)	Number of errorless trials in six eight-trial blocks[1]						Number of errors in six eight-trial blocks[2]					
			1	2	3	4	5	6	1	2	3	4	5	6
1. A.P.	F.	44	3	4	4	5	5	7	5	5	4	3	3	1
2. J.G.	F.	56	5	5	4	6	5	5	4	5	6	2	4	3
3. S.R.	F.	56	2	5	6	7	7	5	7	4	3	1	1	3
4. M.C.	F.	36	5	8	4	8	6	6	4	0	4	0	2	2
5. J.C.	M.	108	3	5	6	7	3	7	7	3	2	1	5	1
6. E.K.	M.	44	4	6	6	6	6	7	7	3	2	2	2	1
7. S.T.	F.	76	4	4	4	5	7	6	4	5	5	3	1	2
8. K.M.	M.	68	3	5	3	7	3	5	9	4	7	1	7	4
9. L.S.	F.	60	5	4	5	7	5	5	4	4	3	1	4	3
10. D.C.	M.	24	5	5	7	8	8	7	3	3	1	0	0	1

1. Errorless trial totals for all 48 trials can be obtained by summing the six eight-trial block totals.

2. Error totals for all 48 trials can be obtained by summing the six eight-trial block totals. Because up to three errors could be scored on a given trial, some Ss had more errors than trials.

Table C2

Data for group NS-O

Subject	Sex	Number of premotor experiences (including 12 criterion trials)	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
			1	2	3	4	5	6	1	2	3	4	5	6
1. G.M.	F.	108	5	3	3	4	2	3	4	8	8	9	14	9
2. G.B.	M.	108	5	4	5	7	4	4	5	4	3	1	7	4
3. B.F.	F.	100	4	4	6	8	8	6	5	5	2	0	0	2
4. I.A.	M.	116	3	6	8	6	7	7	8	3	0	2	1	1
5. R.V.	M.	124	3	5	5	5	6	7	6	3	3	5	2	1
6. N.C.	F.	84	2	5	6	6	7	8	7	3	3	3	1	0
7. C.C.	M.	76	4	8	7	8	6	8	5	0	1	0	2	0
8. G.J.	M.	116	4	6	4	6	6	5	6	2	4	3	2	4
9. M.C.	F.	60	6	5	8	7	5	6	2	4	0	1	3	2
10. L.P.	F.	84	4	4	8	6	5	5	6	4	0	2	3	4

Table C3

Data for group ES-11

Subject	Sex	Number of premotor experiences (including 12 criterion trials)	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
			1	2	3	4	5	6	1	2	3	4	5	6
1. C.D.	F.	132	6	4	7	6	7	8	2	7	1	2	1	0
2. A.K.	F.	64	2	7	6	4	5	8	10	1	2	4	3	0
3. C.M.	M.	20	2	5	3	6	5	8	9	5	5	2	4	0
4. E.A.	M.	36	3	3	5	8	7	6	6	6	3	0	1	2
5. J.S.	M.	40	2	5	1	2	3	3	10	7	11	9	9	12
6. L.T.	F.	36	3	5	3	5	6	6	7	5	7	3	3	2
7. C.L.	F.	20	6	5	7	7	6	6	2	4	1	1	2	2
8. J.S.	M.	48	4	4	6	7	6	8	7	6	2	1	3	0
9. W.D.	M.	40	4	5	5	8	7	5	7	6	4	0	1	4
10. D.C.	M.	44	3	5	6	5	5	8	7	3	4	3	4	0

Table C4

Data for group ES-O

Subject	Sex	Number of premotor experiences (including 12 criterion trials)	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
			1	2	3	4	5	6	1	2	3	4	5	6
1. M.K.	F.	60	5	5	7	7	6	8	4	3	1	1	2	0
2. M.V.	F.	60	2	4	2	5	8	7	10	8	7	4	0	1
3. E.M.	M.	44	4	3	7	6	5	6	6	7	1	2	3	3
4. M.V.	F.	60	5	5	5	6	5	7	5	4	3	2	3	1
5. C.M.	M.	60	3	5	7	6	8	7	5	3	1	2	0	1
6. A.U.	F.	28	5	6	7	8	6	7	4	2	1	0	2	1
7. E.C.	F.	32	6	2	5	3	6	5	2	9	5	5	2	3
8. R.F.	F.	52	6	7	6	6	7	6	4	1	2	2	1	2
9. R.C.	M.	60	4	3	5	7	6	5	7	6	4	1	2	3
10. R.R.	M.	28	5	5	5	3	8	7	7	4	3	5	0	2

Table C5

Data for group ES-O-48

Subject	Sex	Number of premotor experiences (including 12 criterion trials)	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
			1	2	3	4	5	6	1	2	3	4	5	6
1. D.M.	M.	76	5	5	3	6	7	7	4	4	6	3	1	2
2. D.H.	F.	148	6	7	7	7	7	7	3	2	1	1	1	1
3. R.G.	M.	92	5	4	8	8	6	6	3	8	0	0	3	3
4. M.B.	M.	76	3	6	4	4	4	5	9	4	6	6	5	3
5. B.C.	F.	104	5	6	6	8	4	7	5	3	2	0	4	1
6. V.B.	M.	140	2	4	5	8	7	7	10	7	4	0	1	1
7. G.S.	M.	108	3	5	5	8	6	5	7	3	4	0	2	4
8. J.K.	F.	100	4	5	5	8	7	6	5	4	5	0	1	2
9. J.B.	F.	116	6	3	6	7	7	5	3	5	2	1	1	4
10. J.L.	F.	116	3	4	8	8	6	8	8	4	0	0	2	0

Table C6

Data for group SS-11

Subject	Sex	Number of premotor experiences (including 12 criterion trials)[1]	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
			1	2	3	4	5	6	1	2	3	4	5	6
1. F.G.	M.	32	4	6	7	8	6	4	6	2	2	0	2	5
2. P.S.	F.	32	7	5	6	4	4	8	1	3	3	5	4	0
3. R.T.	M.	52	5	6	7	6	5	6	4	2	1	2	3	2
4. W.C.	M.	32	4	5	5	7	6	6	4	4	3	1	2	2
5. M.U.	F.	116	4	2	3	5	6	6	8	10	6	4	2	4
6. M.G.	F.	64	2	4	5	4	4	5	11	6	4	6	5	4
7. S.R.	F.	104	1	3	3	4	3	6	12	7	7	5	9	3
8. A.B.	M.	68	5	7	6	7	5	8	4	1	2	1	4	0
9. H.S.	F.	56	2	3	4	7	6	5	12	6	4	1	2	4
10. E.B.	M.	68	3	2	1	3	2	2	8	12	13	14	12	9

1. These totals include the first 12 trials on which no reinforcement was administered.

Table C7

Data for group SS-O

Subject	Sex	Number of premotor experiences (including 12 criterion trials)[1]	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
			1	2	3	4	5	6	1	2	3	4	5	6
1. P.P.	F.	68	4	3	4	7	5	7	6	9	6	1	3	1
2. A.K.	M.	60	6	6	7	7	5	7	2	4	1	1	3	2
3. A.P.	M.	100	5	6	5	4	6	5	4	2	3	4	2	3
4. S.D.	F.	52	3	3	5	8	5	5	6	12	4	0	3	5
5. P.B.	M.	68	4	4	2	1	2	6	6	8	12	16	7	2
6. B.B.	F.	68	2	5	6	4	7	6	10	3	2	4	1	2
7. M.G.	F.	52	5	7	4	6	7	6	8	1	4	2	1	2
8. C.C.	M.	84	2	3	2	4	5	6	9	5	9	4	3	2
9. J.H.	F.	164	3	7	8	4	8	8	5	1	0	4	0	0
10. P.H.	F.	36	3	3	8	7	7	8	6	8	0	1	1	0

1. These totals include the first 12 trials on which no reinforcement was administered.

Table C8

Data for group SS-O-28

Subject	Sex	Number of premotor experiences (including 12 criterion trials)[1]	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
			1	2	3	4	5	6	1	2	3	4	5	6
1. D.M.	M.	120	3	4	5	7	7	8	7	6	4	1	1	0
2. R.C.	M.	88	2	6	4	7	8	6	10	2	4	1	0	2
3. L.M.	M.	64	7	6	7	6	6	5	1	2	1	2	3	3
4. J.M.	F.	112	3	2	5	6	8	8	7	10	5	2	0	0
5. B.S.	F.	104	3	6	8	8	8	8	7	2	0	0	0	0
6. B.D.	F.	88	4	4	6	6	5	6	4	4	3	2	3	2
7. S.B.	M.	96	3	4	6	5	7	8	7	5	2	3	1	0
8. D.E.	M.	104	1	4	5	5	6	6	9	6	5	3	2	2
9. A.J.	F.	112	3	6	4	7	6	6	6	2	5	1	2	2
10. C.W.	F.	56	6	5	6	8	7	8	3	4	2	0	1	0

1. These totals include the first 12 trials on which no reinforcement was administered.

Table C9

Data for group SDNO-64[1]

Subject	Sex	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
		1	2	3	4	5	6	1	2	3	4	5	6
1. M.H.	F.	4	7	6	7	7	8	7	1	2	1	1	0
2. R.M.	M.	3	7	8	7	6	8	6	1	0	1	2	0
3. F.D.	F.	2	4	4	6	5	8	8	6	6	2	3	0
4. C.A.	F.	3	4	7	6	6	8	11	4	1	3	2	0
5. B.W.	F.	3	7	6	7	6	7	6	1	2	1	2	1
6. J.C.	F.	3	5	8	7	3	7	9	3	0	2	6	1
7. E.V.	M.	5	7	6	5	7	7	4	2	2	3	1	1
8. V.M.	M.	5	1	2	1	1	4	7	13	9	16	12	7
9. J.W.	F.	3	2	3	4	5	6	10	8	9	5	6	4
10. P.C.	M.	4	6	3	8	5	7	4	2	5	0	3	1

1. All Ss had 64 pre-motor trials.

Table C10

Data for group SDNO-92[1]

Subject	Sex	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
		1	2	3	4	5	6	1	2	3	4	5	6
1. M.C.	F.	2	1	6	8	4	7	9	10	2	0	4	1
2. D.W.	M.	4	4	5	6	4	6	10	4	3	3	6	3
3. R.C.	M.	4	3	1	1	1	1	6	8	14	15	14	14
4. M.F.	F.	4	6	6	8	7	8	4	3	2	0	1	0
5. J.S.	F.	7	5	5	7	6	7	1	3	3	1	2	1
6. J.B.	F.	4	5	4	7	4	4	6	3	4	1	6	4
7. J.M.	F.	3	6	5	6	5	5	10	4	4	2	4	4
8. H.S.	M.	2	3	4	2	1	2	12	6	7	11	18	9
9. D.G.	M.	2	6	8	7	7	7	9	2	0	1	1	1
10. R.G.	M.	5	6	6	7	7	6	6	3	2	1	1	2

1. All Ss had 92 pre-motor trials.

Table C11

Data for group SDNO-108[1]

Subject	Sex	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
		1	2	3	4	5	6	1	2	3	4	5	6
1. B.B.	F.	4	6	7	8	6	6	6	2	1	0	2	2
2. M.U.	F.	4	3	8	5	5	7	7	6	0	6	6	1
3. H.F.	F.	3	1	5	5	7	6	10	10	6	3	1	2
4. N.J.	F.	4	4	7	8	6	6	8	5	1	0	2	2
5. E.K.	M.	2	6	6	7	8	7	10	2	2	1	0	1
6. L.H.	M.	5	3	6	8	6	6	6	9	2	0	4	2
7. A.E.	M.	3	3	5	6	6	6	6	7	4	2	2	2
8. L.W.	M.	7	5	7	7	6	6	1	3	2	1	2	2
9. R.F.	M.	1	2	4	7	5	5	13	8	5	1	3	4
10. J.S.	F.	5	6	6	7	6	7	3	2	3	2	2	1

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1. All Ss had 108 pre-motor trials.

Table C12

Data for group SDNC-64[1]

Subject	Sex	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
		1	2	3	4	5	6	1	2	3	4	5	6
1. B.R.	M.	6	3	5	3	1	4	3	11	6	11	11	5
2. J.O.	F.	3	2	3	3	2	5	9	13	6	10	6	7
3. B.B.	F.	3	4	6	7	5	8	10	4	2	1	3	0
4. B.K.	F.	4	2	3	5	3	5	6	9	6	4	5	3
5. J.L.	F.	3	4	8	8	6	6	7	4	0	0	2	2
6. J.C.	M.	5	7	8	7	5	8	4	1	0	1	3	0
7. B.W.	M.	2	5	4	7	6	6	12	2	7	1	4	2
8. K.G.	F.	3	2	6	6	6	6	8	7	2	3	3	3
9. J.M.	F.	3	4	4	6	7	5	9	6	4	2	1	8
10. E.C.	M.	4	1	2	2	3	1	8	11	9	11	9	18

1. All Ss had 64 pre-motor trials.

Table C13

Data for group SDNC-92[1]

Subject	Sex	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
		1	2	3	4	5	6	1	2	3	4	5	6
1. A.D.	M.	3	6	5	7	5	5	6	3	3	1	4	4
2. C.M.	F.	3	6	7	6	3	6	9	2	1	2	6	2
3. D.B.	M.	5	6	7	8	6	6	5	2	1	0	2	2
4. K.H.	M.	4	2	4	8	5	6	7	6	4	0	3	2
5. D.C.	M.	5	6	5	8	8	8	3	2	3	0	0	0
6. M.M.	F.	3	4	7	7	6	7	11	4	1	2	3	1
7. E.C.	F.	3	3	4	7	6	7	9	8	6	1	3	2
8. R.G.	M.	7	6	5	6	6	6	2	2	4	2	2	2
9. J.P.	F.	5	3	4	6	5	5	4	6	4	2	3	3
10. L.C.	F.	4	7	6	6	7	6	7	1	2	2	1	2

1. All Ss had 92 pre-motor trials.

Table C14

Data for group SDNC-108[1]

Subject	Sex	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
		1	2	3	4	5	6	1	2	3	4	5	6
1. K.W.	F.	6	7	7	5	7	5	2	2	1	3	1	3
2. W.H.	F.	4	2	6	6	7	6	5	7	2	2	1	2
3. N.W.	F.	5	3	6	6	5	7	4	5	4	2	4	1
4. R.S.	M.	4	4	1	2	4	5	6	8	14	11	6	3
5. R.R.	M.	2	4	4	7	4	6	9	7	6	1	5	3
6. J.B.	M.	4	6	7	7	6	8	7	4	1	1	2	0
7. J.D.	M.	6	6	8	8	7	8	5	2	0	0	1	0
8. C.S.	F.	4	2	4	4	7	5	8	11	5	4	2	6
9. G.K.	M.	7	3	7	5	7	6	2	8	1	3	1	3
10. D.D.	M.	5	7	6	4	8	8	5	1	2	4	0	0

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1. All Ss had 108 pre-motor trials.

Table C15

Data for Control group[1]

Subject	Sex	Number of errorless trials in six eight-trial blocks						Number of errors in six eight-trial blocks					
		1	2	3	4	5	6	1	2	3	4	5	6
1. M.B.	M.	1	4	5	3	5	6	14	4	4	9	3	5
2. C.H.	M.	4	1	0	3	2	0	7	17	14	11	11	14
3. C.E.	M.	6	2	4	3	3	6	4	8	7	9	10	4
4. J.O.	M.	2	3	2	2	3	4	12	8	12	10	9	8
5. B.R.	F.	1	1	4	1	2	2	13	15	8	17	10	13
6. E.D.	M.	2	5	7	8	7	7	10	3	1	0	1	1
7. H.M.	M.	2	1	1	2	1	3	9	13	13	11	15	10
8. R.B.	M.	3	5	3	4	3	0	9	4	7	5	7	14
9. E.T.	F.	1	5	4	6	6	6	13	3	5	2	2	2
10. L.C.	F.	5	8	7	7	7	7	4	0	1	1	1	1

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1. This group had no pre-motor experiences.

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