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Paired-associates learning under classical conditioning and selective learning paradigms as functions of similarity variables.

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PAIRED-ASSOCIATES LEARNING UNDER CLASSICAL CONDITIONING AND SELECTIVE LEARNING PARADIGMS AS FUNCTIONS OF SIMILARITY VARIABLES

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Introduction

This experiment was concerned with relative rates of acquisition of paired associates under "classical conditioning" and "selective learning" paradigms of presentation. Also of interest were acquisition rates under both or one of these paradigms as functions of similarity among stimulus members of the paired-associates units, similarity among response members of the paired-associates units, and similarity between alternative response members of the paired-associates units of the selective learning paradigm.

Classical conditioning and selective learning paradigms. In a symposium on automatic teaching, Zeaman (1959) questioned Skinner's use of the free-operant paradigm in analyses of teaching-machine tasks. Instead, Zeaman proposed that both classical conditioning and controlled operant paradigms were more appropriate. Regardless of which of these paradigms is more appropriate, Zeaman made an important point: effective design of all teaching devices presupposes knowledge of relative rates of acquisition of the responses of each learning task under different paradigms of presentation of a task. The primary purpose of the present study was, therefore, to determine relative rates of mastery of the stimulus-response relationships of a verbal paired-associates task under classical conditioning and selective learning paradigms of presentation. In view of the scarcity of information about acquisition of paired associates under different

paradigms of presentation (Battig, 1965), the data reported here extend current understanding of laboratory-based paired-associates learning. Since many of the tasks that have been programmed for automatic teaching approximate verbal paired-associates learning, knowledge of relative rates of acquisition under these two paradigms should be of significance for further developments in automatic teaching.

Figure 1 shows the stimulus-response relationships of initial and terminal phases of paired-associates learning under the classical conditioning paradigm conventionally used for paired-associates learning. Under this paradigm, several different formats of presentation are possible. Two common formats are often labeled the anticipation and recall formats (Goss & Nodine, 1965, pp. 284-285). The anticipation format involves the occurrence of the stimulus member of each paired-associates unit and then of the response member, with or without the stimulus member. The recall format involves the occurrence of the stimulus member and response member together and then of the stimulus member alone. Typically, all units are presented before any one is repeated.

The classical conditioning paradigm of this experiment was under the anticipation format. The presentation of each paired-associates unit involved the occurrence of a first stimulus or stimulus member (S_{i1}), followed by the occurrence of a second stimulus or response member (S_{i21}) to which S responded by repeating that stimulus (R_{i21}). The task was to learn to say the response to the second stimulus before the

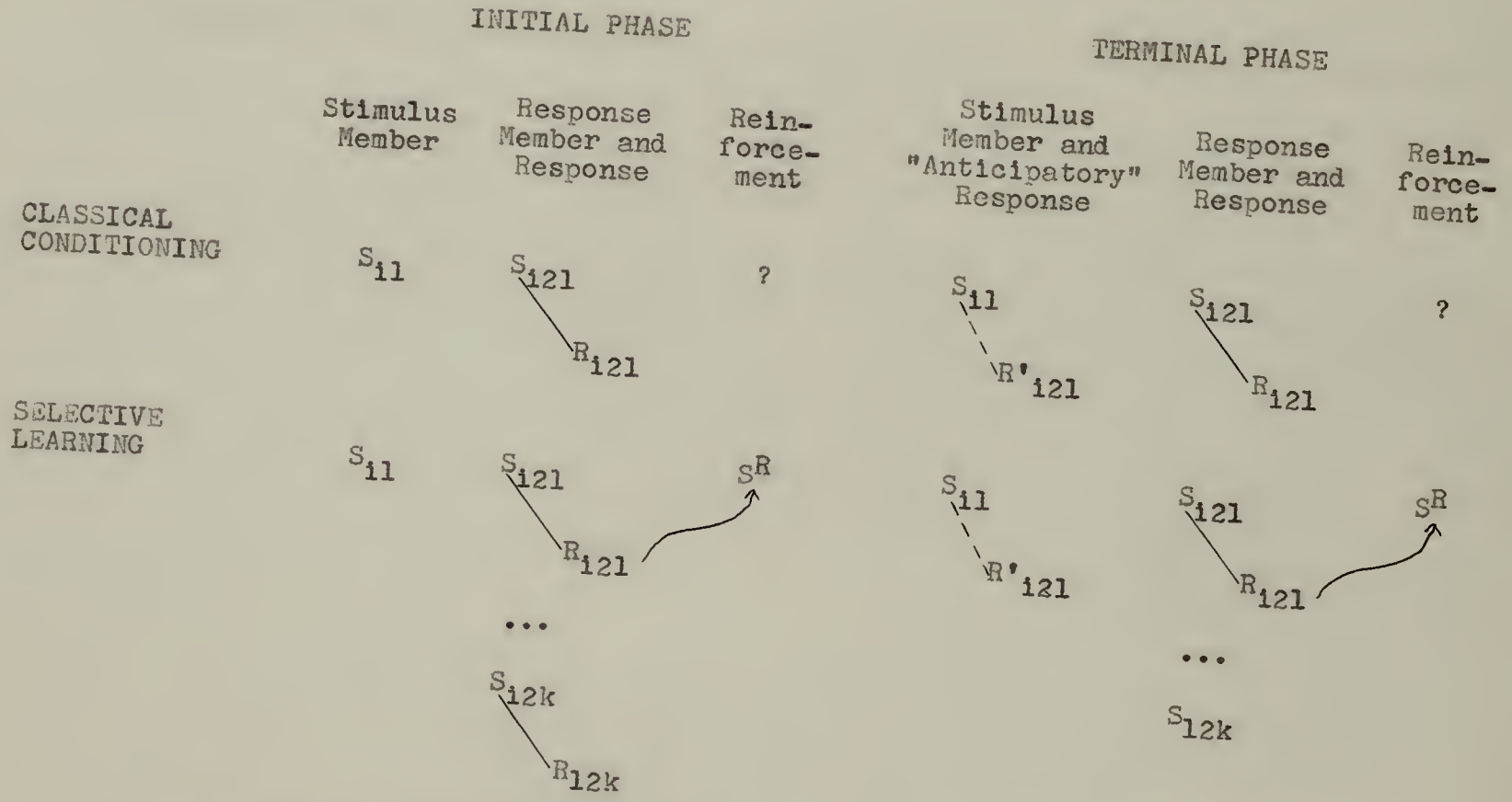

Fig. 1. Stimulus-response relationships of initial and terminal phases for each paired-associates unit under classical conditioning and selective learning paradigms of presentation.

occurrence of that stimulus; R'_{i21} designates this "anticipatory" response. In this paradigm S_{i1}, S_{i21}, R_{i21}, and R'_{i21} were considered analogous to the CS, UCS, UCR, and CR of the classical conditioning paradigm, respectively.

The selective learning paradigm involved the occurrence of a first stimulus or stimulus member (S_{i1}), simultaneously with or followed by the occurrence of from two to k second stimuli or response members (S_{i21}, ..., S_{i2k}), each of which evokes a different response (R_{i21}, ..., R_{i2k}). Which of the from two to k different responses is correct is indicated by a consequent stimulus change that might be a light or buzzer, or removal of the particular unit. The consequent stimulus change is often called a reinforcing event or reinforcer (S^R). Correction of incorrect choices might be permitted or forbidden. When occurrence of the stimulus member precedes occurrence of the response members, both anticipation and selection may occur. Figure 1 shows both anticipation of the correct alternative and its subsequent selection during the terminal phase. As usually arranged, selective learning of paired associates involves only selection. In the present experiment, to permit direct comparison between the classical conditioning paradigm with an anticipation format, in one of the formats of the selective learning paradigm overt anticipation and overt selection were combined. The other format was overt selection with no overt although presumably with some covert anticipation.

The classical conditioning paradigm is conventional for

presentation of verbal paired-associates tasks; the selective learning paradigm has also been used (e.g., Peterson, 1956). But the two paradigms have been employed together infrequently. They were employed simultaneously in two studies (Goss & Greenfeld, 1958; Holton & Goss, 1956). These experiments were not designed to compare relative rates of acquisition under the two paradigms. Consequently, under the classical conditioning paradigm the same responses were acquired by different Ss, while under the selective learning paradigm different sets of responses were acquired. Thus unequivocal comparison of rates under the two paradigms was not possible.

In Underwood and Schulz's (1960) experiment, acquisition of paired associates was faster under a classical conditioning paradigm than under a selective learning paradigm. However, the selective learning paradigm allowed S-supplied responses from classes of different and indeterminate numbers of responses among Ss. Riley (1952) also found faster learning under a classical conditioning paradigm than under a selective learning paradigm.

Similarity. The primary purpose of the present study was comparison of rates of acquisition of anticipatory responses under classical conditioning and selective learning paradigms. Before one paradigm or the other can be considered preferable, however, its superiority must be demonstrated across values and combinations of values of other variables. Because of the demonstrated potency of attributes of stimulus members and of response members (Goss & Nodine, 1965), they

are among the more important of such other variables. As a first step in determining the generality of any superiority of one paradigm to the other, therefore, similarity among stimulus members and similarity among response members of the paired associates were varied. Similarity between alternative response members of the paired-associates units of the selective learning paradigm, because of presumed significance, was also varied.

That similarity among stimulus members of paired-associates units is one of the most potent and most general determinants of the rate at which paired associates are acquired under a classical conditioning paradigm has been demonstrated repeatedly (Goss & Nodine, 1965; Polson, Restle & Polson, 1965). The effects of similarity among response members may be less marked and less pervasive, at least for some sets of nonsense syllable response members. But similarity among response members is also related to difficulty of acquisition (Goss & Nodine, 1965).

Whether acquisition is faster under a classical conditioning paradigm than under a selective learning paradigm may also depend on similarity between the alternative response members of each unit presented under the latter paradigm. Underwood and Archer (1955) investigated the effects on rate of verbal discrimination learning of similarity between pairs of consonant nonsense syllables. Similarity between members of pairs was, however, confounded with similarity among pairs. Thus, the relative influence of both kinds of

similarity on the inverse relationship between learning rate and similarity could not be determined.

Method

Stimuli and apparatus. Table 1 shows the stimulus and response members of the paired-associates units employed under both selective learning and classical conditioning paradigms of presentation. Each of the four lists for the classical conditioning paradigm had the same eight stimulus members (HOM, HON, NOM, MON, WAK, YAJ, VIF, and TEX). The first four were of high similarity to each other and the last four were of low similarity both to the first four and to each other. The four lists differed only in the particular pairings. In each list, two of the stimulus members of high similarity were paired with two response members of high similarity (e.g., for List 1, SAR, RAS) and the other two of the stimulus members of high similarity were paired with two response members of low similarity (e.g., for List 1, GIV, COZ). In each list, also, two of the stimulus members of low similarity were paired with two of the response members of high similarity (e.g., for List 1, MOL, LOM) and the other two of the stimulus members of low similarity were paired with two of the response members of low similarity (e.g., for List 1, PUD, DEC). The four lists differed in that each of the two sets of stimulus members of high similarity and each of the two sets of stimulus members of low similarity were paired with each of the two sets of response members of high similarity and each of the two sets of response members of low similarity. The four lists counterbalanced pairings of

Table 1

Lists of Pairs of CVCs of Units for Acquisition under Classical Conditioning and Selective Learning Paradigms of Presentation. The CVCs under Column I are the Response Members for the Units for the Classical Conditioning Paradigms. The CVCs under Columns IIa and IIb are the Alternative CVCs for the Units under the Selective Learning Paradigms. The Alternative CVCs of IIa are of High Similarity to the CVCs of I and the Alternative CVCs of IIb are of Low Similarity to the CVCs of I

Stimulus Members	Response Members											
	List 1			List 2			List 3			List 4		
	I	IIa	IIb	I	IIa	IIb	I	IIa	IIb	I	IIa	IIb
HOM (100%)	SAR (100%)	SER (93%)	KET (87%)	GIV (100%)	GOV (93%)	BEQ (67%)	MOL (93%)	MIL (93%)	JUP (73%)	PUD (93%)	PED (100%)	ZIG (60%)
HON (100%)	RAS (93%)	RES (87%)	KOT (73%)	COZ (93%)	CUZ (73%)	FEB (73%)	LOM (73%)	LIM (100%)	JOP (67%)	DEC (100%)	DIC (100%)	QAW (60%)
NOM (93%)	GIV (100%)	GOV (93%)	BEQ (67%)	SAR (100%)	SER (93%)	KET (87%)	PUD (93%)	PED (100%)	ZIG (60%)	MOL (93%)	MIL (93%)	JUP (73%)
MON (100%)	COZ (93%)	CUZ (73%)	FEB (73%)	RAS (93%)	RES (87%)	KOT (73%)	DEC (100%)	DIC (100%)	QAW (60%)	LOM (73%)	LIM (100%)	JOP (67%)
WAK (100%)	MOL (93%)	MIL (93%)	JUP (73%)	PUD (93%)	PED (100%)	ZIG (60%)	SAR (100%)	SER (93%)	KET (87%)	GIV (100%)	GOV (93%)	BEQ (67%)
YAJ (93%)	LOM (73%)	LIM (100%)	JOP (67%)	DEC (100%)	DIC (100%)	QAW (60%)	RAS (93%)	RES (87%)	KOT (73%)	COZ (93%)	CUZ (73%)	FEB (73%)
VIF (100%)	PUD (93%)	PED (100%)	ZIG (60%)	MOL (93%)	MIL (93%)	JUP (73%)	GIV (100%)	GOV (93%)	BEQ (67%)	SAR (100%)	SER (93%)	KET (87%)
TEX (100%)	DEC (100%)	DIC (100%)	QAW (60%)	LOM (73%)	LIM (100%)	JOP (67%)	COZ (93%)	CUZ (73%)	FEB (73%)	RAS (93%)	RES (87%)	KOT (73%)

particular sets of stimulus members with particular sets of response members.

The selective learning paradigm required eight stimulus members each paired with one of eight pairs of alternative response members. One of the alternatives of each of the eight pairs of alternative responses was one of the response members of the lists for the classical conditioning paradigm. The pairings of these alternatives with the stimulus members were the same as the pairings for the classical conditioning paradigm of presentation. The four lists counterbalanced pairings of stimulus members with pairs of alternative response members.

The other alternative of each of the eight pairs of response members were of high or low similarity to the first alternative. Each high-similarity alternative of a unit had the same initial and final consonant as the first but a different middle vowel. Each low-similarity alternative of a unit, one pairs whose members have the same vowel excepted, had no letter in common with the other alternative.

The nonsense syllables were typed in pica capitals with the stimulus and response members 1 in. apart. The two response members paired with each stimulus member for the selective learning paradigm were on two lines with one syllagle directly under the other. Half of the time one was on top, half of the time the other was on top. The single response member of the classical conditioning paradigm appeared equally often in the top and bottom position to control for

any differences due to location of response members. The strips of paper on which the stimuli of each unit was typed were cemented to plastic cards which are used for presentation by a Hunter Cardmaster.

Procedure. For both classical conditioning and selective learning paradigms of presentation, the eight units appeared in four different random orders. A randomly determined sequence of these orders was repeated every four trials. A trial was the presentation of all eight units once. An S was run until he reached a criterion of one perfect trial. Any S who had not reached criterion at the end of 48 trials was dropped.

There were two classical conditioning and two selective learning paradigms of presentation. The first classical conditioning paradigm, coded CC-1, involved presentation of the stimulus member of each unit alone for 2 sec. and the stimulus member and response member together for 2 sec. Interpair and intertrial intervals were each 2 sec.

Selective learning, with overt anticipation required, involved presentation of the stimulus member of each unit alone for 2 sec. For the format of overt anticipation and selection, Ss were instructed to anticipate the correct response member during this interval. The two response members appeared after 2 sec. and remained in view until Ss responded by saying one or the other of the alternative response members. If the response was correct, the shutter closed. If the response was incorrect, Ss were permitted to correct

themselves and then the shutter closed. The interpair interval and the intertrial interval were each 2 sec. The same procedure was used with the lists with alternative response members of each unit of high or of low similarity to each other. The former condition was coded SL-OA-HS for selective learning, overt anticipation, high similarity; and the latter was coded SL-OA-LS for selective learning, overt anticipation, low similarity.

The second classical conditioning paradigm, coded CC-2, controlled for possible effects of the lengths of time stimulus and response members were exposed together under classical conditioning and under selective learning paradigms. In the CC-1 condition, duration of stimulus and response members together was fixed at 2 sec. Under the selective learning paradigm, Ss often required longer than 2 sec. to make their choice. Thus, they received a longer exposure to the pair. A pilot group of eight Ss run under the selective learning paradigm provided average times during which stimulus and response members were exposed together for selection. For the CC-2 condition, the stimulus and response members were exposed together for 3 sec. during the first eight trials and for 2 sec. during the later trials. These durations approximated the average durations obtained under the selective learning paradigm.

The two additional selective learning conditions differed from the first two only in the absence of instructions to anticipate overtly. Presumably some to frequent covert

anticipations might occur. With covert anticipation designated CA, these conditions were coded SL-CA-HS and SL-CA-LS. As previously, the HS and LS are for alternative response members of high and of low similarity to each other, respectively.

Subjects. The Ss were 48 summer students enrolled in the course in general psychology and in other undergraduate courses at the University of Massachusetts. Most were naive with respect to paired-associates learning. They were paid for participating. Each S, as he appeared, was randomly assigned to one of the six conditions. A cycle of six Ss was repeated until there were eight Ss in each condition.

Results

In the classical conditioning conditions and the selective learning conditions with overt anticipation, Ss' acquisition was expressed in terms of correct anticipations. In the selective learning conditions with or without overt anticipation, Ss' acquisition was expressed in terms of correct choices. Separate analyses were carried out on correct anticipations and on correct choices. For comparable selective learning conditions, choices were learned markedly faster than anticipation. For this reason and because no comparisons of paradigms was involved, no analyses comparing correct anticipations and correct choices were undertaken.

Anticipations. For each pair of units representing the four combinations of high and low similarity of stimulus and response members, correct anticipations were scored as number of trials to one perfect performance. Acquisition of each of the pairs of units was also scored as number of correct anticipations to the criterion of one perfect performance with all eight units. Means and SDs of the two measures are presented in Table 2 for each combination of conditions of presentation and of similarity. Differences among these means were assessed by the analyses of variance summarized in Table 3. In the analyses of variance, the "between Ss" variable was the four conditions of presentation and the "within Ss" variables were similarity of stimulus members and of response members.

Table 2

Means and Standard Deviations of Trials to One Perfect Performance on Anticipations for Units Representing Each Combination of Similarity of Stimulus and Response Members and also of Correct Anticipations for those Units to One Perfect Performance on All Eight Units

Paradigm and Further Conditions	Similarity of		Trials		Correct Anticipations	
	Stimulus Members	Response Members	Mean	SD	Mean	SD
CC-1	High	High	11.9	5.1	9.9	7.3
		Low	10.4	3.8	13.5	11.2
	Low	High	7.9	3.8	15.1	7.9
		Low	9.1	3.5	16.1	12.2
CC-2	High	High	8.6	5.4	25.1	21.7
		Low	9.9	4.7	20.1	14.5
	Low	High	11.4	7.1	21.5	16.2
		Low	6.6	4.8	33.0	21.0
SL-OA-HS	High	High	13.4	8.2	22.0	16.7
		Low	14.2	8.0	12.9	9.8
	Low	High	16.9	10.1	17.6	12.7
		Low	13.0	7.3	24.7	21.3
SL-OA-LS	High	High	17.0	13.6	16.1	8.1
		Low	14.9	12.0	16.9	10.7
	Low	High	16.4	11.7	22.3	13.3
		Low	8.3	4.0	22.5	30.1

Table 3

Summary of Analyses of Variance on Anticipation Measures

Source	df	Trials		Correct Anticipations	
		MS	F	MS	F
Between Ss	31				
Conditions (C)	3	246.70	1.81	760.66	1.14
error (b)	28	136.42		665.72	
Within Ss	96				
Stimulus Similarity (SS)	1	57.78	1.62	1182.20	8.10*
Response Similarity (RS)	1	144.50	3.48	250.32	3.17
SS x RS	1	98.00	3.70	876.76	13.76*
SS x C	3	37.70		125.73	
RS x C	3	36.08		78.60	
SS x RS x C	3	35.42		162.02	2.54
error (w_1)	28	35.66		145.91	
error (w_2)	28	41.49		78.96	
error (w_3)	28	26.47		63.73	

*Significant at <.01

The differences among the four conditions of presentation were not significant either for trials to one perfect performance for each of the four pairs of units representing different combinations or for correct anticipations to one perfect performance with all eight units. Similarity of stimulus members and similarity of response members alone and also in combination with each other and with conditions of presentation had no significant effects on trials to one perfect performance. Because these Fs were not significant, no further analyses were undertaken with respect to possible differential effects of rate of presentation under the classical conditioning paradigm or of similarity between alternative response members under the selective learning paradigm.

For correct anticipations with each pair of units to one perfect performance with all eight units, the Fs for similarity of stimulus members and for the interaction of similarity of stimulus and of response members were both significant at less than .01. Fewer correct anticipations ($\bar{X}$ = 17.1) occurred with stimulus members of high similarity than with those of low similarity ($\bar{X}$ = 23.1).

With stimulus members of low similarity, response members of low similarity were anticipated correctly more often ($\bar{X}$ = 27.2) than response members of high similarity ($\bar{X}$ = 19.2). With stimulus members of high similarity, response members of low similarity were anticipated correctly less often ($\bar{X}$ = 15.8) than response members of high similarity ($\bar{X}$ = 18.3). These differences in direction of effects of similarity of response

members for stimulus members of low and of high similarity account for the significant interaction of similarity of stimulus and of response members. These differences in direction also account for the failure to obtain a significant difference between means for response members of high similarity ($\bar{X}$ = 18.7) and of low similarity ($\bar{X}$ = 21.5).

In comparison between all possible pairs of means by the New Duncan Multiple Range Test, the mean of 27.2 for the combination of stimulus and response members both of low similarity differed significantly from the means of each of the other three combinations of similarity. None of the differences involving the other pairs of means was significant.

Choices. Choices were scored as number of trials to one perfect performance in selecting the correct alternative for each pair of units representing the four combinations of similarity of stimulus and response members. Choices were also scored as number correct for each pair of units to the criterion of perfect performance with all eight units. Means and SDs for the four combinations of similarity within the SL-OA-HS, SL-OA-LS, SL-CA-HS, and SL-CA-LS conditions are presented in Table 4. Differences among these means were assessed by the analyses of variance summarized in Table 5. The "between Ss" variables were overt or covert anticipation and high or low similarity between alternative response members of a unit. The "within Ss" variables were similarity of stimulus members and similarity of response members.

None of the Fs involving overt or covert anticipation

Table 4

For the Selective Learning Paradigm, Means and Standard Deviations of Trials to One Perfect Performance on Choices for Units Representing Each Combination of Similarity between Response Alternatives and of Similarity of Stimulus and Response Members and also of Correct Choices for those Units to One Perfect Performance on All Eight Units

Similarity between Response Alternatives	Similarity of		Trials		Correct Choices	
	Stimulus Members	Response Members	Mean	SD	Mean	SD
SL-OA-HS	High	High	1.5	1.8	8.6	4.4
		Low	1.5	2.1	8.4	6.5
	Low	High	0.9	0.8	9.3	5.9
		Low	3.3	3.0	8.7	7.4
SL-OA-LS	High	High	1.9	2.9	4.1	3.7
		Low	0.6	0.7	5.5	4.6
	Low	High	2.4	1.2	4.1	4.6
		Low	1.1	1.1	5.3	5.2
SL-CA-HS	High	High	0.4	0.7	9.6	4.7
		Low	2.6	2.6	7.4	4.3
	Low	High	2.1	1.4	6.9	5.1
		Low	2.3	2.1	6.1	3.8
SL-CA-LS	High	High	1.7	1.6	6.5	5.2
		Low	1.9	2.0	6.6	2.5
	Low	High	2.0	1.4	5.6	5.1
		Low	1.3	1.0	6.7	2.3

Table 5

Summary of Analyses of Variance on Choice Measures

Source	df	Trials		Correct Choices	
		MS	F	MS	F
Between Ss	31				
Overt or Covert Anticipation (A)	1	0.63	-	1.13	-
Similarity within Pairs (P)	1	1.32	-	53.87	-
A X P	1	0.19	-	222.37	2.99
error (b)		3.35		74.36	
Within Ss	96				
All Components	12	5.52	1.7	6.40	
error (w)	84	3.19		7.15	

or similarity between alternative response members of a unit was significant for either response measure. Nor were any of the Fs involving similarity of stimulus members or similarity of response members significant for either measure.

Discussion

The primary purpose of this experiment was to determine relative rates of mastery of a paired-associates task under classical conditioning and selective learning paradigms of presentation. The secondary purpose was to determine the generality of any differences due to paradigms across combinations of similarity of stimulus members and of response members. The results are discussed with respect to each of these objectives.

Paradigms. Relative rates of mastery under classical conditioning and selective learning paradigms were expressed as trials to one perfect performance for pairs representing each combination of similarity and as correct anticipations for each pair of units to a criterion of one perfect trial for the entire list. Under the classical conditioning paradigm two different rates of presentation of stimulus members alone and together with the response member were employed. One was a 2:2-sec. rate through all trials; the other was a 2:3-sec. rate through the first eight trials and a 2:2-sec. rate thereafter. Under the selective learning paradigm the alternative response members of the paired-associates units were of low or high similarity to each other. In the comparisons among all four of these conditions, no significant differences emerged. Therefore, no further analyses were carried out on possible effects of rates of presentation under the classical conditioning paradigm or on possible

effects of similarity between alternative response members. The conclusion drawn is that anticipations were mastered at equal rates under classical conditioning and under selective learning paradigms. The former paradigm is the easier to use. In general, therefore, it would seem the preferred paradigm.

One reason for the failure to obtain a difference between the classical conditioning and selective learning paradigms might be lack of a pronounced difference between the two paradigms as they were used in this experiment. The correction procedure of the selective learning paradigm assured that the last response made to each stimulus was the correct response. Thus the main difference between the two paradigms was Ss' incorrect choices prior to a correct choice. Because of the rapid mastery of choices, this difference held only for from about one to slightly over three trials. Once choices were mastered, the paradigms became essentially the same.

With the classical conditioning paradigm, the different rates of presentation had no differential effects. Within the selective learning paradigm, similarity between alternative response members had no differential effects. The differences between rates of presentation under the classical conditioning paradigm were probably too small to have any marked effects (Nodine, 1963). Similarity between alternative response members did not influence rates of mastery of choices. Without such a difference and with mastery of

choices in only a few trials, similarity between alternative response members was probably not a significant variable for enough trials to influence rate of mastery of anticipations.

Under the selective learning paradigm, choices were mastered in markedly fewer trials than anticipations. The difference was expected and is consistent with prior findings of faster acquisition of selection or recognition responses than of responses which must be produced (McGeoch & Irion, 1952).

Similarity. Similarity of stimulus and of response members did not have significant effects on trials to criterion. For correct anticipations to mastery of all eight units, however, similarity of stimulus members had the usual significant inverse effect on mastery of anticipations under both classical conditioning and selective learning paradigms. Disregarding similarity of stimulus members, the inverse effect of similarity of response members was not significant. Considering similarity of stimulus members, the inverse effect held for stimulus members of low similarity. A slight direct effect held for stimulus members of high similarity.

Typically, the slowest learning is obtained with the combination of stimulus members and of response members both of high similarity. Instead, this combination was slightly but not significantly superior to the combination of stimulus members of high similarity but response members of low similarity. The reason for this difference and, therefore, for the slight direct effect of similarity of response members for stimulus members of high similarity may be some Ss' use of a principle to "deduce" the correct response. For the

combination of stimulus members and of response members both of high similarity, the two response members were made up of the same letters. The difference between these members was in reversal of the order of the initial and terminal consonants. Once the response to one stimulus member of a pair of units had been mastered, the response to the other stimulus member of the pair of units could be deduced by means of a principle of reverse the order of the consonants. Such a deduction would be easier with stimulus members of high similarity than with those of low similarity. A parallel finding was reported in Experiment 6 in Goss and Nodine (1965).

None of the interactions involving conditions of presentation and similarity of stimulus and of response members was significant. Thus, the failure to obtain significant differences among conditions of presentation was not due to effects in opposite directions of different combinations of similarity. For each combination of similarity, there were no pronounced differences among conditions of presentation. Alternatively, for each condition of presentation, the effects of similarity of stimulus and of response members were about the same.

For choice responses under the selective learning paradigms only, similarity of stimulus members and of response members had no differential effects on acquisition rate. The outcome held for these variables alone and in combination with the other variables of similarity between alternative response members of a unit and overt or covert anticipation.

Conceivably, choices were mastered too rapidly to demonstrate any effects of the similarity variables at least with the relatively small number of Ss and of units exemplifying particular combinations of similarity employed in this experiment.

Summary

The primary purpose of the present study was to compare rates of acquisition of anticipatory responses under classical conditioning and selective learning paradigms of presentation. To demonstrate the generality of any difference in relative rates under these paradigms, similarity among stimulus members of the paired-associates units and among response members of the paired-associates units were varied. Similarity between alternative response members of the paired-associates units of the selective learning paradigm was also varied.

Under the classical conditioning paradigm, there were two conditions; these differed only in duration of presentation of stimulus and response members together through the first eight trials. Under the selective learning paradigm, there were four conditions generated by high or low similarity between alternative response members and no requirement or requirement of overt anticipation before choices.

The lists of eight paired-associates units were comprised of four pairs of units. Each pair represented one of the combinations of stimulus and response members of high or low similarity. These lists were presented by means of a Hunter Cardmaster to Ss individually. Acquisition was continued to a criterion of one perfect trial or performance on all eight units.

Anticipations were mastered at equal rates under

classical conditioning and selective learning paradigms. Neither rate of presentation under the classical conditioning paradigm nor similarity between alternative responses under the selective learning paradigm had a significant effect on rate of mastery. Correct choices were acquired rapidly and rate of acquisition was not influenced by similarity among stimulus members, among response members, or between response alternatives. Also, acquisition rate was not influenced by overt or covert anticipation.

Similarity of stimulus members had the expected inverse effect on rate of mastery as specified by correct anticipations to perfect performance on the entire list. Similarity of response members did not have a significant inverse effect, probably because the principle used to compose the lists was used by some Ss to "deduce" some of the correct responses, particularly for units representing high similarity of both stimulus and response members.

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