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The effects of value ratio shifts on item processing in short term memory.

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The Effects of Value Ratio Shifts on Item Processing in Short Term Memory

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Table of Contents

List of Tables

List of Figures

Introduction

The results of studies by Teichner, Dalquist, Eddy, and Pesner (1963) and Seibel, Christ, and Teichner (1965) strongly suggest that human information processing ability is affected more by experimental conditions which force S to rely on his capacity to store and extract information from short term memory, than by input variables such as exposure time and load.

Taub (1965) tested this suggestion by introducing differential value for targets in the visual display. Using two equally frequent subsets of targets, Taub defined differential value as the number of points assigned to a correct report of a target within that subset. With four differential ratios of value (2:1, 4:1, 8:1, 16:1), Ss competed for monetary prizes which were awarded to those Ss who achieved the highest point totals.

Taub predicted that Ss would employ certain response strategies and shift these strategies as the ratios of differential values of the correct responses shifted. As an indication of a strategy shift, the percentage of correct responses to the higher valued targets should increase with the size of the ratio, while responses to low valued stimuli should decrease. The results indicated that differential value ratio for the two subsets of targets do indeed reflect differential information processing, but not in the predicted direction. The percentage of correct reports of the high valued targets always exceeded that of the low valued targets; however, the percentage of correct reports of high valued targets remained constant with increasing value

ratio while the percentage of correct reports of low valued targets showed an inverse relationship with value ratio. This result led to an overall decrease in the percentage of correct reports as value ratio increased.

Teichner, Christ, and Fergenson (1965) suggested that increasing value ratio produces concomittant increases in interference of item processing in short term memory; consequently, fewer correct targets should be reported at the higher value ratio levels. In an attempt to test this suggestion, these investigators studied the effects of value ratio, probability of occurence of a high or low valued target, and cost for omission of a target. It was expected that these variables would effect the processing of stored information and lead to a change in overall performance.

Contrary to the results obtained by Taub and the predictions made by these investigators, none of the variables affected information processing as reflected by correct performance. Teichner et.al. concluded that the Ss in this experiment, unlike those in the Taub experiment, did not adjust their strategy as a function of value ratio; therefore, the mutual interference hypothesis was not supported.

Recent research with incentive variables in learning situations have indicated that incentive effects can be enhanced or deflated depending on the type of experimental design used in the study (Pubols, 1960, Harley, 1965a, 1965b). After a review of this literature, Lipkin (1966) concluded "that a necessary condition to observing an effect among positive levels of incentive would seem to be that each S has

experience with more than one incentive level." Ss in the Teichner, Christ, and Fergenson design had experience with more than one incentive level, i.e. value, but they experienced only one level of the variables which were to produce mutual interference, namely value ratio. Therefore, the main purpose of the present experiment is to have each S experience more than one level of value ratio. This was accomplished by originally training Ss at one level of value ratio and then shifting them to one other value ratio level.

Method

Subjects

The Ss were 72 undergraduate female students enrolled in the introductory psychology courses at the University of Massachusetts. All Ss received course credit for their participation and monetary rewards based on their performance.

Apparatus

The first ten letters, A through J, and the last ten letters, Q through Z, of the English alphabet provided two subsets of category value. The letters K through P were never used in order to create a clear distinction between the two subsets of letters.

The stimulus display consisted of 150 different slides with white alphabetic characters on a black background. The slides varied in number of categories (load) with each letter of the alphabet representing a category. The three levels of load were 4, 8, and 12 letters per slide. Each level of load was replicated 50 times with a different random sample of the alphabet with the restriction that within each alphabet half, the letters appear equally often over the 50 slides. After each letter was chosen, it was randomly assigned to a location within a 10 x 10 matrix with the restriction that on the average, .5 of the letters selected from each alphabet half be placed in the center 36 positions of the matrix and the other .5 placed in the peripheral 64 positions. Following letter selection and position assignment, capital letters were typed on blank cards using typewriter spaces as matrix

cells. These cards were then photographed and made into 2 x 2 inch negative projection slides.

The slides were presented automatically by a Kodak Carousel slide projector which had been wired for control of exposure time and inter-slide interval. The projected size of the letters was 1.5 x 1 inch. The experimental room was a small classroom and the subjects sat in student arm chairs in groups of four each. The average distance from the projection screen to the subjects chairs was 10 feet.

Procedure

The complete experimental design is a 3 x 3 x 3 x 2 x 5 factorial with original training and shift training as between-subjects variables and load, value, and trial blocks as within-subjects variables. Original training (OT) and shift training (ST) refer to the levels of value ratio that were used in the two successive experimental sessions. For each value ratio, the first number refers to the number of points awarded for a correct report of a high value target and the second number refers to the number of points awarded for the correct reporting of a low valued target. The value ratios 2:1, 4:1, and 8:1, were paired such that each level served in both original training and shift training. For example, Ss originally trained at 2:1 were shifted to either 4:1 or 8:1 level except for those Ss in the control group (2:1 to 2:1). By pairing each original training value ratio with each shift training value ratio, a total of nine different experimental groups were formed. Load refers to the number of letters per slide (4, 8, and 12). Value refers to the two subsets of letters which were designated as high and

low valued for each group. Trial blocks refer to the 5 successive blocks of 15 slides.

Ss were tested in groups of 4. All Ss in these groups were in the same OT and ST combinations but with 2 of the Ss having the first half, and the other 2 the second half of the alphabet designated as high valued. During the first 10 minutes of the OT session, Ss were given instructions and practice. Specifically, these instructions consisted of telling the Ss that the stimuli were the two halves of the English alphabet, which alphabet half was designated as high or low valued, and which value ratio was being used. Cards containing the same information were given to the Ss to read and refer to during the experiment. The Ss were then shown three slides for an extended time and the experimenter pointed out the high and low valued targets. Further practice was provided by permitting the Ss to view ten slides under experimental conditions.

During the first few minutes of the ST session new cards were distributed on which were printed the same material as in OT except that the value ratios had been changed. Control groups received exactly the same instructions as in original training (value ratio did not change in shift training). No practice trials were run.

During the OT session, all Ss were presented with 75 slides in random order. After a five minute rest, ST instructions were provided and 75 more slides were presented. Order was constant over groups. Over every block of 15 slides, there were 5 slides from each load condition arranged in a random sequence.

A 0.5 second warning buzzer signaled the start of every trial. This was followed by a one second preparation period during which Ss were to focus their attention on the projection screen. Each slide was exposed for .75 seconds, after which the Ss were given 7.25 seconds to record what they could remember from the slide.

Following the main part of the experiment, Ss were asked to record their answers to two questions concerned with the strategy they used during the experiment and if this strategy changed during the shift part of the experiment.

Results

A separate analysis of variance was performed on each of the following dependent measures: 1) the total number of high and low valued reports; 2) the percentage of times the initial report was a high valued letter; 3) the percentage correct of responses made (the number of correct responses divided by the number of responses reported); 4) the percentage correct of the available responses; and 5) the number of correct initial reports. The original training and shift training data were considered separately making a total of 10 different analyses. The arc sine transformations of the percentages served as data for the analyses of measures 2, 3, and 4. Appendix A provides a summary of the original training analyses while Appendix B presents a similar summary for the shift training analyses.

The following results will be divided between two general characteristics of Ss responding; response strategy and response accuracy. The former will be discussed in relation to measures 1 and 2, while the latter will be discussed with special emphasis given to measures 3, 4, and 5.

Response Strategy

A study by Hearns (1966) indicates that method of payoff provides Ss with instructions concerning the choice of strategies for maximizing total point accumulation. He suggests that Ss report as many targets as possible when they are paid for the number of points accumulated. In the present study it is expected that Ss will rely on a

similar response strategy since they too are being paid for the number of points accumulated. In addition, it is expected that Ss will adjust this strategy when they are shifted to a different value ratio. Within this context, an adjustment in strategy refers to an attempt by Ss to report more or less information depending on the direction and extent of the value ratio shift.

Two measures, total reports and percentage of high valued first reports, should reflect changes in Ss response strategy. The total reports measures provides an overall index of what the Ss are doing (increases or decreases in responding) and it also shows if these changes are accompanied by adjustments in differential responding. The first reports measure provides a comparison measure for total reports by indicating whether effects noted in total responding are also present at the initial report level.

Total Reports. Figure 1 is a plot of the mean number of reports as a function of blocks with training sessions as a parameter. There is a greater amount of responding in ST than OT and this effect is largely due to practice as is indicated by the 4:1 and 8:1 control groups. The effects of the two extreme shifts, (2:1/8:1) and (8:1/2:1), are largely responsible for the significant ST effects ($p < .05$). There is a large enhancement in responding for the 2:1/8:1 shift group and a large decrement in responding when the shift is in the opposite direction. These effects support Taub's (1965) suggestion that Ss would shift their response strategies as the value

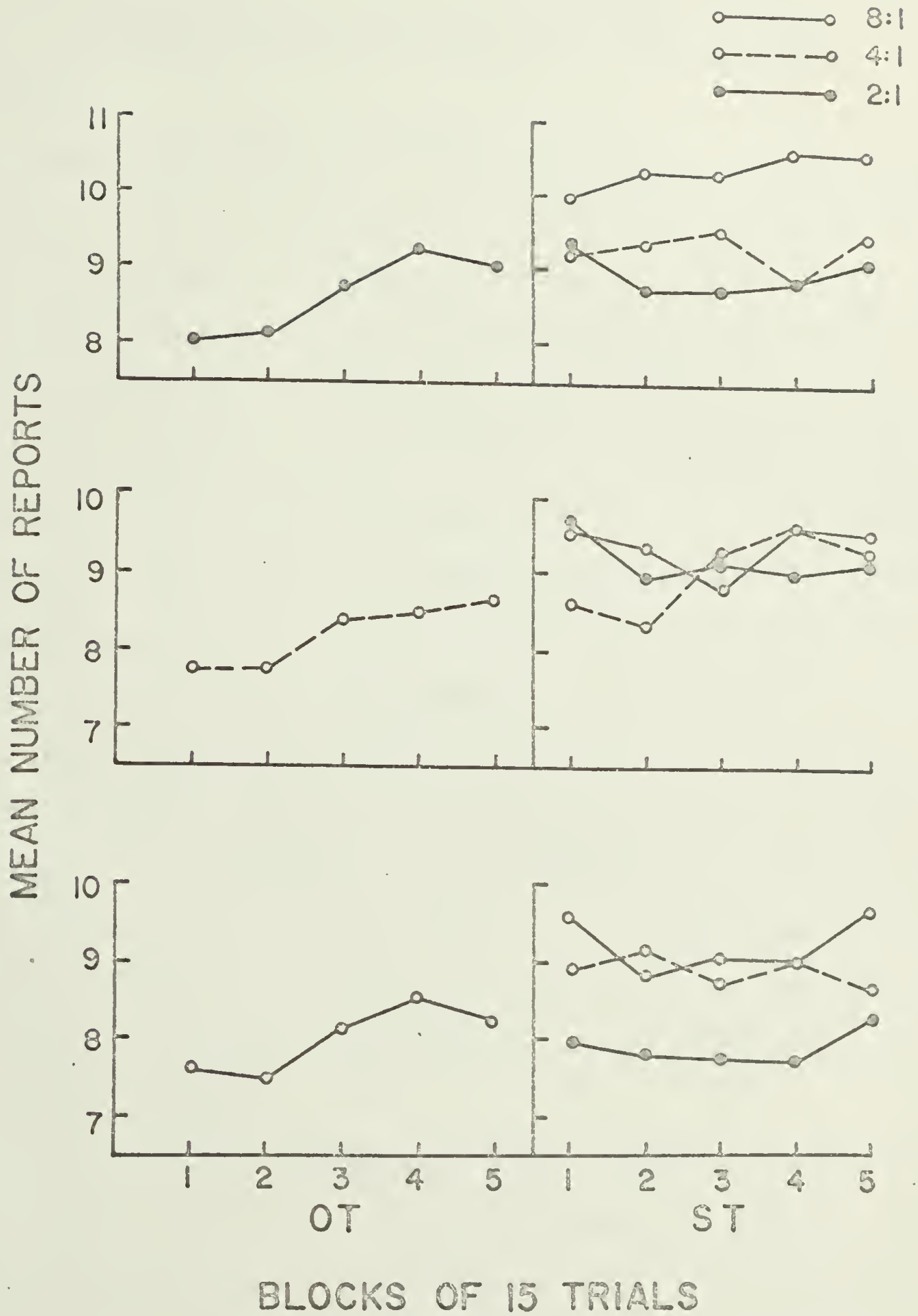

Fig. 1. Mean number of reports as a function of trial blocks with training sessions as a parameter.

of the correct responses shifted. It is important to note, however, that the strategy shift was observable only under the extreme shift conditions.

Figure 2 shows the mean number of reports as a function of trial blocks with load as a parameter. It is clear that responding increases as a function of load in each session ($p < .001$) therefore supporting previous research in this area (Teichner, Dalquist, Eddy, and Pesner (1963), Seibel, Christ, and Teichner (1965), Taub (1965), and Teichner, Christ, and Fergenson (1965)). There is also an orderly increase in responding over trial blocks during OT for all load levels ($p < .001$), but this trend is much less in evidence during ST ($p < .05$). Corresponding with these effects is the significant load x blocks interactions ($p < .05$) found in each session.

Figure 3 presents the mean number of reports as a function of trial blocks with value as a parameter. It is apparent that there is a higher rate of responding during ST relative to OT. Similarly, more high valued reports than low valued ones were made during OT ($p < .05$) and this effect increases in ST ($p < .001$). Both the increased responding and the increased value differentiations in ST are clearly related to practice effects.

The percentage of high valued first reports was to be used as an indicator of Ss response strategy but an analysis of this data yielded only one significant source of variance (Blocks x Load x OT) which showed no consistent trends. This finding indicates that the serial position of Ss report may not indicate Ss response strategy and is

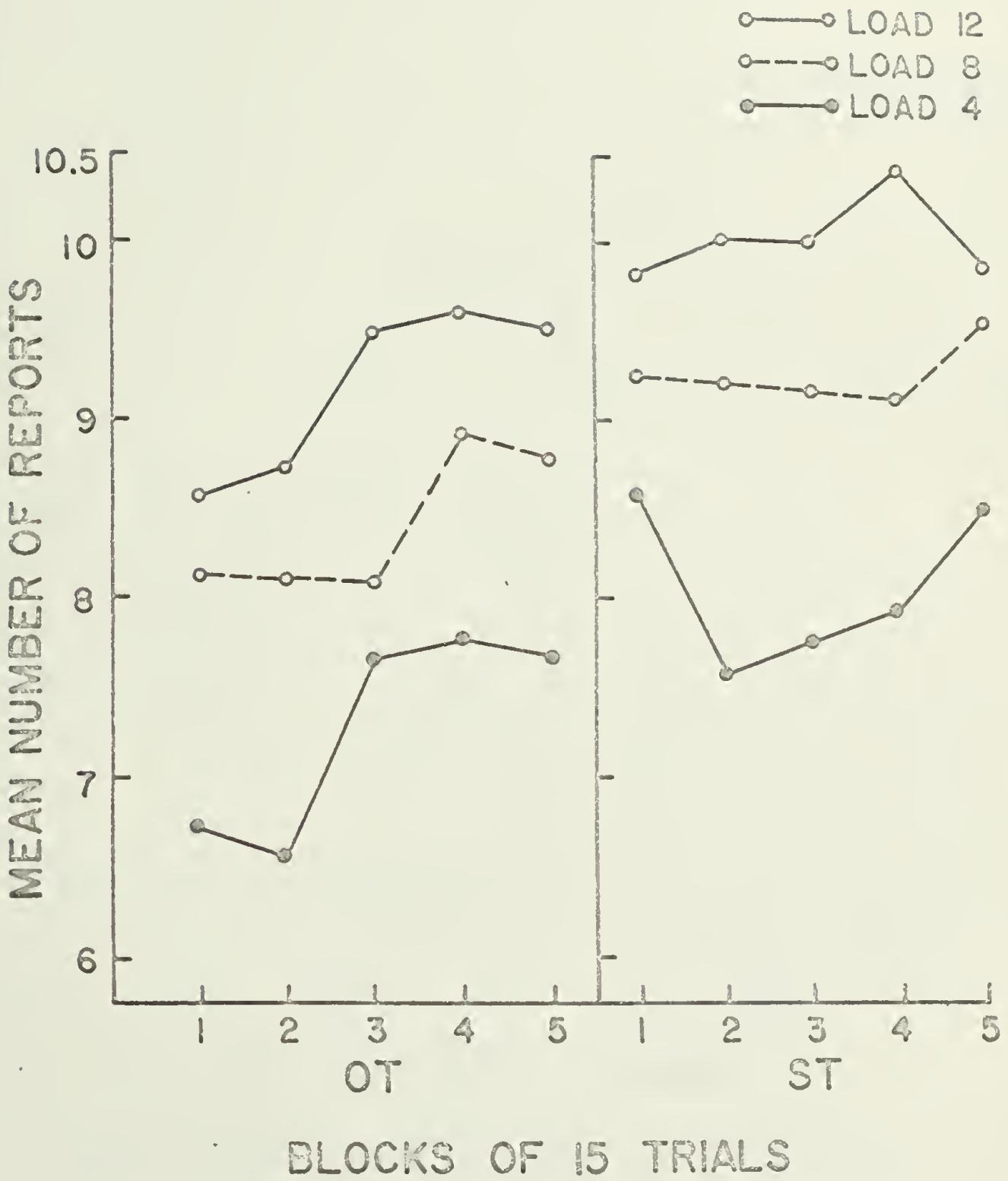

Fig. 2. Mean number of reports as a function of trial blocks with load as a parameter.

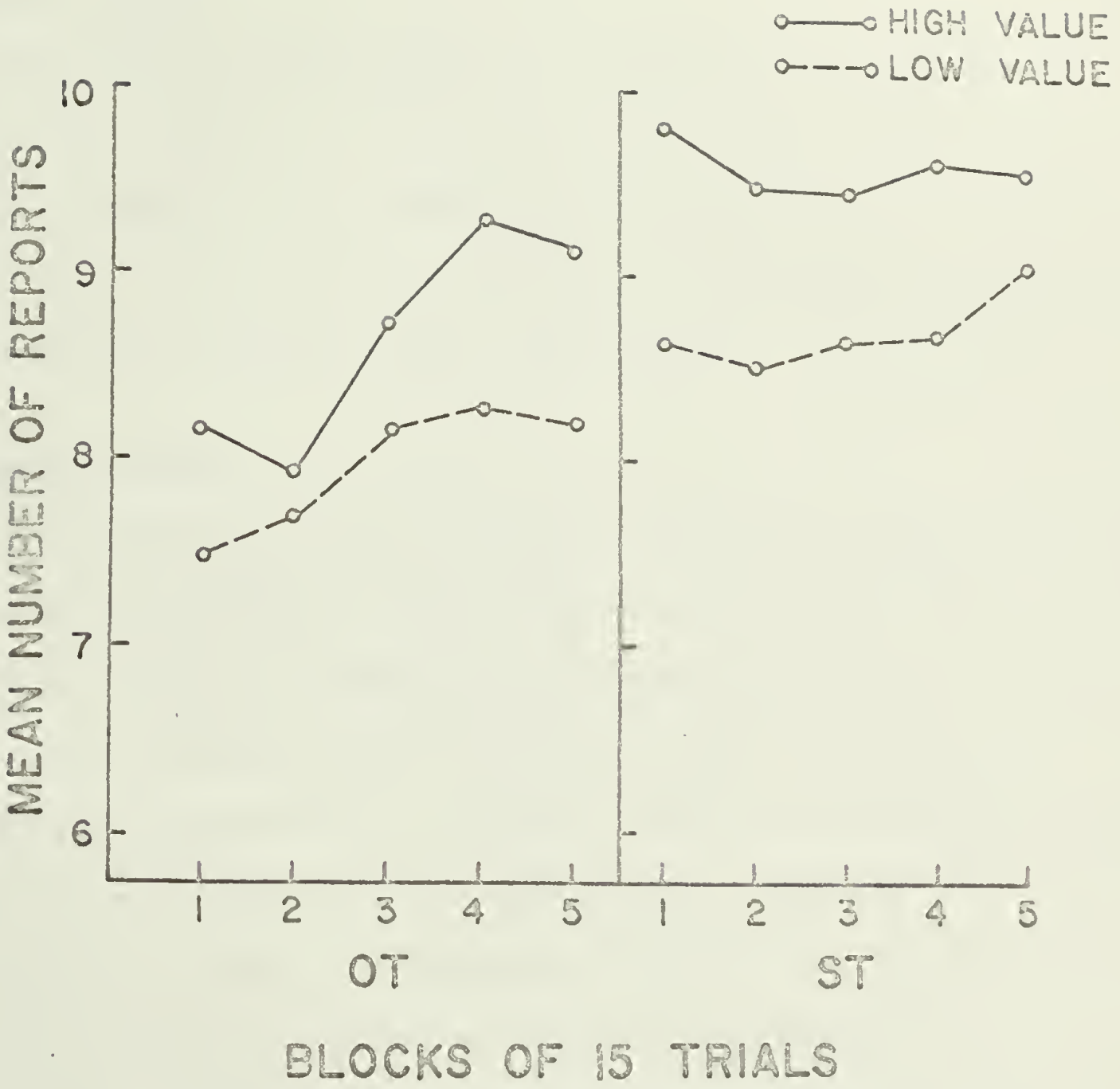

Fig. 3. Mean number of reports as a function of trial blocks with value as a parameter.

contrary to a result reported by Taub (1965) who found the percentage of high valued first reports increasing as value ratio increases. The lack of an effect for this measure is also important because an accuracy measure, number of correct first reports, shows some very significant effects.

To summarize response strategy, Ss markedly increase their response rates relative to a control condition when there is a large upshift but depress their responding with a large downshift. This result is taken as evidence that Ss shifted their response strategy when the values for the high valued targets changed.

Response Accuracy

The percentage correct of responses made, the percentage correct of responses available, and the number of correct first reports are all measures of response accuracy but each serves a different function in the overall interpretation of response accuracy. The percentage correct of responses made is inversely related to percentage error so this measure provides an index of error rate. The percentage correct of responses available is independent of error rate (number correct divided by number available) so this measure provides a correct rate. The number of correct first reports provides a correct rate but only with respect to the initial reports.

Percentage Correct of Responses Made. This percentage was calculated for each load x block condition by dividing the total number of responses made into the total number of correct responses.

Figure 4 is a plot of the percentage correct of responses made

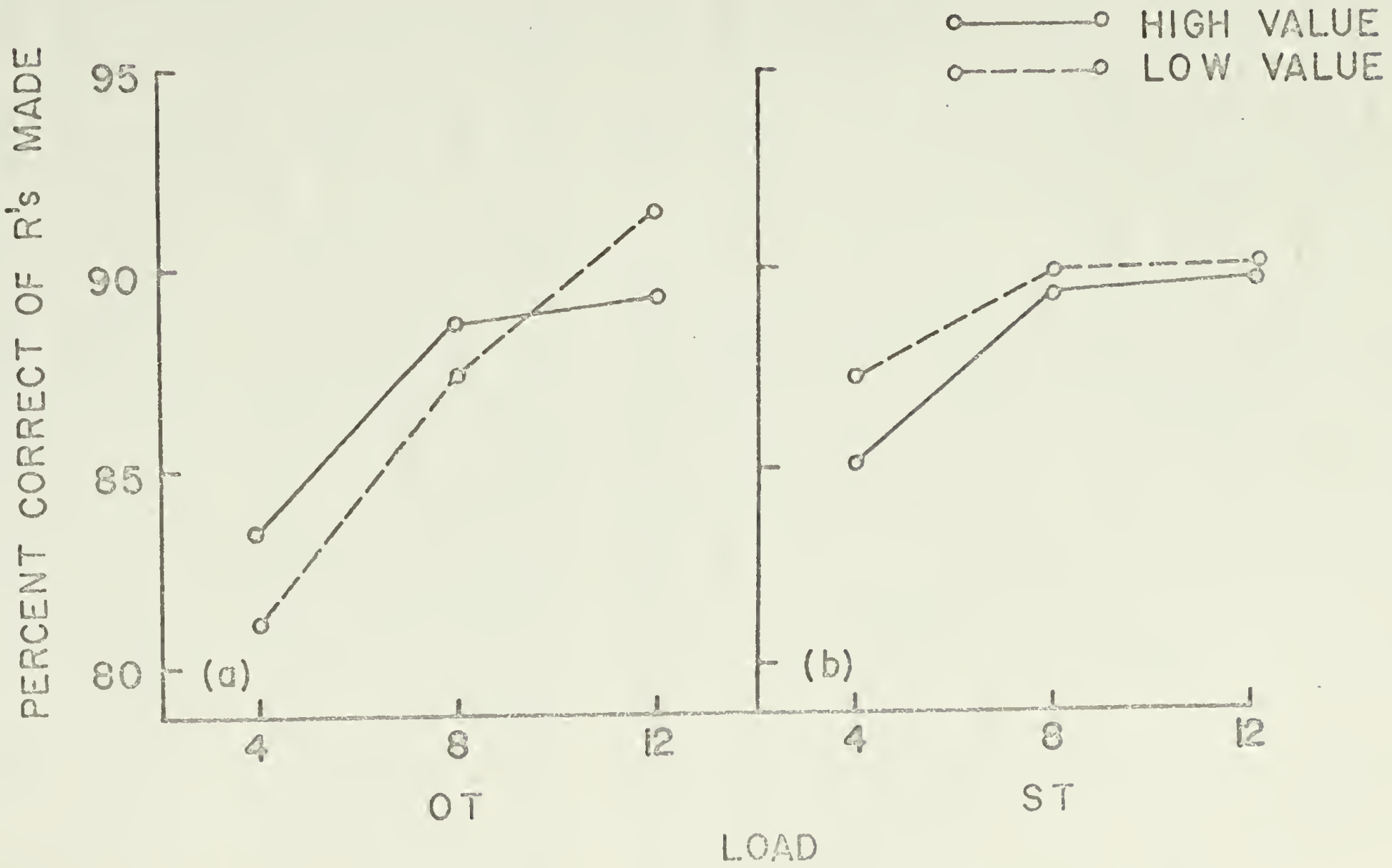

Fig. 4. Percentage correct of responses made during (a) OT and (b) ST with value as a parameter.

during (a) OT and (b) ST with value as a parameter. Percent correct responding increases as load increases in both sessions ($p < .001$), however, there is no value effect in either session. The latter result is important because it represents a reversal of trends in both the total reports data and past research. Taub (1965) and Teichner, Christ, and Fergenson (1965) have consistently shown a small value effect for their accuracy measures, i.e., a greater percentage correct of responses available for high valued targets and interpreted this as an indication of selective recall from short term memory. The present data indicate that Ss are trying to process information in a selective way (total reports), but may not be succeeding, at least when error rates are considered. It is important to note, however, that the high valued reports reflect a slightly higher error rate than the low valued reports.

The load x OT and load x ST interactions are plotted in figures 5(a) and 5(b) respectively. Both are significant at less than .05. Figure 5(a) shows that correct responding during ST is higher for the 4:1 and 8:1 OT groups than for the 2:1 OT group. This difference is greatest at load 4 where the 8:1 OT group is approximately 18% higher than the 2:1 OT group.

Figure 5(b) shows that percent correct responding during ST is grouped according to the ST value ratio with the 2:1 and 4:1 shift groups having a higher percentage correct than the 8:1 group. Shift performance at all loads deteriorates as the ST value ratio increases to 8:1 but this effect is most dramatic at load 4. In this case there

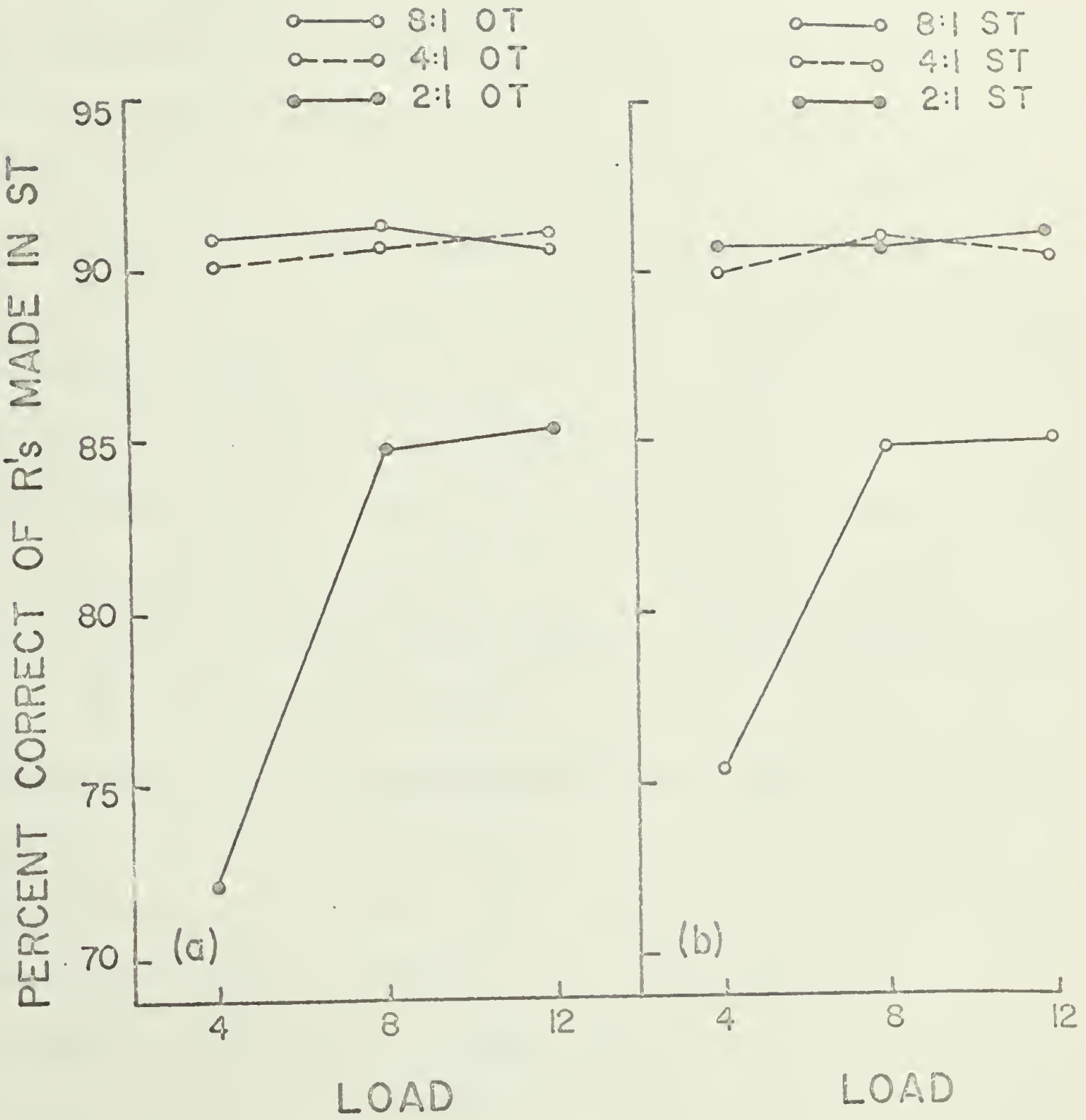

Fig. 5. Percentage correct of responses made in ST as a function of load with (a) OT and (b) ST as a parameter.

is a 15% difference in performance at 2:1 and 8:1.

Figure 6 is a plot of the percentage correct of responses made as a function of ST with OT as a parameter. Although this interaction is non-significant, the figure shows the performance of the control groups and the direction of the shift effects. The 4:1 control group has a higher percentage correct than the other control groups which show almost equal levels of accuracy. Percentage correct performance for the shift groups is clearly related to the magnitude and direction of the value ratio shift. An upshift produced a decrement in accuracy (increased error rate) and a downshift produced an increment in accuracy (decreased error rate) relative to the control groups. While the effects are greatest for the extreme shift conditions, similar trends are also present for the smaller shifts. Figure 6 also shows that the shift effects are not symmetrical; that is, an upshift produced a larger decrement in percent correct responding than the increment produced by the corresponding downshift.

Percentage Correct of Responses Available. Figure 7 shows the percentage correct of responses available as a function of value with training sessions as a parameter. The significant value effects during both sessions ($p < .05$) is evidence that a greater percentage of high valued targets were correctly reported. While there is an increase in percentage correct for both levels of value during ST, the increase is greater for low valued targets and results in a very slight reduction of the value effect in the shift sessions. Since this measure is sensitive to the absolute number of items correctly reported, it is

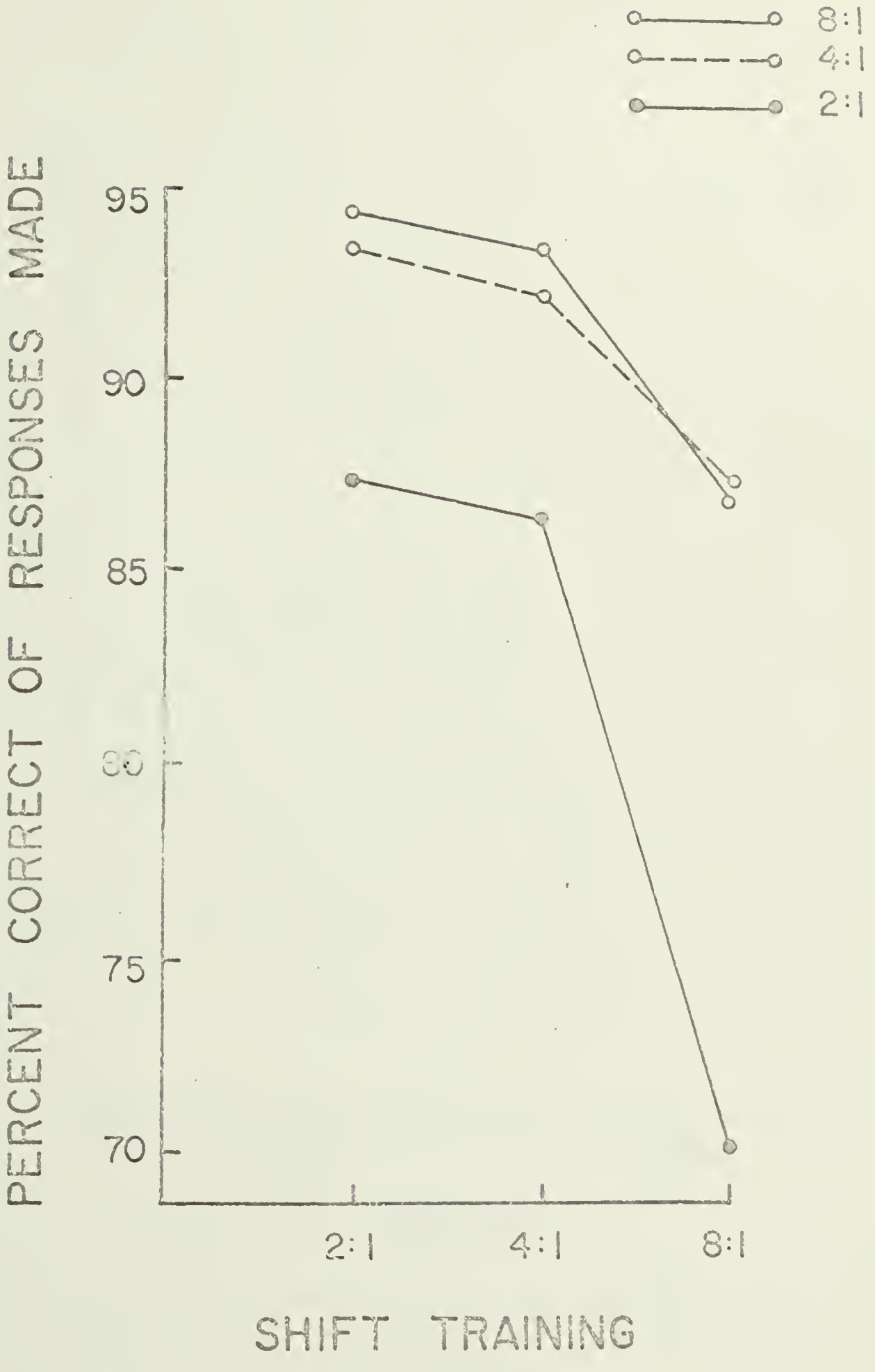

Fig. 6. Percentage correct of responses made as a function of ST with OT as a parameter.

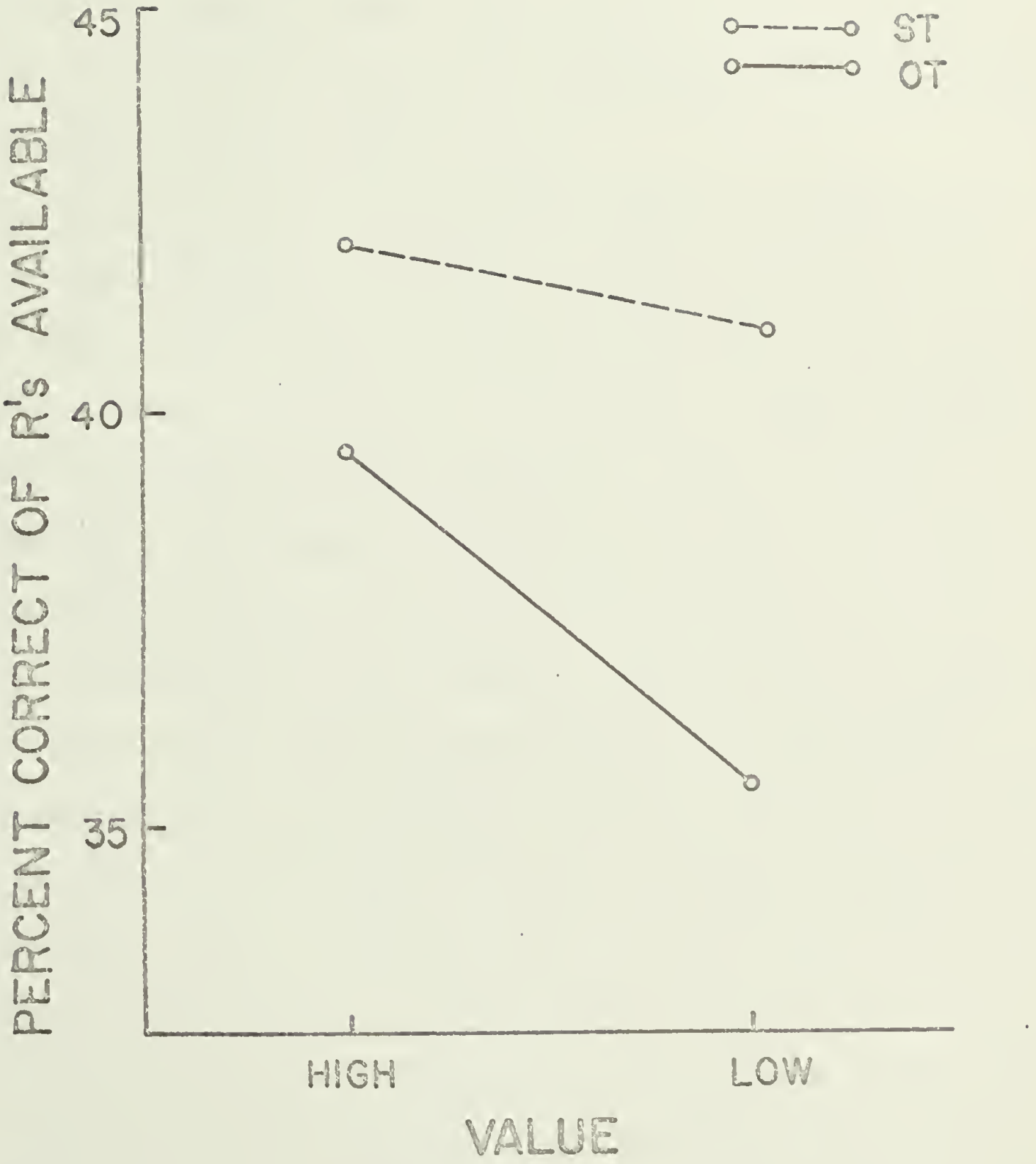

Fig. 7. Percentage correct of responses available as a function of value with training sessions as a parameter.

clear that Ss report a significantly greater number of correct high valued reports in both experimental sessions. This is particularly important in light of the value effect trends reported for the percentage correct of responses made. Taken together, these two measures indicate that both the rates of correct responding and error responding are greater for the high valued reports.

Figure 8 reveals that the percentage correct of responses available decreases as a function of load during both sessions ($p < .001$). This decrease can be accounted for by the differential gain in the number of targets reported; that is, the number of targets reported increases at a slower rate than the number of targets available.

The load x OT and load x ST interactions ($p < .05$) show trends which are very similar to those already described for the percentage correct of responses made data. Once again the effects are largely due to the extreme shift conditions and are most pronounced at load 4.

Number of Correct First Reports. Figure 9 is a plot of the number of correct reports as a function of blocks with value as a parameter. The significant blocks effect during OT ($p < .001$) did not reveal any consistent trends, however, the figure does display the significant value effects in each session ($p < .001$), i.e., a greater number of high valued first reports were correct. It is important to note that a significant percentage of first reports were not high valued (see percentage high valued first reports) so that Ss actually reported an average of 2.5 high and low valued responses for each load by trial block condition. Referring back to Figure 9 it is evident that

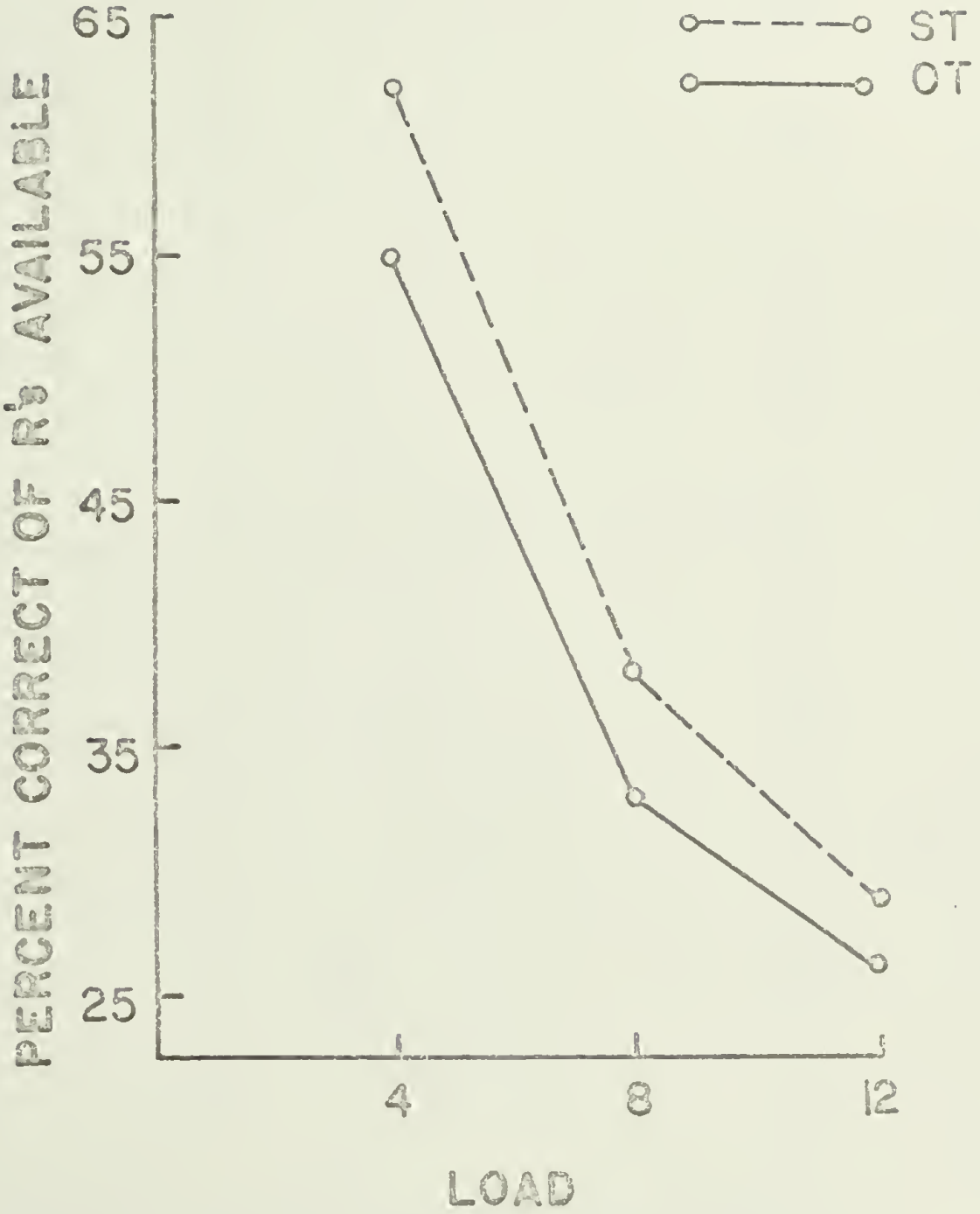

Fig. 8. Percentage correct of responses available as a function of load with training sessions as a parameter.

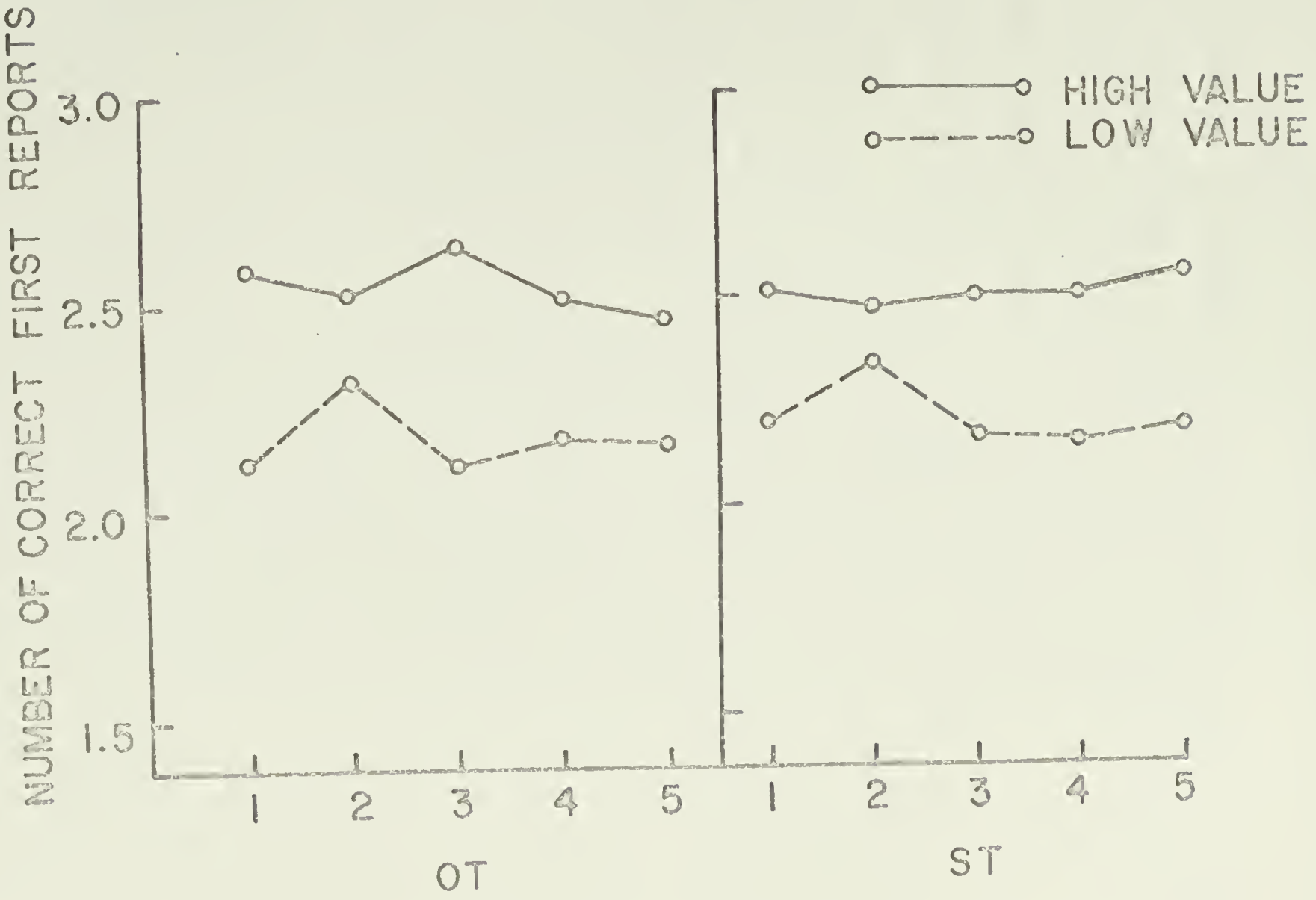

Fig. 9. Number of correct first reports as a function of blocks with value as a parameter.

accuracy for first reports was greater for the high valued targets even though the number of first reports was approximately the same for both sets of targets.

During OT, the number of correct initial reports is directly related to load ($p < .001$), but this manner of responding did not carry over into ST as no load effect is observed in that session. As was the case with previous accuracy measures, the load x ST interaction showed that accuracy decreased with a shift to 8:1 and the decrease was greatest for load 4. The 2:1/8:1 group performed at a much lower level than did any of the other experimental groups so that the shift effect is unidirectional rather than bidirectional as was the case with the other accuracy measures.

Discussion

The OT session of this experiment was essentially a replication of the Taub (1965) study. While the differential value effects that he reported were observed, the effects of value ratio were not in accord with his findings. The results more closely approximated those reported by Hearns (1966) who found accuracy to be highest at value ratio 4:1 when Ss were paid for the number of points accumulated.

The total response data indicate that Ss do adjust their response strategy as a function of the direction and extent of the value ratio shift. This was shown by the increase in responding with a large up-shift (2:1/8:1), and the decrease in responding with a large down-shift (8:1/2:1). In contrast to these effects, measures of accuracy were inversely related to value ratio during ST. Once again the extreme shift conditions were largely responsible. The accuracy effect due to shift is consistent with Taub's value ratio effect, but differs with his value x value ratio interaction. Using a between Ss design, Taub showed that accuracy was inversely related to value ratio due to a decrease in accuracy for the low valued targets at the higher value ratios. In the present experiment, accuracy decreased for both high and low valued reports when the shift was to a higher value ratio and increased for both types of reports when the shift was in the opposite direction.

The overall trends during ST support the notion that shifting to a higher value ratio leads to increased mutual interference of item processing in short term memory, which in turn, results in decreased

accuracy. This increased interference is due to the increased number of items that Ss attempt to process when shifted to the higher value ratios. Mutual interference decreases when the shift is to a lower value ratio due to the fewer number of items that Ss are processing and results in increased accuracy.

Although the mutual interference hypothesis does explain the overall shift effects, a modification of the assumptions is required to account for the marked effects at load 4. This modification takes the form of a guessing factor which assumes a higher rate of guessing at load 4 than at the other two load levels. To explain why there is more guessing at load 4, Ss response strategy must again be considered. At high shift value ratios, Ss are attempting to process large amounts of information. This is difficult at load 4 because of the small number of targets available and related search problems, i.e., Ss reported in the post-session questionaire that it was difficult to find targets at load 4. To compensate for this it seems likely that Ss resorted to sampling the information contained in the larger subsets (guessing) rather than extracting the information available on the screen. This resulted in poor performance because the probability of a correct guess at load 4 is small.

There is strong experimental evidence to support the guessing modification of the mutual interference hypothesis. For example, the percentage correct of responses made data indicate that there was a 40% difference in performance at load 4 for the extreme shift conditions. The 2:1/8:1 group is only 55% correct, whereas, the 8:1/2:1 group is 95% correct at load 4. This result shows that nearly half of

Ss responses under the extreme upshift condition are incorrect. Examination of the percent correct of responses available at this load shows the 2:1/8:1 group to be 45% correct whereas the opposite downshift produced a percentage of 64% correct. Considering the two accuracy measures together, it is clear that there were fewer correct reports and more errors for the upshift than for the corresponding downshift. These percentages indicate that Ss in the extreme upshift condition were responding at a high guessing level, whereas Ss in the extreme downshift condition were processing information with greater veridicality.

The shift effects at load 8 and 12 do not appear to be related to the guessing probabilities associated with these loads, i.e., the probability of a correct guess increasing as load increases. This is concluded because the shift effects, as seen by the increments and decrements in accuracy, were of equal magnitude at these loads. For example, the percentage correct of responses made show values of 77% and 76.3% for the extreme upshift conditions at loads 8 and 12 respectively. Similarly, the extreme downshift produced percentages of 94.3% and 93.7% for these same two loads. This finding is important because it indicates that the shift effects at these loads are not a function of the guessing probability, but are related to the processing of items in short term memory. The mutual interference hypothesis, then, accounts for the decrements and increments in accuracy noted at loads 8 and 12.

In summary, the data of the present experiment indicate that re-

sponse strategy and response accuracy do change when the values of the correct responses shift. The mutual interference hypothesis provides a description of the accuracy data, but Ss tendency to guess accounts for, at least, part of the decrement at the high shift levels. Until guessing can be controlled experimentally or handled statistically, the mutual interference hypothesis cannot be adequately tested.

Appendix A

Summary of the F Ratios

for the Analyses of Original Training Data

Table A-1

F Ratios and Error Terms for the Response Strategy Measures
(Original Training)

Source of Variance	df	1	2
Between Ss			
Original (O)	2	1.356	.853
Ss/O	69	(56.740)	(.258)
Within Ss			
Value (V)	1	5.749*	-
O x V	2	.228	-
V x Ss/O	69	(44.811)	-
Load (L)	2	196.276***	.278
L x O	4	1.887	.237
L x Ss/O	138	(3.379)	(.059)
Blocks (B)	4	35.395***	.686
B x O	8	.743	.518
B x Ss/O	276	(2.598)	(.110)
L x V	2	1.409	-
L x O x V	4	.317	-
L x V x Ss/O	138	(10.931)	-
B x V	4	1.151	-
B x O x V	8	.764	-
B x V x Ss/O	276	(9.335)	-
B x L	8	5.749***	.588
B x L x O	16	1.342	2.016*
B x L x Ss/O	552	(1.511)	(.056)
B x L x V	8	.660	-
B x L x O x V x Ss/O	552	(5.746)	-

* P is less than .05
** P is less than .01
*** P is less than .001

1-Total Reports
2-% High Valued First Reports

The values in parentheses are the appropriate error terms.

Table A-2

F Ratios and Error Terms for the Response Accuracy Measures
(Original Training)

Source of Variance	df	3	4	5
Between Ss				
Original (O)	2	.124	2.572	.523
Ss/O	69	(.057)	(.464)	(.344)
Within Ss				
Value (V)	1	5.358*	.338	13.467***
O x V	2	.060	.893	1.122
V x Ss/O	69	(.046)	(.310)	(5.418)
Load (L)	2	1297.056***	67.837***	7.206***
L x O	4	4.192	3.092	1.579
L x Ss/O	138	(.005)	(.040)	(.145)
Blocks (B)	4	8.770**	9.432***	4.914***
B x O	8	.510	.514	.373
B x Ss/O	276	(.004)	(.052)	(.174)
L x V	2	.628	5.053**	.530
L x O x V	4	.066	1.222	.121
L x V x Ss/O	138	(.010)	(.047)	(1.929)
B x V	4	1.143	1.546	.557
B x O x V	8	.515	1.360	.392
B x V x Ss/O	276	(.008)	(.053)	(3.388)
B x L	8	10.372***	8.995	4.096
B x L x O	16	1.154	.784	.748
B x L x Ss/O	552	(.003)	(.046)	(.135)
B x L x V	8	.783	1.094	.748
B x L x O x V	16	.545	.749	2.222**
B x L x V x Ss/O	552	(.005)	(.049)	(1.737)

* P is less than .05
** P is less than .01
*** P is less than .001

3-% Correct of Responses Available
4-% Correct of Responses Made
5-# Correct Firsts

The values in parentheses are the appropriate error terms.

Appendix B

Summary of the F Ratios

for the Analyses of Shift Training Data

Table B-1

F Ratios and Error Terms for the Response Strategy Measures
(Shift Training)

Source of Variance	df	1	2
Between Ss			
Shift (S)	2	3.861*	.891
Original (O)	2	3.132*	.050
S x O	4	.859	.233
Ss/S x O	63	(44.699)	(.217)
Within Ss			
Value (V)	1	18.894***	-
S x V	2	.781	-
O x V	2	.603	-
S x O x V	4	.578	-
V x Ss/S x O	63	(22.114)	-
Load (L)	2	183.062***	1.580
L x S	4	1.168	.656
L x O	4	1.354	1.563
L x S x O	8	.289	.477
L x Ss/S x O	126	(4.207)	(.142)
Blocks (B)	4	2.389*	.380
B x S	8	1.546	.417
B x O	8	1.019	.265
B x S x O	16	1.989	.911
B x Ss/S x O	252	(2.882)	(.141)
L x V	2	5.177*	-
L x S x V	4	.011	-
L x O x V	4	.275	-
L x S x O x V	8	2.040	-
L x V x Ss/ x O	126	(7.353)	-
B x V	4	.619	-
B x S x V	8	.525	-
B x O x V	8	1.255	-
B x S x O x V	16	.356	-
B x V x Ss/S x O	252	(10.462)	-
B x L	8	8.213***	.657
B x L x S	16	1.259	.724
B x L x O	16	2.469**	.684
B x L x S x O	32	1.084	1.044
B x L x Ss/S x O	504	(2.254)	(.110)
B x L x V	8	.901	-
B x L x S	16	.822	-

Table B-1 (continued)

F Ratios and Error Terms for the Response Strategy Measures
(Shift Training)

Source of Variance	df	1	2
B x L x O x V	16	.963	-
B x L x S x O	32	.745	-
B x L x V x Ss/S x O	504	7.606	-

* P is less than .05
** P is less than .01
*** P is less than .001

1-Total Reports
2-% of High Valued First Reports

The values in the parentheses are the appropriate error terms.

Table B-2

F Ratios and Error Terms for the Response Accuracy Measures
(Shift Training)

Source of Variance	df	3	4	5
Between Ss				
Shift (S)	2	1.848	9.462**	3.943*
Original (O)	2	4.536*	9.955**	4.220
S x O	4	.748	.563	3.614*
Ss/S x O	63	(55254.690)	(517948.524)	(1.957)
Within Ss				
Value (V)	1	5.127*	1.295	12.644***
S x V	2	1.026	.062	.691
O x V	2	.485	.242	.122
S x O x V	4	.409	1.864	.078
V x Ss/S x O	63	-	(106514.858)	(5.067)
Load (L)	2	507.436***	10.196**	1.314
L x S	4	3.187*	3.648**	3.409*
L x O	4	4.754*	6.214**	1.580
L x S x O	8	1.181	.563	1.480
L x Ss/S x O	126	(15809.629)	(71291.245)	(.379)
Blocks (B)	4	2.947*	1.074	.375
B x S	8	.759	.780	1.223
B x O	8	1.279	1.225	.477
B x S x O	16	1.796	1.496	1.061
B x Ss/S x O	252	(10458.008)	(72627.473)	(.363)
L x V	2	.083	.565	1.030
L x S x V	4	.548	1.285	.536
L x O x V	4	.476	1.922	.955
L x S x O x V	8	.545	2.279*	.154
L x V x Ss/S x O	126	(14851.371)	(58279.768)	(3.681)
B x V	4	.583	.788	.145
B x S x V	8	1.119	.770	.684
B x O x V	8	.557	2.463**	.403
B x S x O X V	16	.594	.831	.512
B x V x Ss/S x O	252	(14671.902)	(73257.727)	(3.431)
B x L	8	5.132*	1.693	1.364
B x L x S	16	1.326*	1.670	1.486
B x L x O	16	1.036	1.141	1.771
B x L x S x O	32	1.123	1.006	1.294
B x L x Ss/S x O	504	(9830.145)	(64015.169)	(.354)

Table B-2 (continued)

F Ratios and Error Terms for the Response Accuracy Measures
(Shift Training)

Source of Variance	df	3	4	5
B x L x V	8	2.134*	1.626	.518
B x L x S	16	.676	1.451	.444
B x L x O x V	16	.923	.611	.355
B x L x S x O	32	1.078	.763	.658
B x L x V X Ss/ S x O	504	(14170.311)	(70117.653)	(2.536)

* P is less than .05
** P is less than .01
*** P is less than .001

3-% of Correct Responses Available
4-% Correct of Responses Made
5-# of Correct First Reports

The values in the parentheses are the appropriate error terms.

Appendix C

Instructions for Original Training and Shift Training

Instructions

Original Training

This is an experiment in target detection. The targets are characters selected from the American-English alphabet. You will be presented 75 slides which have varying numbers of targets on them. Your job will be to report the characters on the answer sheets which have been provided. There is one line for each slide. Be careful not to write in the small blocks but only on the lines (illustrate).

The stimuli you are about to see are divided into two categories. The A-J letters of the alphabet make up one category and the Q-Z letters the other category. The letters KLMNOP are never used.

For two of you the A-J letters will be high valued and the Q-Z letters low valued; for the other two the Q-Z stimuli will be high valued and the A-J letters low valued.

Now read the cards which I have placed on your chairs. You will notice the alphabet halves are placed at the top of the card and you may refer to this during the experiment. The high valued targets are worth __ points. The low valued targets are worth __ points. Since each point is worth .5 cent, you will receive __ cents for every high valued target reported and __ cents for every low valued target reported. As you see the amount of money that you accumulate is dependent on how you respond in the experiment.

(Turn on projector) These instructions will become clearer as I point out the targets for each of you. (Point out the high and low characters for each group) Change slides. Now point out the highs and

lows again and illustrate the load difference.

We will now see 8 practice slides. Write down your responses on the sheets that have been provided. This will get you accustomed to the sequence of events in the experiment. You will hear a warning buzzer and immediately a slide will appear. The slide will be exposed for a short time and then you will be given 8 seconds to make your responses. The buzzer will again sound and this will start a new trial. Be sure to look at the screen just as soon as you hear the buzzer. After you have viewed the 8 slides I will be glad to answer any questions. Are there any questions?

Shift Training

You will now be shown 75 more slides. Again the alphabet has been divided into two categories. You will have the same category halves of high and low that you had before the break. (illustrate)

Now the high valued targets are worth __ points and the low valued targets __ points. Since each point is again worth .5 cent, you will receive __ cents for every high valued target reported and __ cents for every low valued target reported. Again you see that the amount of money that you accumulate is dependent on how you respond in the experiment. Are there any questions?

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