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AUTHOR Victor, Jack

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ABSTRACT

In this research project, the problems studied were as follows: (1) Are there differences in scanning patterns between preschool children who show Positional Response Sets (PRS) and normal adults? (2) Do the techniques utilized in "An Exploration of PRS in Disadvantaged children and a Technique for Reduction of Such Sets" change scanning patterns? and, (3) Do these techniques change PRS behavior as was shown in previous work? The subjects (40 preschool children from low-income areas of New York City) were shown a quadrant Chinese letter array, and eye movement patterns were monitored by an Eye Movement Recorder. Subjects were then given training in a technique designed to encourage scanning through entire arrays. Following training, subjects were again recorded as to eye movement patterns and retested on the Chinese Letter Naming Task. In terms of directly changing scanning behavior, evidence of the ficacy of the training procedure is absent. Whether or not training edures similar to the one used here can produce changes in nning remains to be seen. [Final report, December 1969, which included in this document, is substantially the same as documen 039 268, except for appended illustrative material.] (Author/JW)

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The Role of Scanning in Positional Response Sets in Disadvantaged Children

Institute for Developmental Studies
School of Education
New York University

Director: Martin Deutsch, Ph. D.

Principal Investigator: Jack Victor, Ph.D.

ABSTRACT

Victor (1969) showed that Positional Response Sets (PRS) in multiple-choice type tasks occurs frequently among preschool disadvantaged children, but that this tendency was modified through a brief training procedure. The effect of training also transferred to a situation using the same array arrangements, but different stimuli. While it does appear that the techniques have an effect on positional response sets, it is possible that effects are stronger than those measured. Since positional response sets may or may not be indicative of inadequate scanning behavior, analysis of eye movement behavior can tell us whether or not scanning is changed by use of the training techniques previously developed.

The problems with which this project is concerned are as follows:

1) Are there differences in scanning patterns between preschool children who show PRS and normal adults?

2) Do the techniques utilized in "An Exploration of Positional Response Sets in Disadvantaged Children and a Technique for Reduction of Such Sets" change scanning patterns?

3) Do these techniques chanfe PRS behavior as was shown in the previous year's work?

Forty children of preschool age obtained from Day Care Centers in low income areas of New York City were chosen from a larger sample of children who were tested with the Chinese Letter Naming Task. This task is an unsoluable, multiple choice test and criterion for selection was the presence of PRS as determined by chi-square analysis.

These subjects were then shown a quadrant chinese letter array and eye movement patterns were monitored by an Eye Movement Recorder. Subjects were then given training in a technique designed to encourage scanning through entire arrays. Following training subjects were again recorded as to eye movement patterns and retested on the Chinese Letter Naming Task.

This reserach has supported the findings of the previous year in regard to the efficacy of special training procedures in eliminating PRS in low SES preschool children. While the pattern of positional choices was different in this sample than for the previous year's sample, training worked as well if not better. Although the experimental treatment had an effect on both the deviation score and the number of PRS subjects, the group pattern remained non random even thought some pattern change was apparent. The group pattern, however, cannot be considered seriously unless a much larger sampling was taken. In this regard it is obvious that there are many individual differences in the particular pattern of preferences and avoidances.

In terms of directly hanging scanning behavior, evidence of the efficacy of the training procedure is absent. Few preschool children ever showed the correct scanning sequence, even at post test time. One reason which might partially account for the failure to improve scanning may be the dissimilarity between the training condition and the test condition.

Whether or not training preocedures similar to the one used here can produce changes in scanning remains to be seen. Too many variables intervened in our experience. Being able to record children of this age at all was a severe problem, and we are not at all confident that what information we do have is accurate. This uncertainity must exist because of the sensitivity of the instrument, the difficulty of achieving proper alignment, and the great loss of accuracy caused by even the slightest postural changes in the subject

BRIEF DESCRIPTION OF PROJECT

It is generally assumed that when a group of respondents have no information concerning a set of multiple choice questions, there is an equal probability that any of the "k" choices will be selected.

Many test constructors and evaluators, therefore, institute a correction for "guessing" formula under the assumption that in any test, several items may be checked correctly by mere chance. Given "n" items and "k" choices for each of the "n" items, the number of correct guesses expected by chance is readily obtainable and may be taken into consideration in correcting the score for each respondent, from the total number of correct responses.

There has been a great deal of literature in psychology and education dealing with "response sets"--tendencies among individuals or groups to select certain types of responses so that if the choices were presented in some other form, a different response would have been selected.

However, much of this research concerns response sets for judgment categories in scaling problems, and little attention has been given to response sets in multiple-choice situations. Indeed Cronbach (1946) claimed that the multiple-choice pattern is free from response sets.

A type of response set to which multiple-choice type items would be prone and that has been relatively ignored is positional response sets. While such response sets may not play a strong role in testing adults, we have found strong positional response set tendencies, over a variety of tests which we have been constructing (Early Childhood Inventories), in pre-school aged children.

Such tendencies must play a strong role in the scoring and interpretation of tests for young children. This problem is most acute when tests are to be used diagnostically. If a teacher is interested in which colors a child does and does not know on a receptive level, the child is typically presented with arrays of size k and is asked to choose the color which the tester names. If positional response sets play a role, then those items whose correct choice is in a favored position will have a greater probability of being chosen than those items where the correct choice is in a less favorable position. Under such conditions, therefore, the question of which colors the child knows receptively cannot be adequately answered.

A child showing such positional response sets is very likely to be displaying a lack of adequate scanning behavior. Evidence to support this view is given : the finding that response sets tend to occur in the first position in young children. This finding suggests that their scanning is only partial and may be a function of lack of searching for the correct response. If children are given special experience in successful scanning, it may be possible to reduce the positional sets, thus providing truer measures of the child's ability.

In the previous year's work, "An Exploration of Positional Response Sets in Disadvantgaed Children and a Technique for Reduction of Such Sets," evidence was obtained which indicated that methods designed to encourage scanning significant affected group performance. While such training did have an overall effect in reducing the magnitude of positional response set behavior (PRS), the appearance of a response set itself may not always indicate a lack of adequate scanning. PRS could also be accounted for by a second factor which we term motor persistance. This behavior might be especially manifested in situations where the subject has little knowledge regarding the test items. The resultant behavior may be merely a decision by the subject to limit his responses to particular positions.

On the other hand, nondetection of positional response sets in some subjects may not be indicative that adequate scanning is taking place. A subject may decide to choose a different position on each item but choose theposition with disregard to the other items. This behavior would be similar to closing ones eyes and "pinning the tail on the donkey."

The crucial question then, is whether the scanning training has changed the subjects <u>scanning</u> behavior when presented with the test arrays. Subjects who show only "motoric" positional response sets are not a problems since they already are scanning adequately and if presented with a soluble problem or one in which they have knowledge they would most likely respond appropriately. On the other hand, subjects who show no positional response set on the pretest may really have poor scanning ability which was improved by the training but not picked up by analyzing their positional response behavior. What we are suggesting is that the training may have been even more effective than the results of the study will indicate, positive as they seem. More subjects than were detected may have shown improvement in scanning due to training and subjects with response sets who indicated no improvement may not have had any problem to begin with. To investigate this problem a more direct measure of scanning is called for.

The problems with which this project is concerned are as follows:

1) Are there differences in scanning patterns between preschool children who show PRS and normal adults?

2) Do the techniques utilized in "An Exploration of Positional Response Sets in Disadvantaged Children and a Technique for Reduction of Such Sets" change scanning patterns?

3) Do these techniques change PRS behavior as was shown in the previous year's work?

METHODOLOGY

Subjects

The subjects consisted of forty children of preschool age obtained from Day Care Centers in low income areas of New York City. The children were selected from a larger group of children who were administered the Chinese Letter Naming Task. The criterion for inclusion was a significant X^2 indicative of the presence of PRS and a willingness by a child and parent to takepart in further experimentation. Subjects who showed a great deal of restlessness were also eliminated from the sample as adequate recording of eye movements was impossible. The original design had called for 30 males and 30 females, 15 E and 15 C of each sex. Because of some of the reasons mentioned above and some further complications (e.g., overexposed and underexposed film, failure to participate in post test), only 14 females (6 E and 8 C) and 26 males (14 E and 12 C) constituted the final sample. Almost all of the children were of Puerto Rican background and all were of low SES.

Materials and Procedures

Pretest

All subjects were given a 32 item, four choice Chinese Letter Naming Task.[1] The four choices were arranged in quadrants, and were presented to S individually by E in a booklet. The children were asked to look at the four choices and select the one which they thought was the "real" Chinese letter.[2]

Subjects who showed PRS were then individually taken to the laboratory within one to two weeks after the Chinese Letter Naming Task was administered. Subjects were seated before the Eye Movement Recorder V-1164, amnufactured by the Polymetric Company. He sat, head fixed on a bite plate, teeth planted in dental wax. The subject looked through a lens tube at a field shown on a target card (a diagram is included in the appendix).

The subject first fixated on the nose of a clown in order to correctly allign the apparatus. Following the clown, the subject was shown a four choice Chinese letter array similar to those in the Chinese Letter Naming Task. We had originally intended to use two such arrays and two other linear arrays. However, it was difficult for such young subjects to maintain adequate posture for more than a brief period of time. Hence, only one array, a quadrant, was exposed for 15 seconds. Following the presentation of the critical

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1 Half of the letters were chosen from pilot testing which indicated that subjects from the same background as those used in the experiment neither favored nor avoided those particular letters. (Victor, 1968). The remaining letters consisted of the chosen letters turned upside down.

2 It was necessary to utilize an insoluble task because we were interested a pure guessing pattern.

stimulus, the clown was again presented to determine what drift had occurred. Where drift was severe the subject was eliminated. While the critical stimulus was shown, a Beaulieu 16MM movie camera recorded the subject's eye movements as reflected through a mirror onto the target at a speed of eight frames per second.

Training

Experimental:

Experimental subjects were shown four choice arrays of 16 sets of pictures and symbols. Twelve of these were readily identifiable and easy to discriminate for the age group involved. The remaining four were difficult for the age group in order to produce a few errors and make a second trial logical. In trial one, subjects were shown the pictures exposed through a sliding window, containing four openings, which E slid across the page in the linear array, exposing one picture, then two, then three and then all four in a left-right sequence. For the quadrant array, two sliding windows were used, each having two openings. They were placed across the quadrant arrays, one above and parallel to the other. First, the top left window was exposed by E and then the top right. Finally, the bottom windows were exposed to show the remaining two pictures. Hence, both exposure sequences resembled adult reading patterns (left to right, or top left to right and then bottom left to right). E also instructed S in both procedures to look at all of the pictures before choosing one.

Control:

Control subjects were shown single pictures and asked to name them. The single pictures were the critical items from the experimental training procedure. Again two trials were used.

Post Test

Immediately following the training session, a post test of the original Chinese Letter Naming Task was administered to both E and C subjects. Immediately following the post test the subject was again seated at the Eye Movement Recorder and photographed under the same conditions as in the pretest.

FINDINGS

Table 1 shows the distribution of choices among the four positions for each subject on the pretest and post test of the Chinese Letter Naming Task. The table also shows the deviation score which is obtained by the following formula: (O-E), where O equals the obtained frequency of responses for any position and E equals the expected frequency of responses for any position. Since there were always four positions and 32 test items, E was always equal to 8. The use of these deviation scores enable us to express the amount of PRS quantitatively.

At post test 14 E subjects and only 7C subjects improved to performance showing no significant deviation from random guessing. While these results indicate support from the previous year's finding, the percentage of children who improved to nonsignificant X^2 levels was greater here. However, in the current population, only children who showedPRS on the pretest were used. From the control group data it can be seen that with such a population some scores will improve with no specific training. The E group, however, showed twice as many changes to non-significant patterns.

Table 2 shows the X^2 number and percent responses per position for E and C subjects on the pretest and post test. The X^2 for the pretest group results was significant for the E group ($X^2 = 29.44$; p .001), the C group ($X^2 = 42.24$; p .001) and of course for the E and C group combined ($X^2 = 67.94$; p .001). It can be seen from the distribution that subjects tended to prefer the top left position (35%). This finding is in contrast to the finding of the previous year's study in which the top left position was chosen less frequently than any of the other positions. The lower left position, which was the most popular choice in the previous study (Victor, 1970) was chosen approximately as often as the lower right position. Following training, a shift in behavior occurred for the E group whereby the top left position was no longer favored as much (30%) and in which there was a reduction in choices for the bottom right position. X^2 was significant (X^2 = 13.35; p .01), but less so than at pre-test. The C group actually showed a greater disparity in choices by position than on the pretest (X^2 = 65.89; p .001). The preponderance of choices in the top left position remained, but there was a great reduction in the number of choices of the bottom right position and a considerable increase in choices of the upper right position than was found on the pretest.

Table 3 shows the Means and Standard Deviations of the deviation scores for the pretest and post test. The E and C groups are not equal in regard to pretest deviation score means. The E group shows more extreme PRS behavior than does the C group. Nevertheless, at post test, the C group evidences virtually no change from pretest level while the E group improves to such an extent that the difference between it and the C group is as great at post test in the direction of the E group as was twice in the pretest where the direction indicated better C group performance.

Table 4 shows the analysis of covariance of the post test scores with pretest scores as the covariate. The F does not reach significance. A likely critical factor was the great variance of the groups as seen in Table 3. In fact, the standard deviation of the E post test was nearly as large as the mean. Another way to look at the efficacy of the training procedure is to examine the number of subjects in each treatment group who showed positive and negative or no change from pre to post test in terms of deviation score. As seen in Table 5, 15 of the 20 subjects showed improvement while only 9 of the 20 subjects evidenced reduced deviation socres. A X^2 test for two independent samples, however, indicated that X^2 was slightly below the necessary significane level ($X^2 = 2.60$).

The results of the scanning part of our study are shown in Table 6. Indicated here is whether or not the correct sequence namely top left to top right to bottom left to bottom right was evidenced in the film records of the subjects. We felt that only this gross measure could be utilized to tell us much about scanning performance. Time per position was not considered an altogether useful measure because subjects might select out after a brief scanning some of the choices for consideration. Rememberthe subject's task was to choose one of the four. We felt then that whether or not the correct sequence appeared would give us enough information regarding the efficacy of the training for scanning behavior. Only the first 10 seconds (or 80 frames) were analyzed. From Table 6 it is apparent that most adults do tend to use the correct sequence during the course of their scanning. There were two exceptions among the adults. One subject tended to scan in a box like fashion. The other subject showed no particular pattern, but avoided the bottom left position until over 5 seconds had elapsed. In contrast to the adult pattern, only 2E and 2C subjects showed correct sequence scanning on pretest. On the post test 5E's and 3C's showed the correct sequence.

CONCLUSIONS

This research has supported the findings of the previous year in regard to the efficacy of special training procedures in eliminating PRS in low SES preschool children. While the pattern of positional choices was different in this sample than for the previous year's sample, training worked as well if not better. Although the experimental treatment had an effect on both the deviation score and the number of PRS subjects, the group pattern remained non random even though some pattern change was apparent. The group pattern, however, cannot be considered seriously unless a much larger sampling was taken. In this regard it is obvious that there are many individual differences in the particular pattern of preferences and avoidances.

In terms of directly changing scanning behavior, evidence of the efficacy of the training procedure is absent. Few preschool children ever showed the correct scanning sequence, even at post test time. One reason which might partially account for the failure to improve scanning may be the dissimilarity between the training condition and the test condition. In pilot testing during the previous year's work, it was found that training where a box with sliding windows was used instead of using the sliding windows directly on the booklets produced little effect. The novelty of the box in the former case and the Eye Movement Recorder in the present case may have detracted from the learning, although the box in the previous study was a training procedure and the Eye Movement Recorder is a test procedure, the same principle may have been operating. If the training procedure could have been arranged in a setting more similar to the eye movement recording procedures, more success might have been obtained. Whether or not training procedures similar to the one used here can produce changes in scanning remains to be seen. Too many variables intervened in our experience. Being able to record children of this age at all was a severe problem, and we are not at all confident that what information we do have is accurate. This uncertainity must exist because of the sensitivity of the instrument, the difficulty of achieving proper alignment, and the great loss of accuracy caused by even the slightest postural changes in the subject.

We have discovered a technique which does improve PRS. At this time, however, it is not possible to ascertain why. If the procedure does not work through the improvement of scanning, then perhaps it works through the information given to the child that the correct choice can occur in more than one position. If so, an experiment could be set up which would give the subject this information, but would involve minimal scanning training. At any rate, training children effectively to scan in the proper sequence would probably involve a much greater degree of training than the 10 minute procedure undertaken here.

RECOMMENDATIONS

1. Further research should be undertaken in respect to the following related problems:

a) To determine the generality of the findings regarding the degree and pattern of positional response set behavior with children of other background and SES characteristics.

b) To determine whether PRS behavior is a function of scanning. PRS Ss should be examined as to eye movement patterns in relation to eye movement patterns of good scanners.

c) To develop methods to produce more extensive changes in test-related scanning skills.

d) To determine the extent and pattern of positional response sets with other array arrangements and sizes.

e) To determine whether mere awareness that the correct answer can occur in any of the four positions can significantly change PRS.

f) Whether PRS is related to performance on language or pre reading skills which have a visual component.

2. The results of our investigation imply that positional sets are very common among low SES, preschool age children. Since this behavior may reflect the lack of adequate scanning by these children, these findings have important implication for preschool programs, especially in reference to prereading skills and test taking skills. It is possible that low scores on tests by these children, when such tests involve multiple choices, may reflect not so much a cognitive

deficit, but, rather, an inadequate registration of the choices offered. If a child is not adequately registering information appearing on a page, then reading cannot take place. Perception must precede cognition.

3. Given the problem outlined above, remedial steps can be taken and should be incorporated into preschool curricula. A step in this direction could be more extensive use or some adaptation of the training methods utilized in the current study. The method has the advantage of training the children to look at all of the choices in a manner which reinforces the correct scanning patterns for reading in the English language, that is, from left to right. It should be pointed out that our training did not produce a strong enough change insofar as changes in number of PRS Ss. However, distributed practice over a longer period of time could produce the desired change. After all, our training period entailed only one, ten minute session.

4. Test users and cosntructors should be aware of PRS. One technique used by this investigator in the Early Childhood Inventories (Coller and Victor, 1967), is to utilize a second form of a test in which the same choices are given, but their positions changed. If a child is correct on both, we can be reasonably sure that the answer is known. This procedure is desirable for diagnostic testing. Other procedures might utilize some instructional procedures to emphasize to the children the need for looking at all choices. A sliding window technique, for example, could be used for sample items prior to the test.

5. If the investigator is interested in eye movement locations (as we were), rather than such other variables as fixations, regressions, etc., the Eye Movement Recorder is far from an ideal means of obtaining such data from children of this age and SES level. Perhaps a more direct method of registering corneal movement would be more desireable. However, there could be a problem creating discomfort by such a procedure in children this young. In any event, it is difficult to expect that parents of children from our population would allow their children to undergo such procedures.

TABLE 1

Distribution of Choices, E and C Subjects, Pretest and Posttest

Experimental

Subject	Pretest A	Pretest B	Pretest C	Pretest D	Pretest Deviation Score	Posttest A	Posttest B	Posttest C	Posttest D	Posttest Deviation Score
1	4	4	11	13	16	7	8	10	7	4
2	0	0	32	0	48	32	0	0	0	48
3	32	0	0	0	48	32	0	0	0	48
4	14	10	4	4	16	10	7	5	10	8
5	6	18	0	8	20	9	11	6	6	8
6	16	16	0	0	32	7	9	5	11	8
7	18	4	6	4	20	11	11	5	5	12
8	14	1	10	7	16	5	17	3	7	18
9	10	15	7	0	18	7	10	7	8	4
10	16	8	8	0	16	7	9	6	10	6
11	21	3	3	5	24	11	7	6	8	6
12	15	5	2	10	18	9	6	7	10	6
13	4	3	12	13	18	0	0	32	0	48
14	0	32	0	0	48	3	8	10	11	10
15	3	7	15	7	14	8	6	11	7	6
16	16	7	5	4	16	7	5	12	8	8
17	7	14	9	2	14	3	14	10	5	16
18	0	0	0	32	48	6	5	11	10	10
19	0	2	27	3	38	6	19	3	5	21
20	17	7	3	5	18	15	7	8	2	14

Quadrant Position: A, B, C, D

Control

Subject	Pretest A	Pretest B	Pretest C	Pretest D	Pretest Deviation Score	Posttest A	Posttest B	Posttest C	Posttest D	Posttest Deviation Score
1	22	6	0	4	28	7	8	8	9	2
2	15	6	7	4	14	8	5	2	17	18
3	14	13	3	2	22	14	10	4	4	16
4	23	2	7	0	30	30	0	2	0	44
5	15	11	3	3	20	11	15	3	3	20
6	22	5	3	2	28	24	3	3	2	28
7	0	6	21	5	26	1	5	22	4	26
8	10	3	6	13	14	16	8	3	5	16
9	4	11	5	12	14	4	10	8	10	8
10	7	20	5	0	16	0	32	0	0	48
11	4	14	2	12	20	9	11	6	6	8
12	11	4	13	4	16	10	8	11	3	10
13	32	0	0	0	48	32	0	0	0	48
14	15	6	6	5	14	17	8	5	2	18
15	13	3	6	10	14	16	8	3	5	16
16	11	2	13	6	16	1	1	28	2	40
17	4	13	5	10	14	14	10	4	4	16
18	3	4	13	12	18	9	12	6	5	10
19	2	4	13	13	20	5	10	8	9	6
20	4	0	10	18	24	7	10	9	6	6

TABLE 2

x^2, Number and Percent Responses per Position for E and C Subjects on Pretest and Posttest

	Position A	Position B	Position C	Position D	x^2	
etest:						
E	213 (33%)	117 (18%)	154 (24%)	156 (24%)	29.44	**
C	231 (36%)	133 (21%)	141 (22%)	135 (21%)	42.24	**
l S's	444 (3[illegible])	250 (19%)	295 (23%)	291 (23%)	67.94	**
sttest:						
E	195 (30%)	159 (25%)	157 (25%)	130 (20%)	13.35	*
C	235 (37%)	174 (27%)	135 (21%)	96 (15%)	65.89	**
l S's	430 (33%)	333 (26%)	292 (23%)	226 (18%)	68.40	**

* $p < .01 = 11.34$
** $p < .001 = 16.27$

TABLE 3

Means and Standard Deviations of Deviation Scores by Treatment and Test Period (N = 20)

	Pretest		Posttest	
	$\overline{X}$	S.D.	$\overline{X}$	S.D.
E	25.3	13.03	15.4	14.75
C	20.8	8.34	20.2	14.36

TABLE 4

Analysis of Covariance for Deviation Scores of E vs. C Subjects

Source	SS	df	MS	F
Total	7072.36	38		
Error	6558.40	37	177.25	
Treatments	513.96	1	513.96	2.90

$F = 4.08$, $p < .05$

TABLE 5

Distribution of E and C Subjects Who Showed
Pre-Post Improvement (+), Loss (-) or No Change (0)

	+	-	0
E	15	3	2
C	9	7	4

$x^2 = 2.60$

$x^2 = 2.71$, $p < .01$ (one-tailed)

TABLE 6

Appearance (+) or Absense (-) of Correct Sequence of Movements on Eye Movement Recorder

	+		-		
Adults (n = 10)	8		2		
Children (n=20)	Pretest			Posttest	
	+		-	+	-
E	2		18	5	15
C	2		18	3	17

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APPENDIX

OEO Contract No. B89-4612 (B)

Final Report, December, 1969

An Exploration of Positional Response Sets in Disadvantaged Children and a Technique for Reduction of Such Sets

Institute for Developmental Studies
School of Education
New York University
Director: Martin Deutsch, Ph.D.

Principal Investigator: Jack Victor, Ph.D.

ABSTRACT

Positional response sets (PRS), to which multiple-choice type items are prone, have been relatively ignored in test construction and interpretation. There is evidence indicating that children have strong PRS tendencies, though such sets may not play a strong role among adults. Evidence further suggests that PRS may indicate a lack of adequate scanning behavior.

The problems with which this study is concerned are as follows:

(1) Given two commonly used four-choice array arrangements administered to disadvantaged children, what are the positional response patterns for each of the arrays, when information is not available to the respondent?

(2) Do age and sex variables affect positional response tendencies in disadvantaged children?

(3) Can techniques be devised which can reduce the strength of the response sets?

One hundred twenty-eight Ss of preschool age and of low SES background were tested by means of an unsolvable multiple choice test, the Chinese Letter Naming Task. E subjects were given training in a technique designed to encourage scanning through entire arrays. E and C Ss were then retested either following training or, as in the case of the C group, following an interpolated task. Ss were then given a second "unsolvable" multiple choice task, that of recognizing flags of different nations.

The main results are: (1) positional response set behavior occurs with great frequency among preschool, disadvantaged children, and this behavior is subject to modification by training; (2) characteristic group patterns emerge when scores are combined; (3) sex of S seems to have some effect on the patterns obtained; (4) age seems to strongly influence the probability of occurence of PRS Ss; (5) utilization of a procedure in which Ss are given training in scanning arrays similar to the test arrays, resulted in significant alteration of guessing patterns in relation to the patterns of groups not similarly trained; and (6) the effect of the training procedures on choice patterns on the Chinese Letter Naming Task transfered to the situation utilizing the same array arrangements, but different stimuli (flags).

The facts that PRS occurs frequently among low SES, preschool children and that PRS may be caused by inadequate perusal of the stimulus field (thereby leading to a lack of registration of all the choices), have important implications for preschool programs,

especially in reference to prereading and test-taking skills. It is possible that low scores by these children on tests involving multiple choice may reflect not so much a cognitive deficit, but, rather, an inadequate registration of the choices offered. If a child is not adequately registering information appearing on a page, reading cannot take place--perception must precede cognition. Given the problem outlined above, remedial steps can be taken and should be incorporated into preschool curricula.

BRIEF DESCRIPTION OF PROJECT

It is generally assumed that, when a group of respondents have no information concerning a set of multiple-choice questions, there is an equal probability that any of the "k" choices will be selected. Many test constructors and evaluators, therefore, institute a correction for "guessing" formula under the assumption that, in any test, several items may be checked correctly by mere chance. Given "n" items and "k" choices for each of the "n" items, the number of correct guesses expected by chance is readily obtainable and may be taken into consideration in correcting the score for each respondent from the total number of correct responses.

There has been a great deal of literature in psychology and education dealing with "response sets"--tendencies among individuals or groups to select certain types of responses so that, if the choices were presented in some other form, a different response would have been selected.

However, much of this research concerns response sets for judgment categories in scaling problems, and little attention has been given to response sets in multiple-choice situations. Indeed, Cronbach (1946) claimed that the multiple-choice pattern is free from response sets.

A type of response set to which multiple-choice type items would be prone and that has been relatively ignored is positional response sets. While such response sets may not play a strong role in testing adults, we have found strong positional response set tendencies over a variety of tests which we have been constructing, Early Childhood Inventories (ECI), for children of preschool age.

Such tendencies must play a strong role in the scoring and interpretation of tests for young children. This problem is most acute when tests are to be used diagnostically. If a teacher is interested in which colors a child does and does not know on a receptive level, the child is typically presented with arrays of size "k" and is asked to choose the color which the tester names. If positional response sets play a role, then those items whose correct choice is in a favored position will have a greater probability of being chosen than those items where the correct choice is in a less favorable position. Under such conditions, therefore, the question of which colors the child knows receptively cannot be adequately answered.

A child showing such positional response sets is very likely to be displaying a lack of adequate scanning behavior. Evidence to support this view is given in the finding that, on ECI protocols, response sets tend to occur often in young children. This finding suggests that their scanning is only partial and may be a function of lack of searching for the correct response. If children are given special experience in successful scanning, it may be possible to reduce the positional sets, thus providing truer measures of the child's ability.

The problems with which this project is concerned are as follows:

(1) Given two commonly used four-choice array arrangements administered to disadvantaged children, what are the positional

response set patterns for each of the arrays, when information is not available to the respondent?

(2) Do age and sex variables affect positional response tendencies in disadvantaged children?

(3) Can techniques be devised which can reduce the strength of the response sets?

By determining the positional response set behavior of young children, test constructors will be in a position to construct more valid instruments or test procedures (e.g., most of the Early Childhood Inventories consist of two similar forms, both of which are administered to young children who are prone to positional response set behavior). A technique which can be used to reduce response sets by creating appropriate scanning behavior would result in more valid data. This, in turn, would enable educators to more effectively diagnose the child's ability and plan remedial curricula.

It is suggested here that positional response sets may be caused by inadequate perusal of the stimulus field, thereby leading to a lack of registration of all the choices. The technique utilized here combines three types of instructional aids:

(1) verbally telling the subject to look at all positions;

(2) guiding the child to look at the arrays in a consistent and systematic manner and in such a way to be consonant with the development of appropriate English language reading skills (left to right, or left to right and then down to the next line and left to right);

(3) through the training series, showing the child that a correct answer can occur in more than one position.

METHODOLOGY

Subjects

One hundred twenty-eight subjects were utilized. Sixty-four of these subjects served as subjects in the linear array condition and the other 64 served as subjects in the quadrant condition. Half of the linear and half of the quadrant subjects were given the experimental treatment. The remaining subjects acted as controls. Half of the experimental subjects in each array condition were male, as were half of the control subjects in each array condition. The children ranged in age from 4-6 years.[1] All subjects were of low SES.

Materials and Procedure

Pretest

All subjects were exposed to 24 four-choice Chinese Letter Naming Task items.[2] For the linear array, the letters were arranged, each choice in a box, with the choices appearing in a left-right linear arrangement. For the quadrant array Ss, the four choices were arranged, also each in a box, but in a quadrant arrangement (each box appearing toward one of the four corners of the page). The letters were drawn on wallboard with magic marker. All the

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1 Since birth dates of the Ss were difficult to obtain beforehand, age groupings were determined later. For the linear array Ss, 17 Es were in the younger age group and 15 in the older group. Half the linear Cs were in the older group and half in the younger group. For the quadrant arrays 14, Es belonged to the older group and only 11 Cs; while 18 Es and 21 Cs were in the younger age group.

2 Thirty-two of the letters were chosen from pilot-testing which indicated that Ss, from the same background as those used in the experiment, neither favored nor avoided those particular letters (...ctor, 1968). The remaining letters consisted of some of the 32 ...ters placed upside down.

boxes were equal in size, and the size of the letters were also approximately equal. Items were presented to S by having E expose the boards, one by one, as if turning the pages of a booklet. The children were asked to look at the four choices and select the one which they thought was the "real" Chinese letter.[3]

Training

Experimental:

Experimental subjects were shown four-choice arrays of 16 sets of pictures and symbols. Twelve of these were readily identifiable and easy to discriminate for the age group involved. The remaining four were difficult for the age group in order to produce a few errors and make a second trial logical. In trial one, subjects were shown the pictures exposed through a sliding window, containing four openings, which E slid across the page in the linear array, exposing one picture, then two, then three and then all four in a left-right sequence. For the quadrant array, two sliding windows were used, each having two openings. They were placed across the quadrant arrays, one above and parallel to the other. First, the top-left window was exposed by E and then the top-right. Finally, the bottom windows were exposed to show the remaining two pictures. Hence, both exposure sequences resembled adult reading patterns (left to right, or top-left to right and then bottom-left to right). E also instructed S in both procedures to look at all of the pictures before choosing one.

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[3] It was necessary to utilize an unsolvable task because we were interested in a guessing pattern.

Control:

Control subjects were shown single pictures and asked to name them. The single pictures were the critical items from the experimental training procedure. Again two trials were used.

Posttest

Exactly the same as Pretest.

Transfer

In order to see whether the changes that occurred in the response patterns for the Chinese Letter Naming Task would be maintained in a different situation, a second task was presented. Arrays of flags of different countries were presented in the same manner as the posttest. The child's task was to choose the flag which E named. Again, knowledge could not have been a factor with children of this age and background. Sets were arranged to provide maximal similarity between the flags used in any single array and care was taken to avoid placing any single flag which stood out from any of the others in its array.

FINDINGS

Tables 1 and 2 show the distribution of choices among the four positions for each subject on the pretest. Subjects whose choice pattern reveals a distribution of choices which deviates significantly from chance by x^2 test (d.f. = 3) are indicated by asterisks.

Inspection of Table 1 indicates that 14 E and 12 C subjects did not respond randomly. Hence, almost half the group tested evidenced positional response set behavior when linearly arranged patterns of four choices were presented and when knowledge was not a factor.

Table 2 shows 18 E and 16 C subjects evidencing positional response set behavior. This proportion represents more than half of the group tested with four-choice items arranged in quadrants when knowledge was not a factor.

Tables 3 and 4 show the distribution of choices among the four positions for each subject on the posttest.

Inspection of Table 3 shows 11 E and 14 C subjects with significant positional response sets. Therefore, compared to the pretest, three less E subjects and two more C subjects showed significant positional response sets following training.

Table 4 indicates 10 E and 15 C subjects showing significant positional response set behavior. Therefore, compared to the pretest, eight less E and only one less C subject showed significant positional response set behavior following training.

TABLE 1

Pretest: x^2 and Frequency Distribution of Choices for Linear E (Experimental) and C (Control) Subjects for Each Position

E					C				
Subject	a	b	c	d	Subject	a	b	c	d
1	* 16	0	3	5	1	9	3	7	5
2	2	8	8	6	2	* 17	2	2	3
3	* 1	3	13	7	3	* 10	4	1	9
4	2	8	10	4	4	11	5	3	5
5	* 24	0	0	0	5	4	7	4	9
6	10	6	6	2	6	* 3	2	9	10
7	* 14	8	2	0	7	6	6	7	5
8	4	3	11	6	8	6	9	7	2
9	* 8	16	0	0	9	* 0	24	0	0
10	* 0	1	23	0	10	5	7	4	8
11	* 12	4	4	4	11	7	1	8	8
12	6	5	7	6	12	7	4	7	6
13	* 0	1	23	0	13	* 2	5	12	5
14	6	8	4	6	14	5	9	3	7
15	9	5	3	7	15	* 12	5	4	3
16	5	11	3	5	16	9	3	7	5
17	7	6	8	3	17	* 5	11	7	1
18	3	9	6	6	18	4	4	9	7
19	* 18	3	2	1	19	5	4	7	8
20	* 11	9	2	2	20	7	4	4	9
21	* 1	18	5	0	21	* 0	0	0	24
22	* 2	10	11	1	22	* 0	1	21	2
23	5	7	7	5	23	10	8	5	1
24	7	5	8	4	24	* 14	5	2	3
25	2	5	11	6	25	6	7	7	4
26	7	8	5	4	26	* 0	22	2	0
27	* 4	12	5	3	27	9	5	3	7
28	4	7	8	5	28	2	9	7	6
29	7	8	6	3	29	2	5	6	11
30	5	5	4	10	30	* 0	1	23	0
31	3	7	10	4	31	3	5	11	5
32	* 0	4	17	3	32	4	11	4	5

* $x^2 > 7.82$, $p < .05$

TABLE 2

Pretest: x^2 and Frequency Distribution of Choices for Quadrant E (Experimental) and C (Control) Subjects for Each Position

	E					C			
Subject	a	b	c	d	Subject	a	b	c	d
1	7	8	5	4	1	* 3	13	1	7
2	* 0	24	0	0	2	4	8	5	7
3	* 0	0	8	16	3	* 19	3	2	0
4	* 4	1	11	8	4	7	3	4	10
5	10	6	2	6	5	8	6	3	7
6	6	6	8	4	6	* 3	12	0	9
7	* 2	21	1	0	7	8	4	6	6
8	6	5	8	5	8	* 0	3	2	19
9	* 0	0	0	24	9	9	5	3	7
10	5	6	6	7	10	* 2	10	3	9
11	* 4	13	2	5	11	4	6	4	10
12	* 0	17	0	7	12	* 2	1	12	9
13	2	5	7	10	13	* 16	8	0	0
14	* 1	3	2	18	14	6	7	6	5
15	* 8	1	15	0	15	* 9	10	3	2
16	4	6	5	9	16	7	6	4	7
17	3	6	8	7	17	* 6	4	14	0
18	4	3	9	8	18	* 0	24	0	0
19	* 0	0	22	2	19	* 9	14	0	1
20	* 1	0	13	10	20	5	3	6	10
21	8	9	2	5	21	5	8	6	5
22	3	7	4	10	22	5	6	6	7
23	* 4	2	13	5	23	7	4	6	7
24	6	6	5	7	24	6	5	6	7
25	* 0	0	24	0	25	5	6	6	7
26	6	3	5	10	26	* 4	0	13	7
27	* 3	0	12	9	27	* 2	2	6	14
28	* 4	4	1	15	28	* 0	0	24	0
29	1	10	8	5	29	4	7	9	4
30	* 1	11	5	7	30	* 5	2	16	1
31	*12	5	6	1	31	6	5	7	6
32	* 0	23	0	1	32	* 0	0	24	0

* $x^2 > 7.82$, $p < .05$

TABLE 3

Posttest: x^2 and Frequency Distribution of Choices for Linear E (Experimental) and C (Control) Subjects for Each Position

E						C					
Subject		a	b	c	d	Subject		a	b	c	d
1	*	6	6	12	0	1		7	5	6	6
2		1	6	8	9	2	*	15	6	3	0
3	*	2	8	8	6	3	*	10	6	5	3
4		5	6	5	8	4		12	3	5	4
5	*	24	0	0	0	5		12	8	2	2
6		8	10	6	0	6	*	2	12	9	1
7	*	23	1	0	0	7		7	8	6	3
8		7	6	7	4	8		3	8	9	4
9	*	6	7	7	4	9	*	0	24	0	0
10	*	0	2	22	0	10		3	9	4	8
11	*	2	7	5	10	11		8	5	6	5
12		8	6	4	6	12		8	4	8	4
13	*	0	0	24	0	13	*	1	7	9	7
14		1	6	15	2	14		6	7	2	9
15		14	3	2	5	15	*	10	3	6	5
16		4	7	3	10	16		22	1	1	0
17		9	6	3	6	17	*	11	6	5	2
18		3	11	5	5	18		3	6	8	7
19	*	10	12	2	0	19		5	9	5	5
20	*	6	10	5	3	20		6	5	6	7
21	*	1	12	8	3	21	*	0	0	0	24
22	*	4	10	7	3	22	*	2	14	8	0
23		6	4	9	5	23		11	5	6	2
24		5	7	8	4	24	*	9	7	8	0
25		3	7	8	6	25		5	5	7	7
26		8	4	6	6	26	*	0	24	0	0
27	*	5	7	6	6	27		14	6	1	3
28		7	7	4	6	28		3	7	8	6
29		4	14	4	2	29		1	4	13	6
30		10	5	7	2	30	*	0	6	13	5
31		5	3	10	6	31		10	8	3	3
32	*	6	9	6	3	32		0	7	9	8

* $x^2 > 7.82$, $p < .05$

TABLE 4

Posttest: x^2 and Frequency Distribution of Choices for Quadrant E (Experimental) and C (Control) Subjects for Each Position

E					C				
Subject	a	b	c	d	Subject	a	b	c	d
1	8	7	3	6	1 *	6	5	2	11
2 *	5	9	4	6	2	10	4	5	5
3 *	5	12	0	7	3 *	15	0	9	0
4 *	6	3	7	8	4	1	3	6	14
5	7	4	5	8	5	11	4	8	1
6	7	7	6	4	6 *	8	8	2	6
7 *	6	14	4	0	7	6	7	5	6
8	6	6	5	7	8 *	2	5	3	14
9 *	4	3	9	8	9	7	6	3	8
10	8	4	1	11	10 *	7	5	4	8
11 *	8	7	3	4	11	6	4	6	8
12 *	0	14	0	10	12 *	2	1	9	12
13	4	6	6	8	13 *	8	16	0	0
14 *	9	7	5	3	14	8	5	8	3
15 *	0	0	24	0	15 *	8	4	7	5
16	8	5	7	4	16	7	6	5	6
17	5	5	8	6	17 *	4	13	7	0
18	4	8	6	6	18 *	0	24	0	0
19 *	4	17	1	2	19 *	10	9	3	2
20 *	4	0	14	6	20	6	4	9	5
21	8	7	5	4	21	4	6	5	9
22	5	3	6	10	22	2	5	9	8
23 *	6	5	8	5	23	10	7	5	2
24	5	5	11	3	24	3	11	5	5
25 *	8	2	11	3	25	7	8	3	6
26	10	7	4	3	26 *	0	0	14	10
27 *	9	2	9	4	27 *	12	0	7	5
28 *	3	6	5	10	28 *	0	0	24	0
29	4	8	4	8	29	12	0	7	5
30 *	5	2	6	11	30 *	0	0	24	0
31 *	13	5	6	0	31	6	5	7	6
32 *	0	24	0	0	32 *	0	0	24	0

* $x^2 > 7.82$, $p < .05$

TABLE 5

Transfer Test: x^2 and Frequency Distribution of Choices for Linear E (Experimental) and C (Control) Subjects for Each Position

E					C				
Subject	a	b	c	d	Subject	a	b	c	d
1 *	5	5	7	7	1	5	6	10	3
2 *	0	4	7	13	2 *	21	1	0	2
3 *	7	3	3	11	3 *	8	7	5	4
4	9	2	6	7	4	4	10	5	5
5 *	21	0	1	2	5	3	15	2	4
6	0	1	0	23	6 *	1	5	9	9
7 *	3	6	11	4	7	11	5	5	3
8	0	0	14	10	8	5	11	7	1
9 *	4	7	4	9	9 *	0	24	0	0
10 *	0	0	23	1	10	4	9	5	6
11 *	2	12	4	6	11	8	4	5	7
12	10	3	5	6	12	3	11	7	3
13 *	0	0	24	0	13 *	7	3	9	5
14	7	8	4	5	14	8	8	2	6
15	8	13	1	2	15 *	9	8	4	3
16	11	5	5	3	16	7	2	7	8
17	5	2	9	8	17 *	9	13	1	1
18	7	6	9	2	18	5	2	7	10
19 *	1	12	11	0	19	6	9	8	1
20 *	3	13	6	2	20	2	4	10	8
21 *	3	10	6	5	21 *	0	0	0	24
22 *	3	14	6	1	22 *	1	0	21	2
23	5	6	8	5	23	5	6	7	6
24	4	4	12	4	24 *	2	6	12	4
25	4	6	6	8	25	3	5	9	7
26	1	7	7	9	26 *	0	24	0	0
27 *	4	8	4	8	27	13	5	4	2
28	4	4	7	9	28	2	6	13	3
29	8	12	2	2	29	9	3	4	8
30	4	6	10	4	30 *	0	2	18	4
31	7	6	7	4	31	7	7	9	1
32 *	2	7	10	5	32	1	6	11	6

* $x^2 > 7.82$, $p < .05$

TABLE 6

Transfer Test: x^2 and Frequency Distribution of Choices for Quadrant E (Experimental) and C (Control) Subjects for Each Position

E					C				
Subject	a	b	c	d	Subject	a	b	c	d
1	8	5	6	5	1 *	0	21	0	3
2 *	7	6	5	6	2	5	3	11	5
3 *	5	11	0	8	3 *	7	4	9	4
4 *	11	5	5	3	4	6	1	8	9
5 *	11	1	8	4	5	11	7	4	2
6	6	6	6	6	6 *	2	11	0	11
7 *	0	21	0	3	7	6	5	6	7
8	6	6	7	5	8 *	5	5	5	9
9 *	0	11	3	10	9	5	8	2	9
10	4	7	6	7	10 *	6	4	4	10
11 *	8	12	2	2	11	4	8	6	6
12 *	14	5	3	2	12 *	2	0	17	5
13 *	13	4	3	4	13 *	24	0	0	0
14 *	4	5	11	4	14	4	3	4	13
15 *	9	3	7	5	15 *	2	5	9	8
16	4	8	6	6	16	7	5	8	4
17	5	3	9	7	17 *	12	6	1	5
18	7	6	5	6	18 *	2	22	0	0
19 *	10	3	7	4	19 *	2	2	1	19
20 *	2	1	15	6	20	7	4	7	6
21	8	10	2	4	21	7	9	3	5
22	4	11	4	5	22	10	3	8	3
23 *	9	6	5	4	23	8	4	8	4
24	4	4	7	9	24	5	5	5	9
25 *	2	1	9	12	25	7	5	4	8
26	9	3	7	5	26 *	2	4	14	4
27 *	7	5	7	5	27 *	2	3	9	10
28 *	5	5	6	8	28 *	0	0	24	0
29	10	2	10	2	29	2	5	1	16
30 *	2	4	6	12	30 *	5	8	2	9
31 *	23	1	0	0	31	7	4	4	9
32 *	3	17	0	4	32 *	0	0	8	16

* $x^2 > 7.82$, $p < .05$

TABLE 7

Pretest: x^2, Number and Percent Responses per Position for All Ss and for Ss with Significant Pretest Positional Response Sets Only

	Position A	Position B	Position C	Position D	x^2	p
Linear:						
All Ss (N=64)	389 (25%)	408 (27%)	438 (29%)	301 (20%)	27.10	$<.001$
PRS Ss (N=26)	174 (28%)	171 (27%)	193 (31%)	86 (14%)	43.71	$<.001$
Quadrant:						
All Ss (N=64)	291 (19%)	406 (26%)	424 (28%)	415 (27%)	30.45	$<.001$
PRS Ss (N=34)	124 (15%)	231 (28%)	255 (31%)	206 (25%)	47.71	$<.001$

Tables 5 and 6 show the distribution of choices among the four positions for each subject on the transfer test.

Table 5 shows that 14 E and 14 C subjects had significant positional response sets. This finding shows no gain for the E group from performance on the pretest. However, two more C subjects than on the pretest had significant positional response sets.

Inspection of Table 6 indicates that 13 E and 13 C subjects showed significant positional response sets. Improvement from pretest performance is therefore present in both groups. Five less E and three less C subjects showed significant sets than on the pretest.

Table 7 shows the x^2, distribution and percent responses per position on the pretest for E and C subjects combined. E and C subjects are combined here due to the fact that, since E and C treatments had not as yet been administered, treatment group was not considered a significant variable for analysis here. Also included are scores for subjects who showed significant positional response sets (PRS Ss).

Both the linear and quadrant subjects evidenced significant positional response sets as groups. For the linear arrays the set seems to be characterized by a strong avoidance of the last position. The quadrant arrays are yielded a group set of similar magnitude characterized by avoidance of the first or top left position. Regarding the PRS Ss alone, the same pattern is evidenced but emphasized for both array arrangements. In addition to these Ss, there seems to be a preference for the third position of the inear array and for the third, or bottom left, position of the uadrant array.

Table 8 shows the x^2, distribution and percent responses per osition on the pretest for E and C subjects considered by sex. n the linear condition while male subjects could be characterized y having a group positional set female subjects could not be so haracterized. A larger proportion of males (15 of 32) than females 11 of 32) evidenced significant sets. However, seven female PRS s did not exhibit a characteristic group effect, but rather xhibited more idiosyncratic behavior. In the quadrant condition, oth males and females exhibited an avoidance of the top left posi- ion. However, while males favored the bottom right position, fe- ales favored the bottom left position. Both male and female trends ere exaggerated when considering the PRS Ss alone. In the case of he male Ss the group patterns seem to indicate a favoring, then, f the right hand choices.

Table 9 shows the x^2, distribution and percent responses per osition on the pretest for E and C subjects considered by age. ll groups showed significant sets except the older Ss on the inear array. In this case when PRS Ss are considered alone there s a significant set characterized by a favoring of the first and hird positions in relation to the other two positions. The younger ubjects show a strong avoidance for the fourth position and seem to favor the middle positions (second and third) in relation to the end positions (first and fourth). In the quadrant array, the older subjects showed a strong preference for the bottom right

TABLE 8

Pretest: x^2, Number and Percent Responses per Position by Sex, for All Ss and for Ss with Significant Pretest Positional Response Sets Only

	Position A	Position B	Position C	Position D	x^2	p
Linear:						
All M (N=32)	210 (27%)	204 (27%)	227 (30%)	127 (17%)	30.83	<.001
All F (N=32)	179 (23%)	204 (27%)	211 (27%)	174 (23%)	5.20	NS
PRS M (N=15)	105 (29%)	111 (31%)	120 (33%)	24 (7%)	56.80	<.001
PRS F (N=11)	69 (26%)	60 (23%)	73 (28%)	62 (23%)	1.67	NS
Quadrant:						
All M (N=32)	147 (19%)	212 (28%)	158 (21%)	251 (33%)	36.78	<.001
All F (N=32)	144 (19%)	194 (25%)	266 (35%)	164 (21%)	45.87	<.001
PRS M (N=16)	57 (15%)	128 (33%)	69 (18%)	130 (34%)	46.14	<.001
PRS F (N=18)	67 (16%)	103 (24%)	186 (43%)	76 (18%)	81.60	<.001

TABLE 9

Pretest: x^2, Number and Percent Responses per Position by Age Group, for All Ss and for Ss with Significant Pretest Positional Response Sets Only

	Position A	Position B	Position C	Position D	x^2	p
Linear:						
All 66 + (N=31)	187 (25%)	190 (26%)	206 (28%)	161 (22%)	5.61	NS
All 65 - (N=33)	202 (25%)	218 (27%)	232 (29%)	150 (19%)	19.58	$<.001$
PRS 66 + (N= 9)	64 (30%)	45 (21%)	66 (31%)	41 (19%)	9.15	$<.05$
PRS 66 - (N=17)	110 (27%)	126 (31%)	127 (31%)	45 (11%)	44.26	$<.001$
Quadrant:						
All 66 + (N=25)	122 (20%)	134 (22%)	130 (22%)	214 (36%)	36.92	$<.001$
All 65 - (N=39)	169 (18%)	272 (29%)	294 (31%)	201 (21%)	43.41	$<.001$
PRS 66 + (N= 9)	35 (16%)	39 (18%)	45 (21%)	97 (45%)	46.60	$<.001$
PRS 65 - (N=25)	89 (15%)	192 (32%)	210 (35%)	109 (18%)	71.78	$<.001$

position while the younger subjects acted quite differently, showing a strong preference for the bottom left position and a strong avoidance for the top left position.

Table 10 shows the x^2, distribution and percent responses per position on the pretest for E and C subjects considered by sex and age group. In the linear array, it is clearly shown that the sex effect shown in Table 8 is not a function of interaction with age. Neither female group exhibits a group PRS. The younger males show a much stronger group effect than do the older males. In the quadrant array condition only the older females show no group PRS, henc the fact that on Table 9 older S groups showed a significant set seems to be primarily a function of the older males. Interestingly, it is the younger females who show much more marked positional set than the younger males. The patterns for the four groups were all quite different, the older females as mentioned before had no group effect; the older males seemed to favor the bottom right position and avoid the top left position; the younger males showed a strong preference for the top right position; the younger females showed an avoidance of the top left position similar to that of the older males and a preference for the bottom left position, a trend not characteristic of any other g..oup.

Table 11 shows the means and S.D.'s by treatment, array arrangement and test period. Deviation scores are obtained by the following formula: $\sum(O-E)$, where O = the obtained frequency of responses for any position; and E = the expected frequency of responses fo~ any position; since there are al.ay3 four positions an^ 24 for test items, E was always equal to 4. The use of these deviation scores

TABLE 10

Pretest: x^2, Number and Percent Responses per Position by Sex and Age Group for All Ss[4]

	Position A	Position B	Position C	Position D	x^2	p
Linear:						
M 66 + (N=13)	93 (30%)	82 (26%)	84 (27%)	53 (17%)	11.69	<.01
M 65 - (N=19)	117 (26%)	122 (27%)	143 (31%)	74 (16%)	22.06	<.001
F 66 + (N=18)	94 (22%)	108 (25%)	122 (28%)	108 (25%)	3.62	NS
F 65 - (N=14)	85 (25%)	96 (29%)	89 (26%)	66 (20%)	4.31	NS
Quadrant:						
M 66 + (N=14)	48 (14%)	69 (21%)	71 (23%)	142 (42%)	58.74	<.001
M 65 - (N=18)	99 (23%)	143 (33%)	81 (19%)	109 (25%)	18.85	<.001
F [illegible] + (N=11)	[illegible] (28%)	65 (25%)	53 (20%)	72 (27%)	4.18	NS
F 65 - (N=21)	70 (14%)	129 (26%)	213 (42%)	92 (18%)	94.20	<.001

4 Distributions for Ss with significant positional response sets only are not included in this table because of the small Ns involved.

enabled us to express the amount of PRS behavior quantitatively.

In Table 11, we note that, on the pretest, the average deviation score (DS) for each group, with the exception of the E quadrant group, was between 13 and 14. The EQ group obtained a mean DS of 16.12. On both the post and the transfer tests, both E groups obtained lower mean scores than their respective C groups.

These scores were tested for significance by a three-way analysis of variance (Treatment x Array Arrangement x Test Period). The hypothesis tested was that the interaction between treatment and test period should be significant in that while the E and C groups should be equal at pretest, the E group scores should drop significantly on the post and transfer tests. The only significant effect obtained was the above interaction. From Table 11 we see that the significant interaction occurred as predicted. On the pretest, the E scores were generally lower than the C scores, while on the post and trans er tests, the opposite was true.

Table 13 shows the means and S.D.'s of deviation scores by treatment, sex and test period.

Scores were tested to see whether sex, either alone or in interaction with treatment and/or test period had a significant effect on the results. (Table 14). Again, the only significant effect was the treatment x test period interaction.

Table 15 presents the means and S.D.'s of the deviation scores by treatment, age group, and test period. The Ss were divided into two groups within each treatment condition as to whether they were 66 months of age and above or 65 months of age and below.

TABLE 11

Means and Standard Deviations
of Deviation Scores by Treatment, Arr
Arrangement and Test Period (n = 32)

	Pretest		Posttest		Transfer	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
E Linear	13.81	9.32	12.09	10.38	13.50	9.17
E Quadrant	16.12	10.50	11.12	8.32	11.06	8.29
C Linear	13.34	9.79	13.06	9.59	14.12	9.38
C Quadrant	13.59	10.46	14.00	10.40	13.88	9.32

TABLE 12

Three-Way Analysis of Variance with
Repeated Measures of Deviation Scores
(Treatment x Array Arrangement x Test Period)

Source	SS	df	MS	F	p
Between Ss		127			
A (Treatment)	48.88	1	48.88	<1	
B (Array Arrangement)	.06	1	.06	<1	
AB	11.00	1	11.00	<1	
Ss within groups	25648.18	124	206.84		
Within Ss		383			
C (Test Period)	179.41	2	89.70	2.81	
AC	235.85	2	117.92	3.69	<.05
BC	110.24	2	55.12	1.73	
ABC	71.65	2	35.82	1.12	
CxSs within groups	7918.85	248	31.93		

TABLE 13

Means and Standard Deviations of Deviation Scores by Treatment, Sex and Test Period (n = 32)

	Pretest		Posttest		Transfer	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
E Males	15.19	9.95	12.69	8.89	13.50	9.30
E Females	14.75	10.03	10.53	9.08	11.06	7.84
C Males	13.69	10.43	13.44	9.71	13.25	9.07
C Females	13.25	9.65	13.63	10.15	14.75	9.57

TABLE 14

Three-Way Analysis of Variance with
Repeated Measures of Deviation Scores
(Treatment x Sex x Test Period)

Source	SS	df	MS	F	p
Between Ss		127			
A (Treatment)	48.88	1	48.88	<1	
B (Sex)	38.13	1	38.13	<1	
AB	105.20	1	105.20	<1	
Ss within groups	25515.91	124	205.77	<1	
Within Ss		256			
C (Test Period)	179.41	2	89.70	2.77	
AC	235.85	2	117.92	3.64	$<.05$
BC	6.03	2	3.02	<1	
ABC	62.78	2	31.39	<1	
CxSs within groups	8031.93	248	32.39		

TABLE 15

Ns, Means and Standard Deviations of Deviation Scores by Treatment, Age Group and Test Period

			Pretest		Posttest		Transfer	
		n	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
E	66+	29	12.48	9.76	11.69	9.44	10.69	7.37
E	65-	35	17.03	9.69	11.54	8.89	13.60	9.43
C	66+	27	11.96	10.15	11.33	8.54	12.74	9.80
C	65-	37	14.57	9.97	15.14	10.67	14.92	8.90

Table 16 shows the analysis of variance calculated to ascertain whether age, either singly or in interaction with treatment and/or test period, was a significant factor. Again, only the treatment x test period interaction reached an acceptable ($p < .05$) level of significance. The main effect of age did not quite reach this level.

TABLE 16

Three-Way Analysis of Variance with
Repeated Measures of Deviation Scores
(Treatment x Age Group x Test Period)

Source	SS	df	MS	F	p
Between Ss		127			
A (Treatment)	34.74	1	34.74	<1	
B (Age)	666.02	1	666.02	3.06	
AB	.14	1	.14	<1	
Ss within groups	26993.93	124	217.69		
Within Ss		256			
C (Test Period)	162.95	2	81.48	2.56	
AC	207.80	2	103.90	3.27	<.05
BC	48.95	2	24.47	<1	
ABC	153.48	2	76.74	2.41	
CxSs within groups	7898.10	248	31.85		

CONCLUSIONS

1. This research has shown that positional response set behavior occurs with great frequency among preschool age, disadvantaged children, and that this behavior is subject to modification by training.

Of the Ss tested, 40% of those exposed to linear (left to right) arrays exhibited PRS behavior, while over 50% of those exposed to quadrant arrays showed PRS tendencies.

2. When scores are combined, it can be seen that characteristic group patterns emerge. When exposed to linear arrays, PRS is characterized by a relative avoidance of the fourth or right-hand most position. When the stimuli are arranged in quadrant patterns, group avoidance is shown for the first or upper-left position.

Considering only PRS Ss, we may also conclude that, with linear arrays, there is a preference for the third position. With quadrant arrays, preference is also for the third, but in this case bottom-left, position.

3. Sex of the subject appeared to have some effect on the patterns obtained. With linear arrays, while males reflected the trend cited in (2), females were quite idiosyncratic and did not display a distinctive group pattern. With quadrant arrays, both males and females displayed the characteristic avoidance of the top-left position, but preferences differed. Males tended to choose positions on the right, whether upper or lower, while females showed a strong preference for the bottom-left position.

4. Age seemed to strongly influence the probability of occurence of PRS Ss. While about one-third of Ss, 66 months of age and above were PRS Ss, over 50% of those Ss, 65 months of age and below, showed significant sets. With linear arrays, while the PRS Ss in both age groups tended to avoid the fourth position and favor the third position, the younger children seemed to also prefer the second position. With quadrant arrays, both age groups, with the exception of the older females, show the top-left position avoidance, but the older Ss showed a strong preference for the lower-right position, while the younger female Ss showed a strong preference for the bottom-left position. The younger males showed a preference for the top-right position.

5. By utilizing a procedure in which Ss were given training in scanning arrays similar in pattern to the test arrays, guessing patterns were significantly altered in relation to patterns of groups not similarly trained. By training Ss to scan arrays properly, i.e., to look at each position, and by showing them that a correct answer could occur in any of the four positions, substantial change in behavior occured.

6. The training procedures adopted in this research, which succeeded in changing choice patterns in regard to the Chinese Letter Naming Task, also succeeded in transferring the benefit to a situation utilizing the same array patterns, but different stimuli (flags).

RECOMMENDATIONS

1. Further research should be undertaken with respect to the following related problems:

a.) To determine the generality of the findings regarding the degree and pattern of positional response set behavior with children of other background and SES characteristics.

b.) To determine whether PRS behavior is a function of scanning. PRS Ss should be examined as to eye movement patterns in relation to eye movement patterns of good scanners.

c.) To develop methods to produce more extensive changes in test-related scanning skills.

d.) To determine the extent and pattern of positional response sets with other array arrangements and sizes.

2. The results of our investigation imply that positional sets are very common among low SES, preschool-age childre Since this behavior may reflect the lack of adequate scanning k these children, these findings have important implications for preschool programs, especially in reference to prereading skills and test-taking skills. It is possible that low scores on tests by these children, when such tests involve multiple choice, may reflect not so much a cognitive deficit, but, rather, an inadequate registration of the choices offered. If a child is not adequately registering information appearing on a page, then reading cannot take place. Perception must precede cognition.

3. Given the problem outlined above, remedial steps can be taken and should be incorporated into preschool curricula. A step in this direction could be more extensive use or some adaptation of the training methods utilized in the current study. The method has the advantage of training the children to look at all of the choices in a manner which reinforces the correct scanning patterns for reading in the English language, that is, from left to right. It should be pointed out that our training did not produce a strong enough change insofar as changes in number of PRS Ss. However, distributed practice over a longer period of time could produce the desired change. After all, our training period entailed only one, ten minute session.

4. Test users and constructers should be aware of PRS. One technique used by this investigator in the Early Childhood Inventories (Coller and Victor, 1967), is to utilize a second form of a test in which the same choices are given, but their positions changed. If a child is correct on both, we can be reasonably sure that the answer is known. This procedure is desirable for diagnostic testing. Other procedures might utilize some instructional procedures to emphasize to the children the need for looking at all choices. A sliding window technique, for example, could be used for sample items prior to the test.

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Cronbach, L. J. Response sets and test validity. Educational and and Psychological Measurement, 1946, 6, 475-494.

Victor, J. An exploration of positional response sets in disadvantaged children and a technique for the reduction of such sets. Office of Economic Opportunity, Progress Report No. 1, New York: Institute for Developmental Studies, 1968 (mimeo).

APPENDIX

A. CHINESE LETTERS - Linear Array

B. CHINESE LETTERS - Quadrant Array

C. TRAINING FIGURES - Linear Array

D. TRAINING FIGURES - Quadrant Array

E. CONTROL FIGURES - Linear and Quadrant Arrays

F. FLAGS - Linear Array

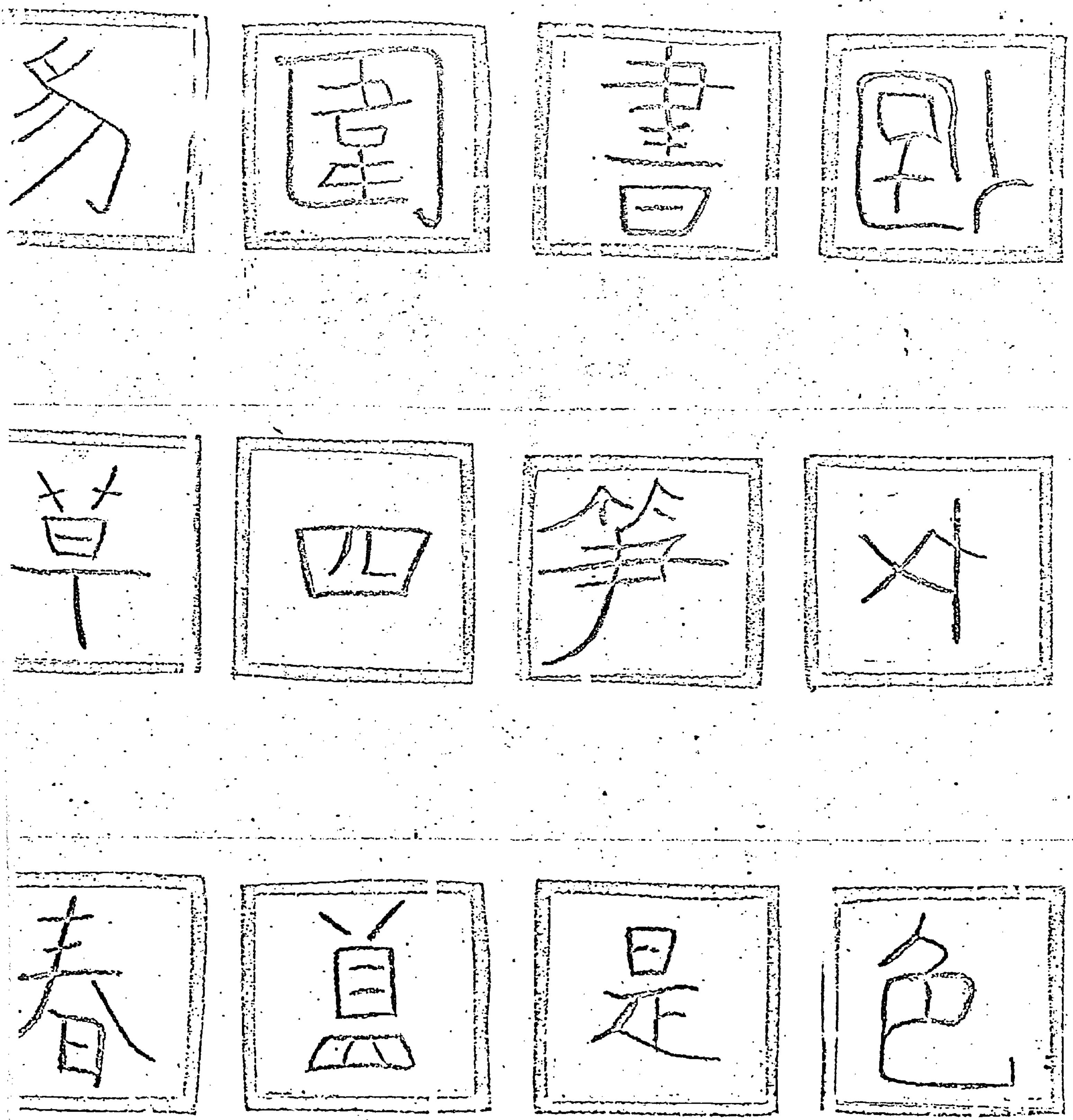
G. FLAGS - Quadrant Array

H. Answer Sheet

I. SLIDING WINDOW - Linear Array

J. SLIDING WINDOW - Quadrant Array

CHINESE LETTERS - Linear Array



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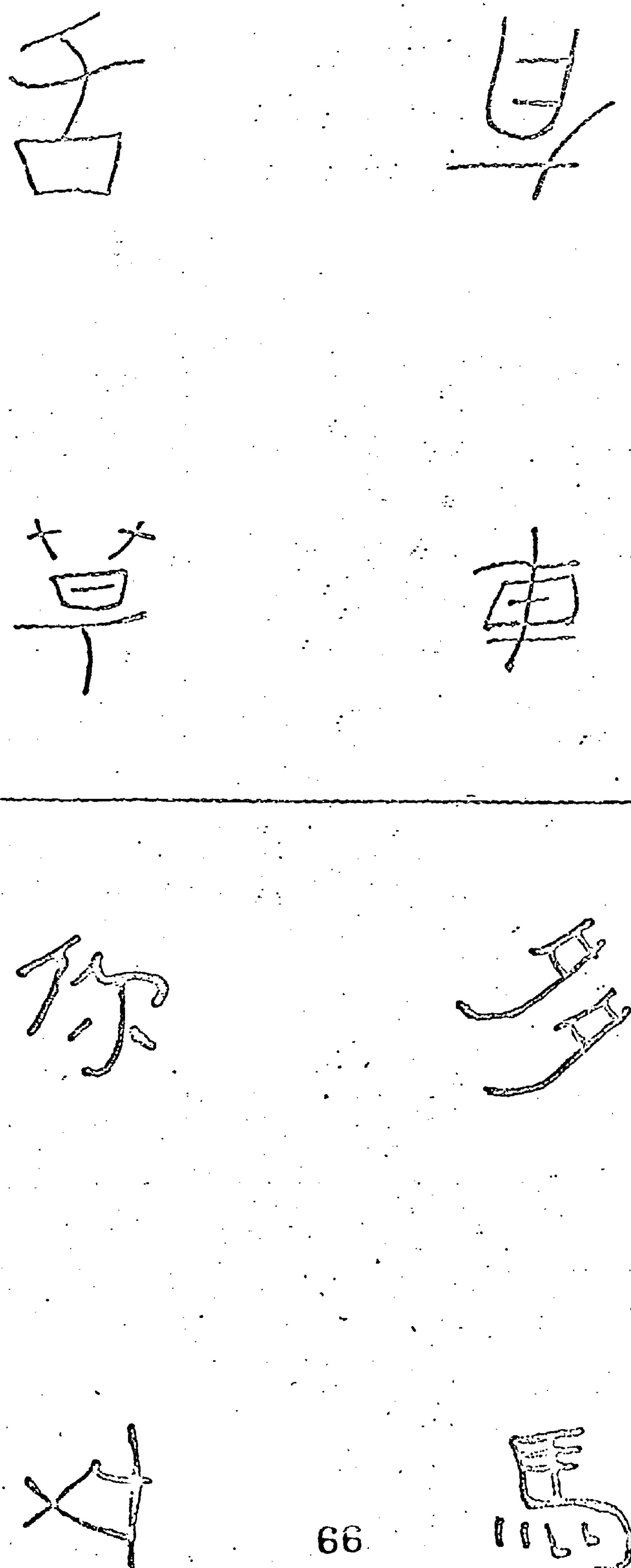
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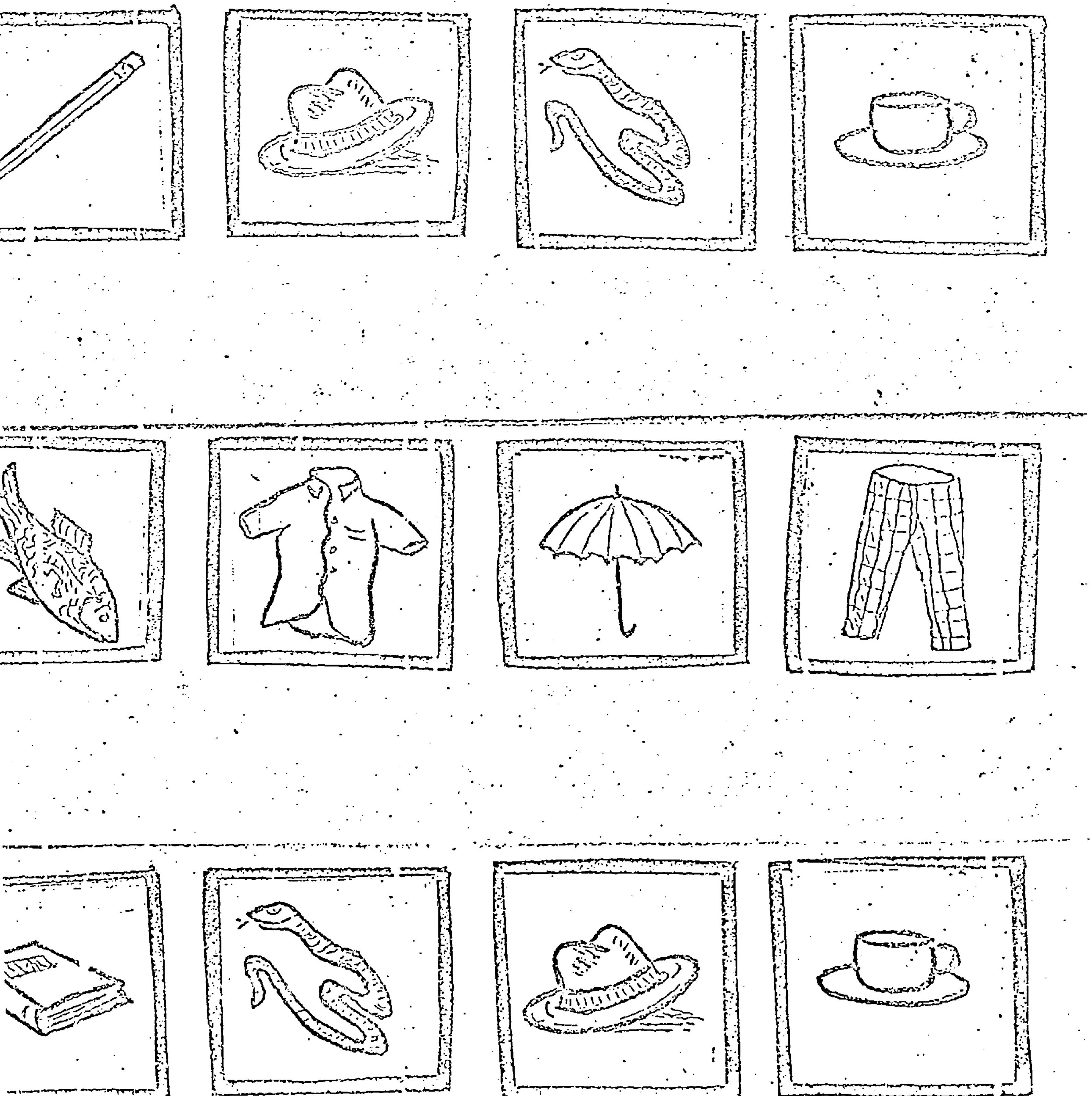
TRAINING FIGURES - Linear Array



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TRAINING FIGURES - Quadrant Array

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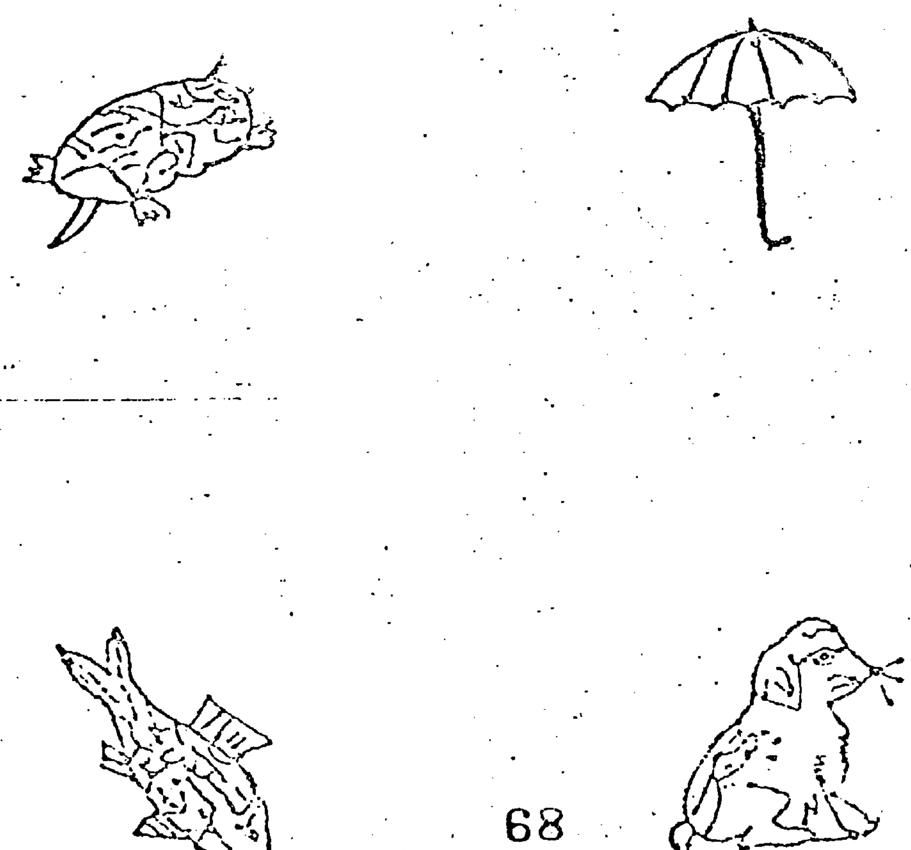
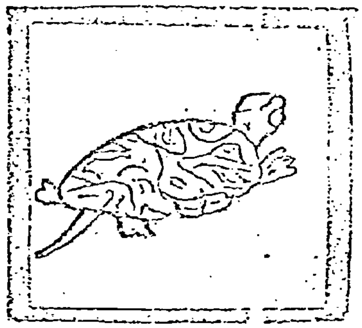
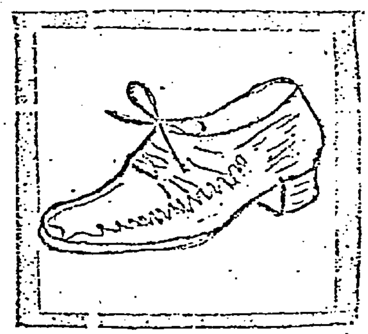
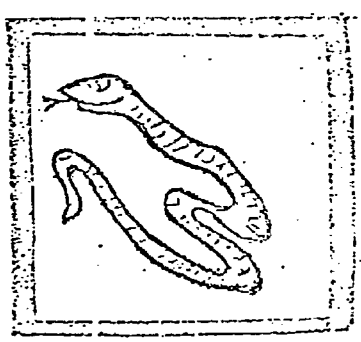


CONTROL FIGURES - Linear and Quadrant Arrays







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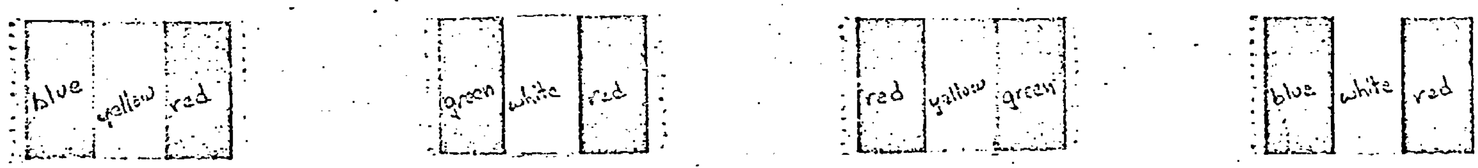
4.

FLAGS - Linear Array



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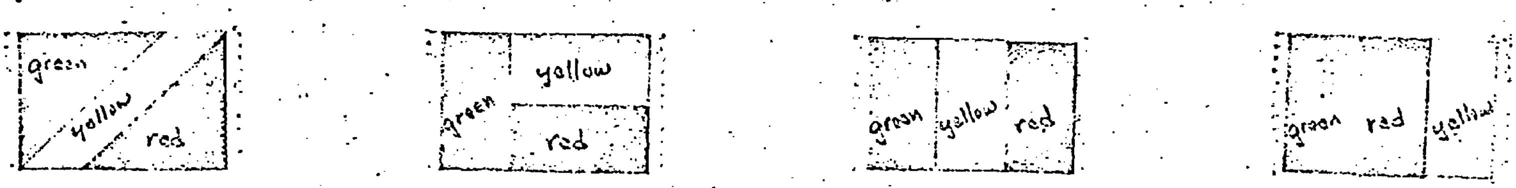
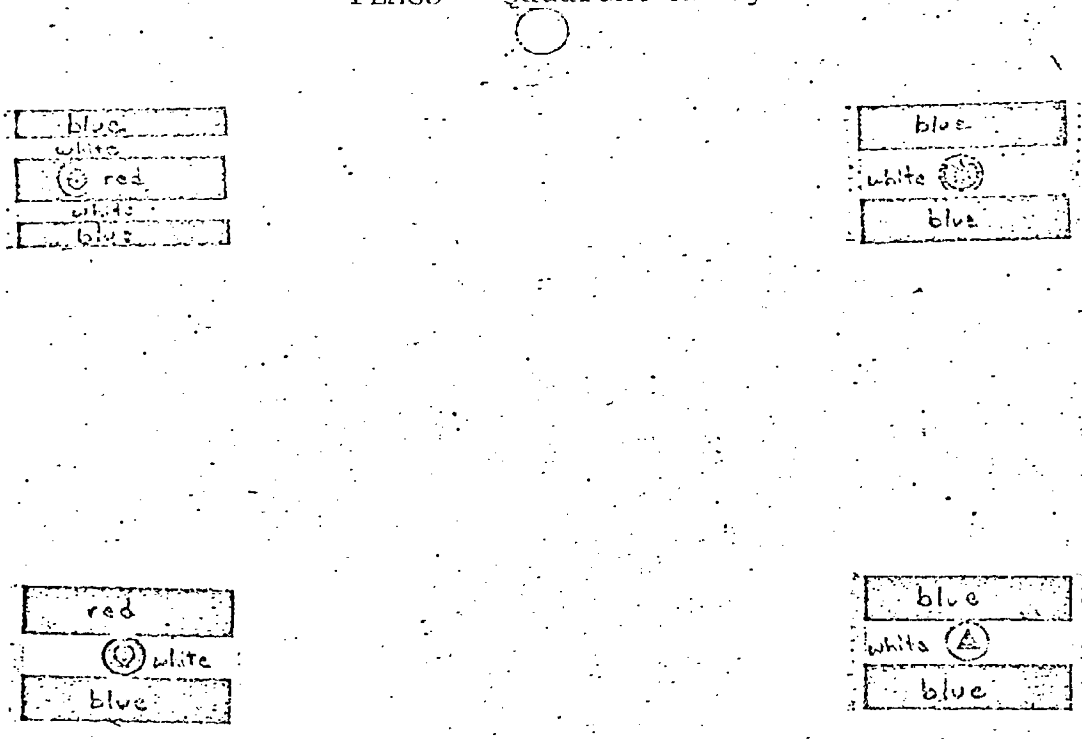


FLAGS - Quadrant Array



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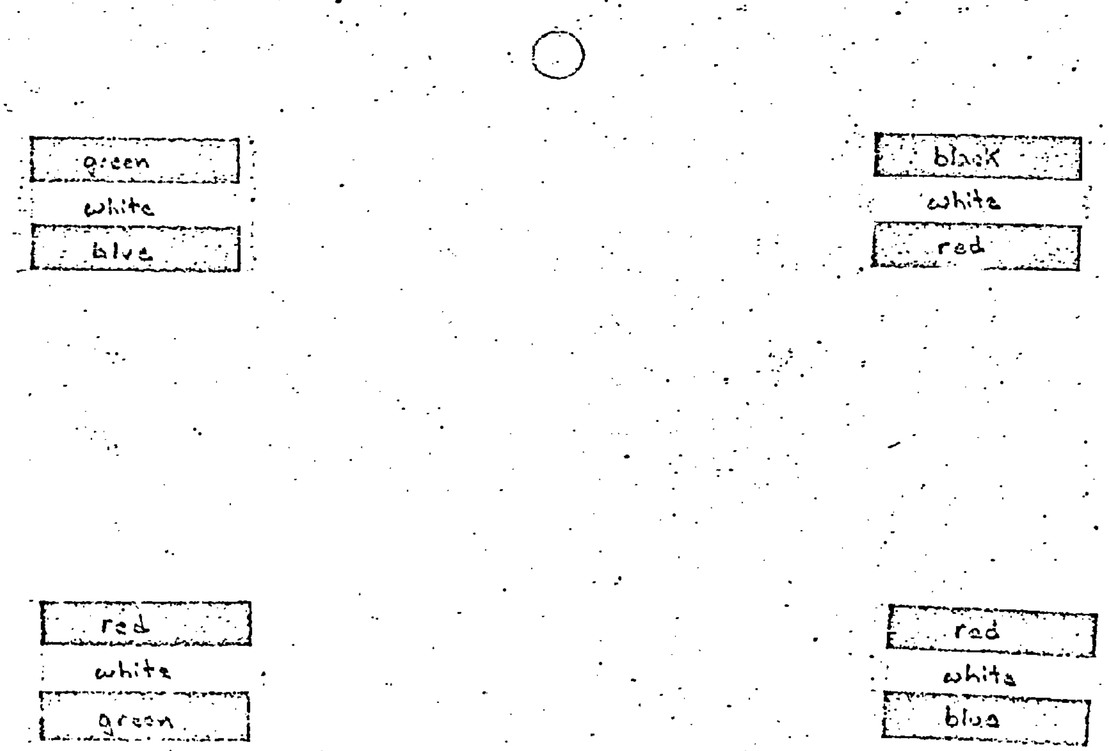

POSITIONAL RESPONSE TEST

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LINEAR

QUAD.

CONT

-test

a	b	c	d
a	b	c	d
a	b	c	d
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Training

1.	a	b	c	d
2.	a	b	c	d
2a.	a	b	c	d
3.	a	b	c	d
4.	a	b	c	d
5.	a	b	c	d
5a.	a	b	c	d
6.	a	b	c	d
7.	a	b	c	d
8.	a	b	c	d
8a.	a	b	c	d
9.	a	b	c	d
10.	a	b	c	d
11.	a	b	c	d
11a.	a	b	c	d
12.	a	b	c	d

TOTAL

Training II

1.	a	b	c	d
2.	a	b	c	d
2a.	a	b	c	d
3.	a	b	c	d
4.	a	b	c	d
5.	a	b	c	d
5a.	a	b	c	d
6.	a	b	c	d
7.	a	b	c	d
8.	a	b	c	d
8a.	a	b	c	d
9.	a	b	c	d
10.	a	b	c	d
11.	a	b	c	d
11a.	a	b	c	d
12.	a	b	c	d

TOTAL

Post Test

1.	a	b	c	d
2.	a	b	c	d
3.	a	b	c	d
4.	a	b	c	d
5.	a	b	c	d
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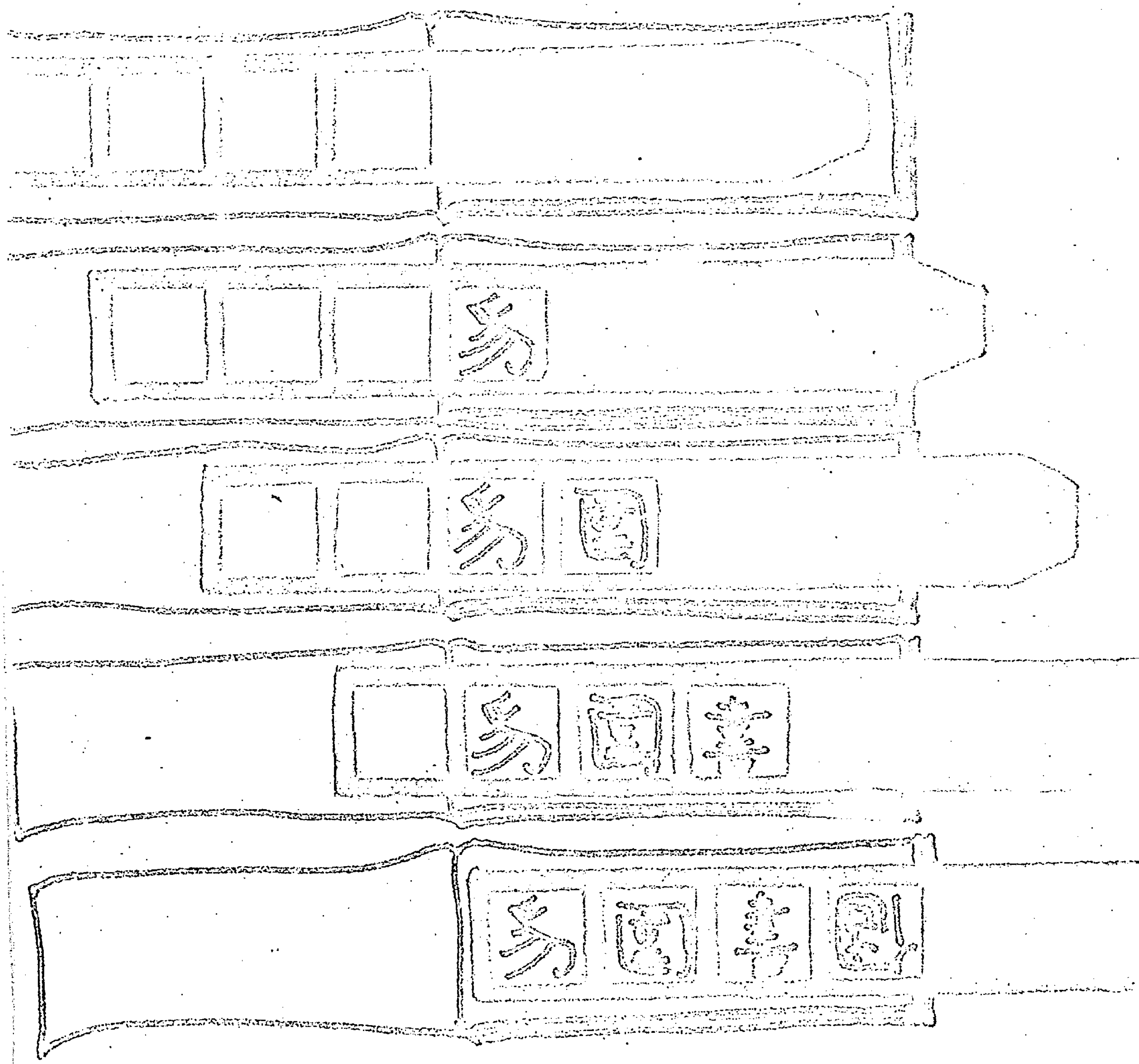
8.	a	b	c	d
9.	a	b	c	d
10.	a	b	c	d
11.	a	b	c	d
12	a	b	c	d
13.	a	b	c	d
14.	a	b	c	d
15.	a	b	c	d
16.	a	b	c	d
17.	a	b	c	d
18.	a	b	c	d
19.	a	b	c	d
20.	a	b	c	d
21.	a	b	c	d
22.	a	b	c	d
23.	a	b	c	d
24.	a	b	c	d

TOTAL

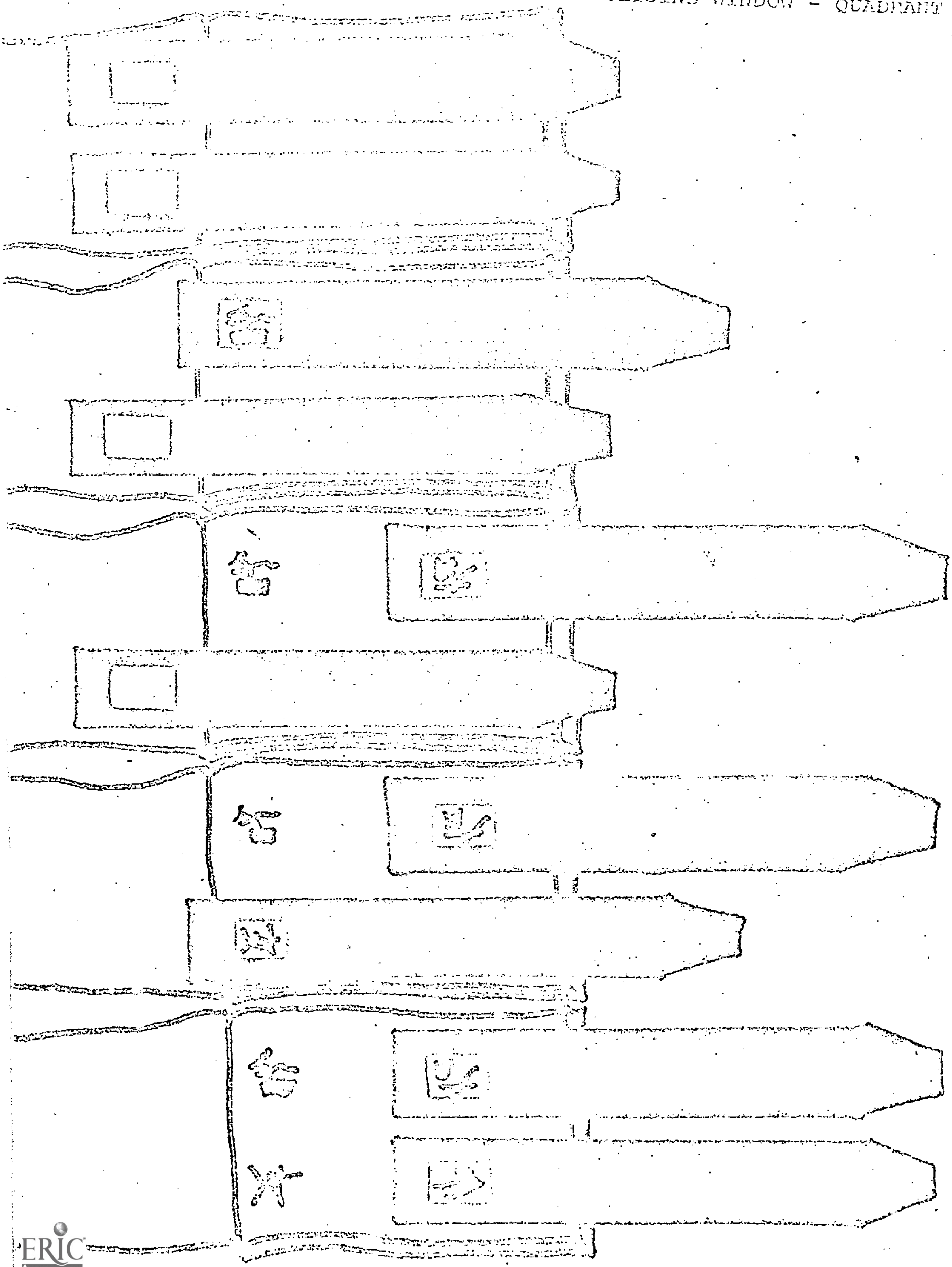
Flags

1. Phill.	a	b	c	d
2. Belg.	a	b	c	d
3. Denmk.	a	b	c	d
4. Chad.	a	b	c	d
5. Cameroon	a	b	c	d
6. Iraq	a	b	c	d
7. Neth.	a	b	c	d
8. Nicarg.	a	b	c	d
9. Roumania	a	b	c	d
10. Ethiopia	a	b	c	d
11. Burma	a	b	c	d
12. Morocco	a	b	c	d
13. Aust.	a	b	c	d
14. Ghana	a	b	c	d
15. Malaya	a	b	c	d
16. Panama	a	b	c	d
17. Czech.	a	b	c	d
18. Cabon.	a	b	c	d
19. Norway	a	b	c	d
20. Guinea	a	b	c	d
21. Mali	a	b	c	d
22. Yemen	a	b	c	d
23. Hungary	a	b	c	d
24. Parag.	a	b	c	d

TOTAL



SLIDING WINDOW - LINEAR ARRAYS



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