Exposure time as a variable of the two-stimulus transposition problem in pre-school children

Byron Arthur McBride

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EXPOSURE TIME AS A VARIABLE OF THE TWO-STIMULUS
TRANSPOSITION PROBLEM IN PRE-SCHOOL CHILDREN

By

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1971

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3/12/71
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The Christian Brothers, who make an inexpensive but palatable sherry, are the second party to whom go my thanks. Their product summoned the stubborn muse and quieted my turbulent innards for hours on end while writing.
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CHAPTER I

INTRODUCTION

The Historical Issue

The nature of relations between or among stimuli has been debated philosophically for two centuries. The issue during this time has fallen into two main arguments. One position holds that the relation is external and present in a given stimulus complex and the other position holds that characteristics are given relational qualities intra mentis. Because of its very nature, the transposition phenomenon has been used by proponents of both points of view to attempt to provide empirical support for each respective position. Transposition refers to any kind of transfer that appears to result from responding to relations among stimuli.

The foremost proponents of the view that relations were an implicit and emergent part of stimulus patterns were the Gestalters. Kohler (1929), chief spokesman for the relational position, argued that while absolute qualities of stimuli can be responded to, the predominant qualities are relational. Kenneth Spence (1942) presented the strongest absolute stimulus theory, but allowed for the possibility of response to relations as well as for verbally mediated relational responses. Bergmann (1957, p. 270) has
argued that the positivist-like position implicit in either argument is inadequate. The assertion that one can point at absolute qualities but not at relational qualities and therefore that the absolute qualities exist, is untenable, since one cannot really even point at an absolute quality but only at objects which exemplify it. Since one can also point to objects which exemplify relationships, it follows that natural relations exist in the same sense as absolute qualities. Reese (1968, p. 7) points out, "the problem is, therefore, not only to determine whether organisms of a given species or age level can respond to relations, but also to determine under what conditions they do or do not respond to relations."

The philosophical question of relations and the transposition phenomenon are of interest to psychology for a number of reasons, some of which have practical as well as theoretical interest. Theories of learning and theories of development must consider the nature and the sequence of concept learning and the ordering of stimulus variables. Practical considerations, which rely upon the empirical investigation of theoretical descriptions of these variables, could influence applications ranging from the evaluation of conceptual development of humans to the design of curricula.

The Transposition Paradigm

The transposition problem originally referred to the spatial relationships of stimuli within a single dimension.
The literal meaning of transposition is "a change in spatial location" (Reese, 1968, p. 8). It has since evolved to mean any transfer based on relative position on any dimension, whether spatial, temporal, or attributive. For example, transposition of tones and of loudness have been studied (Riley & McKee, 1963), transposition of form (Michels & Zusne, 1965) and cross-model transposition studies have been conducted, as well as the extensive investigation of spatial transposition.

The basic two-stimulus, spatial transposition problem consists of a learned discrimination between two stimuli which differ in size. Once the discrimination is learned to a given criterion, the subject is shifted to a new stimulus pair for a test trial or trials as illustrated in Figure 1.

![Figure 1](image)

**ACQUISITION**

**TEST**

Figure 1. Illustration of Spatial Transposition Stimuli Using a One-Step Positive Test, in the Upward Direction

Given a set of stimuli distributed along a dimension in some defined relation to each other, the following operational terminology customarily applies to stimulus properties,
stimulus position, and operations in transposition studies:

1. Upward refers to stimuli shifted in the direction of
greater size, in the spatial size dimension. Downward refers
to shifts to stimuli which are smaller in the direction of
size than the training stimuli.

2. A positive transposition test is a shift to stimuli in
the direction of the positive training stimulus, i.e.,
upward if the larger of two stimuli was reinforced during
acquisition; downward if the smaller was reinforced. A
negative test is shifted in the direction away from the
stimulus reinforced during acquisition.

3. Stimulus relations are usually operationally defined
according to some constant, e.g., a ratio. A step in a
two-stimulus problem is a new set of stimuli shifted one
unit along the dimension in either direction. Figure 1
illustrates a shift of one step. A shift to C and a new
circle, D, would constitute two steps, etc.

4. Near tests usually are operationally designated as
within one step of the acquisition set. Occasionally, two-
step shifts are classified as near, but this is not common.

5. Far tests are shifts greater than one-step (or two, if
so designated) from the acquisition stimuli.

6. The distance effect refers to the decrease of transposition
which is commonly reported in both humans and infra-
humans as test stimuli are more distant on the continuum
from the training stimuli.

7. Intermediate-size transposition problems are composed of
three stimuli with responses to the middle-sized one reinforced.

Rationale and Review of Research

The possible effect of mediation upon transposition responses has led to studies of transposition at various levels of verbal development; some of these have included data related to sex differences and to the relationship of concept knowledge to transposition. Herbert and Kranta (1965) call for systematic studies of the parameters of the transposition phenomenon. Among the parameters considered to date have been the effects of reward (Terrel, 1958; Terrel & Kennedy, 1975), the effect of delay between acquisition and test (Stevenson & Langford, 1957; Stevenson & Weiss, 1955), and the relation between age level and two-stimulus transposition (e.g. Alberts & Ehrenfreund, 1951; Jackson, Stonex, Lane & Dominguez, 1938; Kuenne, 1946; Marsh & Sherman, 1966; Rudel, 1958; Sherman, 1966, and Stevenson, Iscoe & McConnell, 1955). While this is not an exhaustive list of the parameters which have received attention, nor do these studies represent a systematic, coordinated effort, they are parameters to which a number of studies pertain and about which there is some consistency in the available data.

All the two-stimulus, spatial transposition studies have had a few operations in common. In most, objects varying in size have been presented in random positions
to subjects from behind a screen. Movement or selection of the correct object has resulted in a verbal or a tangible reinforcement during acquisition. There has been a criterion level of responses and a test with some variations in the time from arrival at criterion to the onset of the test. Test response latencies have not been investigated, although some theories suggest that these might vary.

Investigation of the age parameter was initiated by Margaret Kuenne (1946), a student of Kenneth Spence. Spence (1937) had suggested that the distance effect, predicted by his theory, might not occur in older humans, because they have the capacity to mediate the absolute stimulus properties through the use of verbal relational labels. Kuenne reasoned that transposition should vary as verbal development varied. She presented size stimuli to preschool children who had been tested for their ability to articulate size relationships such as "bigger" or "the smaller one." She found more transposition among those who were able to state the relationship verbally than among those who were not.

She also reported a significant trend toward less transposition among her younger subjects. Rudel (1958) reports a trend of increased transposition responses by subjects whose ages increased from 1.5 to 3.5 years. Marsh and Sherman (1966) report similar findings with two-to four-year-olds. Alberts and Ehrenfreund (1951) report a trend toward increased transposition in three- to five-and-a-half-
year-old children.

Marsh and Sherman investigated mediation and concept knowledge as well as age. Their subjects learned a size concept or a redundant brightness concept during acquisition. Test stimuli were shifted on the size dimension only and the brightness dimension became irrelevant. Older children trained to articulate the size dimension transposed more than children who learned to verbalize the brightness dimension. Younger subjects did not differ in transposition responses whether they were trained to verbalize the dimension or not.

Concept knowledge is usually tested in one of two ways: the subject verbalizes the solution spontaneously or in response to probes during testing, or the subject is asked to name the stimulus at which the experimenter points. Both methods suffer the shortcoming that subjects who possess the concept but do not use it are not detected.

Kuenne (1946) has reported that 93% of subjects possessed the concept "bigger," "the big one," etc. Of her subjects, only 70% verbalized the solution to the problem. Alberts and Ehrenfreund (1951) reported 100% of the three-to four-year-old children in their study tested after acquisition by experimenter questioning, possessed the concept but only 38% verbalized the solution to the problem. Children whose ages ranged from 4.5 to 5.5 years could all state the concept, but only 89% verbalized the solution.
Zeiler (1965) manipulated the difficulty of the two-stimulus problem by manipulating the ratios of the stimuli. He found no distance effect when a 2:1 ratio was used, but obtained the distance effect when a 1.4:1 ratio was used with verbal children in both cases.

Reese (1962) suggests that the verbal expression of a relational concept by a subject is insufficient to predict if the subject responds according to that concept. White (1965) suggests a transitional period in the use of verbal concepts between the ages of five and seven years during which a child may use verbal expressions denoting concepts, but may not have learned the concepts themselves sufficiently to operate from them.

Few studies have manipulated the concept-knowledge variable, but many studies include some sort of probe or post-test incidentally. In general, the data indicate an increase in transposition with age and an increase in concept knowledge with age. The evidence for a relationship between concept knowledge and transposition is inconclusive below seven years of age.

In two-stimulus transposition, no sex differences have been reported. Neither Sherman (1966) nor Caron (1966) report sex differences in multiple problem training. Reese (1961) reported in Reese (1968) reports differences using the three-stimulus transposition problem. According to Reese, preschool boys transpose more than girls on "easy"
intermediate-size transposition, but less on difficult problems.

Transposition scores generally increase if only transposition responses are rewarded during test trials (e.g. Stevenson & Iscoe, 1955; Stevenson, et al., 1955; Terrell, 1959; Terrell, Durkin & Wiesley, 1959). Studies in which all test trials were rewarded yield mixed results. Of 20 studies with humans, 11 report an increase in transposition over test trials, 6 report a decrease and 3 report no change. The rewarding of transposition responses in tests introduces the problem of new learning, which serves to confound the results. While the rewarding of all responses does not eliminate the problem of additional learning after acquisition trials, it may tend to increase the tendency of a given subject to respond in a given way on his first trial, whether that first trial response is a tendency toward absolute transposition or to random responding.

The distance effect in transposition is the phenomenon around which the relational-absolute controversies have revolved. No theory completely predicts all of the effects of distance. Spence's theory predicts the distance effect in one direction, but fails to account for transposition in the negative direction. While the Gestalters allude to the distance effect at extremes of a dimension, they do not attempt to explain its occurrence per se.
Gulliksen and Wolfle's configuration theory (1939) does not predict it. Explanations of transposition in terms of generalization or of discrimination are more descriptive than theoretical (e.g. Stevenson & Bitterman, 1955). Reese (1968) makes a sensible statement about transposition and the relation vs. absolute issue:

... even if relation perception is undeniably possible, it is still important to ask whether it is usual... The question has to do with the stimulus control of behavior, which is a pervasive problem in psychology. (p. 16)

The first task, then, is to discover what is known about transposition, and then to determine the implications of the facts. (p. 17)

The distance effect has occurred in virtually all investigations of transposition at some distance on the continua. Of ten studies of two-stimulus transposition in children ranging from 21 months to 7 years of age, three studies showed no distance effect on a one-step test (100% transposition), one study showed no effect at two steps, and all showed a distance effect at three or more steps (40% to 90% transposition). The mean per cent of transposition at three steps and at four steps was 64% and 68% respectively. Rudel (1965) and Thompson (1965) report no significant distance effect in retarded subjects among one-, two-, and three-step tests.

In summary, the evidence indicates that 80% or more transposition responses may be expected at one-step and a maximum distance effect may be expected at three and four steps (40% to 80% transposition responses). In
two-stimulus problems transposition may increase again at distances greater than four steps. The distance effect in two-stimulus transposition is a shift to chance-level responding rather than to absolute responding as distance increases.

Stevenson and Bitterman (1944) and Stevenson and Iscoe (1955) propose a less specific generalization explanation for transposition than Spence's. They propose that transposition takes place when the S fails to discriminate between the training and test condition. Jackson and Domingues (1939) and Zeiler (1963) varied the similarity of test stimuli to training stimuli with children. Jackson and Domingues report a drop in transposition with greater dissimilarity. Zeiler reports a greater decrease in transposition with dissimilar stimuli.

Reese (1968) attempts to formulate a comprehensive theory of transposition which assumes both relational and absolute responding. He postulates an orienting response which is protracted during acquisition, but which becomes inhibited as the discrimination is learned. He defines the orienting reflex as including attention and comparison behavior, or scanning. Inhibition of the scanning response during acquisition represents a shift from responses to the properties of individual stimuli to those of the total stimulus configuration. Shifts to stimuli which are not sufficiently different from the acquisition stimuli to disinhibit the scanning reflex will result in the subject's
responding to the stimuli as equivalent to the training stimuli. Stimuli which are sufficiently different from the acquisition stimuli to disinhibit the orienting response will elicit scanning and responses made on the basis of the stimulus values on absolute and relational gradients.

The stimulus control of the orienting response suggested by the above cited theory of transposition is implied to be a factor influenced by time. The parameter of the effect of response time or of exposure time has not been investigated thus far.

Purpose

The purpose of this study was to investigate the effects of varying stimulus exposure time and its consequent effect upon transposition.

If, as Reese suggests, the orienting response becomes inhibited upon shifts to new stimuli before transposition decreases, varying exposure time should have measurable effects upon transposition by constricting or extending the time during which the orienting response can take place. The null hypothesis, therefore, is that no differences exist between groups.

H₁ - Reducing stimulus exposure time decreases transposition.
H₂ - Exposure times greater than acquisition exposure time will increase transposition.
CHAPTER II

METHOD

Subjects

Subjects were 30 boys and 30 girls from the Immanuel Lutheran kindergarten classes whose ages ranged from 58 to 78 months. All subjects were white.

Apparatus

The apparatus was a model V-0959T Tachistoscope manufactured by the Polymetric Company, Reading, Pennsylvania. The tachistoscope was mounted behind a 4' x 3' machine-gray screen which was equipped with two doorbell buttons, mounted bilaterally, four inches above the bottom of the screen. Each button activated a light in the back so that E could register the responses. To the right of the right-hand button was an opening with an aluminum spout through which "M & M" candies were dropped into a paper cup following correct responses. The tachistoscope aperture protruded through the front of the screen at the approximate eye level of the standing S when the apparatus was placed upon a 30 inch high table. A six-inch stool was used if Ss were too short to reach the aperture.
Stimuli were as follows:

1. Acquisition stimuli were paired, solid black circles 1.5" and 1.25" in diameter on a white 4" x 5" card. Their centers were three inches apart; their horizontal axis bisected the card.

2. Test stimuli were solid black circles positioned in like manner but differing in size. The near-test stimuli were circles 1.25" and 1.00" in diameter (one step downward from the acquisition stimuli). The far-test stimuli were circles .5" and .25" in diameter (four steps downward). The ratio of the area of each circle to its adjacent circle is 1:1.44.

Procedure

The subjects were selected from the class list using a table of random numbers. Two female subjects were replaced because they failed to learn the problem. Five subjects, three boys and two girls, refused to participate in the experiment. Each male and each female was assigned to a group using a table of random numbers. Each was brought in to the apparatus and was given the following instructions:

"We are going to play a game to see how much candy you can win. Put your face in there (E points) and look in the window. (The first acquisition pair are exposed for 1.0
sec.) Do you see two black circles? The game is to see if you can pick the correct circle each time I show them to you. Do you see these two buttons (E points them out)? If you think the circle on this side is the correct one, you push this button. If you are right a candy will come from here and fall into the cup. If you are wrong, I will say, 'wrong,' and no candy will come out. If you want to pick the circle on that side, what do you do? Right. You push that button. (E points to the left button) and if you are right a piece of candy will come out. If you are wrong, I will say, 'wrong,' and no candy will come out. OK? Do you understand?"

"Now, put one hand on each button so you will be ready and put your face in the window." (E moves to the rear of the screen and states, "Ready?" before the first and before each subsequent trial.)

If the S pushed both buttons or neither button after any trial, the E instructed, "Push only one button. Which circle do you choose?"

The acquisition stimuli were then presented for a 1.0 second exposure for each trial. Their relative lateral positions were varied according to a two-stimulus Gellerman random alternation sequence. Responses to the smaller of the two circles were rewarded until a criterion of nine correct responses was achieved.

Test stimuli were presented for ten trials in random right-left sequence. All test responses were rewarded with
candy. No knowledge of results was given during the test trials. Transpositions were recorded as plus (+) and absolute responses minus (-) on the score sheet.

Candy rewards, stimulus changes, and response recordings were made manually for each trial. The average time for each trial was approximately five seconds. There was no added delay in shifting to test stimuli.

The design is illustrated in Table 1.

**TABLE 1**

**EXPERIMENTAL DESIGN**

<table>
<thead>
<tr>
<th>Test Stimuli Exposure Time</th>
<th>Test Stimuli Exposure Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Test</td>
<td>Far Test</td>
</tr>
<tr>
<td>Group I</td>
<td>Group II</td>
</tr>
<tr>
<td>n=10</td>
<td>n=10</td>
</tr>
</tbody>
</table>

Following the completion of the test trials, the S was shown a white card with a 1" and a .5" circle on it. He was asked, "Which one of these circles would you choose?" If the S pointed he was asked, "What is that one called?" If the S was unable to name the size relationship by stating, "the small one," "the littlest," etc., he was scored as "no concept." If any form of relationship or
size was made, he was scored as a concept S. Spontaneous accurate references to the size relationship were counted as evidence of the presence of the concept. The concept test was omitted on those occasions when the concept was emitted spontaneously.
CHAPTER III

RESULTS

Training Trials:

The mean number of trials required by all Ss to reach the nine-out-of-ten trial criterion was 34.63 and the standard deviation was 30.9.

Table 2 includes mean scores and mean ages of male and female subjects and correlations of acquisition trials with age.

TABLE 2

ACQUISITION DATA

<table>
<thead>
<tr>
<th>Acquisition Trials</th>
<th>Age</th>
<th>Correlation of Number of Trials with Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>X</td>
<td>SD</td>
</tr>
<tr>
<td>All Subjects</td>
<td>60</td>
<td>34.6</td>
</tr>
<tr>
<td>Boys</td>
<td>30</td>
<td>29.7</td>
</tr>
<tr>
<td>Girls</td>
<td>30</td>
<td>39.7</td>
</tr>
</tbody>
</table>

*P<.01

A t-test for differences between the mean numbers of trials to criterion for boys and for girls was non-significant (t=1.250, df=58). Two girls were dropped from the study for failure to learn the initial discrimination.
problem. Both were tested on two successive days and had failed to reach criterion well after 200 trials.

Forty-six Ss verbalized the concept according to the criterion, 14 Ss could not or did not verbalize the concept. Thirty-seven of the former and ten of the latter transposed on trial one of the test trials. Chi square for the relationship of concept knowledge with first trial transposition was non-significant ($X^2=0.660$, df=1).

To test for possible sampling biases an analysis of variance on acquisition scores for the experimental groups resulted in no significant results.

Chi square for the proportions of first-trial transposition responses among groups was non-significant, $X^2=0.359$, df=2.

Analysis of variance of the sum transposition responses in ten test trials is summarized in Table 3. The mean transposition scores are listed in Table 4, and Figure 2 illustrates these results graphically.

An a posteriori comparison of means (Winter, 1962, p. 209) indicates a significant difference between Groups IV and VI, $P<.01$, and between both .05-second exposure groups and all others, $P<.01$.

A $2 \times 2 \times 3$ analysis of variance to test for the effect of sex of subjects upon transposition resulted in no significant main effect nor interaction effects which could be attributable to sex.
### TABLE 3

**ANALYSIS OF VARIANCE OF TEST SCORES**

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>.01</td>
<td>1</td>
<td>.01</td>
<td>.0047</td>
</tr>
<tr>
<td>Exposure Time</td>
<td>188.83</td>
<td>2</td>
<td>94.42</td>
<td>44.33**</td>
</tr>
<tr>
<td>Test X Exposures</td>
<td>21.36</td>
<td>2</td>
<td>10.68</td>
<td>5.01 *</td>
</tr>
<tr>
<td>Error</td>
<td>114.78</td>
<td>54</td>
<td>2.13</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>324.98</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**P < .01

* P < .01

### TABLE 4

**MEAN TRANSPOSITION SCORES**

<table>
<thead>
<tr>
<th>Exposure Time</th>
<th>.05 Seconds</th>
<th>1.0 Seconds</th>
<th>1.95 Seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Test Gp. I</td>
<td>5.7</td>
<td>9.2</td>
<td>8.6</td>
</tr>
<tr>
<td>Far Test Gp. II</td>
<td>5.5</td>
<td>8.0</td>
<td>9.9</td>
</tr>
</tbody>
</table>
Figure 2. Mean transposition scores of groups tested on near and far tests at .05 sec., 1.0 sec., and 1.95 sec. exposures. Scores are based upon the number of transposition responses in ten test trials.
The acquisition data indicate a negative relationship between age and rate of discrimination learning in this problem. The relationship is of moderate strength, however, which supports White's (1965) hypothesis that this age range is transitional with respect to various learning and verbal skills. According to White, children under five years learn in an associative manner; after seven, they have the capability to use internal language to mediate responses. This latter stage does not eliminate associative functioning, and which type occurs depends upon stimulus and contextual conditions. The transitional period between five and seven years is characterized by the presence of both forms of functioning in varying situations. The stronger negative relationship between trials to criterion and acquisition does not agree with reports that girls learn discriminations more rapidly during the transitional period than boys, presumably due to earlier language development (McCarthy, 1954).

Lipsitt (1961) reports that simultaneous discriminations were more difficult to learn than successive discriminations for both children and adults if the response locus was
separated from the stimuli, but Jeffrey (1961) in a similar study did not find this. It is possible that both the apparatus and the kind of response required resulted in more difficulty for the younger girls to master the task than for boys. It is possible that differential experience with toys and mechanical contrivances would have a differential effect in this transitional period.

It is of no statistical value, but it is interesting to note that the predominant strategy used by the two girls who failed to learn the discrimination and also by the girls with the two highest numbers of acquisition trials was that of alternating responses. Jeffrey and Cohen (1965) studied response sets by rewarding children of different ages on all trials of a two-stimulus discrimination. Children younger than four perseverated in responding to one stimulus; four-year-olds and older children alternated responses. This pattern has been shown to persist until about nine years of age (Rieber, 1966). It seems reasonable that a child who does not comprehend the requirements of an experimental task such as this would revert to his predominant response set as a partial solution.

The results of the transposition tests indicate an interaction between exposure time and distance and a main effect of exposure time.

The .05 second exposure time reduced transposition
responses to chance level. Hence, there was neither consistent transposition nor consistent absolute responding. Reese's (1968) transposition theory, which incorporates both absolute and relational elements in transposition, predicts one-step transposition, as do generalization theories and Gestalt theory. As the discrimination is learned, according to Reese, the duration of the orienting response becomes shorter or inhibited. His theory postulates that absolute responses obtain at the end of acquisition and that these responses are made to both absolute and relative cues. Changes which can lead to the disinhibition of the orienting response may be represented by the absolute change between the acquisition and the test stimuli, changes between the acquisition situation and the test situation, and changes resulting from shifts of the relational cues. In this experiment, changes represented by different exposure times, and by near and far test stimuli are assumed to contribute to the disinhibition of the orienting response. Once the orienting response is disinhibited, the duration of scanning increases. The response made will depend on the strength or value of the test stimuli on the absolute and on the relative generalization gradients. Each category of cues has its own generalization gradient. The gradient for the relative cues is assumed to be broader than that for the absolute cues. On near tests, therefore, both absolute and relative
cues influence the response; on intermediate tests the absolute responding tendency operates in conflict with the relational tendency and transposition drops resulting in the distance effect; at extreme distances, the relational gradient has more value than the response tendency resulting from the absolute gradient value and transposition responses dominate. If there is not a sufficient change between the acquisition situation and the test situation to disinhibit the orienting response, however, the S will respond as he would to the acquisition stimuli.

The .05 second exposure time disinhibits the orienting response but orienting or scanning initiates at the offset of the stimulus exposure. The S is left without a stimulus display to which to respond, hence, responding reverts to chance level. Neither stimulus gradient value operates in this condition for either near or far tests.

Tests using the 1 second exposure time (the same exposure time as used during acquisition) resulted in a predictable, moderate, reduction of transposition on the far test, and a high level of transposition on the near test. Any disinhibition of the orienting response could be considered to be a result of changes in the stimuli and not to changes in the exposure time.

Assuming that the far test disinhibits the orienting reflex, the change in the exposure time from that of the acquisition trials renders the far test situation even
more discriminable. The far stimuli elicit orienting; as the exposure time exceeds one second there is further disinhibition since a further change has occurred. As distance increases beyond the effective generalization gradient of the absolute cues, the generalization gradient for the relational cues becomes the determining factor in the response, because the relational gradient is broader.

Greater scanning or orienting time could serve two purposes. It could allow more time for mediation to take place. White (1965) suggests that verbal mediation takes more time than an S-R response. Secondly, it could serve to affect the influence of the absolute gradient and of the relative gradient upon the orienting response, so as to reduce the absolute effect by allowing more time to attend to differences so as to place the effective stimulus under the sole influence of the relative generalization gradient.

These results have implications for the mediation theory of transposition in that, if mediated responses require longer latencies than non-mediated responses, the length of stimulus exposures is bound to affect the mediated response. If transposition is increased by mediation, as Spence has suggested, it could be argued that short exposure time did not allow mediation to take place and that longer exposures allowed mediation and therefore, increased transposition. The evidence of this study
leaves the mediation time question open, but suggests that response latencies, measured from the onset of the test stimulus might provide data for this parameter.
CHAPTER V

SUMMARY

Spatial transposition was studied as a function of the exposure time of stimuli. Restriction of stimulus exposure time and extension of exposure time during test trials were studied for their relative effects upon near and far transposition in preschool boys and girls.

Six groups of ten Ss each were tested on near and far transposition pairs one-step and four-steps from an acquisition pair. Exposure times of .05 seconds, 1.0 seconds and 1.95 seconds were used to present the above stimulus sets.

With an analysis of variance design, evidence was found for a reduction of transposition with rapid exposures in both near and far groups. The distance effect was found for moderate exposures and an increase of transposition was found for long exposures.
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