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ABSTRACT

The experiment described in this report investigates the effects of various cognitive cues in questions asked regarding the relationship of elements in pictorial depth perception. The subjects of this study are 40 third grade Black and Puerto Rican children. They are confronted with four pictures from the Hudson Depth Perception Tests and asked to reply to questions concerning depth perception relationships. The varying cues in the question on relationships draw varying reactions from the subjects, thereby suggesting certain conclusions. The results support the theory that expressions containing marked adjectives are more difficult than their counterparts. Details of the experiment, findings, and discussion are included in this report. References are provided. (VM)

Differential Cognitive Cues in Pictorial Depth Perception[1]

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ABSTRACT

Forty predominantly Black third grade children were randomly assigned to eight groups and were asked a question regarding the relationship of elements in Hudsons' pictorial depth perception task. The question varied in terms of "which (looks or is), (nearer or farther) to (you or man), the elephant or the antelope?" Performance in terms of ability to perceive depth was statistically significantly higher when Ss were asked "which looks/is farther....rather than nearer." No other effects were significant. Results are discussed in terms of the effects of lexical marking and attentional factors inherent in the relational words used in the question.

[1] Draft of paper presented at AERA annual convention Chicago, Illinois, 1972.

DIFFERENTIAL COGNITIVE CUES IN PICTORIAL DEPTH PERCEPTION[1]

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Hudson (1960) demonstrated that size perspective, linear perspective, and overlap are used as sources of information in the judgment of distance relationship between objects in pictorial depth perception. Hudson used pictures which depict an elephant in the center, drawn small to indicate distance (far back); and a man and an antelope drawn large at the margins. In each picture the man is aiming a spear aligned with both the elephant and the antelope and S is asked three questions: (1) What do you see in the picture? (2) What is the man doing? (3) Which is nearer the man, the elephant or the antelope? Ss are categorized as 3-dimensional perceivers if they indicate that the antelope rather than the elephant is nearer to the man. In general, studies based on Hudson's pictures support his findings that 1) both Black and White literate Ss perceive depth in 3-dimensional pictures but this is not true of illiterate Ss; and 2) that for the Black African Ss there is little relationship between level of education and the ability to perceive depth in 3-dimensional pictures.

Segall, Campbell and Herskovitz (1966) reviewed Hudson's studies and mentioned that Hudson's findings may be specific to the pictures employed and questions asked about them. Specifically, Deregowski (1968) demonstrated that Ss judged to be 2-dimensional in Hudson's test were able to successfully construct 3-dimensional models, and he suggested that the ability to interpret depth depends on, among other things, the questions directed to the Ss, a plausible hypothesis rejected by Hudson.

Wohlwill (1965) in a study of perception of relative distance, suggested that the relational questions "which is..." and "which looks---" are probably very different questions, directing the respondent to objective and phenomenal relationships respectively. In addition, studies of egocentrism (Piaget, 1967) suggests

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that young children are more capable of relating themselves to objects in pictorial space than of assuming the role of a second person, live or in a picture. Thus in Hudson's pictures, the questions "Which is (looks) nearer to the man (to you)..?" may produce differential results. Furthermore, extrapolating from the Piagetian concept of temporal decalage and the findings of H.H. Clark (1971), Huttenlocher and Higgins (1971) and Sherman (1969) on lexical marking and relational terms, it is likely that the spatial relational concept "nearer" (as used by Hudson and others) may not be functionally equivalent to the concept "farther". Thus, the present study investigated the effects of various cognitive cues in the questions asked regarding the relationship of elements in pictorial depth perception.

METHOD

Subjects and Design. Forty third grade children, about thirty American Blacks and the remainder Puerto Ricans, from a lower-middle class school in New York City were randomly assigned to one of eight groups in a 2 x 2 x 2 factorial design. The factors in terms of the cues used in the questions were 1) either "man" or "you", 2) either "is" or "looks", and 3) either "nearer" or "farther". One S failed to complete all the questions and was dropped from the study.

Materials. Four pictures from Hudson Depth Perception Test containing overlap, size and linear perspective cues were administered to all Ss. The pictures were counterbalanced to control for order of presentation.

Procedure. Each S was individually brought into the experimental room, seated alongside a Black E, and shown one at a time, each of the four pictures. For each picture S was asked three questions: (1) What do you see in the picture? (2) What is the man doing? (3) Which (looks/is, nearer/farther) to (you/man), the elephant or the antelope?

Question (1 above was asked in order to familiarize Ss with the elements in the pictures and was not scored. Question (2) was asked in order to determine if S was orienting to the cues in the picture and was scored correct if S said the man was doing something to the antelope. The main measure of the dependent variable

was obtained from Question (3). For four of the groups (the "nearer" condition) Question 3 was scored correct if S indicated that the antelope "is/looks" (nearer) to the man/you", whereas for the remaining four groups (the "farther" condition) elephant was the correct answer.

RESULTS AND DISCUSSION

A 2 x 2 x 2 analysis of variance was performed on the total number of correct responses to the third question for all four pictures. The only statistically significant finding obtained was a main effect for the "nearer-farther" factor, $F(1,39)=5.85$ $p. < .025$. The means being 1.6 and 2.8 respectively. This finding indicated that the question "which looks/is farther to the man/you...?" produced more correct responses concerning the relationships of elements in the depth perception task than the question "which looks/is nearer to the man/you...?" There was a statistically significant correlation ($r=.53$) between scores on question two and three, and the overall mean score on question two and three were both 2.3.

In solving problems involving relational terms, it has long been observed by linguists (e.g. Bierwisch, 1967; Greenberg, 1966; and Lyons, 1968) that word pairs like "good" and "bad" are not symmetrical. Thus in three term series problems, Clark (1969a) demonstrated that Ss take longer to store and retrive the semantically more complex, marked adjectives (e.g. "bad") than the unmarked adjectives (e.g. "good"). These findings are explained in terms of the principle of lexical marking which states that the meaning of certain positive adjectives (e.g. "good" and "long") are stored in memory in a less complex form than the meaning of their antonyms. Clark (1969b) also demonstrated that problems containing the term "deep" in the continuum of "deep"--"shallow", are easier to solve than those containing the term "shallow". In addition, Sherman (1969) reported that negative sentences with marked adjectives are more difficult to comprehend than identical sentences with their unmarked counterparts, and Huttenlocher and Higgins (1971) demonstrated that it is more difficult to comprehend comparative expressions involving marked adjectives than identical expressions involving their unmarked counterparts.

The results of the present study support the above findings that expressions containing marked adjectives are more difficult than their counterparts. According to Clark's (1969a) principle of lexical marking, the concept "farther" can be assumed to be the positive, unmarked member of the pair "farther"--"nearer". The criterion for judging positive unmarked and negative marked adjectives (though somewhat controversial) involves the possession of more of the quality or quantity implicitly expressed in the continuum--e.g. good-bad, up-down, farther-nearer. The concept "farther", assuming it is unmarked (is stored in memory and processed in a less complex form than "nearer") might have facilitated the conceptualization of the relationships implicit in the stimuli. The use of "farther" thus may have "simplified" the question, in contrast to the use of "nearer".

Alternatively and/or concomitantly, the question "which looks/is farther...?" might have a directive or attentional function, facilitating the Ss focusing on the inverse relationship of changing size with distance. Whereas, the question "which looks/is nearer...?" may not provoke such cognitive or attentional processes. Indeed, the word "nearer" may serve to distract S's attention from the background depth perception cues inherent in the problem of inverse distance-size relationship when pictorially presented. The word "farther" on the other hand may semantically cue the Ss to such relationships. Thus, the present findings also suggest that the relative difference obtained between the "nearer-farther" conditions could have been brought about as a result of "nearer" functioning as an interfering cue, rather than "farther" functioning as a facilitative cue.

Mundy Castle (1966), supposedly replicating and extending Hudson's findings, changed the key question to "which is closer"...?, though he did not refer to the possible differential effects of the words "nearer" and "closer." In using Hudson's pictures and questions as a test of depth perception caution should be exerted, since the nature of the question asked appears to be an important determinant of the nature of response. Hudson's and similar results might have been spuriously depressed by the nature of the question asked, whereas optimum results may be

obtained by manipulating the cues inherent in the question, specifically substituting the word "farther" for "nearer."

It's interesting to note that Carroll, Davis and Richman (1971) report that the word "farther" is more frequently used in books written for third and fourth grade children than the word "nearer", the frequencies being 86-86 for "farther" and 25-30 for "nearer" for grades three and four respectively. Their data indirectly supports the notion that the concept "farther" is the unmarked, positive and less complicated adjective. And Clark, E.V. (1971) demonstrated that children seem to acquire the meanings of the unmarked (positive) member of pairs of antonymous relational concepts earlier than the marked (negative) member in the "more-less, high-low, before-after" continuum of relational terms. Thus, though the present findings may be age specific, additional developmental research is warranted not only to determine the order of acquisition of different relational concepts, but to assess their role and efficacy as cues in a variety of learning tasks.

Indeed, the cross-sectional nature of the present design, the restricted age range of the Ss and the sample size limit the generalizability of the finds, but those educators concerned with mathematical and scientific concepts entailing quantification of space should be aware of the possible differential efficacy of cues inherent in instructional procedures involving relational concepts.

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