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ABSTRACT

The purpose of this study was to investigate the relationship between conservation status and relational terms by means of the semantic differential. Sixty-one children classified according to Piaget's three levels of conservation development judged the relational terms "more" and "less" on concrete semantic differential scales. It was found that Logical Conservers were able to distinguish between "more" and "less" better than either Intuitive Conservers or Non-Conservers, and that there was an apparent developmental progression in the use of these terms reflecting Piaget's stages of conservation attainment. These findings have particular relevance to verbal methods of assessing conservation ability. (Author)

USE OF "MORE" AND "LESS" IN CONSERVATION: A SEMANTIC DIFFERENTIAL ANALYSIS

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In a typical conservation task, the subject (S) is usually asked whether two objects "are the same, or does one have more?" In order to respond correctly, S must not only perceive the presence or absence of equivalence, but also understand the question posed and answer it verbally. Accordingly, a child's failure to conserve might be due to linguistic incompetence. Because of this, only those children who understand the meaning of relational terms might be expected to emerge as conservers. Conversely, children who cannot distinguish relational terms might not be expected to conserve. This implies that verbal assessment of a mental operation limits that assessment to those individuals who have verbal understanding.

Within this limitation a number of researchers have explored the relationship between relational terms and conservation. For example, it has been found that very young children tend to confuse meanings of "more" and "less" (Donaldson & Balfour, 1968), and that correct use of the concepts "more" and "less" seems to be related to conservation ability (Griffiths, Shantz, & Sigel, 1967; Sinclair-de-Zwart, 1969).

In order to clarify the relationship between relational terms and conservation, the semantic differential was selected to evaluate children's meanings for these terms. This instrument has been specifically designed to measure meaning, and has the advantages of objective scoring and easy administration. Moreover, biases arising in connection with direct

interrogation and evaluation by the experimenter (E), as well as fluency and spontaneity of response by S can be eliminated. Although the semantic differential has been used primarily to measure connotative meanings through factor analysis procedures, techniques are available for making quantitative comparisons of the similarity of meaning between concepts (Osgood, Suci, & Tannenbaum, 1957, pp. 87-97). Furthermore, the semantic differential has proved workable with young children (Maltz, 1963; Di Vesta, 1966).

Thus, the purpose of this study was to investigate the relationship between relational terms and conservation ability by means of the semantic differential.

Method

Subjects

Eighty-five children with a mean age of 93 months were given the EITS Conservation Concept Assessment Kit, Form A. The children were enrolled in grades one, two and three in three different schools in a rural county. There were forty-two boys and forty-three girls.

The conservation test was administered individually and scored according to the procedures outlined in the manual (Goldschmid and Bentler, 1968). Form A consists of six conservation tasks: Two-Dimensional Space, Number, Substance, Continuous Quantity, Weight, and Discontinuous Quantity. On each task, S's performance was assessed in terms of his conservation behavior as well as his explanation of the principle involved.

For both the behavior and explanation aspects of a task, a correct response was scored as 1, an incorrect response as 0, thereby making a total possible conservation score of 12. For behavior, S's response was scored correct if he indicated that the two objects were the same, even though one had been transformed by the examiner. If he indicated that one or the other object was more, his response was scored 0. If a child's conservation behavior was scored correct, then his explanation was examined. An explanation conforming to one or more of the principles of invariant quantity, compensation or reversibility was scored 1, that not conforming to any of these principles was scored 0.

On the basis of the total conservation score, Ss were classified into three groups, reflecting Piaget's (1950, p. 4) three stages of conservation development. Those who scored 0 overall were designated Non-Conservers (NCs). They did not recognize object equivalence on any of the tasks. Those Ss who scored 4, 5, or 6 overall were labelled Intuitive Conservers (ICs). They generally perceived sameness, but could not explain why. Finally Ss who scored 12 were named Logical Conservers (LCs). These children not only perceived equivalence, but also gave logical reasons. The specific cut-off categories were determined on an *a priori* basis in that they seemed to reflect discrete levels of conservation development. In order to obtain a minimum of 20 Ss in each classification, it was necessary to test 85 children. Details concerning the number, sex, mean age, and age range for conservation group (NC, IC and LC) are presented in Table 1.

Insert Table 1 about here

Semantic Differential Testing

Since "more" and "less" indicate size or direction of measurable difference in a comparison, concrete adjectives referring to tangible characteristics of objects were selected to provide relevant opportunities for meaning discrimination. Accordingly, the concepts "more" and "less" were judged on six concrete scales: "low-high", "long-short", "wide-narrow", "big-small", "thin-fat" and "up-down". A five-step rating system was used, with scales and favorable and unfavorable poles being randomly presented.

The semantic differential was administered in group form with Osgood's instructions being modified for use with young children (Osgood et al., 1957, pp. 82-84). In addition, there was a 15 to 20 minute instructional period, during which the method for making ratings was explained and practised until all children demonstrated they knew what to do. In administering the test, E read the concepts and scales aloud so as to pace S's responses. There were periodic reviews of the rating procedure, where necessary, to ensure that Ss continued to understand the task. Moreover, Ss judged a particular concept against all scales before proceeding to the next concept. Total semantic differential testing time varied between 25 and 35 minutes per class. Four classes were tested, with class size ranging from 13 to 30 children.

Results

The judgments made on the twelve polar scales by each S were scored by assigning the lowest value of 1 to the left hand pole of the scale and the highest value of 5 to the right hand pole, irrespective of the adjective defining the ends of each pole. Then, for each group (NC, IC and LC), an average value was calculated for each scale by summing over Ss and dividing by the number of Ss, first for the concept "more" and then for the concept "less". These average values ranged from 1 to 5, with 3 being the middle value. The results for the three groups are plotted in Figure 1.

Insert Figure 1 about here

It was hypothesized that children who conserve are capable of making finer quantitative discriminations than children who do not conserve. Thus, LCs would be expected to differentiate meanings of the quantitative concepts "more" and "less" to a greater degree than ICs and NCs. This prediction seems to be supported in Figure 1.

For LCs the profiles for "more" and "less" seem to be opposite to each other. If one pole of the scale is relevant for "more", the other pole appears to be relevant for "less". For example, "low" is chosen for "less" but "high" is chosen for "more". On the other hand, NCs do not appear to distinguish "more" from "less". In fact, they tend to select the same pole for both concepts. Thus both "more" and "less" are judged to be "short", "narrow", "small", "thin" and "down".

The profiles for ICs combine features of both LCs and NCs. As in NCs, there is some overlap of meaning. For example, both "more" and "less"

are judged to be "narrow". There is, however, a difference between "more" and "less" on the scales similar to that associated with conservers, although this difference is not as pronounced.

By inspection of Figure 1 it can also be seen that the profile for "less" remains fairly stable across the three groups while the profile for "more" is increasingly dissociated from "less" with attainment of conservation. Therefore, for NCs "more" is associated with "less", for ICs "more" hovers around the neutral point of the scale, while for LCs "more" is opposite to "less".

Discussion

The findings generally support the position that children with conservation status have a greater understanding of relational terms used in conservation testing than children who do not conserve. LCs, who not only demonstrate equivalence but also given logical explanations, tend to see "more" and "less" as opposites, while NCs confuse the two terms. ICs, who demonstrate equivalence without giving adequate explanations, seem to see the two terms as being different but not opposite. Thus there appears to be a development involving meaning of relational terms that parallels acquisition of conservation.

One aspect, however, of these findings flatly contradicts evidence cited by Donaldson & Balfour (1968) and Griffiths et al. (1967). Whereas Donaldson & Balfour found "less" to be confused with "more" in young children, this study shows that NCs confuse "more" with "less". Specifically, in the present study all three groups -- NCs, ICs and LCs --

show very similar meanings for "less", but the meanings for "more" change with conservation status. Furthermore, whereas the Griffiths et al. study found that "more" was used correctly to a greater extent than "less", this study found that "less" was used correctly more often by children than "more". A possible reason for this difference in findings might lie in the use of an objective testing technique, the semantic differential, as contrasted with the subjective methods involving personal questioning and performance used in the cited studies. In addition, group procedures were used with the semantic differential instead of individual tests. Another reason might be the ages of the children tested in that school-age children instead of pre-schoolers were used here.

In short, the ability to conserve and the ability to distinguish meanings of relational terms seem to develop together in young children. Further studies concerning the nature of this development seem warranted. The meanings that children differing in conservation status have for "same" could be explored, and parallels drawn between the use of "same", which implies qualitative evaluations, and "more" and "less", both of which imply quantitative evaluations. Investigations of the relationship between conservation ability and relational terms have important relevance to verbal methods of assessing conservation.

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TABLE 1

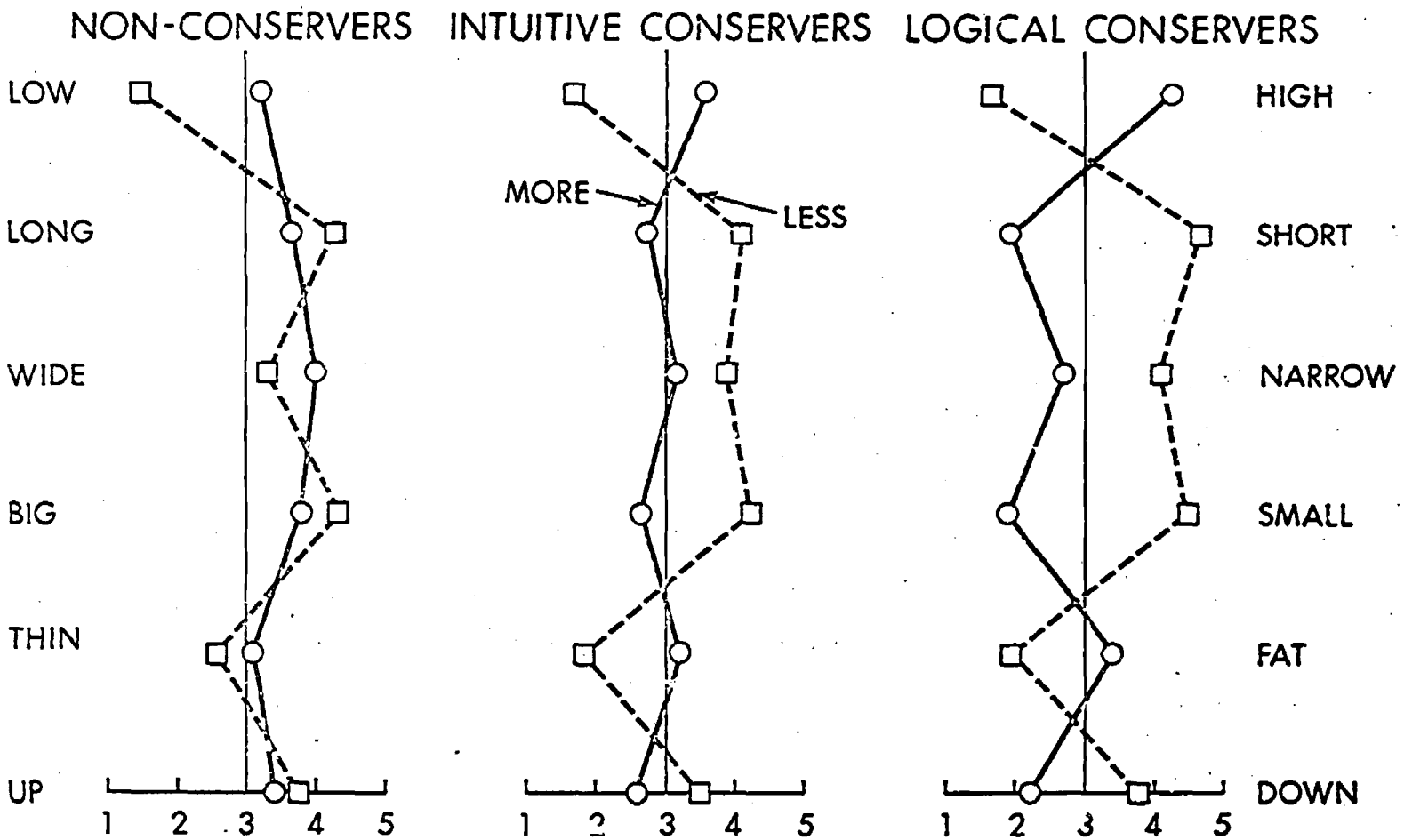
Number, Sex, Mean Age and Age Range of Non-Conserver, Intuitive Conserver and Logical Conserver Groups

	Non-Conservers			Intuitive Conservers			Logical Conservers		
Variable	Total	Male	Female	Total	Male	Female	Total	Male	Female
Number	21	10	11	20	8	12	20	12	8
Mean Age [a]	82.8	80.8	84.6	91.2	90.3	91.8	102.3	103.5	100.4
Age Range [a]	74-110	75-94	74-110	76-120	76-120	78-106	83-125	83-125	86-109

[a] in months

Figure Captions

Figure 1 Semantic differential profiles for mean D scores for NCs, ICs and LCs over concrete scales for the concepts "more" and "less".


NON-CONSERVERS
INTUITIVE CONSERVERS
LOGICAL CONSERVERS
LOW
LONG
WIDE
BIG
THIN
UP
MORE
LESS
HIGH
SHORT
NARROW
SMALL
FAT
DOWN
1 2 3 4 5
1 2 3 4 5
1 2 3 4 5