

# The transitivity of children's inferences about preferences\*

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Following Smedslund's (1960) findings concerning the intransitivity of preschoolers' inferences about the preferences of others, three age levels of public school children were tested on an inference-preference task, using colors as stimuli. The median ages of groups tested were 6;3, 9;2, 11;2. Appreciable transitivity of response appeared only in the eldest group. Verbal explanations for transitive responses were required for an additional group with a median age of 7;0. The data suggest that the nontransitive hypotheses described by Smedslund (1963) do contribute to the inferences of children, but indicate that egocentrism is not, as Smedslund (1960) contended, an adequate explanation for the intransitivity of children's inferences about preferences.

A substantial developmental literature had accumulated involving measures of transitivity. This interest stems from the Genevan establishment of transitive inference as a skill characteristic of concrete operational thought (Piaget & Inhelder, 1941; Piaget, Inhelder, & Szeminska, 1960). Piaget and his coworkers used a tower-building task requiring coordinated measurements to test the age and form of emergence of the logical operation,  $A = B$ ,  $B = C$ , therefore  $A = C$  (Piaget, Inhelder, & Szeminska, 1960). This task allows the coordination of the heights of two separate towers only by use of a middle term as a truly operational measuring device, which is the crux of the transitive inference.

The Genevan studies maintained that the child does not gain complete competence for transitive measurement operations until between 7 and 8½ years of age. Others, using quite different diagnostic criteria, have suggested considerably discrepant age norms for the transitive inference. The controversy (Braine, 1959, 1964; Smedslund 1963, 1965, 1966) raised a number of questions concerning procedures and criteria for diagnosing the presence of cognitive structures.

In opposition to the Genevan requirement of verbal justification for response, Braine (1959) provided an entirely instrumental means by which the S could employ the transitive inference, and observed that 50% of children around 5 years of age demonstrated the skill in judgments of length. Smedslund (1963) charged that Braine's procedure allowed false-positive classification of number of pretransitive Ss on the grounds that some could have guessed the transitive answer, made a direct

perceptual judgment, or made use of so-called nontransitive hypotheses. The nontransitive hypotheses involve reaching the correct conclusion without use of all the premise information, notably by judging  $A > C$  because  $A > B$ , without taking into account  $B > C$ . Smedslund proposed an experimental procedure to diagnose attainment of the inference without contamination by these nonlogical response strategies. This required a verbal explanation following a transitive length judgment impeded by illusion. The age of minimal detection of transitive inference was around 8 under this procedure.

Related to the controversy with Braine, an earlier paper by Smedslund (1960) recognized the difference between transitive behavior supported by verbal justification and "a purely functional transitivity." In this paper, Smedslund reported data on preschool children's inferences about the preferences of others. Eight of the 40 Ss tested (i.e., 20%) passed the criterion, leading Smedslund to conclude that children of preschool ages do not possess the transitive skills required by the task.

The present study was conducted to determine the levels of transitivity of the Smedslund-type inference-preference judgments by various ages of children without the requirement of verbal justifications for responses, and, further, to explore the relation between such judgments and the nontransitive hypotheses and egocentrism suggested by Smedslund.

## METHOD

### Subjects

One hundred and ninety-seven public elementary school children served as Ss. They were divided into the following four experimental groups by their membership in four age-class levels in the school system: Group 1,  $N = 49$ , median age = 6;3; Group 2,  $N = 74$ , median age = 9;2; Group 3,  $N = 52$ , median age = 11;2; Group 4,  $N = 22$ , median age = 7;0.

### Materials and Procedure

In classroom demonstration, Ss of the first three experimental groups were shown two pairs of colors, red with green and red with blue, in Munsell glossy finish papers: red, 5.0 R 4/14; blue, 5.0 PB 5/12; and green 2.5 G 5/12. These are highly saturated hues of medium lightness to which there is a relatively consistent application of color names by English-speaking adults (Chapanis, 1965). In the demonstration of the two sets of color pairs, marks beneath appropriate colors indicated that red was preferred to green and blue was preferred to red. The Ss were told that the marked colors represented the preferences of a comparable age group of children, and were asked to indicate on response sheets provided whether the other class preferred green or blue in a third choice following the two demonstration choices. The individual response sheets contained square samples of the green and blue Munsell papers beside one another with a blank square response space beneath each color. The two demonstration choices were displayed while the Ss deliberated and made responses. Left and right position of the transitive color (i.e., blue) on the response sheets was randomized.

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**Table 1**  
**Transitive and Intransitive Responses by Children of Three Ages\***

Group	N	Frequency Transitive	Frequency Intransitive	Percent Transitive
1	49	22	27	45
2	74	33	41	45
3	52	32	20	62

\*The children were shown demonstration cards indicating red preferred to green and blue preferred to red, told that the demonstration represented the preferences of another group of comparable age, and asked to pick the other group's subsequent choice between blue and green. Median ages: Group 1, 6.3; Group 2, 9.2; Group 3, 11.2.

The 22 Ss of Group 4 were run individually in the procedure described above. The S sat in a student desk with the answer sheet in front of him as the E made the demonstration of the alleged other class's preferences, red preferred to green and blue preferred to red. He was then asked which color he thought the other class preferred between those shown on the answer sheet. After he had marked his answer, if the answer was transitive, he was asked why he thought the class had preferred that color over the other one. This explanation was also requested of some of the Ss who gave intransitive responses. Just before being dismissed, each of these Ss was asked which of the two colors on the answer sheet (i.e., green and blue) he personally preferred.

## RESULTS

Table 1 shows the distributions of transitive and intransitive responses for the Ss tested in groups.

Ss of the younger two groups seem not to grasp the pertinence of the information in the demonstration cards for the third choice. With a 50% transitive level expected by chance, these groups show, overall, no evidence of the operation of the logical principle. This is not to suggest that these same Ss would fail the more common transitive diagnostic tasks, such as transitivity of length. In fact, the middle group is well beyond the age of satisfaction of even the Genevans' diagnostic criteria for transitive operations. However, so far as inference about preference is concerned, it is only the eldest group tested that is clearly in partial command of the transitive relation. Even here, the result is far from conclusively transitive. It seems that inferences about preferences, as Smedslund designed them, are more difficult than the common concrete transitivity problems.

Table 2 shows all responses by the 22 Ss who were run individually. This group was, on the average, somewhat older than the youngest group reported above. As with all but the eldest of the other experimental groups, these Ss' responses were no more transitive than would have been expected by chance. However, various of these 22 Ss' responses, summarized in Table 2, require discussion.

## DISCUSSION

According to Smedslund's (1960) position, the predominantly intransitive response bias of preschool children is attributable to egocentrism (i.e., they miss the relevance of demonstrations of  $A > B$  and  $A < C$  for comparison  $B ? C$  because they tend to evaluate the BC relation in terms of their own preferences). One

indication of the alleged effect of egocentrism in the present data would be a relation between the color the child chooses for the other class and his own preference. The influence might also be inferred from explanations. Of the explanations offered by transitive Ss here, 27% are clearly egocentric. These are the explanations given by Ss 3, 15, and 19 listed in Table 2. S 19, for example, explained that she thought the other class preferred blue to green "because it's pretty." Some of the intransitive responses were also clearly egocentric. For example, S 6 said he thought the other class preferred green to blue "because it's pretty."

The .68 proportion of Ss who picked as their personal preference the color they had previously indicated as the other class's choice would seem at first glance to support the egocentrism view (i.e., more than half of the Ss said the other class preferred the color they, themselves, preferred). However, the influence between inference and preference need not work in only one direction (i.e., preference influence on inference). The transitive relation or other information in the demonstration could influence the child's personal preference. The .68 figure, representing Ss who gave the same response for the other class's and for their own preference, is composed of two quite different relations.

Following the demonstration, one half of the Ss made the judgment that the other class preferred blue (transitive), and one half of them indicated green (intransitive). Of those who indicated blue, 82% said that they also preferred blue, while of those who indicated green, 55% said that they also preferred that same color. In other words, a majority of Ss shared the preference of the other class when this preference was transitive, while only about half shared an intransitive choice. On the basis of egocentrism, we should expect these two figures to be the same unless either the green or the blue were preferable to the children in and of itself. This is an issue since, in the procedure under discussion, blue was always the transitive choice and green was always the intransitive choice. In another experiment conducted by the present writer, when green and blue appeared as the first of several pairs tested, blue was preferred by 53% of 240 Ss with a median age of 6;10. So, there is apparently not a general preference bias for the green or blue used.

Egocentrism would maintain that a high proportion of Ss would make the personal choice of the color green after attributing it intransitively to the other class, since selection of that color for the other class was supposedly based on the personal perspective. This seems not to be the case. The high frequency (i.e., 82%) with which Ss followed the other class's transitive choice with their own personal choices implies, on the contrary, that some aspect of the relation of the colors in the demonstration cards substantially influenced personal preference. This influence could be the transitive relation. It could be the factor behind Smedslund's (1963) nontransitive hypotheses. Explanations offered by three of these Ss (i.e., 27%) for transitive responses were clear examples of the same nontransitive hypothesis:  $B < C$  because  $A < C$ .

The data suggest that the preference-influence task designed by Smedslund is considerably more difficult than the concrete tasks commonly used to test for transitive inference. The judgment is not one concerning the child's own preference for the stimuli, or one about concrete physical properties of stimuli. Rather, it is a judgment of the responses of someone else based on a perspective established by the other person's other responses. There is an element of hypothetical thought involved, and the solution seems to be several operations removed from such tasks as inference for stick length. The age at which the solution only begins to appear in this data (i.e., about 11 years) suggests that formal, as opposed to concrete, skills are required.

Smedslund's proportion of 8 preschool Ss out of 40 (i.e., 20%) passing the transitivity criteria seems high in the light of this data. However, his requirement for verbal explanations was admittedly, even purposefully, loose. He got no "complete" explanations (i.e., explanations relating both of the responses prior to the test card), and accepted "partial explanations,"

Table 2  
 Transitive (t) and Intransitive (c) Judgments by 22 Children with Verbal Explanations by some Ss  
 and Each S's Personal Preference Between the Stimuli†

S	Sex	Age	Transitive or Cyclic Response	Personal Preference	Explanations (Nontransitive Hypotheses Indicated by an Asterisk)
1	M	7.5	c	G	—
2	M	7.3	c	G	—
3	M	6.11	t	B	"Because it's prettier than green."
4	M	6.10	t	B	"Because it has an X under it."*
5	M	7.0	c	B	"Don't know."
6	M	6.10	c	G	"Because it's pretty."
7	M	7.0	t	B	"Because it's the favorite." (Answered only when pressed.)
8	M	7.4	t	B	"Because it had a mark." (Questioned, indicated reference to red-blue card.)*
9	M	7.9	c	B	—
10	M	8.3	c	G	—
11	M	6.9	t	B	Hesitated, gestured toward the red-green card, then said he didn't know; questioned, said the demonstration cards didn't contribute to the answer.
12	M	7.8	c	B	—
13	M	7.1	t	B	Could give no explanation.
14	M	6.10	c	G	—
15	F	6.6	t	B	"Because sometimes green looks nice and sometimes it looks awful."
16	F	7.0	c	G	Could give no explanation.
17	F	6.11	t	G	Could give no explanation.
18	F	7.5	c	B	—
19	F	6.8	t	B	"Because it's pretty."
20	F	6.10	t	B	Could give no explanation; said the demonstration cards didn't contribute to the answer.
21	F	7.6	t	G	"Because it was second." Questioned, indicated reference to the red-blue card.*
22	F	7.2	c	B	—

  

Proportion giving transitive response	.50
Proportion who preferred the color they had reported as the other class's preference	.68
Proportion who preferred the color they had reported as the other class's preference when that choice was transitive	.82
Proportion who preferred the color they had reported as the other class's preference when that choice was intransitive	.55
Proportion of transitive responses supported by apparent egocentric explanations	.27
Proportion of transitive responses supported by explanations indicating nontransitive hypotheses	.27
Proportion of transitive responses supported by transitive explanations	.00
Proportion of transitive responses supported by other explanations or by no explanation	.46

†The children individually were shown demonstration cards indicating red preferred to green and blue preferred to red, told that the demonstration represented the preferences of another group of comparable age, and asked to pick the other group's choice between blue and green. Median age: 7.0.

which included references to either of the two previous cards independently. This sort of "partial explanation" is, in fact, what Smedslund later defined as the nontransitive hypothesis. The proportion of children (i.e., 8 out of 40) in whom Smedslund observed the response is quite close to the proportion obtained in the present study (i.e., 3 out of 22). In this sense, the present data support Smedslund's data, and specifically indicate the presence of nontransitive hypotheses behind the responses of some children in inference tasks.

### SUMMARY

The experimental procedure followed here was quite close to that reported by Smedslund (1960) for the study of preference, and the data reflect on his egocentrism explanation and on the issue of nontransitive hypotheses raised by the same writer (Smedslund, 1963). These data suggest that egocentrism is not an adequate explanation for the Ss' lack of transitivity, and indicate that, in fact, some aspect of the demonstration choices substantially influenced the Ss' own preferences. The data support the contention that

nontransitive hypotheses contribute to young children's judgments.

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