Verticality as the cue for "bigger" in tactile and visual tasks

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Pairs of three-dimensional objects, equal in volume but differing in height, were presented visually to 105 Ss and tactually to 105 Ss from Grades 1-7. Ss selected the "bigger" of each pair. Verticality was the dominant visual cue for first and second graders only. In Grades 1-6 verticality was the dominant tactile cue, with some exceptions; seventh graders' choices were a 50-50 split. Results indicated that developmentally verticality remains the dominant cue for "bigger" in the tactile sense longer than in vision.

Some recent investigators have found that children, aged 6 and 7, choose the taller of two visual displays as "bigger." Lumsden & Poteat (1968) used planimetric figures equal in area for presentation; Poteat & Hulsebus (1968) employed three-dimensional figures. Hulsebus (1969), presenting objects visually to Ss in Grades 1-7, found that verticality as a cue for "bigger" decreases in importance as a function of increasing grade level. In another study (Poteat & Hulsebus, 1968), it was reported that college students are not unduly influenced by verticality in their choice of "bigger," choosing the shorter as frequently as the taller of two visual displays.

The relationship between visual and tactile input has been studied by presenting contradictory sensory material simultaneously (Rock & Victor, 1963; Rock & Harris, 1967). Results have consistently indicated the dominance of vision over touch. No studies have been reported, however, in which the importance of a single dimension of concrete objects has been comparatively examined in the visual and tactile senses. That is, the question of whether the vertical dimension is equally important in size judgments in the visual and tactile senses remains unexplored.

The present study compared the role verticality plays when the same task, selecting the "bigger" of two equal-volume objects differing in height, is presented visually and tactually to children in Grades 1-7. Does verticality as a cue for "bigger" diminish in importance as a function of increasing grade levels in tactile tasks as has been reported (Hulsebus, 1969) in visual tasks?

SUBJECTS

There were 210 Ss from a metropolitan public school. Thirty Ss were randomly selected from each of the seven grades in the school. One-half of the Ss at each educational level were assigned to the visual presentation (VP) group and the other half, to the tactile presentation (TP) group.

MATERIALS

The apparatus consisted of three stimulus displays, each a pair of wooden three-dimensional objects (rectangles, cones, and cylinders) mounted on a board. Each pair of stimuli was of equal volume but differed in height. The dimensions were as follows: rectangles, 3 x 3 x 9 in. and 4.02 x 4.02 x 5 in.; cones, 5.75 x 18.25 in. and 8.24 x 8.89 in.; and cylinders, 3 x 10 in. and 4 x 5.63 in.

The stimulus displays were painted a glossy gray and, for the VP Ss, were presented in front of a dull green backdrop.

Adjustable opaque laboratory goggles were used by the TP Ss.

PROCEDURE

The same basic procedure was followed in testing both the VP and the TP groups in that all Ss were given three trials, one for each of the stimulus display pairs. The order of display presentation to each S was chosen randomly from 48 different sequences, 24 random order permutations and their reverses.

Ss were seated before a table and told: "Two objects will be placed in front of you. You are to tell me which is bigger. Are there any questions?" As each display was presented, the question, "Which is bigger?" was asked. No judgments of equality were accepted. When a S asked if the display might be ambiguous or if the task could be clarified, the reply was, "Which is bigger to you?"

The only difference in treatment of

the groups was that Ss in the TP group were given goggles to wear after being seated. Instead of visual observation of the displays, their hands were placed on the display bases and they were allowed to explore the objects by touch.

RESULTS

The salience of the vertical dimension in judgments of "bigger" by the VP and TP groups was examined by chi-square analyses. The computed values are shown in Table 1.

DISCUSSION

In visual tasks the present results indicate that verticality as a cue for "bigger" diminishes in importance rather quickly as a function of increasing educational level. The taller displays were chosen as "bigger" significantly more often by first and second graders in the VP group; at no other grade level was a significant difference found. This lends support to the Hulsebus (1969) finding that interaction between vertical dimension and grade level decreases with increasing grade level.

With the TP group, different results emerged. Ss in Grades 1-3 chose the taller of each tactually presented stimulus pair as "bigger" significantly more often. In Grades 4, 5, and 6, choices did not differ from a 50-50 split in the rectangle, cone, and cylinder displays, respectively, although all other display choices at those grade levels did differ significantly in the direction of the taller of each stimulus pair. At the seventh-grade level, the TP group showed no significant preference for the taller of the displays.

The present findings indicate that verticality remains the dominant cue in judgments of "bigger" for a longer time in tactile than in visual tasks. A possible explanation is that the development of the ability to judge volume tactually is slower than the development of the ability to judge it visually. Therefore, young children may erroneously rely more on the verticality of an object when judging it tactually than when judging it visually.

It is possible that some children may interpret "bigger" as "taller." Lumsden & Kling (1969), in an

Table 1
Chi-Square Analyses to Compare VP and TP Choices of Taller Stimuli

Grade Level	Visual Displays			Tactile Displays		
	Rectangle	Cone	Cylinder	Rectangle	Cone	Cylinder
1	8.07*	11.27*	11.27*	15.00*	15.00*	15.00*
2	15.00*	15.00*	15.00*	8.07*	11.27*	11.27*
3	3.27	.83	.03	15.00*	15.00*	11.27*
4	.60	.83	.03	.83	11.27*	8.07*
5	.03	.83	.03	5.40*	3.27	5.40*
6	.83	.83	.03	8.07*	8.07*	.83
7	.83	.03	3.27	3.27	.60	.83

*p < .05 for taller stimuli

attempt to teach children a multidimensional concept of "bigger" described "bigger" to their Ss as the display "that has the most wood in it." In the present study, however, no attempt was made to explain the concept of "bigger" or to determine the Ss' understanding of the word.

Although the importance of verticality as a salient dimension in the young child's judgments of "bigger" has been verified by several investigators (Hulsebus, 1968; Lumsden & Kling, 1969; Lumsden & Poteat, 1968; Poteat & Hulsebus,

1968), a future study is planned in which the stimulus displays will be rotated 90 deg. It may be that despite previous interpretations the relevant dimension in children's choosing the "bigger" of two objects is elongation rather than verticality.

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