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Young Children's Knowledge About Visual Perception: Effect of Observer's Distance From Target on Perceptual Clarity of Target

John H. Flavell, Eleanor R. Flavell, Frances L. Green, and Sharon A. Wilcox
Stanford University

Children of ages 3, 3½, and 4½ years were tested for a previously unstudied form of knowledge about visual perception, namely, that an observer stationed closer to a small object will be able to see it better than an observer stationed farther away on roughly the same line of sight, whereas they will be able to see it equally well if stationed side by side at the same distance from it. The data suggest that this knowledge undergoes considerable development during the preschool period, with many 4½-year-olds seemingly possessing it in the form of a general rule.

According to a recent theory (Flavell, 1978), there are two major steps or levels in the development of the child's knowledge about visual perception. At Level 1, the child understands that self and other may see different objects from different viewing positions. At Level 2, the child further understands that even when self and other see the same object, they may nevertheless have different visual experiences of it if they view it from different positions. There is now considerable evidence in support of this theory (Flavell, 1978; Hughes, 1975; Masangkay et al., 1974; Flavell, Abrahams, Croft, & Flavell, Note 1). In all studies of Level-2 knowledge done so far, the different visual experiences and different positions have been those of some version of the traditional spatial perspective-taking task. That is, the tasks used test for the knowledge that the same visual display will present a different appearance to two observers who view it along different lines of sight from different station points *around* it, for example, from 0° versus 180°.

The present investigation tested for the possible development of a different and apparently unstudied form of Level-2 perspective-taking knowledge; that is, that one observer will see a small display better (more clearly, in finer detail) than another who shares roughly the same line of sight if she is substantially closer to it than the other observer and will see it about equally well if they are side by side and hence equidistant from it. Like the type of Level-2 knowledge already investigated, this knowledge also involves the insight that there can be a difference in perceptual experience (one observer sees the display better than the other) nested within a similarity in perceptual experience (both see the selfsame display).

Method

Subjects

The subjects were eight male and eight female preschool children at each of three age levels. The mean ages of the groups were 3 years 3 months (range: 3 years to 3 years 5 months), 3 years 8 months (range: 3 years 6 months to 3 years 11 months), 4 years 9 months (range: 4 years 6 months to 4 years 11 months).

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Requests for reprints should be sent to John H. Flavell, Department of Psychology, Stanford University, Stanford, California 94305.

Procedure

Each child was tested individually by two female experimenters. A pretest was first given to assess at least minimal comprehension of the expression, *see better*. The child was shown a picture containing a sailboat and a tiny ambiguously drawn animal, which the experimenter called a dog. The picture was then moved about 5 feet (152 cm) away and the child was asked which object he or she could see better. All subjects responded correctly (see Table 1). The child was then familiarized with the target stimulus, a colorfully drawn picture of a bird. Attention was drawn to the bird's eye (.5 cm in diameter), with its tiny eyelashes. The child was told that the experimenters could also see the eye and that each could see it as well as the other. (Neither experimenter wore glasses.) The bird picture was then placed vertically at the child's eye level 9.5 feet (290 cm) from the child's chair. The bird's eye could still be seen at this distance, but none of its details were visible. The child sat at this location throughout the experiment, facing the experimenters.

There were three experimental conditions given in the following order. In the Different-Position-1 condition, the experimenters sat in chairs about 4.5 feet (137 cm) from the child and about 3 feet (91 cm) from each other, with one situated 8 feet (244 cm) from the bird and the other 11 feet (336 cm) from it. In the same-position condition, their chairs were side by side, each 11 feet (336 cm) from the bird. In the Different-Position-2 condition, they were 5 feet (152 cm) and 11 feet (336 cm) from the bird, respectively, and about 6 feet (182 cm) from each other. In all conditions, the experimenters viewed the bird along roughly the same line of sight. Each experimenter forcibly called the child's attention to where she was going to sit each time ("Now I'm going to sit *here*").

After they were seated, each experimenter in turn told the child that she could see the eye. The same two questions were then asked in each condition: "Can I see it better than she can or can she see it better than I can?" followed by "How come I can see it better?" The first, or judgment, question was asked by the experimenter seated farthest from the bird in the different-position conditions and the order of the pronouns in the question was randomly varied. The second, or explanation, question was asked by the chosen experimenter. In each of the two different-position conditions, the experimenters exchanged positions after the initial questioning, and the judgment and explanation questions were asked a second time.

A child was scored as giving a correct answer to the four judgment questions of the different-position conditions if he said the experimenter seated closer to the bird could see it better and to the judgment question of the same-position condition if he said "same" or otherwise indicated an unwillingness to choose. A child was scored as giving a correct answer to an explanation question if he appropriately referred to the location of one experimenter relative to another and/or to the bird, for example, "You're in front," "She's closer," "You're in the same place." As a final probe, all but three of the children (three 3½-year-olds) were shown two spots on the floor, one 4.5 feet (137 cm) from the bird and the other 7.5 feet (229 cm) from it, and asked which spot one of the experimenters should stand on if she wanted to see the bird's eye better.

In these tasks, unlike previous Level 2 tasks of the conventional perspective-taking sort, the observers are not self and other but two others (the two experimenters). This was done to avoid making the children do two things that we thought might interfere with the expression of their knowledge about the distance–visual clarity relation: (a) make estimates of how well they saw the eye; (b) decide whether they or an adult of unknown visual and other powers could see it "better," with all that term's evaluative and competitive connotations.

Results and Discussion

Table 1 shows the number of subjects in each age group who correctly answered each successive question from initial pretest to final probe. It also presents the mean numbers of correct answers in each age group to the five judgment and explanation questions. An Age × Sex analysis of variance of number of correct judgments yielded a significant effect for age only, $F(2, 42) = 9.31$, $p < .001$. The same analysis for correct explanations gave the same result,

Table 1
Number of Subjects in Each Age Group Giving Correct Judgments (J) and Explanations (E) in Three Position Conditions and Giving Correct Answers to Pretest and Probe Questions

		Different Position 1		Same position		Different Position 2		Mean			
Age	Pretest	J	E	J	E	J	E	J	E	J	E	Probe
3	16	11	1	11	1	1	1	9	0	7	1	2.44	.25	7
3½	16	9	6	9	6	8	4	12	6	12	7	3.13	1.50	9[a]
4½	16	13	10	13	10	13	11	16	13	15	12	4.38	3.50	15

[a] Only 13 of the 16 3½-year-olds were asked this question.

$F(2, 42) = 14.17$, $p < .001$, suggesting that the ability to consciously identify the basis of correct decisions also shows substantial development during this age period. As Table 1 shows, performance level was fairly similar within each age group across judgments and across explanations, except that the youngest subjects apparently found the same-position judgment questions harder than the different-position ones. Any interpretation of these performance patterns can only be tentative, however, since condition and order of condition presentation were confounded in this study. The following are the number of subjects (set in parentheses and ordered from youngest to oldest age group) meeting various criteria of interest: at least four out of five correct judgments (3, 8, 13); a correct judgment and explanation on at least one of the four different-position trials (2, 8, 13); a correct judgment and explanation in the same-position condition (1, 4, 11); a correct response to the final probe (7, 9, 15). Each of these four age comparisons was also significant, χ^2s(2) ranged from 9.33 to 15.41, all $p < .01$. There appeared to be little consistency or pattern in the youngest subjects' responding. For example, eight gave the same answer and eight gave different answers to the two judgment questions in Different Position 1 and did the same in Different Position 2.

In contrast to the 3-year-olds, especially the younger ones, most of the 4½-year-olds clearly believed that the closer experimenter could see the little eye better than the farther one could, and that neither could see it better if they were both the same distance from it. Indeed, some of them seemed amused that the experimenters kept asking such easy questions. Moreover, this belief frequently seemed to have the status of a general rule for them. For instance, their answers were usually given very quickly, sometimes even before the question was asked. Likewise, most of them could adequately explain the basis for their judgments (Table 1). In fact, it is hard to imagine what they could have based their judgments on other than something akin to a rule. They obviously were not trying to figure out and compare the two experimenters' exact visual experiences of the eye; indeed, unlike the case with conventional perspective-taking tasks, such inferences are virtually impossible here. It is worth noting, although perhaps only a coincidence, that all previous Level 1–2 studies have also shown that 3-year-olds perform poorly on Level-2 tasks (although excellently on Level-1 tasks), whereas 4-year-olds perform well on both of them.

As always, it is harder to be sure of what the younger and less successful performers did and did not know. They often fidgeted, kept choosing the same experimenter wherever she sat, or otherwise acted as if they did not really understand the problem, despite their apparently correct comprehension of "see better" in the pretest (Table 1). It is, of course, possible that they really possessed the knowledge under study but that we simply could not find a way to evoke it. However, the present data, plus pilot data with other procedures, suggest to us that any such knowledge that they might possess is at least less accessible to conscious, explicit representation or is otherwise less well developed than that of the older subjects. In conclusion, it appears that this form of Level-2 knowledge about visual perception also undergoes development, and that this development also largely takes place during the 3- to 5-year age period.

Reference Note

1. Flavell, J. H., Abrahams, B., Croft, K., & Flavell, E. R. *Upside-down looks right-side-up to me: The young child's understanding of another's visual perspective*. Paper presented at the meeting of the Society for Research in Child Development, San Francisco, March 1979.

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