

Intellectual Realism: The Role of Children's Interpretations of Pictures and Perceptual Verbs

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PILLOW, BRADFORD H., and FLAVELL, JOHN H. *Intellectual Realism: The Role of Children's Interpretations of Pictures and Perceptual Verbs*. CHILD DEVELOPMENT, 1985, 56, 664-670. *Intellectual realism* refers to the tendency of young children to indicate incorrectly all that is present in an object array when asked to indicate only what they can see of it from a particular perspective. 3 experiments tested and confirmed the hypotheses that children's interpretation of (a) pictorial conventions and of (b) the expression "look like" may increase this tendency. The results of this and other studies suggest that young children's difficulties with adult pictorial conventions, with the wording of task instructions, and with the concept of a momentary, view-determined appearance can all lead to intellectual realism errors.

Intellectual realism refers to children's tendency to respond to requests for perceptual reports by indicating what they know about an object or array, rather than strictly what they can see from their present perspective. Although intellectual realism has been noted since the turn of the century (Clark, 1897), its causes remain unclear. Most studies of intellectual realism have involved young children's drawings. For instance, Freeman and Janikoun (1972) found that children instructed to draw "exactly what you can see from where you are sitting" would include a coffee cup's handle in their drawings even when the cup was turned so that the handle was not in view. However, Liben and Belknap (1981) found that children of 3-5 years also exhibit intellectual realism when asked to select, rather than draw, a pictorial representation of their own perspective. While looking at an array of blocks, subjects were shown six pictures of block arrangements and asked to "point to the picture that shows exactly what you can see from where you are sitting." When one of the blocks was hidden behind the others and children were aware of its presence, they often selected a picture showing the block that they could not see.

Although the tendency for knowledge of a display's hidden aspects to intrude during perceptual reports has been demonstrated

with a variety of tasks (Freeman, 1977; Freeman & Janikoun, 1972; Liben, 1978; Liben & Belknap, 1981), many studies of perspective-taking have found that young children accurately report what objects are and are not visible from another person's point of view, though they have difficulty describing how they would look. Flavell (1978) distinguished between two levels of knowledge about the visual percepts of others (see also Hughes, 1975; Hughes & Donaldson, 1979). At Level 1 the child can infer what objects can or cannot be seen from another person's viewpoint. At Level 2 the child also knows that a single object may present different appearances to viewers at different locations. A number of studies have shown that 3-year-olds are very competent at Level 1, but not Level 2, inferences (Flavell, 1978; Flavell, Everett, Croft, & Flavell, 1981; Flavell, Shipstead, & Croft, 1978; Masangkay, McClusky, McIntyre, Sims-Knight, Vaughn, & Flavell, 1974). They can report accurately what object another person sees (Level 1), but not how that object looks to the person (Level 2). If 3-year-olds can infer what objects are visible from perspectives other than their own, they should also be able to report what objects they themselves currently see. Why, then, do they often commit the intellectual realism error of indicating what they know about an array when asked to report only what they can see from their own perspective?

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The apparent contradiction between findings of intellectual realism and findings of Level 1 knowledge of visual perception may be resolved by examining more closely the characteristics of the tasks that have elicited each type of response. In studies of intellectual realism the perceived demands of the task situation may lead children to assume that the unseen attributes of a display are most relevant. For instance, children in Freeman and Janikoun's (1972) study may have drawn the coffee cup handle because they believed inclusion of the handle, a characteristic feature of the cup, was critical for specifying the subject of the drawing to others. In other cases, children may not understand the test question as a request for a perceptual report, even if they are capable of screening out knowledge and attending to perceptual information. Expressions such as "looks like" are ambiguous and may be misinterpreted. Furthermore, children's interpretation of the task may be influenced more by the structure of the situation than by the wording of questions. Having seen one object hidden behind another, subjects may expect to be asked about its location or presence. Young children's comprehension of speech tends to be context dependent (Donaldson, 1978), so they may assume that the test question concerns the hidden object. Therefore, despite the seemingly clear wording of the questions used in previous studies, subjects may have believed that the adult experimenter really wanted to know if they had seen and could remember the occluded objects.

In the studies of intellectual realism described earlier, subjects responded by attempting to match their own view with a pictorial representation. Thus, success required an understanding of pictures and knowledge of representational conventions. However, young children may not understand or use the pictorial conventions generally assumed by adults. Studies of children's drawings show that when asked to draw a display in which one object occludes another, young children tend to draw the two objects separately (Light & Humphreys, 1981; Light & MacIntosh, 1980; Taylor & Bacharach, 1982). Similarly, children in a perspective-taking study by Light and Nix (1983) showed a preference for selecting pictures showing both objects in an array separately, even when one object partially occluded the other from the subject's view as well as from the perspective they were asked to match. Although experimenters may regard view pictures as depictions of what can be seen from particular station

points around an array, young children may regard them as depictions of what is present in the array.

In Experiment 1 we tested the hypothesis that children's understanding of pictorial conventions can lead to intellectual realism errors. A hidden-objects task was used that was simplified by using only two blocks and two view pictures. In order to clarify the task requirements, test questions were phrased simply and directly, with stress on reporting what could be seen at the particular moment, and children's attention was focused on the act of seeing by looking at the block array through a viewing tube. The hypothesis was tested by comparing performance on a picture selection task with performance on a verbal response task, in which subjects were asked simply to say what object(s) they saw. If the tendency for knowledge to interfere with perceptual reports is a general property of children's thought, then intellectual realism should impair performance regardless of response mode. However, if children's understanding of the view pictures is a contributing cause of such errors, then performance in the verbal response condition should be better than performance in the picture selection condition.

Experiment 1

Method

Subjects.—The subjects were 24 nursery school children, ranging in age from 3;0 to 4;9 (mean age, 4;1). Fifteen were female and nine were male.

Materials.—The stimuli were large (8 × 8 cm) and small (5 × 5 × 5 cm) blocks made of cardboard covered with construction paper. View pictures consisted of squares of construction paper pasted on white cards. The pictures showed either a single large block or else a small block on top of a large block. The squares in the pictures matched the blocks in the array in color, size, and material, since the same construction paper was used for both the blocks and the pictures. A viewing tube (diameter 15 cm) was made from a large sheet of black construction paper.

Procedure.—All subjects were tested with three types of arrays. Hidden arrays consisted of two blocks of different sizes and colors. The smaller block was placed on the table first, and then the larger block was put in front, occluding the small block from the subject's view. In addition, there were two types of visible arrays, consisting of either a single large block or a small block on top of a

large block. Pairs of blocks were always of different colors, and no pair was seen more than once by each subject. There were six hidden trials, three single-block visible trials, and three two-block visible trials, making a total of 12 trials for each subject, half hidden and half visible. Order of trials was randomly determined for each subject, with the constraint that each of the three array types could occur no more than twice consecutively.

Half of the subjects were randomly assigned to each of two conditions: picture selection (mean age, 4-2) and verbal response (mean age, 3-11). On each trial they watched through the viewing tube as the experimenter constructed a block array. Then subjects were instructed as follows: (a) "Take a good look through here. Look at what you see through here, and look at these pictures. Now, which one of these pictures looks like what you see when you look through here right now?" (picture selection), or (b) "Take a good look through here. Look at what you see through here. Now, when you look through here right now, do you see just an X block, or do you see an X block and a Y block?" (verbal response). In the picture condition, one picture was held vertically on each side of the array. The right-left position of the one-block and two-block pictures was counterbalanced, as was the order of the choices in the verbal response question.

Results and Discussion

Since performance on the two types of visible arrays was at or near ceiling in each condition, scores on single-block and two-block visible arrays were combined to yield an overall visible array score. Mean scores for each array type and condition are shown in Table 1. A 2 x 2 (array type x condition) mixed analysis of variance, with array type as a within-subjects variable and condition as a between-subjects variable, yielded significant main effects for array type, $F(1,22) = 10.12, p < .01$, and for condition, $F(1,22) = 15.29, p < .01$. The array type x condition interaction was also significant, $F(1,22) = 4.62, p < .05$.

TABLE 1
MEAN NUMBER CORRECT BY CONDITION AND ARRAY TYPE

CONDITION	ARRAY TYPE	
	Visible	Hidden
Picture	5.42	2.83
Verbal	5.92	5.17

NOTE.—Maximum score per cell is 6.

Tests for simple main effects show that performance on visible arrays was significantly better than performance on hidden arrays for both picture selection, $F(1,11) = 11.15, p < .01$, and verbal response, $F(1,11) = 5.20, p < .05$. In addition, with hidden arrays, performance was significantly better with verbal responses than with picture selection, $F(1,22) = 7.87, p < .025$. However, there was no significant difference between the two conditions on visible arrays, $F(1,22) = 4.17, p > .05$. Nonparametric analyses yielded the same significant differences. Eight subjects in the picture selection condition performed better on visible arrays than on hidden arrays, one performed better on hidden than on visible, and three showed no difference, $p < .05$, by Sign Test. For hidden arrays, performance was better with verbal response than with picture selection, $p < .06$, by a Mann-Whitney Test. In the picture selection condition, individual subjects' performance tended to be either consistently correct or consistently incorrect: five subjects answered 0 or 1 of the 6 hidden-array questions correctly, five answered 5 or 6 correctly, and only 2 subjects answered 2, 3, or 4 correctly. The number of correct responses for each subject in the picture selection condition was not significantly correlated with age, $r = .11, p > .70$.

This pattern of results supports the hypothesis that children's understanding of pictures can lead to intellectual realism errors. Since both the view pictures and the verbal questions offered the same two alternatives and made reference to the hidden block, both pictures and questions should have cued knowledge of its presence. Nevertheless, children behaved quite differently in the two conditions. As shown by the high level of correct responses in the verbal response condition, if task demands are made clear enough, young children are capable of correct perceptual reports, even when conceptual knowledge competes for attention. However, when subjects must select a picture corresponding to their own view, intellectual realism errors occur frequently. Thus, whereas the verbal response results demonstrate that children can restrict their attention to only that which they see, the picture selection results indicate that they still recall all that is present. Therefore, both pieces of information, perceptual experience and knowledge, are available, and which one appears in subjects' responses depends upon how the perceptual report is solicited.

Those subjects who made many errors apparently did not construe the pictures as

representations of a visual image, and, consequently, did not respond simply by comparing the visual impression of the pictures with the visual impression of the blocks. This result is particularly striking in view of the fact that the squares in the pictures were the same size and color as the blocks, and both were made from the same material. Moreover, since only one face of each block was visible from the subject's point of view, the perceptual similarity between each block and its matching view picture was very pronounced. With a single large block in view and a nearly identical picture on one side of it, subjects who made intellectual realism errors had to overcome the seemingly natural tendency to choose a perceptual match. Therefore, it appears that they were systematically imposing their own interpretative conventions on the pictures. Finally, the results of Experiment 1 suggest a methodological caution. Although perspective-taking studies often rely on non-verbal responses, these and other results (Hughes & Donaldson, 1979) show that non-verbal tasks may not always be more sensitive measures of young children's ability to report perspectives than are verbal tasks. Nonverbal responses such as picture selection may introduce unwanted demand characteristics of their own.

Experiment 2

Although the results of Experiment 1 and of other studies might suggest that intellectual realism is solely a manifestation of the way children think about pictures, studies not involving pictures have also elicited intellectual realism. In a study by Flavell, Flavell, and Green (1983), 3- and 4-year-olds saw the experimenter hide a small object (e.g., a toy horse) behind a larger one (e.g., a stuffed bear). The children were asked questions of the form: (a) "When you look at this with your eyes right now, does it look like a bear here by itself or does it look like a horse and a bear here?" and (b) "What is this really, really? Is it really, really a bear here by itself or is it really, really a horse and a bear here?" Although errors on the "really, really" question were rare, errors on the "look like" (appearance) question were frequent. That is, the children often said "a horse and a bear" in response to both questions—an intellectual realism response pattern. Recall that, in contrast to Flavell et al.'s "look like" question, the verbal response question in Experiment 1 was, "When you look through here right now, do you see just a blue block, or do you see a blue block and a red block?" The discrepancy between the results of these two studies sug-

gests that the distinction between "look like" and "see" may be important. Children may construe "look like" as "what is this?" or "what do you think this is?" Experiment 2 was designed to replicate the findings of Flavell et al. (1983) and to test the hypothesis that subjects' interpretation of the test question, specifically the expressions "look like" and "see," produced the contrasting patterns of results in the two studies.

Method

Subjects.—The subjects were 19 nursery school children ranging in age from 3-6 to 4-7 (mean age 4-2). Seven were female and 12 were male.

Materials.—The blocks and viewing tube from Experiment 1 were used again in this experiment.

Procedure.—The procedure was the same as in the verbal response condition of the first experiment. However, the test question was: "Take a good look through here. Look at what you see through here. When you look through here right now, does this look like just an X block or does this look like an X block and a Y block?" Again, there were six hidden trials, three one-block visible trials, and three two-block visible trials, presented in a different random order for each subject. Furthermore, in a direct test of the effects of the two wordings, at the end of the initial 12-trial procedure all subjects who made three or more intellectual realism errors were presented with an additional six follow-up hidden trials using the "see" question from the first experiment. A high error rate on hidden but not visible trials with the "look like" question (i.e., a pattern of errors similar to that found in the Experiment 1 picture selection condition), coupled with immediate improvement when asked the "see" question, would provide strong evidence that children's interpretation of the expression "looks like" contributes to intellectual realism.

Results and Discussion

As in Experiment 1, performance on both types of visible arrays was virtually perfect. Consequently, scores for single-block and two-block visible arrays were combined, yielding an overall visible array score that was then compared with performance on hidden arrays. A one-way within-subjects analysis of variance revealed that subjects performed significantly better on visible displays (mean number correct = 5.89) than on hidden arrays (3.53), $F(1,18) = 17.37$, $p < .001$. This result was also significant by Sign Test, $p < .001$. Twelve subjects responded correctly more of-

ten on visible arrays than on hidden arrays, and seven performed equally well on the two types of arrays. These results contrast sharply with those of the Experiment 1 verbal response condition, where performance on visible and hidden arrays was comparable and near ceiling. Performance on the six hidden arrays again tended toward bimodality, although less strongly than in the Experiment 1 picture selection condition: five subjects answered 0 or 1 questions correctly, nine 5 or 6, and five 2, 3, or 4. Again, performance on hidden arrays was not correlated with age, $r = .00$. Performance on the follow-up trials given to the eight subjects who made three or more errors on hidden trials provides additional support for the importance of the wording of test questions. As Table 2 shows, when asked the "see" question, all but one of these subjects improved; more important, the magnitude of the improvement was usually substantial. On the average these subjects made 3.13 more correct responses during the follow-up session using the "see" wording than they did when the "look like" question was asked. This improvement is remarkable for the following reasons. First, any response set built up during the first 12 trials had to be overcome in order for this change to occur. Second, the only subjects tested with the follow-up questions were those who demonstrated a tendency toward intellectual realism. Finally, the findings suggest that subjects not only noticed a subtle change in wording, but also gave it weight and responded very differently as a consequence.

Experiment 3

The results of Experiments 1 and 2 suggest that children's interpretation of view pictures, on the one hand, and the expression

"look like," on the other, may contribute to intellectual realism errors. However, the two factors were confounded in the picture selection condition of Experiment 1 because the question, "Which one of these pictures looks like what you see?" contained the words "look like" as well as the word "see." Therefore, to rule out the possibility that the wording of the question alone was responsible for errors in the picture selection condition of Experiment 1, in Experiment 3 the picture selection task was administered with instructions that did not contain the phrase "look like."

Method

Subjects.—The subjects were 12 nursery school children ranging in age from 3-6 to 4-10 (mean age 4-3). Nine were female and three were male.

Materials.—The blocks, pictures, and viewing tube from Experiment 1 were used again in this experiment.

Procedure.—The procedure was the same as in the picture selection condition of the first experiment. However, the test question was, "Take a good look through here. Look at what you see through here. Which one of these pictures shows what you see right now?" Each subject received six hidden trials, three one-block visible trials, and three two-block visible trials in a different random order.

Results and Discussion

As in the first two experiments, performance on both types of visible arrays was virtually at ceiling. Therefore, scores for single-block and two-block visible arrays were combined into an overall visible array score that was compared with performance on hidden arrays. A one-way within-subjects analysis of variance yielded a significant difference between performance on visible arrays (mean number correct = 5.75) and hidden arrays (2.08), $F(1,11) = 61.68, p < .001$. All 12 subjects made more errors on hidden arrays than on visible arrays, $p < .001$, by Sign Test. These results replicate those obtained in Experiment 1, and indicate that picture selection can elicit intellectual realism errors even when the words "look like" are not included in the instructions. In contrast to the picture selection condition of Experiment 1, performance on hidden arrays in Experiment 3 did not show a bimodal distribution. Four subjects answered 0 or 1 questions correctly, seven 2, 3, or 4, and one 5 or 6. Furthermore, performance on hidden arrays was correlated with age, $r = .56, p < .06$.

TABLE 2

TOTAL NUMBER CORRECT ON HIDDEN ARRAYS BY QUESTION FOR SUBJECTS MAKING THREE OR MORE ERRORS

Look Like	See
0.....	0
0.....	4
0.....	6
0.....	6
1.....	2
2.....	4
2.....	5
3.....	6

NOTE.—Average improvement is 3.13.

General Discussion

As evidenced by the results in the verbal response condition of Experiment 1, 3- and 4-year-old children are capable of limiting their perceptual reports to those contents of an array that are presently visible to them, even when they are aware of other, presently unseen, contents of the array. However, under certain conditions some children consistently commit intellectual realism errors, that is, they also include these unseen aspects of an array when asked for a strictly perceptual report. Both the picture selection condition of Experiments 1 and 3 and the "look like" instructions used in Experiment 2 elicited intellectual realism. It can be argued that both tasks presented children with a referential expression or symbol that was ambiguous for them, that is, open to a possible interpretation other than the intended normative one.

Children who make intellectual realism errors in a picture selection task may not yet understand the pictorial convention of representing a scene as it appears from a single station point. Studies of children's drawings by Light and his co-workers support this position. Their subjects' drawings demonstrated a concern for showing the contents of an array and their spatial relationships rather than the content of the visual field, indicating that an overriding drawing rule may be to create a depiction that conveys as much information as possible about an array (Light & Humphreys, 1981; Light & MacIntosh, 1980; Light & Simmons, 1983; Taylor & Bacharach, 1982). The results of Experiments 1 and 3, together with those of Liben and Belknap (1981), suggest that the same attitude toward pictorial representation may operate in comprehension as well.

An explanation for the intellectual realism errors in Experiment 2 may lie in the different meanings that "looks like" has in everyday speech. Of course, "looks like" can be used to refer strictly to perceptual appearance, as in Experiment 2 and Flavell et al. (1983). On the other hand, "looks like" can also refer to the state of things or to one's beliefs or expectations about them. For example, the sentence, (a) "It looks like this class is going to be hard" may be equivalent to (b) "I think this class is going to be hard." Similarly, some children could take "Does this look like an X or does it look like an X and a Y?" to mean "Do you think there is just an X here or do you think there is an X and a Y here?" Whereas older children and adults realize that "looks like" may have different meanings in different situations, young chil-

dren may have identified only some of them. Lacking a sophisticated appreciation of its subtly different senses, they may not be able to use contextual cues to select the intended usage. After considering various uses of the expressions "look" and "look like," Austin (1964) concluded, "There is, of course, no general answer at all to the question how 'looks' or 'looks like' is related to 'is'; it depends on the full circumstances of particular cases" (p. 39). Sentences such as (a) are quite common, and therefore it seems plausible that at least some children might infer that "It looks like X" is synonymous with "X is the case," or "I think X."

In contrast, the subjects in Experiment 1 demonstrated a clear understanding of the word "see." The ceiling performance in the verbal response condition shows that children of this age can easily report only what they see, even when they are aware of unseen objects. According to Flavell's (1978) distinction between Level 1 and Level 2 knowledge of visual perception, children at Level 1 can infer what object can or cannot be seen from another person's viewpoint, whereas at Level 2 they also know that a single object may present different appearances to viewers at different locations. The Experiment 1 verbal response condition could be regarded as a very simple Level 1-like task that provides a clear test of children's perceptual report abilities. The nearly perfect performance of 3- and 4-year-olds on this task indicates that they can distinguish between the visible and known contents of an array. This result is consistent with previous findings, cited earlier, that Level 1 knowledge is acquired by age 3.

Finally, although the results of these three experiments seem clear and interpretable, their generality may be limited to specific task situations. The hidden-objects task required subjects to make judgments about the presence and visibility of objects in an array. Thus, subjects had to discriminate those objects that were visible to them at a given moment from occluded objects that they knew to be present. However, children also have been found to make intellectual realism errors in tasks that involve differentiating the identity of a single object from its outward appearance. The presence and visibility of objects are not in question in such tasks. For instance, Flavell et al. (1983) showed 3- and 4-year-olds a small pencil drawing of a face that resembled a circle rather than a face when viewed from a distance at which the features of the face were no longer detectable. Nevertheless, their sub-

jects frequently claimed that the drawing resembled a face, rather than a circle, at that distance. Although the identity of the depicted object was clearly distinct from the drawing's appearance when viewed from that distance, many children failed to distinguish the two. Children also tended to make intellectual realism errors when questioned about the appearance of a sponge that looked like a rock and other objects of this sort (Flavell et al., 1983). Thus, when the real and apparent identity of an object are discrepant, children tend to make intellectual realism errors, that is, they report the object's identity when asked about its appearance. Judgments concerning the visibility and presence of an occluded object seem quite different from judgments concerning a visible object's known identity and its perceptual properties. The "see" question in the Experiment 1 verbal response condition required subjects to detect and report visible objects. This task did not present subjects with a discrepancy between the real and apparent identity of a single visible object. Because object-identity tasks involve factors not present in the hidden-objects task, the results of the present study do not allow the conclusion that all cases of intellectual realism are purely artifactual or that young children have no difficulty differentiating between knowledge of an object or scene and its momentary appearance. Although children's interpretations of view pictures, on the one hand, and the expression "look like," on the other, may contribute to intellectual realism in the hidden-objects task used here, they may not wholly account for the intellectual realism tendencies observed in other task settings. Indeed, children's susceptibility to misinterpretations both of pictures and of the words "look like" may partially reflect an underlying disposition to ignore momentary outward appearances and think in terms of what objects are present.

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