Seeing and Believing: Children's Understanding of the Distinction between Appearance and Reality

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TAYLOR, MARJORIE, and FLAVELL, JOHN H. *Seeing and Believing: Children's Understanding of the Distinction between Appearance and Reality.* CHILD DEVELOPMENT, 1984, **55**, 1710–1720. When young children are asked questions about objects with misleading appearances, they make two kinds of errors: (1) *phenomenism*—they report appearance when asked to report reality; and (2) *intellectual realism*—they report reality when asked to report appearance. Two studies with 3-year-old children tested the hypothesis that phenomenism errors predominate when children are asked about objects' real and apparent properties, whereas intellectual realism errors predominate when children are asked about objects' real and apparent identities. The results of these studies provided some support for the property-identity hypothesis; children's appearance-reality judgments about properties tended to differ from those about identities. More phenomenism errors were elicited when the stimuli were described to the children in terms of their properties than when the very same stimulus objects were described in terms of their identities. Identity tasks were not found to elicit predominantly intellectual realism errors, although the data showed trends in this direction. The implications of these results for theories about young children's tendency to accept things in terms of their perceptual characteristics were briefly discussed.

A variety of studies indicate that young children do not clearly understand the conceptual distinction between what something really is and what it appears to be (Braine & Shanks, 1965a, 1965b; Flavell, Flavell, & Green, 1983; Liben & Belknap, 1981). The development of knowledge about this distinction is an interesting topic for developmental research because the distinction between appearance and reality is an abstract metaconceptual notion that is pervasive in adult thinking about the world, and is probably a universal development in human beings. Adults may not always know what the reality of a given object or event is, but they are aware of the possibility that its appearance may turn out to be deceiving, that is, different from reality. Children's confusion about appearance and reality may contribute to difficulties with various types of cognitive tasks such as conservation, reality monitoring, and perspective taking.

There are two possible types of appearance-reality errors that might occur in situations where appearance and reality differ, and there is empirical evidence that young children make them both (see Flavell et al., 1983).

One type of error, called *phenomenism*, occurs when children report information about an object's appearance when asked to report the object's reality. Phenomenism has been documented by Braine and Shanks (1965a, 1965b) and others (e.g., Elkind, 1966; Langer & Strauss, 1972; Murray, 1968) investigating the relationship between appearance-reality knowledge and conservation. In these studies, children were asked questions about the apparent and real sizes of lines and shapes that they saw distorted by visual illusions. The children reported that the lines not only looked longer after being distorted, but in reality were longer. They interpreted the apparent changes in length and shape as being real.

The other possible type of error, called *intellectual realism*, occurs when children report information about reality when asked only about appearance. Intellectual realism is usually associated with a stage in drawing development during which children draw what they know to be present instead of what they see from their current perspective (Freeman & Janikoun, 1972; Luquet, 1927); however, intellectual realism errors have also been reported in a study using a picture-selection task

(Liben & Belknap, 1981). In this study, children were asked to select a picture from an array to match their view of a display of three blocks. From the child's perspective, one large block occluded the other two. Children who were not aware of the hidden two blocks selected a picture showing a single block. Children who knew about the hidden blocks tended to select a picture of three blocks, reporting reality (what they knew to be true about the display) despite instructions to report appearance (a specific view of the display).

Although in the past, intellectual realism and phenomenism have been investigated separately by different researchers, Flavell et al. (1983) have conceptualized intellectual realism and phenomenism as psychologically related errors because both appear to demonstrate incomplete or unstable understanding of the appearance-reality distinction. In three studies, Flavell et al. tried to determine what kinds of tasks elicit each error type. To do this, they used a large variety of objects that all had misleading appearances. Some of the stimuli were fake objects, such as a piece of sponge that looked very much like a rock, a candle that resembled an apple, and a stone "egg." For these objects, the distinction was between real and apparent *identity*. Flavell et al. also created discrepancies between apparent and real *properties* by placing objects behind colored filters to disguise their true color, by magnifying or minifying objects to change their apparent size, and by immersing objects in water to distort their true shape. Preschool children were first acquainted with the stimuli's real and apparent identities or properties and then asked questions about the appearances and the realities of the stimuli.

The finding of principal concern to the present experiments was that young children tended to give intellectual realism responses to questions about apparent and real object identities and phenomenism responses to questions about apparent and real size, color, and shape properties. For example, children tended to assert that the fake rock both "really really" was a sponge and that it "looked like" a sponge (intellectual realism), but that an object viewed through a magnifying lens both "looked like" it was big and "really really" was big (phenomenism). This pattern of results held across the three studies and has since been replicated in a study conducted in the People's Republic of China (Flavell, Zhang, Zhou, Qi, & Dong, 1983).

Flavell et al. (1983) explained this pattern of results by suggesting that young children's experiences with real and apparent changes in identities differ from those with real and apparent changes in properties. In the case of size, color, and shape object properties, real changes are commonplace. Probably all children have had experience painting, sculpting, mashing, and cutting various materials—making real changes in the material's color, size, or shape. Apparent changes in properties, however, are relatively rare. It is uncommon for an object initially to appear blue and then turn out really to have been red. The human perceptual system operates to maximize the perceived constancy of color and size across different lighting conditions and distances. As a consequence, young children may tend to regard any phenomenal property as being real, that is, if it *looks* blue, then it really *is* blue.

For object identity, the reverse is true; children probably have had more experience with apparent than with real changes. Real changes in identity are rare; once a child learns an object's identity, she has acquired an enduring piece of information about the object. In contrast, apparent changes in identity occur frequently. For example, most children are familiar with the practice of dressing up in costume to disguise their true identities. Given that a change in identity is usually not a real change, Flavell et al. (1983) argue that the real identity of an object or event might constitute salient information for a child, who might thus tend to report reality in response to all questions about object identity; that is, if it *is* a sponge, then it *looks like* a sponge.

Although the property-identity hypothesis is intriguing, there is another way to explain the Flavell et al. (1983) results. Preschool children tend to interpret any intentional manipulation of a display as effecting a real change (McGarrigle & Donaldson, 1974). The property tasks used by Flavell et al. all involved active transformations of the stimuli. The experimenter changed the objects' appearances by interposing a colored filter or magnifying glass or in some other way intentionally manipulating the stimuli to produce the apparent properties. These tasks may have elicited phenomenism because of a bias to report the end points of the transformations rather than because the tasks involved properties as opposed to identities.

In contrast, most of the apparent identities in the Flavell et al. (1983) tasks were not produced by transformations. For example, the fake rock (sponge) always looked like a rock. The children learned its true identity by feeling its spongy texture and light weight,

but they never saw the stimulus look like a prototypical sponge and then look like a rock after some manipulation by the experimenter. Like the other identity stimuli, the fake rock simultaneously looked like a rock and really was a sponge throughout the procedure. It is possible that it was the presence or absence of a transformation that determined the type of appearance-reality error the children made rather than whether the task involved properties or identities.

The results of existing research on appearance-reality do not rule out either of these hypotheses. In the studies by Braine and Shanks (1965a, 1965b), Elkind (1966), and Murray (1968), children were asked about apparent changes in properties that had been produced by transformations. These tasks elicited phenomenism, a result consistent with both hypotheses. DeVries (1969) asked children about real and apparent identities using a procedure that involved a transformation. She found that children tended to make phenomenism errors, but this finding (which supports the transformation hypothesis) may in part be due to the use of leading questions. In her study, a real cat was outfitted with a lifelike dog mask and the children were asked, "What animal is it now?"—a question that implies a change in the animal's identity.

Experiment 1 was designed to determine which hypothesis—property-identity or transformation—better fits children's performance on appearance-reality tasks. Theoretically, a 2 × 2 design with task type (property or identity) and transformation (presence or absence) would constitute the best design for testing the two hypotheses. Unfortunately, stimulus constraints make such a study difficult to implement. We know of no way to produce an apparent size or color without performing a transformation. In lieu of varying the presence-absence of a transformation, we held presence of a transformation constant across property and identity conditions, but varied between groups the *direction* of the transformations, from real to apparent identity/ property or the reverse. This manipulation was used because the effect of a transformation on the kind of error children make must be related to the kind of transformation that takes place, that is, which property/identity constitutes the end point of the transformation.

The stimuli and transformations in property and identity conditions were identical. The property-identity factor was manipulated between groups by varying the way the experimenter described the exact same stimuli

(either in terms of their properties or in terms of their identities). For example, a glass of milk that was disguised as Koolaid by the experimenter wrapping the glass with orange plastic was described either in terms of the change in identity (milk that looks like Koolaid) or the change in property (something white that looks like something orange). This manipulation provided a quite stringent test of the property-identity hypothesis, because it involved only a small variation in stimulus description.

The property-identity hypothesis predicts that children in the identity conditions should exhibit primarily intellectual realism responses, and those in the property conditions primarily phenomenism responses. According to the transformation hypothesis, phenomenism errors should predominate in the real-to-apparent condition and intellectual realism errors in the apparent-to-real condition.

Experiment 1

METHOD

Subjects

The subjects were 68 nursery school children of mostly middle-class and upper-middle-class backgrounds. Their ages ranged from 2-11 to 4-4, with a mean of 3-6. The 17 subjects in each of the four conditions included approximately equal numbers of boys and girls.

Materials

The stimulus objects were a necklace, a glass of milk, a white toy horse, a viewing box, and two pieces of plastic. One of the plastic pieces was a translucent orange color and shaped so that when wrapped around the glass and viewed at eye level, it occluded the milk, but no other part of the glass. The other plastic piece was a transparent sheet with a horse-shaped area marked with black stripes. When the toy horse was positioned behind the plastic sheet, the stripes exactly coincided with the outline of the horse, causing it to look like a zebra. The viewing box was a 75-cm cube with an open top. The sides and bottom of the box were constructed with white bristol board. A 15 × 10-cm rectangular opening on one side of the box was covered with a minifying lens.

Procedure

To ensure that the apparent properties and identities used in the experiment were convincing, four 3-year-old children who did not participate further in the experiment were shown each of the disguised stimulus objects

in turn and queried about their appearances. For example, the children were shown the toy horse disguised to look like a zebra and asked, "Does this look like a horse or a zebra?" All the children chose the apparent rather than the real properties and identities for all three stimuli, thus validating the intended appearances of the disguised objects to a naive preschool-aged observer.

Pretraining.—The experimental session began with pretraining to acquaint the child with the expressions "looks like" and "really and truly." The experimenter showed the child two stuffed bears and said, "I have two bears here but I can make it look like there is only one bear." Then the experimenter placed the smaller bear out of view behind the bigger bear and said, "See, now it looks like there is only one bear but really and truly there are two bears. The baby bear is hiding behind its mother."

Demonstration.—Two transformation directions were used in the demonstration phase of the experiment. Children in the real-to-apparent condition first saw the stimuli in their undisguised states and then watched as the experimenter transformed the appearances of the stimuli, producing apparent properties/identities. Children in the apparent-to-real condition first saw the disguised stimuli and then watched the experimenter remove the disguises to reveal the true identities/properties of the stimuli. A child was introduced to the three stimuli in one of six orders that each occurred equally often across the four conditions. The numbers of children within a condition who received each order were approximately equal. The procedure for the real-to-apparent demonstration of the stimuli was as follows:

1. white/horse: The experimenter showed the white toy horse to the child and said either, "*Really and truly,* this is a horse, but I can make it *look like* it's a zebra" (identity condition), or "*Really and truly,* this is white, but I can make it *look like* it's striped" (property condition). Then she positioned the horse directly behind the striped plastic sheet, said, "See?" and, after about 5 sec, removed the horse from behind the plastic sheet.

2. white/milk: The experimenter showed the child the glass of milk and said either, "*Really and truly,* this is milk but I can make it *look like* it's Koolaid" (identity condition), or "*Really and truly,* this is white, but I can make it *look like* it's orange" (property condition). Then the experimenter positioned the orange plastic around the glass so that the

milk was occluded, said "See?" and after about 5 sec, removed the orange plastic.

3. big/necklace: The experimenter showed the necklace to the child and said either, "*Really and truly,* this is a necklace, but I can make it *look like* it's a bracelet" (identity condition), or "*Really and truly,* this is big, but I can make it *look like* it's little" (property condition). Then the experimenter placed the necklace inside the box, asked the child to look through the viewing window at the object, said, "See?" and, after about 5 sec, removed it.

Children in the apparent-to-real condition saw the stimuli first in their disguised states. For each stimulus in turn, the experimenter pointed to the object and said, "This *looks like* it's [apparent property/identity] but *really and truly,* it's [real property/identity]." Then the experimenter removed the disguise and showed the object to the child in its undisguised state.

Test questions.—After the three transformations were demonstrated, the experimenter said to the child, "Now I'm going to ask you some questions about what these things look like and about what they really and truly are." For each stimulus in turn, the experimenter first held the object in front of the child, disguised it, and then asked the child two questions for each object; for example, (1) appearance question: "What does this look like to you right now, milk [white] or Koolaid [orange]?" (2) Reality question: "Really and truly, what is this, milk [white] or Koolaid [orange]?"

In answering these questions, the children had to choose between the real and apparent properties/identities of the stimulus objects. In each condition, eight children were asked the appearance question followed by the reality question, and the other nine children were asked questions in the reverse order. The order in which the apparent and real properties/identities were mentioned within each question was randomized. Responses to the questions were scored as appearance answers if children chose the apparent property/identity and reality answers if they chose the real property/identity.

Results and Discussion

For each of the three stimuli, there were four possible patterns of responses: (1) correct answers to both appearance and reality questions, (2) incorrect answers to both questions, (3) appearance answers to both questions (phenomenism), (4) reality answers to both questions (intellectual realism). Table 1

TABLE 1

DISTRIBUTION OF RESPONSE PATTERNS FOR EACH CONDITION

| | NO. OF CHILDREN SHOWING EACH RESPONSE PATTERN 3, 2, 1, OR 0 TIMES | | | | | | | | | | | | | | | |
| | A Correct, R Correct | | | | A Incorrect, R Incorrect | | | | A Correct, R Incorrect (Phenomenism) | | | | A Incorrect, R Correct (Realism) | | | |
CONDI-TION	3	2	1	0	3	2	1	0	3	2	1	0	3	2	1	0
Identity:																
R-to-A ..	6	3	2	6	0	1	1	15	2	3	3	9	0	2	3	12
A-to-R ..	6	5	1	5	0	1	3	13	0	0	3	14	3	1	3	10
Property:																
R-to-A ..	6	2	4	5	0	1	1	15	3	5	2	7	0	0	1	16
A-to-R ..	4	2	6	5	0	0	3	14	2	0	7	8	1	3	5	8

NOTE.—Task type (identity or property) and transformation direction (R-to-A or A-to-R) are between-group variables. A stands for appearance question; R stands for reality question. R-to-A stands for real-to-apparent; A-to-R stands for apparent-to-real.

shows the distribution of these four response patterns for each of the four between-groups conditions. In Table 1, each child is characterized four times, once for each of the response patterns. For example, if a child produced two phenomenism patterns and one realism pattern, the child would be represented under "0" for the A correct–R correct column, under "0" for the A incorrect–R incorrect column, under "2" for the phenomenism column, and under "1" for the realism column.

The data for the first two response patterns shown in Table 1 indicate that 3-year-old children have some grasp of the appearance-reality distinction as it was instantiated in this experiment. About 12 (out of 17) children in each condition answered both questions correctly for at least one of the three tasks. It also seems clear that even when children made errors, they were not responding randomly. If children were responding randomly, then answering both questions incorrectly would be expected to occur more frequently than shown in Table 1. Very few children answered both questions incorrectly. Flavell et al. (1983) observed this same asymmetry between the both-correct and both-incorrect response patterns and interpreted it as evidence that children of this age are not responding randomly and have some minimal understanding of the appearance-reality distinction.

For the statistical analysis, a difference score was calculated for each subject by subtracting the number of correctly answered re-

ality questions (out of three) from the number of correctly answered appearance questions (out of three). These scores ranged from +3 to −3. If children answered both questions correctly, their score would be 0; similarly, if children answered both questions incorrectly, their score would be 0. The only way to score in the positive range (1,2,3) would be to answer appearance questions correctly and reality questions incorrectly, that is, make phenomenism errors. The only way to score in the negative range (−1,−2,−3) would be to answer appearance questions incorrectly and reality questions correctly, that is, make intellectual realism errors.

The difference scores were normally distributed and the variances for the four conditions were approximately equal, so a 2 × 2 ANOVA was performed. There were significant main effects for task type, $F(1,64) = 4.59$, $p < .05$, and transformation direction, $F(1,64) = 10.05$, $p < .01$. The interaction was not significant, $F(1,64) = .07$, $p > .05$. The difference scores were significantly higher in the property than in the identity condition and in the real-to-apparent than in the apparent-to-real condition. These results are shown in Figure 1.

When the demonstration direction was real-to-apparent, the mean difference scores for property and identity conditions were significantly different, $t(64) = 1.73$, $p < .05$.[1] Children in the property condition made more phenomenism errors, that is, they answered correctly more appearance questions

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[1] All t tests reported for Experiments 1 and 2 are one-tailed because the hypotheses being tested give clear predictions about the directions of the differences.
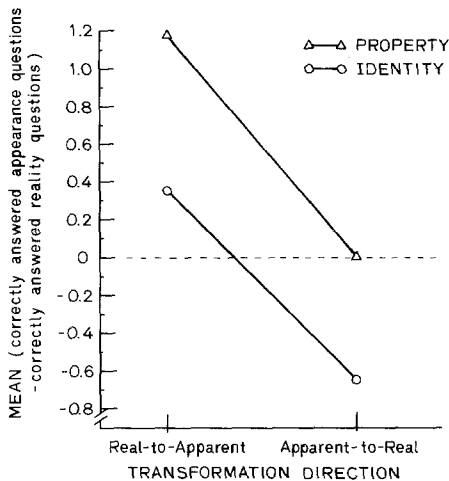
FIG. 1.—Mean difference score as a function of task type and transformation direction.

than reality questions, than children in the identity condition. When the demonstration direction was apparent-to-real, the difference between the mean scores for property and identity was marginally significant, $t(64) = 1.35$, $p < .10$. There was a tendency for children in the identity condition to make more intellectual realism errors, that is, to answer correctly more reality questions than appearance questions, than children in the property condition. The property-identity manipulation may have had less of an effect in the apparent-to-real condition because of the real-to-apparent transformations used immediately before the test questions. The test questions referred to objects with misleading appearances, so children had to view the stimuli in their disguised states when answering them. Therefore, all conditions included a real-to-apparent transformation before testing. Children in the real-to-apparent condition saw two real-to-apparent transformations of the stimuli, once during the demonstration part of the procedure and once before the test questions. Children in the apparent-to-real demonstration order condition saw the stimuli transformed first one way (apparent-to-real) in the demonstration and then the other way (real-to-apparent) before the test questions. The additive effect of seeing two real-to-apparent transformations in one condition combined with the canceling effect of seeing the stimuli transformed in both directions in the other condition might have been partly responsible for the difference between the two transformation direction conditions.

In the identity real-to-apparent condition and in the property apparent-to-real condition,

the mean difference scores did not differ from 0, $t(64) = .729$, $p > .05$; $t(64) = 0$. In these conditions, children gave correct responses to appearance and reality questions equally often, probably because the two manipulations elicited opposite error types (e.g., in the real-to-apparent identity condition, the transformation direction elicited phenomenism and the task type elicited intellectual realism).

Two sets of three Fischer Exact Tests were used to determine if the two significant main effects held for each of the three stimuli. Three Fischer Exact Tests were performed to determine if there was a relationship between task type (identity or property) and the kind of errors (phenomenism or intellectual realism) the children made for each of the three stimuli. Only children who made intellectual realism or phenomenism errors on the stimulus being tested were included in these analyses. For each of the stimuli, children were represented in a 2×2 table as being in either the property or identity condition and having made either intellectual realism or phenomenism errors. The relationship between task type and error type was significant for the necklace stimulus, $p < .001$, marginally significant for the milk stimulus, $p < .10$, and nonsignificant for the horse stimulus, $p > .10$. These analyses indicate that the property-identity effect was found for the milk and necklace stimuli, but not for the horse stimulus. Perhaps the effect was not found for the horse stimulus because, for many 3-year-old children, a zebra might really be a horse with stripes. There was a tendency for children in even the property condition to comment spontaneously on the identity of the horse stimulus ("It's a *zebra!*"), an observation that supports this post hoc explanation. If this was the case, the experimenter might not have been successful in directing the children's attention to only the properties or only the identities of the stimulus. Children in both property and identity conditions might have had both "has stripes" and "zebra" in mind when answering the appearance-reality questions. This problem would be unlikely to occur with the other two stimuli. Children certainly do not think of Koolaid as orange-colored milk, nor is it likely that they conceive of a bracelet as a little necklace.

Three additional Fischer Exact Tests were performed to determine if there was a relationship between transformation direction and the kind of errors the children made for each of the stimulus objects. All three of these tests were significant: necklace, $p < .05$; milk, $p < .05$; and horse, $p < .005$.

To summarize, this study provides support for both the transformation and property-identity hypotheses. Children's responses were affected by the direction of the transformation used to acquaint the children with the apparent and real identities/properties of the stimuli. Phenomenism responses predominated when the direction was from real to apparent property/identity; intellectual realism responses tended to be more frequent when the direction was from apparent to real. This result suggests that the salience of a transformation's end point is greater than that of its starting point. This effect may have been produced because the end point is the label that has most recently been given to the stimulus and/or because the more interesting part of a demonstration for children is not the viewing of a stimulus object but watching as an experimenter changes the object's appearance. The finding that young children's responses were affected by this variable conforms with Flavell et al.'s (1983) conclusion that young children's understanding of the appearance-reality distinction is fragile and easily influenced by task variables.

Children's responses were also affected by the aspect of a stimulus under consideration, that is, its properties or identities. Children in the property condition tended to make phenomenism errors (reported appearance when asked about reality) more often than children in the identity condition. There was a trend for children in the identity condition to tend to make more intellectual realism errors (reported reality when asked about appearance) than children in the property condition. The property condition differed from the identity condition only in the substitution of two words, yet this seemingly subtle change significantly affected the children's appearance-reality judgments as predicted by Flavell et al.'s (1983) property-identity hypothesis.

Experiment 2

This experiment was designed to replicate, clarify, and extend the findings from Experiment 1. The test of the property-identity hypothesis was made more rigorous by varying the property-identity factor within subjects. Each child received both property and identity versions of the three tasks. The prediction was that the same child would tend to make a different kind of error depending on whether she was asked about the properties or the identities of a stimulus; that is, she would tend to make a phenomenism error when asked about real and apparent properties and an intellectual realism error when asked about real and apparent identities.

The effect of transformation direction found in Experiment 1 was discussed as possibly due to the salience of the transformation's end point. This hypothesis predicts that if the end points of the transformations were made less salient, the effect of transformation direction would be reduced. In an attempt to reduce end-point salience and to give children more experience with the reversibility of the transformations, the demonstration part of the procedure was extended. Children saw the transformations occur in both directions and actively participated in performing the transformations. The prediction was that, with this modification of the Experiment 1 procedure, a condition that introduced the stimuli in their disguised states and ended the demonstration with the stimuli in their undisguised states would not elicit different error types from a condition that introduced the stimuli in their undisguised states and ended the demonstration with the stimuli in their disguised states.

Our initial plan to extend the Experiment 1 procedure by using more and different stimuli was thwarted by the extremely constrained nature of the stimuli required for our method. Several new stimuli were piloted with 3-year-old children, but all proved unsatisfactory. To illustrate, a marble (little thing) that looked like a ball (big thing) when magnified was unsatisfactory because some 3-year-old children who were shown the disguised marble said it looked little instead of big. It simply is difficult to make even a magnified marble look objectively large. When we used a larger marble, children did not recognize the undisguised stimulus as a marble. Instead, they called it a ball. We included one new stimulus in this experiment that was very similar to the milk/Koolaid stimulus used in Experiment 1. We disguised lemonade (a yellow drink) as grape juice (a purple drink) by wrapping the glass with purple plastic. The milk/Koolaid and necklace/bracelet stimuli from Experiment 1 and the lemonade/grape juice stimulus were used in Experiment 2.

Two other differences from Experiment 1 were (1) a change in the wording of the test questions designed to remove a possible ambiguity with respect to the intended referent of the questions, and (2) children were asked six probe questions at the end of the experimental session.

METHOD

Subjects

The subjects were 32 nursery school children of predominantly middle-class and upper-middle-class backgrounds: 19 girls and 13 boys (mean age, 3-8; range, 3-2 to 4-1).

Materials

The stimulus objects included a glass of lemonade, a piece of purple transparent plastic, and the milk-Koolaid and necklace-bracelet materials used in Experiment 1. The lemonade could be made to resemble grape juice by wrapping the glass with the purple plastic.

Procedure

Two experimenters worked together to test the children. One experimenter conducted the study while the other recorded the children's responses and comments. Neither experimenter participated in conducting Experiment 1.

To ensure that the apparent properties and identities used in the experiment were convincing, 12 3-year-old children who did not participate further in the experiment were shown each of the disguised stimulus objects in turn and queried about their appearances. Half the children were asked about the objects' identities and half about their properties. For example, children were shown the glass of milk wrapped in orange plastic and asked, "What does this stuff in the glass look like to you right now, milk [white] or Koolaid [orange]?" At least five of the six children in each group chose the apparent rather than the real properties/identities for the stimuli used in the experiment, thus validating the intended appearances of the disguised objects to a naive preschool-aged observer.

Pretraining.—Children in this study received the same pretraining with the expressions "looks like" and "really and truly" as the children in Experiment 1.

Demonstration.—The procedure used to acquaint the children with the real and apparent identities/properties of the stimulus objects was an extended version of the procedure used in Experiment 1. Children saw both real-to-apparent and apparent-to-real transformations and took a more active role in changing the objects' appearances. The order of the first transformation in the demonstration was varied between groups. In the real-to-apparent condition, the experimenter performed a real-to-apparent transformation and then directed the child in transforming the object from its apparent state to its real state and

back again to its apparent state. In the apparent-to-real condition, the children watched and performed the transformations in the reverse order; that is, the experimenter did an apparent-to-real transformation and the child did real-to-apparent and apparent-to-real transformations.

Example (real-to-apparent condition): The experimenter showed the child a glass of milk and said, *"Really and truly,* this is milk, but I can make it *look like* it's Koolaid." The experimenter wrapped the orange plastic around the glass and said, "See, now it looks like it's Koolaid. Show me that *really and truly,* it's milk." The child removed the plastic from the glass. (Some children needed a little assistance from the experimenter.) Then the experimenter said, "Can you make this *look like* it's Koolaid?" The child wrapped the glass with the plastic.

Both property and identity versions of all three tasks were administered to all of the children. Half the subjects received the three identity tasks followed by the three property tasks, and half received the tasks in the reverse order. The demonstration and test questions for the first three tasks (all identity or all property) were completed before the demonstration and test questions for the other condition. For both property and identity conditions, the three demonstrations preceded the test questions. The six possible orders for the three tasks were used, with each order occurring equally often in the two transformation direction conditions. After completing the three tasks in the condition given first, the child spent 3 min looking at a picture book with the experimenter before continuing with the second condition.

Test questions.—The testing procedure was very similar to that used in Experiment 1. Questions for the condition run first (property or identity) were asked before proceeding with the second condition. The questions for the milk and lemonade stimuli were slightly modified to help the child understand that the experimenter was referring to the liquid in the glasses. (1) "What does this stuff in the glass look like to you right now, milk or lemonade?" (appearance question). (2) "Really and truly, what is this stuff in the glass, _____ or _____?" (reality question).

As in Experiment 1, the order of the two questions was counterbalanced and the order in which the apparent and real properties/identities were mentioned within each question was randomized.

After the children had been run in both identity and property conditions, they were asked six probe questions, three about identity and three about property: (1) "If you tasted this, would it taste like milk or Koolaid?" (2) "If I spill this stuff, will the spot be white or orange?" (3) "If you tasted this, would it taste like lemonade or grape juice?" (4) "If I spill this stuff, will the spot be yellow or purple?" (5) "If you were going to wear this, would you wear it around your neck or your wrist?" (6) "How big is that thing? This big [points to cardboard circle the same size as the necklace] or this big [points to cardboard circle the same size as the necklace appears to be when viewed through the minifier]?"

The order of the questions and the order in which apparent and real properties/identities were mentioned within each question were randomized for each subject.

Results and Discussion

Table 2 provides the same summary of the Experiment 2 results as given in Table 1 for the results of Experiment 1 (see Experiment 1 for explanation of the table). As in Experiment 1, most children seemed to have some understanding of the appearance-reality distinction. At least 11 (out of 16) children per condition answered both questions correctly for at least one of the three tasks. Children made more double errors (both appearance and reality questions answered incorrectly) than in Experiment 1, but double errors were still relatively rare. From 11 to 15 children per condition made no double errors at all.

For the statistical analysis, a difference score was calculated for each child by subtracting the number of correctly answered reality questions from the number of correctly answered appearance questions (see Experiment 1). A $2 \times 2 \times 2$ mixed ANOVA with task type (property or identity) as a within-subjects variable and transformation direction (real-to-apparent or apparent-to-real) and condition order (property then identity or the reverse) as between-groups variables yielded a significant main effect for task type, $F(1,28) = 12.62$, $p < .01$. The mean difference between the number of correctly answered appearance and reality questions was significantly greater in the property condition than in the identity condition. The main effects for transformation direction and condition order were not significant, $F(1,28) = .07$, $p > .05$; $F(1,28) = .21$, $p > .05$. None of the interactions were significant: transformation direction $\times$ condition order, $F(1,28) = .21$, $p > .05$; transformation direction $\times$ task type, $F(1,28) = .12$, $p > .05$; condition order $\times$ task type, $F(1,28) = 1.06$, $p > .05$; transformation direction $\times$ task type $\times$ condition order, $F(1,28) = 2.23$, $p > .05$. Figure 2 shows the mean difference scores as a function of task type and transformation direction, collapsing across condition order.

When children were given the property versions of the tasks, they made predominantly phenomenism errors. Both property means plotted in Figure 2 were significantly greater than 0, $t(28) = 2.08$, $p < .025$. When children were given the identity versions of the tasks, they made approximately equal numbers of phenomenism and intellectual realism errors. Although both identity means were less than 0, as predicted, neither was significantly different than 0, $t(28) = .64$, $p > .05$; $t(28) = .15$, $p > .05$.

TABLE 2

DISTRIBUTION OF RESPONSE PATTERNS FOR EACH CONDITION

| | NO. OF CHILDREN SHOWING EACH RESPONSE PATTERN 3, 2, 1, OR 0 TIMES | | | | | | | | | | | | | | | |
| | A Correct, R Correct | | | | A Incorrect, R Incorrect | | | | A Correct, R Incorrect (Phenomenism) | | | | A Incorrect, R Correct (Realism) | | | |
CONDI-TION	3	2	1	0	3	2	1	0	3	2	1	0	3	2	1	0
Identity:																
R-to-A ..	4	5	4	3	0	1	3	12	1	0	5	10	0	2	5	9
A-to-R ..	2	3	6	5	0	2	3	11	0	2	3	11	1	2	4	9
Property:																
R-to-A ..	4	3	5	4	0	1	3	12	1	4	8	3	0	1	4	11
A-to-R ..	2	1	9	4	0	0	1	15	1	5	8	2	0	1	6	9

NOTE.—Task type (identity or property) is within subjects; transformation direction (R-to-A or A-to-R) is between groups. A stands for appearance question; R stands for reality question. R-to-A stands for real-to-apparent; A-to-R stands for apparent-to-real.
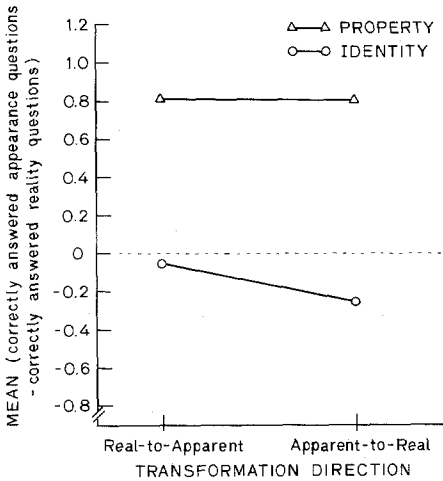
FIG. 2.—Mean difference score as a function of task type and transformation direction.

A matched-pairs t test was used to analyze the children's answers to the probe questions. For each question, children could give the reality answer (correct) or the appearance answer (incorrect). According to the property-identity hypothesis, children should give more appearance answers (make more errors) to the property probes. The matched-pairs t test yielded a significant property-identity effect, $t(31) = 1.78$, $p < .05$. Identity questions were answered correctly significantly more often than property questions. This result is consistent with the property-identity hypothesis, and suggests that children's confusion with the appearance-reality distinction is probably not limited to the way they answer the specific test questions used in Experiments 1 and 2. Thus, the property-identity effect is probably not due solely to some semantic confusion with the expressions "looks like" and "really and truly."

General Discussion

The results of these two studies support several of Flavell et al.'s (1983) conclusions about the development of appearance-reality knowledge. These studies replicate their finding that some understanding of the appearance-reality distinction is present at age 3. In addition, the effect found for transformation direction, strongly present in Experiment 1, but readily removed in Experiment 2, accords with Flavell et al.'s conclusion that 3-year-old children's grasp of the distinction is precarious and easily influenced by task variables. When one of the identities/properties became more cognitively salient than the other for any reason (e.g., by being the end point of a single

transformation), children tended to report that identity/property in response to all questions.

The predictions of the property-identity hypothesis were not completely borne out by the results of the two experiments. Identity tasks were not found to elicit predominantly intellectual realism in either experiment, although the data showed trends in the predicted direction. This result suggests that the identity tasks used in these experiments involving transformations were not exactly analogous to the identity tasks used by Flavell et al. (1983) involving artificial objects. The relatively low incidence of intellectual realism errors may have resulted from the use of real-to-apparent transformations in all conditions immediately preceding the test questions. Nevertheless, the results of both experiments provide clear evidence that children's appearance-reality judgments about object properties tend to differ from those about object identities. In both experiments, phenomenism was much more frequently elicited by property tasks than by identity tasks. These results are especially noteworthy both because the property-identity manipulation appears to be the only possible explanation of them and because a very small change in procedure (the substitution of two words) constituted this manipulation.

The results of these experiments, combined with Flavell et al.'s (1983) findings, suggest that the widespread view of young children as being "prone to accept things as they seem to be, in terms of their outer, perceptual, phenomenal, 'on the surface' characteristics" (Flavell, 1977, p. 79), may be less general than originally thought. Under some task conditions (e.g., when asked about identity, when there was a single apparent-to-real transformation) some children ignored immediately perceived appearances, even very compelling ones. In contrast, when the children were asked about properties such as color and size, they tended to construe the questions as referring to what was immediately perceived. They responded to questions about property as if they believed that when an object looks orange to them, then the true color of the object is orange. These results raise the interesting possibility that children may be strongly perception-bound or phenomenistic *only* when they are asked about properties. The development of a more adult-like understanding of object property may, in part, be mediated by Level 2 perspective taking (Flavell, Everett, Croft, & Flavell, 1981), that is, the development of the knowledge that an object viewed simultaneously by the self and

another person may have different appearances to the two people if their viewing conditions differ. Without this knowledge, the child is unlikely to understand what is meant when an object is described in terms of a property that is different from the one she is presently experiencing (see Liben, 1978). Perhaps when children learn that an object can look orange to them as they view it through a colored filter and simultaneously look white to another observer, they may be more able to appreciate the relative status of the two property descriptions possible when appearance and reality differ, that is, that one description refers to the real property and the other to an apparent property that is present only under special limited viewing conditions.

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