

## REPORT

# Young children's understanding of multiple object identity: appearance, pretense and function

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### Abstract

*Evidence from theory-of-mind tasks suggests that young children have substantial difficulty thinking about multiple object identity and multiple versions of reality. On the other hand, evidence from children's understanding of pretense indicates that children have little trouble understanding dual object identity and counterfactual scenarios that are involved in pretend play. Two studies reported here show that this competence is not limited to pretend play. Three-year-olds also understand the dual identity involved in unusual functional use ( $X$  is being used as  $Y$ ), even though they have difficulty understanding deceptive appearance ( $X$  looks like  $Y$ ). We suggest that children are able to distinguish extrinsic object properties from intrinsic ones (function vs. category-membership) better than they can distinguish superficial object properties from deep ones (appearance vs. category-membership).*

### Introduction

Between the ages of 3 and 5, children's thinking about the mind appears to undergo major change. The limitations of 3-year-olds' mentalistic reasoning are demonstrated by their failure on tasks which require representing false beliefs (Wimmer & Perner, 1983; Gopnik & Astington, 1988; Wellman, Cross & Watson, 2001), deceptive appearances (Flavell, Flavell & Green, 1983; Flavell, Green & Flavell, 1986), and multiple perceptual perspectives (Flavell, 1992). These and other studies have shown that 3-year-olds have trouble acknowledging that somebody could expect a box to contain candy when it really contains pencils, that an object could look like a rock, but really be a sponge, or that the same drawing can look different from different vantage points. By contrast, most 5-year-olds experience little difficulty with these notions. Generalizing from these findings, several authors have posited a qualitative development in the child's theory of mind during this period (e.g. Flavell, 1988; Gopnik & Wellman, 1992). According to these claims, 5-year-olds and adults, but not 3-year-olds, possess the notion of *representation*, which allows them to fathom how a single object or state of affairs can be represented in two ways.

Perner, Stummer, Sprung and Doherty (2002) propose that young children experience a general difficulty with confronting multiple incompatible perspectives upon a single thing, which is responsible for children's avoidance of mapping multiple lexical labels onto a single object, as well as their inability to acknowledge false beliefs and deceptive appearances (see Inhelder & Piaget, 1964; Flavell, 1988; Markman, 1992, for related views).

A problem for both the mental-representations and the multiple-perspectives accounts of theory-of-mind development is posed by pretend play, which emerges reliably in the second year of life in typically developing children (Lillard, 1993a; Harris, 2000). Pretend play involves a dual description of a single state of affairs, often including attaching two incompatible identities to a single object; e.g. a pretend *telephone* is also a real *banana*. Nevertheless, young children seem to have little difficulty negotiating the multiple perspectives involved in pretense. For instance, 3-year-olds are quite good at naming the real and the pretend identity of a pretend prop object, even though they typically fail to do likewise with the real and the apparent identity of a deceptive object (Flavell, Flavell & Green, 1987).

Why do children master the pretense–reality distinction before the appearance–reality distinction? In their analysis of multiple-perspectives tasks Perner *et al.* (2002) draw a

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distinction between truth-compatible perspectives (such as 'apple' and 'red') and truth-incompatible perspectives (such as 'banana' and 'telephone'), arguing that children fail only on those multiple-perspectives tasks which involve mutually contradictory perspectives. The lag between 3-year-olds' performance on pretense-reality versus appearance-reality problems thus suggests that they see a pretend object identity as compatible with real identity, whereas they see looking like X while really being Y as a contradiction. Why would children see pretend role as dissociable from real identity before they do so with deceptive appearance?

Lillard (1993b) proposes that children have an action-based understanding of pretense, which does not require a notion of mental representation. From the young child's point of view, she claims, 'pretending that a rock is a cookie' merely means 'to act upon a rock as one normally acts on a cookie'. This action-based construal of pretense allows children to reconcile pretense with reality, but does not generalize to mental states (such as belief), which do not involve an unusual mode of action, until later in development.

We propose a related explanation for young children's precocious ability to reconcile pretense with reality. Whereas appearance is an intrinsic identity, pretend role is an extrinsic one: an object's appearance is determined by its physical properties, such as shape and color, while an object's pretend role is typically determined by an external agent's behavior, namely a pretender's actions. Therefore, distinguishing between pretense and reality requires distinguishing between stable, intrinsic object properties (what an object really is) and a temporary relational role it occupies (what somebody is doing with it), whereas distinguishing between appearance and reality requires making the finer distinction between two types of intrinsic properties: the essential properties (what an object really is) and the superficial properties (shape, color, etc.). This could be why young children see pretend role as a distinct aspect of an object before appearance.

If this account is accurate, children's ability to recognize multiple object identities should not be limited to pretense. Consider the case of unusual function, e.g. when a *radio* is being used as a *paperweight*. As with both deceptive appearance and pretense, recognizing such functional substitution involves mapping two object identities onto a single object ('radio' and 'paperweight'). Like pretense, and unlike deceptive appearance, functional role is extrinsic in that it captures the role an object temporarily plays in an action. Three-year-olds should therefore find recognizing an object's functional role easier than recognizing an object's deceptive appearance. This prediction is tested in Study 1, which compares 3-year-olds' performance on the Appearance-Reality and Pretense-Reality tasks (Flavell *et al.*, 1987) to an analogously structured Function-Reality task.

## Study 1

### Method

#### Participants

Thirty 3-year-old children (mean age = 41 months; range: 36 to 47 months) attending a university-sponsored preschool participated in Study 1, including an approximately equal number of boys and girls. Children were randomly assigned to one of the three conditions (Appearance, Pretense, Function), 10 children per condition.

#### Stimulus materials

Stimuli for the Appearance task were deceptive artifact objects, each of which resembled another object.

Stimuli for the Pretense task were familiar artifact objects, each of which was used by the experimenter in a pretend action to signify another object.

Stimuli for the Function task were familiar artifact objects, each of which was used by the experimenter to serve the function of another object (see Table 1).

Different stimuli were used in the three tasks, because we wished to compare children's understanding of the

**Table 1** Stimuli in Study 1

#### Appearance condition

	Real identity	Appearance
Training	Pencil sharpener	Potato
1	Candle	Apple
2	Chalk	Egg
3	Eraser	Candy
4	Magnet	Cracker
5	Pen	Toothpaste

#### Pretend condition

	Real identity	Pretend role
Training	Spoon	Telephone
1	Key	Airplane
2	Pencil	Car
3	Rock	Cookie
4	Comb	Fork
5	Toothpaste	Pen

#### Function condition

	Real identity	Functional role
Training	Bottle	Pencil-box (to keep pencils)
1	Trashcan	Chair (to sit on)
2	Forks	Drumsticks (to play a drum)
3	Book	Plate (to put food on)
4	Shoe	Wallet (to keep money)
5	Toothpaste	Pen (to draw a picture)

three types of dual identity using a reasonably naturalistic task format. While deceptive objects are required by the appearance-reality task and can be used as pretend props in the pretend task (Flavell *et al.*, 1987), they are hard to incorporate into a plausible function-reality task: using a fake cookie as a cookie will only get you so far. Moreover, we wished to compare children's ability to negotiate the three forms of dual object identity without confounding them, which would be impossible if we were to use the same stimuli across tasks (e.g. using a fake cookie in pretense would have resulted in confounding appearance and pretense).

### Procedure

Children were tested individually in a small room at their preschool. Each child received one training trial followed by five test trials presented in a random order.

**Appearance.** On each trial, children were presented with a deceptive object, which was introduced as follows:

What does this look like? It looks like an apple, doesn't it? Look what it has on the top. It has a wick that you put on fire and it is made out of wax. Do you know what this really is? This is really a candle, isn't it? So, really and truly this is a candle, but when you look at it with your eyes, it looks like an apple.

On the test trials children were then asked to identify the real and the apparent identity of the object in two separate questions, e.g.

What is this really and truly, an apple or a candle?

When you look at it with your eyes, what does it look like, an apple or a candle?

The order of the two questions and the options given within each of these questions was counterbalanced.

**Pretense.** On each trial the experimenter performed a pretend action by using a prop object, and introduced the prop as follows:

I am going to pretend that I am eating a cookie. I am going to pretend that this is a cookie. Ummm, that's delicious. But do you know what this really is? This is really a rock, isn't it? So, really and truly this is a rock, but right now I am pretending it is a cookie.

On the test trials this was followed by questions about the real and pretend identity, counterbalanced for order:

What is this really and truly, a rock or a cookie?

What am I pretending this is right now, a rock or a cookie?

**Function.** On each trial the experimenter put an object to an unusual use, describing the object as follows:

I have this drum and I want to play it with something. What do we play the drum with? We use drumsticks, don't we? Well, I don't have any real drumsticks, so I am going to use these as drumsticks. But do you know what these really are? That's right, they are really forks. So, really and truly these are forks, but right now I am using them as drumsticks.

On the test trials this was followed by the questions about the object's real and functional identity:

What are these really and truly, forks or drumsticks?

What am I using these as right now, as forks or as drumsticks?

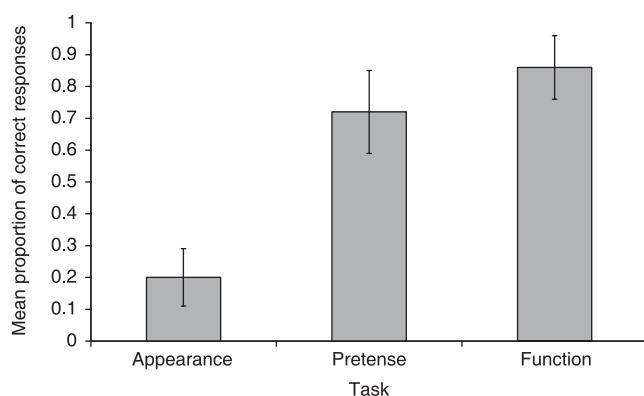
### Results

On each trial children were counted as responding correctly if they gave an appropriate answer to both the Reality and the Appearance/Pretense/Function question.

No difference was found between individual items within each task, nor were there any order effects. Overall, 70% of the children (21 out of 30) either succeeded on all items or failed on all items. Children's correct scores were averaged across trials.

A univariate analysis of variance (Task  $\times$  Age [Younger vs. Older 3-year-olds]  $\times$  Gender) revealed a main effect of Task ( $F = 8.86$ , df = 2,  $p < .003$ ) on correct performance and no other effects or interactions. Post-hoc independent-samples *t*-tests revealed that children in the Pretense task ( $M = 72\%$  correct) and the Function task ( $M = 86\%$ ) performed better than the children in the Appearance task ( $M = 20\%$ ), with both  $ts > 3$ , df = 18, both  $ps < .006$ . There was no significant difference between the Function and Pretense group (see Figure 1).

Children were scored as committing the *realist* error if they only responded correctly to the Reality question, as committing the *non-realistic* error if they only responded correctly to Appearance/Pretense/Function question,



**Figure 1** Study 1 results.

and as making the *reverse* error if they responded incorrectly to both questions. This error scoring was used to compare children's performance in the three conditions to chance. If children respond randomly to the two questions, each with two options, then they as a group should respond correctly on 25% of the trials, and commit each of the three error types (realist, non-realist and reverse) on 25% of the trials. One-sample *t*-tests revealed that the children in the Appearance were more likely to commit the realist error than would be predicted by chance (62% vs. 25%,  $t = 3.84$ ,  $df = 9$ ,  $p < .01$ ), and less likely to commit the reverse error than chance (4% vs. 25%,  $t = -7.86$ ,  $df = 9$ ,  $p < .01$ ), while their tendency to respond correctly (20%) and to commit the non-realist error (18%) did not differ from chance. By contrast, the children in the Pretense and Function conditions responded correctly more often than chance (79% vs. 25%,  $t = 6.53$ ,  $df = 19$ ,  $p < .01$ ), committed the non-realist error less often than chance (6% vs. 25%,  $t = -3.77$ ,  $df = 19$ ,  $p < .01$ ) and never committed the reverse error, although their tendency to commit the realist error (15%) was not different from chance. In summary, children tended to fail the Appearance–Reality task by giving the wrong answer to the Appearance question, but tended to succeed on the Pretense–Reality and Function–Reality task.<sup>1</sup>

### *Discussion*

As predicted, 3-year-olds in Study 1 successfully distinguished between objects' real identities and their functional roles, supporting our hypothesis that children find dual object identity based on role substitution easier to grasp than deceptive appearance. This result suggests that what makes pretense easier to understand than appearance (Flavell *et al.*, 1987) is that it involves a role substitution, as does unusual functional use.

A difficulty with interpreting these data stems from the fact that different stimuli were used in the three tasks. In particular, only the objects in the Appearance task were deceptive.<sup>2</sup> As mentioned earlier, it would have been difficult to come up with a set of objects to serve

as stimuli across all three conditions in Study 1 because of the inherent differences among the three tasks. We address this issue in Study 2.

In Study 2 we designed toy objects, each of which had a deceptive functional part, including a toy house whose roof was made out of a book, so that the book both *looked like* a roof and was being *used as* a roof, as well as a toy chair whose legs were made out of pencils, which both *looked like* and were being *used as* chair legs. We were thus able to equate the stimulus objects for the appearance and function conditions (though not for pretense). This allowed us to address the key question of whether children are better able to understand dual object identity when it is framed as a case of relational substitution, rather than deceptive appearance.

## Study 2

### *Method*

#### *Participants*

Thirty-two 3½-year-old children (mean age = 45 months; range: 42 to 48 months) participated in Study 2, including 16 boys and 16 girls (same population as in Study 1). Younger 3-year-olds (36- to 42-month-olds) were not included in Study 2 because pilot data suggested that they had difficulty initially identifying the relevant functional parts (namely roof and chair leg). However, we did not expect that Study 2 would yield different results due to the age difference alone, since older 3-year-olds have been previously shown to have as much difficulty with appearance–reality tasks as younger 3-year-olds (e.g. Flavell *et al.*, 1986, 1987). Moreover, our Study 1 revealed no significant difference between the two age groups (overall, older 3-year-olds,  $M = 64\%$  correct; younger 3-year-olds,  $M = 55\%$  correct;  $t = .573$ ,  $p > .3$ ).

Children were randomly assigned to the Appearance or Function condition, eight boys and eight girls to each condition.

### *Stimulus materials*

Two test items were used in Study 2. One was a toy house, whose roof was made out of a book. The book's covers were painted and decorated to resemble a tiled

<sup>1</sup> All three conditions included a Toothpaste/Pen item: a pen that looked like the tube of toothpaste in the Appearance condition and a tube of toothpaste that was used as a pen in the Function condition or used as a pretend pen in the Pretense condition. Children's performance on these items showed the same pattern as children's overall performance on the tasks, suggesting that the overall condition difference was not due to differences among the objects used.

<sup>2</sup> An additional concern is that children in the Pretense and Function tasks learn the real identity first, and the non-real identity later. This order of presentation is reversed in the Appearance task, because children first see the object's external appearance, and are then shown its real identity. We ran an additional study comparing two versions of the Function–Reality

task: the standard-order version, where children learned the object's real identity first, and the reverse-order version, where they first learned its functional role (i.e. they were initially deceived about the real identity). Three-year-olds did equally well on both versions, suggesting that the advantage that function has over appearance is not a mere order effect.

roof. The second item was a toy chair, whose legs were made from pencils. The pencils were painted so as to blend with the rest of the chair. Both the book/roof and the pencil/leg were detachable, which allowed the experimenter to demonstrate to the child their real identity.

### Procedure

The two test trials were counterbalanced for order. Children were presented with the stimuli objects, which were introduced as follows:

Look! Do you know what this is? It's a house, isn't it? Can you tell me what you call this part of a house? It's a roof, isn't it?

Can you see what it really is? It's really a book, isn't it?

The contrast was then set up as follows, depending on condition:

So, really and truly this is a book, but when you look at it with your eyes, it looks like a roof.

or

So, really and truly this is a book, but right now it's being used as a roof.

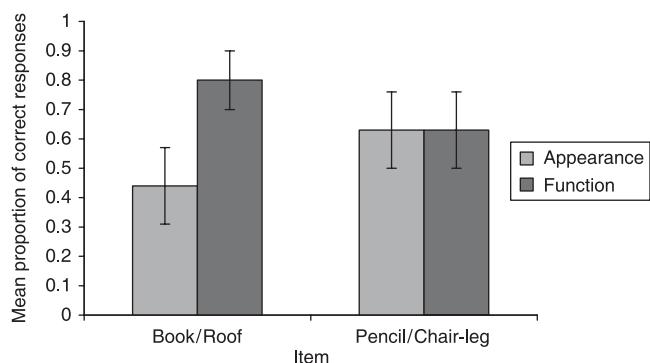
Finally, the child received two questions. The Reality question was identical across conditions:

What is this really and truly, a book or a roof?

Children in the Appearance condition were asked: 'When you look at this with your eyes right now, what does it look like, a book or a roof?' Children in the Function condition were asked: 'What is it being used as right now, as a book or as a roof?' The order of the questions and options was counterbalanced.

### Results

Responses were scored as in Study 1. There were no order effects and no overall difference between the two items. A univariate analysis of variance (Task  $\times$  Gender) revealed no significant effects on correct performance. Examination of the data revealed, however, that children appeared to respond differently to the two task items with respect to the experimental conditions. Non-parametric statistics were thus used to examine children's response to the two items separately. An independent-samples Mann-Whitney U-test showed a significant effect of Task on children's performance on the Book/Roof item ( $U = 76.5, p < .05$ ), with 13 out of 16 children in the Function group, but only seven out of 16 children in the Appearance group succeeding on this item. By contrast, the two groups performed at the same level on the Pencil/



**Figure 2** Study 2 results.

Chair-leg item, with 10 children out of 16 in each group succeeding (see Figure 2). The difference between the two items is thus due in part to children performing unusually well on the Appearance version of the Pencil/Chair-leg item.

Goodness-of-fit chi-square tests were used to compare children's performance on the two items to a chance model, which predicts that 25% of children should respond correctly on a given item, and 25% should commit each of the possible error types (realist, non-realist and reverse). On the Book/Roof item children in the Appearance condition tended to either respond correctly (seven out of 16) or commit the realist error (six out of 16;  $\chi^2 = 6.5, df = 3, p < .1$ ), whereas children in the Function condition tended to respond correctly (12 out of 16;  $\chi^2 = 21.5, df = 3, p < .01$ ), consistently with our predictions. On the Pencil/Chair-leg item, children in the Function condition tended to respond correctly (10 out of 16;  $\chi^2 = 6.5, df = 2, p < .05$ ), as predicted. Unexpectedly, however, children in the Appearance condition also tended to respond correctly on the Pencil/Chair-leg item (10 out of 16;  $\chi^2 = 6.5, df = 2, p < .05$ ).

### Discussion

Study 2 provided a stronger test of our hypothesis by equating the stimuli across tasks. Children in both conditions were presented with an object possessing a secondary identity. The only difference between the two tasks in Study 2 was the language used to describe the dual identity of the object. For one of the items, the function-reality version proved easier than the appearance-reality version, though for the other item the two tasks did not differ. Whatever the reason for this item effect, it should be noted that children in the Function group performed correctly above chance on both items. These results thus confirm our predictions: children were able to recognize an object's functional role as distinct from its real identity. Moreover, on one of two

items they were better at doing so than at recognizing deceptive appearance.

Children in Study 2 were better at naming the same two identities (roof and book) of the same object when the duality was described as functional substitution, rather than deceptive appearance. The less pronounced condition difference in Study 2 is in part due to children performing better on the appearance-reality task than children in Study 1. Perhaps the fact that the stimuli in Study 2 were functional parts made their dual nature easier to recognize, even when appearance language was used to describe it. Taken together, the results from our two studies are consistent with the hypothesis that functional substitution is easier for young children to reconcile than deceptive appearance.

## General discussion

Our findings suggest that pretense is not unique in permitting 3-year-olds to recognize multiple object identities. In Study 1 children were as good at recognizing unusual functional use as they were pretense, while still failing the appearance-reality task. Study 2, in which the same deceptive stimuli were used across tasks, showed the same pattern, although the effect was weaker and less consistent than in Study 1. Overall, children seem to grasp that, for example, a book can be used as a roof before they understand that a book can look like a roof. These results are consistent with prior findings (Flavell *et al.*, 1987), yet they suggest a broader interpretation: children understand multiple object identities better when an object's intrinsic identity is contrasted with its relational role.

Why do young children successfully distinguish function and pretense from reality, yet have trouble distinguishing appearance from reality? This may be due in part to how children interpret appearance language ('looks like') versus language about pretense ('pretend that') and function ('using as'). There is some evidence suggesting that children's difficulty with appearance-reality is partially due to the verbal nature of the task. Sapp, Lee and Muir (2000) have shown that non-verbal versions of the appearance-reality task are easier for young children than the standard version. Moreover, altering the language used in the appearance-reality task so as to emphasize deception or trickery also improves 3-year-olds' performance (Rice, Koinis, Sullivan, Tager-Flusberg & Winner, 1997). Hansen and Markman (2005) provide a discourse-based analysis of the appearance-reality problem. They show that the expression 'looks like' is ambiguous as to whether it refers to the speaker's opinion about likely reality (as in 'That looks like John over

there') or to external appearance contrasted with reality (as in 'Bob looks like John'). Adults and children resolve this ambiguity in everyday conversations through pragmatic reasoning: if reality is present in the discourse as shared knowledge, 'looks like' is interpreted as referring to appearance, whereas if the real identity is unknown, speakers prefer to interpret 'looks like' as referring to reality. Hansen and Markman (2005) found that altering the context in which the appearance/reality questions were framed, making it clear that reality is shared knowledge, resulted in a dramatic improvement in 3-year-olds' performance. For example, when asked about a rock-like sponge 'What does this look like?', 3-year-olds incorrectly said that it looked like a sponge. But when asked 'What does this sponge look like?' they answered correctly that it looked like a rock, suggesting that children's errors on the standard task result from a misinterpretation of the expression 'looks like', rather than from a conceptual difficulty with theory of mind or multiple representations.

This discourse-based explanation may well account for the advantage that pretense and function have over appearance. 'Use as' and 'pretend' do not have the same type of ambiguity as 'looks like' in the sense that they are always used to describe an object's non-real identity. Thus, the function and pretense questions would not generate the same confusion as the appearance question.

However, language factors may be only partially responsible for the difference we found. Although real, apparent, and functional object identities can be expressed with the same category labels, they capture different types of object properties. Reality and appearance both depend on the intrinsic, stable, physical properties of the object in question. Function and pretense depend on the role objects play with respect to actions and other objects. We suggest that children master the distinction between the extrinsic and intrinsic object properties before they master the finer distinction between essential and superficial object properties. This developmental claim is supported by evidence from children's object categorization. In particular, results from object-transformation tasks have shown that while preschoolers understand that wearing a costume (an extrinsic property) does not change an animal's kind identity, they think that permanently altering the animal's external appearance (a superficial intrinsic property) can in fact change its identity (Keil, 1989; Abelev & Markman, 2005).

We propose that 3-year-old children understand that real identity and functional or pretend role are constituted by different sets of object properties and recognize that a real identity X may be compatible with a functional identity Y (cf. Perner *et al.*, 2002). However, they do not yet possess as clear a distinction between essential and superficial intrinsic properties. Therefore, children's

knowledge of what an object really is interferes with their ability to identify deceptive appearances, especially when no pragmatic cues are provided to clarify the distinction further or make the question clearer as in Hansen and Markman (2005).

Our findings help explain the developmental precocity of the pretense-reality distinction and suggest that role substitution is generally a simpler form of multiple object identity than deceptive appearance. Based on this result we conclude that conceptual factors, such as the intrinsic or extrinsic nature of the alternative identity, help shape children's performance on multiple object identity tasks, along with task pragmatics (Hansen & Markman, 2005) and executive-control demands (Carlson & Moses, 2001).

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## References

- Abelev, M., & Markman, E.M. (2005). Transformation task revisited: children's reasoning about object identity. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Atlanta, April.
- Carlson, S.M., & Moses, L.J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development*, **72**, 1032–1053.
- Flavell, J. (1988). The development of children's knowledge about the mind: from cognitive connections to mental representations. In J. Astington, P. Harris, & D. Olson (Eds.), *Developing theories of mind* (pp. 244–267). Cambridge: Cambridge University Press.
- Flavell, J. (1992). Perspectives on perspective taking. In H. Beilin & P. Pufall (Eds.), *Piaget's theory: Prospects and possibilities* (pp. 107–139). Hillsdale, NJ: Lawrence Erlbaum.
- Flavell, J., Flavell, E., & Green, F. (1983). Development of the appearance-reality distinction. *Cognitive Development*, **15**, 95–120.
- Flavell, J., Flavell, E., & Green, F. (1987). Young children's knowledge about the apparent-real and pretend-real distinctions. *Developmental Psychology*, **23**, 816–822.
- Flavell, J., Green, F., & Flavell, E. (1986). Development of knowledge about the appearance-reality distinction. *Monographs of the Society for Research in Child Development*, **51** (1, Serial No. 212).
- Gopnik, A., & Astington, J. (1988). Children's understanding of representational change and its relation to the understanding of false belief and the appearance-reality distinction. *Child Development*, **59**, 26–37.
- Gopnik, A., & Wellman, H. (1992). Why the child's theory of mind really is a theory. *Mind and Language*, **7**, 145–171.
- Hansen, M.B., & Markman, E.M. (2005). Appearance questions can be misleading: a discourse-based account of the appearance-reality problem. *Cognitive Psychology*, **50**, 233–263.
- Harris, P. (2000). *The work of the imagination*. Oxford: Blackwell Publishing.
- Inhelder, B., & Piaget, J. (1964). *The early growth of logic in the child: Classification and seriation*. New York: Norton.
- Keil, F. (1989). *Concepts, kinds and cognitive development*. Cambridge, MA: MIT Press.
- Lillard, A. (1993a). Pretend play skills and the child's theory of mind. *Child Development*, **64**, 348–371.
- Lillard, A. (1993b). Young children's conceptualization of pretense: action or mental representational state? *Child Development*, **64**, 372–386.
- Markman, E.M. (1992). Constraints on word learning: speculations about their nature, origins, and domain specificity. In Megan R. Gunnar & Michael Maratsos (Eds.), *Modularity and constraints in language and cognition* (pp. 59–101). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Perner, J., Stummer, S., Sprung, M., & Doherty, M. (2002). Theory of mind finds its Piagetian perspective: why alternative naming comes with understanding belief. *Cognitive Development*, **17**, 1451–1472.
- Rice, C., Koinis, D., Sullivan, K., Tager-Flusberg, H., & Winner, E. (1997). When three-year-olds pass the appearance-reality test. *Developmental Psychology*, **33**, 54–62.
- Sapp, F., Lee, K., & Muir, D. (2000). Three-year-olds' difficulty with the appearance-reality distinction: real or apparent? *Developmental Psychology*, **36**, 547–560.
- Wellman H.M., Cross D., & Watson J. (2001). Meta-analysis of theory-of-mind development: the truth about false belief. *Child Development*, **72** (3), 655–684.
- Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, **13**, 103–128.

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