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Made to Symbolize: Intentionality and Children's Early Understanding of Symbols

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This experiment tested whether children's insight into a difficult symbolic relation could be increased by explicitly emphasizing the intentionality surrounding the artifact's creation and use. Specifically, I explicitly emphasized (a) the adult's intent to communicate information via the artifact and (b) the artifact's intentional origins and intended function. Both 36- and 30-month-olds showed significantly higher levels of insight compared to a control condition. The results suggest that by their 3rd year, children's sensitivity to intentionality can contribute to their symbolic understanding and development.

Humans are unique as a species in their capacity for creating and using symbols. Adults recognize, comprehend, and employ numerous symbols every day. They represent countries by colored pieces of fabric (also known as flags); identify hundreds of products by their logos; and translate speech sounds, numerical operations, and three-dimensional spatial layouts into ink marks on a two-dimensional surface. Both the range of what can be represented, and the forms the representation might take, are literally limitless.

Symbols often share physical resemblance with their referents, especially pictorial symbols such as drawings and photographs. A photograph of George Bush is an excellent symbol for him because its referent is unmistakable. For example, a picture can clarify whether the elder or younger Bush is meant.

But perceptual similarity is not required. George Bush can also be represented (as of this writing) by the honorific title "Mr. President," by the Presidential seal, or by the 23rd letter of the alphabet. Each of these is a viable symbol—but only if the

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intended referent is clear to all parties involved. The Presidential seal by itself represents different men at different times. The 23rd letter of the alphabet represents George Bush only if one knows his nickname of "W."

What constrains and guides symbol use, then, is not physical form or material but rather the intentions and conventions of a symbol's use. Conventions are simply intentions writ large—the product of mutual agreements that when one uses the presidential seal, the intent is to refer specifically to the president and his office, rather than the vice president or peanut butter or anything else.

In this way, symbols are intrinsically intentional. Indeed, a symbol can be defined as "any entity that someone intends to stand for something other than itself" (DeLoache, 1995b, p. 109). Someone could give directions to an obscure part of a college campus using coffee mugs and paper clips to represent various landmarks but no one following those directions would expect to find a real coffee mug standing in the street. In short, what matters most is not what resemblances reside in the world between the proposed symbol and referent but what resides in the head of the person employing a symbol. The flexibility and power of adults' abilities with symbols arises directly from this fact.

This is not to say that there are no constraints. A proposal to use a swastika as the emblem for a football team would likely meet with great resistance. But the difficulty would arise precisely because the swastika already strongly carries other conventional meanings—meanings that would lead one to suspect ill intent on the part of the proposal-maker. It would not arise because of any limit on people's ability to symbolize.

For adults, then, symbols are inherently intentional. What role might intentionality play in children's understanding of symbols? The studies reported here were designed to address this question. It is possible that intentions play no role in children's understanding of symbols. Young children clearly do not yet hold the same understanding of symbols as adults do, even for very familiar symbols like pictures or words. For example, it is not until age 30 months that children acquire the adult convention that pictures are preferable in their upright orientation rather than upside-down (DeLoache, Uttal, & Pierroutsakos, 2000). Other misunderstandings persist into the 4th year. In one study (Flavell, Flavell, Green, & Korfmacher, 1990), children were shown a TV displaying a picture of a balloon. The majority of 3-year-olds thought that if the top of the TV was taken off, a balloon would come floating out (see also Nye, Thomas, & Robinson, 1995). Similarly, many 3-year-olds assume that the printed word for a larger item (e.g., a house) will be longer than the word for a smaller item (e.g., a caterpillar; Bialystok, 1991). In short, young children often show confusion regarding how properties of the symbol and referent map to each other.

At other times, young children evidence a more fundamental difficulty: recognizing the very existence of the symbolic relation. This has been abundantly demonstrated in the research of DeLoache and colleagues (e.g., DeLoache, 1991,

1995a; DeLoache & Burns, 1994). In the standard task used in this work, the symbolic object-retrieval task, children were asked to find a toy hidden in a room. The toy's location was revealed to the child through symbolic means. For example, the location was pointed out in a photograph, or a miniature version of the toy was hidden in the corresponding location of a scale model of the room. Thus, the task required children to use information from the symbolic artifact to make an inference about current reality.

Years of systematic research have mapped a clear developmental progression. Two-year-olds reliably failed to find the toy, even using familiar symbolic artifacts such as drawings and photographs (DeLoache & Burns, 1994). Although they recognized items in the picture, they apparently failed to understand that what they had been shown in the depiction had any relevance to their search in the room. The two activities—looking at the picture and searching in the room—seemed to be effectively two entirely separate, disconnected events. As a result, children at this age usually searched enthusiastically but incorrectly.

In contrast, children 6 months older consistently found the toy when shown a picture of its hiding place. At 2.5 years, children were able to recognize the representational relation between the picture and the room. They understood that what they were shown in the picture revealed where they should search in the room. However, achieving insight into the symbolic relation between a model and the room is still quite challenging. Children this age typically performed quite poorly in the model version of the task (DeLoache, 1991).

It is not until 3 years of age that children reliably succeeded in the model task, and then only under the most facilitative of conditions—with detailed instructions and a high degree of perceptual similarity between items in the two spaces. When the perceptual similarity was reduced (the "low-similarity" model task), 3-year-olds also struggled (for reviews, see DeLoache, 1995a; DeLoache, Miller, & Pierroutsakos, 1998).

Evidence indicates that children's difficulty is not due to problems remembering the symbolically conveyed information. In the model versions of the task, they were highly successful (75%–85% errorless retrievals; DeLoache, 1995a) at retrieving the miniature toy from the location where they observed it being hidden—the very information that they needed to employ to find the larger toy. Nor does their difficulty seem to be due to lack of motivation. They understood that their job was to find the toy and usually searched readily, albeit incorrectly. Rather, their difficulty seems to lie in recognizing the existence of the representational relation.

One major challenge to achieving insight into symbolic artifacts is their dual nature, noted by both philosophers and psychologists (e.g., DeLoache, 1989; Langer, 1942; Nye et al., 1995; Potter, 1979). To discern the symbolic nature of a scale model, for example, one must simultaneously acknowledge both its concrete, physical existence and its symbolic aspect. DeLoache (e.g., 2000) termed this the

problem of "dual representation." To use the model as a source of information in the model task, children must see past their initial, physical construal of the model (as a toy or dollhouse) to the symbolic construal intended by the experimenter. The model's physical aspect, however, is much more salient for young children, making this a challenging requirement.

The difficulty very young children experience in understanding symbolic artifacts contrasts with their facility in other areas. For example, a growing body of research shows that, at these same ages, children are already highly sensitive to the intentional behavior of others, regarding other people as both intentional agents and potential communicative partners. Sensitivity to goal-directed behavior is evident already in early infancy (Gergely, Nadasdy, Csibra, & Biro, 1995; Rochat, Morgan, & Carpenter, 1997). By 18 months, infants are selective in their perceptions of goal-directedness, differentially imitating the actions of a human agent but not those of a robot (Meltzoff, 1995). Toddlers also make an important further discrimination between human actions that are intentional versus accidental, selectively imitating the former over the latter (Carpenter, Nagell, & Tomasello, 1998), and learning names for actions that are verbally marked as intentional, but not for ones marked as accidental (Tomasello, 1994). In fact, young children are so attuned to intentional cues they are able to infer an agent's goal without ever seeing it realized: 18-month-olds who see an adult unsuccessfully attempt to perform an action will later imitate the intended action, not the failed attempt (Meltzoff, 1995).

Young children further understand other people not only as intentional agents, but also specifically as communicative ones. By 20 months, children are sensitive to an adult's referential intent even when it conflicts with their own focus of attention (e.g., Baldwin & Moses, 1994). By 30 months, children can monitor whether their communicative signals are being understood and clarify their signals accordingly (Shwe & Markman, 1997). Recent research further suggests that children around this age can clarify ambiguous word usage through the speakers' communicative intent (Diesendruck & Markson, 2001) and pragmatic cues from the discourse context (Akhtar, 2002).

Thus, there is a large body of research showing that, at the very same ages at which children have difficulty making use of symbolic artifacts such as pictures and models, they are already strongly attuned to intentional behavior around them and directed toward them. This raises the possibility that children's understanding of a symbolic relation that usually eludes them might be improved if the intentional basis of the relation were more apparent. Specifically, I hypothesized that children's insight into a difficult symbolic relation might be increased by explicitly emphasizing (a) the experimenter's *communicative intent* to impart information via the artifact and (b) the artifact's *intentional origins* and *intended function*.

Note that children participating in a symbolic object-retrieval task are provided extensive guidance. They are always given a thorough orientation to the hiding room and the symbolic artifact and to the correspondence between them. However,

it is still possible that these instructions detailing correspondences are insufficient to convey the more basic and critical point: that the symbolic artifact can help children find the hidden toy. It is easy for symbol-savvy adults to underestimate the challenge that symbols can pose to young children. Although the standard instructions are detailed, they never explicitly point out what to adults is obvious: that the picture or model is intended to show children where to find the toy. But what is obvious for adults may be quite opaque for young children. Children's insight into the symbolic relation might be increased if the model's intended purpose is made more explicit.

The current proposal gains further plausibility from research concerning children's general tendency to assume that all entities have a function (Kelemen, 1999) and their sensitivity specifically to object function. Children as young as 2 years label novel objects based on their function (Kemler Nelson, Russell, Duke, & Jones, 2000). By 3 years, children's naming of artifacts is influenced by intuitions regarding their origin—that is, whether they were created accidentally or on purpose (Gelman & Bloom, 2000; Gelman & Ebeling, 1998), as well as intuitions regarding their creator's intentions in making them (Diesendruck, Markson, & Bloom, 2003). Similarly, Kemler Nelson, Herron, and Morris (2002) demonstrated that 4-year-olds categorize broken artifacts on the basis of their originally intended function, despite their nonfunctionality. Recent work extends this latter finding to 2.5- and 3-year-olds as well (Kemler Nelson, Holt, & Egan, 2003). There has been some controversy concerning the age at which children acquire an adult-like "design stance" (Dennett, 1987), in which the purpose for which the object was originally designed is privileged over other intentional uses of that object (see German & Johnson, 2002; Kelemen; Matan & Carey, 2001). At a minimum, however, preschoolers are clearly attentive to information regarding an object's purpose or function broadly construed.

For all these reasons, I hypothesized that children's insight into a difficult symbolic relation might be increased by clearly communicating the intended purpose of the artifact as a symbol referring to current reality. In other words, I thought that children might benefit if an adult explicitly conveyed that the artifact was deliberately made for the sole purpose of helping the child in the task. An adequate test of this hypothesis required testing children in a task that they usually find demanding. Accordingly, 36-month-olds were tested in the low-similarity version of the model task, and 30-month-olds in the high-similarity version. Previous research has shown that the two age groups show consistently (and equally) poor performance in these tasks (25%–35% errorless retrievals; e.g., DeLoache, 1991; DeLoache, Kolstad, & Anderson, 1991). In other words, using different versions allowed me to equate the relative difficulty of the task for each age.

For both age groups, a control group of children participated using the standard instructions and procedures used in previous research. For the experimental groups, the instructions and (to a lesser extent) the procedures were modified at

each step to convey two interrelated points: (a) the experimenter's intent to communicate information via the symbolic artifact and (b) the artifact's intentional origins and intended function. The toys used in hiding and finding were two stuffed bears, one large and one small. Thus, for example, in the standard condition the experimenter introduced the model as "Little Bear's room." In the intentional condition, the same phrase was prefaced with the explanation, "I made something to help you find Big Bear." The experimenter thus simultaneously highlighted that the model had been created deliberately (intentional origins) and that it had been made to help the child in the task (intended function). Similarly, the standard instructions at the beginning of the test trials were "Look! I'm going to hide Little Bear right here!" as the experimenter hid the miniature toy. For the intentional groups these same instructions were prefaced by the words "I'll help you find Big Bear. I'll show you where Big Bear is hiding. Look!" In this way, the experimenter's intention to communicate relevant information via the symbolic artifact was made more explicit.

METHOD

Participants

Sixty-four children participated and were evenly divided between two age groups, 36 months and 30 months. Half of the children in each age group participated in the intentional condition (for the older group, *M* age = 36.4 months, range = 35.5–38.0 months; for the younger group, *M* age = 30.7 months, range = 29.6–32.4 months), and half participated in the standard condition (for the older group, *M* age = 36.0 months, range = 34.2–38.0 months; for the younger group, *M* age = 30.5 months, range = 28.3–32.6 months). Approximately equal numbers of boys and girls participated in each condition. Parents of participants were recruited by telephone from birth information obtained at a large local hospital. Informed consent was obtained from all parents. Families lived in a large metropolitan area, were mostly White and middle class, and received a small gift for participating.

Stimuli and Apparatus

The same hiding room and toys were used in both conditions. The hiding room measured 1.9 × 2.3 × 2.7 m and contained a large floor pillow with a teddy bear pattern, a small (child-sized) chair covered with black patterned fabric, a blue chair pillow, a black trash basket with stickers on it, and a small set of open shelves with cloth over the openings. On the back wall there was a large curtain hanging from a mantelpiece. The two toys used in hiding and finding were two stuffed Winnie the Pooh bears, one large (8 in.) and one small (2.5 in.).

Both models measured 45.7 × 68.6 × 33.0 cm and were furnished with miniature versions of the same furnishings as the hiding room. The models and all items in them maintained an approximately 1:4 size ratio with the hiding room and its furnishings. The high-similarity model (used with the 30-month-olds) was constructed from the same fabrics and materials as the hiding room, so perceptually similarity between corresponding items was high. The low-similarity model (used with the 36-month-olds) was constructed from different fabrics and materials, so perceptual similarity between corresponding items was low. For example, the chair pillow was maroon and the trashcan was covered with blue corduroy. The model was always placed on the floor outside of the hiding space in the same orientation.

Procedure

The primary difference between conditions concerned the instructions: At every possible step in the procedure, the standard instructions were modified to emphasize the intentionality surrounding the model's creation and use. (See the Appendix for a complete comparison of the differences in phrasing.)

In both conditions, children were first given an orientation to all the components of the task. They were introduced to the toys and then the hiding room. Each item of furniture in the room was pointed out and labeled (e.g., "Big Bear's chair"). Next, the model was introduced and each item in it was also pointed out and labeled (e.g., "Little Bear's chair"). In the standard condition, the model was introduced as "Little Bear's room." In the intentional condition, the same phrase was prefaced by the words "I made something to help you find Big Bear." Thus, in the latter condition the experimenter simultaneously highlighted that the model had been created deliberately (intentional origins) and that it had been made to help the child in the task (intended function). The experimenter then collected all items from the model (except the curtain, which was attached to the model wall) and carried them into the hiding room. Each miniature item was placed by its corresponding item in the room and the correspondence between them was pointed out and described. In the standard condition, the phrasing was: "See, this is Big Bear's [item], and this is Little Bear's [item]. They're just the same." In the intentional condition, the second phrase was changed to "I made them just the same" to again emphasize intentional creation. Following this orientation, all the miniature items were returned to their proper locations in the model ("Let's make Little Bear's room just like Big Bear's again").

A single placement trial was next. Its purpose was to further attempt to convey that actions in the model were relevant to actions in the room. The experimenter placed the miniature toy on the shelves in the model and asked the child to place the larger toy in the same place in the hiding room. Children who erred were reminded of the miniature toy's correct location. If this did not lead to a correct response, the experimenter helped the child place the larger toy correctly.

Next was the introduction to the task, called a "hide-and-find game." This introduction differed slightly between conditions because of the one procedural difference, concerning the order in which the two toys were hidden during the test trials. The standard condition maintained the order utilized in previous research. Children first watched the experimenter hide the miniature toy in the model, then waited while she secretly hid the large toy in the room. In the intentional condition this order was reversed. Children first waited while the experimenter secretly hid the large toy, then watched her hide the miniature toy. Thus, the order in the standard condition is prospective: the experimenter shows the child (in the model) what she will do (in the room). The order in the intentional condition is retrospective: the experimenter shows the child (in the model) what she has just done (in the room). The latter order has more the air of sharing a secret. It thus more naturally conveyed that the act of hiding the miniature toy was a useful hint regarding the hiding place of the larger toy.[1] The related instructions were entirely comparable for the two conditions: "First I'll help [first toy] hide here in [first space]. Then I'll help [second toy] hide in the same place as [first toy], only in his [second space]." The only difference in instruction was the addition of one sentence in the intentional condition explicitly connecting the two hiding acts: "That way, you'll know where to find [the larger toy]." The experimenter thus explicitly communicated the purpose of her actions.

Six test trials followed. In each, children were asked to first find the large toy in the room (the symbol-based retrieval), then the smaller one in the model (the memory-based retrieval). To succeed, they needed to base their search in both spaces on information from the model (where they saw the miniature toy hidden). The experimenter reminded children, as she hid the miniature toy in each trial, that the two toys were hidden in the same place. The intentional condition also included the more explicit suggestion "I'll help you find Big Bear. I'll show you where Big Bear is hiding." The purpose again was to explicitly convey both the experimenter's intent and the model's intended function.

If children did not find the toy in their first search, they were encouraged to continue searching. If the second search was also incorrect, or the child seemed at a loss, he or she was given the prompt that the two toys were always hidden "in the same place." For the intentional condition, the prompt was prefaced by a reminder that the experimenter was trying to communicate helpful information via the model: "Remember the help I gave you? I showed you where the Big Bear is hiding." Finally, if needed, the experimenter pointed out the correct location. Note that

[1]This procedural change meant that children in the intentional condition experienced a slightly shorter delay between witnessing the hiding act and searching in the room (approximately 2–3 sec) than did children in the standard condition, who waited while the toy was hidden (approximately 4–5 sec). The difference in delay was inconsequential, as evidenced in the two groups' equally good performance on the memory-based retrievals.

children received credit for an errorless retrieval only if they found the toy on their first search and without prompts.

The changes for the intentional condition mainly involved adding further instructions. This raises the concern that any improvement in the intentional condition could be due simply to increased quantity of instruction rather than the focus on intentionality per se. However, children varied greatly not just in their understanding but also in their attentiveness and comfort level. Thus, during the introduction and orientation to the various task components, instructions were repeated as needed. Similarly, during the test trials some children searched quickly (regardless of accuracy) and thus never required a prompt, whereas other children were much more inhibited and thus more likely to require prompting. Hence, although the instructions as written are somewhat longer in the intentional condition, the average length of the entire task was comparable between conditions, taking between 20 and 30 min.

The hiding places were in the shelves, under the floor pillow, in the trashcan, under the chair, behind the curtain, and behind the chair pillow. Two different orders of hiding place were used, counterbalanced by age, condition, and gender.

RESULTS

Children in the standard condition succeeded in the symbol-based retrievals only one third of the time. Specifically, performance success rates were 31% for the children in the younger age group and 36% for children in the older age group (*SE* = 6% and 7%, respectively). This is highly consistent with previous research (DeLoache, 1991; DeLoache, et al., 1991). In contrast, children in the intentional condition were more successful overall, retrieving the larger toy without help in well over half the trials. Both age groups succeeded on 57% of the trials (for both groups, *SE* = 9%).

To assess these differences, a 2 (age group: 36 months or 30 months) × 2 (condition: intentional or standard) × 2 (gender) × 2 (retrieval type: symbol-based or memory-based) mixed model analysis of variance (ANOVA) was conducted on the number of errorless retrievals, with retrieval type as the within-subjects variable. Results show main effects of condition, $F(1, 56) = 5.92$, $p < .05$, and retrieval type, $F(1, 56) = 71.85$, $p < .0001$, qualified by an interaction between them, $F(1, 56) = 5.64$, $p < .05$: As expected, children in the intentional condition performed better in the symbol-based retrievals only; performance on the memory-based retrievals did not differ (*M*s = 82% vs. 81% for the intentional and standard conditions, respectively; *SE* = 3% and 4%, respectively). Condition and retrieval type did not interact with age; thus, the pattern of better performance on the symbol-based retrievals in the intentional condition held for both ages (see Figure 1).

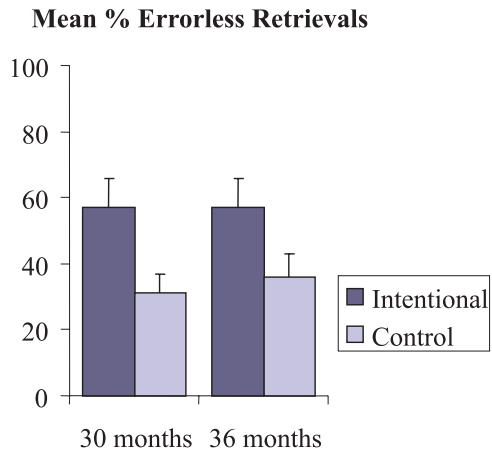

FIGURE 1 Mean performance on the symbol-based retrievals.

There was also a significant interaction between age group and gender, $F(1, 56) = 6.96$, $p < .01$. Inspection of means showed that in the older age group, boys performed somewhat better overall than did girls (72% vs. 63%). In contrast, in the younger age group, boys performed somewhat worse overall than did girls (52% vs. 69%). (Percentages are reported here for ease of interpretation, but all analyses were conducted on raw scores.) These data of course average across the key variable of condition. Although the three-way interaction between age group, gender, and retrieval type was not significant, $p > .15$, it is worth noting that the gender differences were noticeably larger for the symbol-based retrievals (see Table 1).

It is difficult to know how much to make of this. Gender effects have been found only occasionally in previous research using similar tasks. In two studies where there was an effect, girls showed higher levels of symbolic understanding (Marzolf & DeLoache, 1994; Troseth & DeLoache, 1998)—consistent with the current results from the 30-month-olds, but at odds with those of the 36-month-olds. One

TABLE 1
Mean Proportion Errorless Retrievals (and *SE*'s) by Age group, Gender, and Retrieval Type

	Younger		*Older*	
Gender	*Symbol-Based*	*Memory-Based*	*Symbol-Based*	*Memory-Based*
Boys	30 (7)	73 (4)	55 (8)	90 (4)
Girls	58 (7)	80 (6)	40 (8)	85 (5)

possible, albeit conjectural, explanation is based on the fact that girls tend to have more advanced language skills compared to boys. This could have helped the younger girls' comprehension of the crucial manipulations in the intentional condition, which were virtually all conveyed verbally rather than behaviorally. Indeed, for the younger boys, performance on the symbol-based retrievals was essentially the same in the intentional and standard conditions (33% vs. 28%). However, a language-based account cannot explain why boys would then perform better at age 36 months. Finally, gender differences on the memory-based retrievals have never been previously reported, and the magnitude of the differences here were small, especially given the standard errors. Future research will need to look carefully for possible effects of gender on both types of retrievals. No other effects or interactions were significant.

To examine the effect of condition in more detail, a second repeated measures analysis was conducted on performance across the individual trials. Results showed that the finding of better performance in the intentional condition held across all six symbol-based retrievals. Specifically, there was a main effect of condition, $F(1, 62) = 9.05$, $p < .005$, and of trial, $F(5, 310) = 3.89$, $p < .005$, but no interaction between them. A Helmert contrast on the trials effect showed that performance was significantly different (higher) on the first trial compared to all later trials, $F(1, 56) = 8.43$, $p = .005$, which did not differ from each other. This finding is consistent with other recent analyses (DeLoache & Sharon, 2005; Sharon & DeLoache, 2003) that have also found significantly better performance on the first trial. One suggested explanation is that the decrease in performance may be due to increased task demands after the initial trial (for further discussion, see DeLoache & Sharon, 2005; Sharon & DeLoache, 2003). For current purposes, the important point is that the trials effect was present for both conditions; therefore, it need not be of further concern.

Children's individual patterns of performance were also analyzed. Children were deemed successful if they retrieved the toy in their first search on five or six of the six symbol-based retrievals, the level that is significantly better than chance by a binomial distribution. Among the children the older age group, nearly half of those in the intentional condition (7 out of 16, 4 of them boys) achieved this criterion, compared to none of the children in the standard condition, $p < .01$ using Fisher's exact probability test. Similarly, among the younger age group, 6 of the children (1 of whom was a boy) succeeded in the intentional condition, compared to only 1 in the standard condition, $p = .08$ using Fisher's exact probability test. Thus, the nonparametric analysis of individual performance confirmed that children were more successful in the intentional condition.

Finally, children's errors were examined. The most common error was to perseverate, that is, to search the location where the toy was hidden on the previous trial. Such errors accounted for roughly half of all errors in the symbol-based retrievals, across both ages and conditions (older age group: 44% and 63% in the in-

tentional and standard conditions, respectively; younger age group: 44% and 50%, respectively). This finding is consistent with previous research (DeLoache & Burns, 1994; O'Sullivan, Mitchell, & Daehler, 2001; Sharon & DeLoache, in press; Troseth & DeLoache, 1998).

DISCUSSION

The experiment reported here sheds light on a previously unexplored aspect of young children's symbolic development: the role of intentionality in their recognition and appreciation of symbolic relations. Specifically, I sought to test whether children's early sensitivity to intentionality could be recruited to improve their insight into a difficult symbolic relation, one that usually escapes their understanding. The answer is yes. When an adult explicitly communicated the intentional origins and intended function of the scale model, both 30- and 36-month-olds more readily grasped the symbolic relation between the model and room. The focus on intentionality seemed to help the children see past their initial "toy" construal of the model to the symbolic construal intended by the experimenter. With sufficient guidance, they were able to notice and make use of a normally unavailable symbolic relation. At the same time, performance was still far from ceiling. These results thus simultaneously underscore the challenge of acquiring full adult symbolic competence, and suggest part of the route by which this goal may be reached.

This experiment is the first to explore the potential effect of emphasizing intentionality on children's symbolic insight. As such, intentionality was highlighted in every possible way, from the adult's communicative intent (to provide help via the symbolic artifact) to the artifact's intentional origins and intended function. It is thus not possible at this point to disentangle the specific contributions of each factor. For example, as presented in the study's task, the model's originally intended function (what it was designed for) and its current use were the same. The results presented here thus cannot help clarify the age at which children acquire the design stance. However, they do strongly suggest further support for the view that young children are sensitive to object function broadly defined.

Above all, these results highlight the importance of the social context in children's symbolic development. The children in this experiment had, in all probability, never before encountered a three-dimensional model representing a specific space. The difficulty of dual representation would further increase their tendency to construe the model as merely a physical object, unrelated to the task at hand. But given explicit guidance on the intended, symbolic role of the model, many children showed clear evidence of recognizing the usually elusive relation between the model and room.

These results therefore demonstrate nicely what Tomasello and colleagues (Striano, Tomasello, & Rochat, 2001; Tomasello, Kruger, & Ratner, 1993) termed

the "intentional affordances" of objects. They pointed out that children's interactions with artifacts are not just sensory-motor but also deeply social, as the function of many objects is established and maintained through social interactions. In the apt words of Tomasello, "In many instances, the purpose of an artifact can only be discerned through adult demonstration or instruction that establishes what 'we' do with it" (Tomasello, 1999, p. 154). This line of argument suggests that the explicit instructions provided in the task presented in this study may not be that different from those provided in more naturalistic contexts. The caveat of course is that instruction clearly varies for different kinds of symbolic artifacts and across different contexts, in both kind and amount. Parents are unlikely to spend 30 min attempting to explain a model to their child, whereas teachers spend far more time in explicit instruction regarding other symbolic artifacts such as clocks. The more intriguing question concerns the extent to which adults actually focus on the artifact's intended purpose, rather than the mechanics of its use. The symbolic artifacts that adults are likely to share with children (e.g., pictures, clocks) are ones with which the adults are highly familiar; the artifacts' purpose may thus seem transparent to the adults. Adults may then focus on the mechanics of use (e.g., the difference between the large and small hands on a clock) and never think to explain the artifacts' underlying purpose (e.g., to help the child not be late for school).

For adults, symbolic artifacts like models and pictures are inherently intentional, products of human desire and design. Even when a symbol is entirely novel, adults can usually recognize that a symbolic meaning is intended, although the exact meaning may remain unclear. Adults readily appreciate, for example, that the enormous standing stones of Easter Island or a ceremonial mask of the Aztec civilization are symbolically significant, although they may know nothing about the people or culture of either place. Years of experience in a symbol-laden world have left adults acutely sensitive to nearly any intended symbolization. Young children, in contrast, often experience considerable difficulty in recognizing symbolic meaning. However, my research suggests that young children's sensitivity to intentionality offers an opening for acquiring symbolic understanding. It could in this way contribute to their development into full-fledged members of the symbolic species. Just as symbolic artifacts are designed by people to have meaning to other people in a shared context, so too children seem designed through evolution to acquire symbolic meanings from other people in a shared context.

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APPENDIX
Differences in instructions and procedures

Step in procedure	*Standard*	*Intentional*
Introduce model	"Look at this. See, this is Little Bear's room. It's just like Big Bear's room only it's smaller."	"*Look, I made something to help you find Big Bear.* See, this is Little Bear's room. It's just like Big Bear's room only it's smaller."
Orientation to room-model correspondences	"See, this is Big Bear's X, and this is Little Bear's X. They're just the same."	"See, this is Big Bear's X, and this is Little Bear's X. *I made them just the same.*"
Placement trial	Place Little Bear on top of shelves, ask child to put Big Bear "in the same place in his big room"	Place Little Bear on top of shelves, ask child to put Big Bear "in the same place in his big room"
Introduce game[a]	"First I'll help *Little Bear* hide here in his *little room*. Then I'll help *Big Bear* hide in the same place as *Little Bear*, only in his *big room*."	"First I'll help *Big Bear* hide here in his *big room*. Then I'll help *Little Bear* hide in the same place as *Big Bear*, only in his little room. *That way, you'll know where to find Big Bear.*"
Test Trials	"Look! I'm going to hide Little Bear right here. Now I'll help Big Bear hide in the same place in his big room." E1 hides Big Bear in large room.	E1 hides Big Bear in large room. "*I'll help you find Big Bear. I'll show you where Big Bear is hiding.* Look! I'm going to hide Little Bear right here. Big Bear is hiding in the same place in his big room."
Reminder prompt	"Remember, Big Bear's hiding in the same place as Little Bear, only here in his big room."	*"Remember the help I gave you? I showed you where Big Bear's hiding.* Big Bear's hiding in the same place as Little Bear, only here in his big room."

[a]Note that the order of hiding acts (large toy vs. miniature toy) is reversed between conditions. This is the sole procedural difference between conditions.