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Do young children use objects as symbols?

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Much of young children's symbolic play is heavily scaffolded by adult symbolic action models, which children may imitate, and by adult verbal scripts. The current studies attempted to evaluate 18–35-month-old children's symbolic skills in the absence of such scaffolding. In a study of symbol comprehension, children were tested for their ability to comprehend an adult's use of either a replica object or an associated gesture to communicate which object in an array she wanted. In a study of symbol production, children were given some objects that afforded symbolic manipulations, but without adult symbolic action models or verbal scripts. The results of the two studies converged to suggest that children below 2 years of age have symbolic skills with gestures, but not with objects. It was also found that while children at 26 months were able to use an object as a symbol for another object, they had difficulties when the symbol had another conventional use (e.g. a drinking cup used as a hat). The findings are discussed in terms of DeLoache's dual representation model, and a modification of that model is proposed.

Beginning with Piaget (1945/1951), investigators have considered much of young children's play with objects to be symbolic. The conventional wisdom is that symbolic play with objects emerges at the same age as the use of other types of symbols, including true linguistic symbols, at around 18 months of age. Some investigators see evidence for symbolic play at even earlier ages, perhaps as early as 12–14 months, before infants are using true linguistic symbols at all (e.g. Nicolich, 1977).

This classic view relies mainly on naturalistic observations (e.g. Bretherton, 1984; Fenson, 1984; Nicolich, 1977; Shore, 1986). However, a sceptic might legitimately ask the question: When an infant places a doll into a doll bed, on what basis do we determine that he or she is symbolically placing a real baby into a real bed? How do we know that he or she is not simply putting the doll into the bed in the same way he or she puts berries into a bowl—with no symbolism involved at all? Exacerbating such concerns is the fact that the infant has very likely seen an adult putting this same object (doll) into this same container (bed) on previous occasions. And indeed there are a number of observational and experimental observations of children mimicking adults' actions on objects during this age range. For example, Fenson (1984) and Bretherton (1984) both found that 20–28-month-old children in freeplay situations made object substitutions (e.g. using a block as a car) most often immediately after an adult had performed that same act. Tamis-

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Lamonda & Bornstein, 1991, found a strong correlation between the complexity of mothers' and their children's symbolic play actions across the second year of life. Experimentally, when children of this age are systematically exposed to actions that adults see as symbolic, they quite often imitate them (e.g. Bornstein, Vibbat, Tal & O'Donnel, 1992; Jackowitz & Watson, 1980; McCabe & Uzgiris, 1983; Ungerer, Zelazo, Kearsley & O'Leary, 1981; Vibbert & Bornstein, 1989; Watson & Fischer, 1977). Some investigators have considered an imitative explanation for early symbolic play, but dismiss it because the infant shows a playful affect while performing these behaviours. But playful affect by itself does not address the question of symbolic representation since children often display such affect in non-symbolic forms of play.

In other research on symbolic play, young children are verbally instructed to perform actions on objects that adults see as symbolic (e.g. 'Give the dolly a drink' with a doll and cup present), often using objects with which the children are highly familiar. In a task designed to control for familiarity to some degree, Harris & Kavanaugh (1993) presented young children with a verbal script in which there was room for creative symbolic action; for example, 'Teddy is having a bath. This is Teddy's soap (offering a yellow block). Show me what Teddy does with his soap.' Only sometime after their second birthdays were children good at this task. It was not possible for children to imitate adult use of specific objects in this case since the adult did not model the washing action with the yellow block (and presumably the child had not previously seen a block used as if it were soap). But the original identification of the block with soap was accomplished through the child's comprehension of adult language, not his or her own creative imagination—and apparently many children of this age know how to use soap on a doll. Overall, and in a general way, the influence of adult symbolic models and verbal scripts on children's symbolic play is demonstrated by the studies of Slade (1987) and Fiese (1990), who found that children's symbolic play during the second year of life was much more complex when playing with their mothers than when playing alone—possibly because mothers provide verbal scripts and symbolic action models during their child's symbolic play.

There is another line of research that creates problems for a symbolic interpretation of infants' object play. In a series of experiments, DeLoache (summarized in 1995) showed young children an adult hiding a small doll in a miniature doll house; then showed them a larger but otherwise identical doll in a larger but otherwise identical room; made sure that at least at some level they understood the correspondence between the doll-house room and the real room; told them the large doll was hidden in the same place in the real room as was the small doll in the doll-house room; and then asked them to find the large doll in the real room. Until they are 3 years of age—one year and a half after they are supposedly playing with objects symbolically—children perform very poorly in this task. DeLoache's explanation for the difficulty that young children have with objects used as symbols is that these objects create a conflict in children between their material and symbolic aspects or affordances—what she calls the dual representation problem. Young children perceive a doll house as a physical structure to be physically manipulated and explored; to perceive it as a map of something else, they have to see it as a symbolic representation as well. (When the same task is done with photographs, for which affordances for manipulation are less salient, children are considerably better at the task, further supporting the dual representation interpretation; see DeLoache, Pierroutsakos & Troseth, 1997, for a review.) The question is why young children should not have a dual

representation problem in symbolic play as well given that they need to consider, for instance, a block both as a manipulable object and as a car—that is, assuming that they are in fact using objects as symbols in this early play.

One obvious explanation is that DeLoache's task has more representational complexity than does early symbolic play. To find the doll in DeLoache's task, multiple objects and locations must be mapped onto one another simultaneously in spatially relevant ways. However, Tomasello, Call & Gluckman (1997) found that children in this same age range still had difficulties in a task involving only one-to-one object mappings. In their study, children played a hiding–finding game in which an adult gave hints for where to find a prized object by, among other things, holding up a replica object identical to the object under which the prize could be found—requiring the child to map one object onto another identical object. The basic finding was that 3-year-old children were quite skillful in this task. On the other hand, while $2\frac{1}{2}$-year-old children as a group performed at above chance levels, only one child was above chance as an individual. The difficulties of these younger children may be counted as evidence against the hypothesis that children in DeLoache's task have difficulties mainly because of the representational complexity of the task.

The current studies investigate young children's ability to use single objects as symbolic representations of other single objects in situations in which adult action models and verbal scripts were systematically controlled. The attempt was thus to keep representational complexity to a minimum, while simultaneously not allowing children to rely on imitation or verbal instruction from adults in making symbolic mappings. Children at 18, 26 and 35 months of age participated in two studies, one concerning symbolic comprehension and the other concerning symbolic production. The first study consisted of three comprehension tasks, all of which unfolded in a game in which the adult 'asked' the child for a specific object, and the child was supposed to push it (or some foil from an array of choices) down a chute. The asking was done in ways that invoked increasingly abstract symbolic skills. For example, in the first task the adult asked the child, 'Can you give me the . . .', while holding up a toy replica of one of the four objects arrayed in front of the child. In the second task, the adult first acted on an object to symbolically transform it into another object (e.g. putting a cup on her head as a hat) and then asked the child, 'Can you give me the . . .', while holding up a real hat, with the child facing the cup and three foils. Since children have more difficulty imitating symbolic actions performed on 'inappropriate' objects (e.g. using a toy car as a brush; Killen & Uzgiris, 1981), the expectation was that they would have more difficulties with the latter tasks.

In this first study, each of the three comprehension tasks also had a version using gestures rather than objects. For example, the adult asked the child for a hammer by pounding her fist on the floor. These gesture tasks served two functions. First, they served as a kind of 'dual representation' control in that, unlike the replica objects, an adult gesturing would not seem to be the kind of thing to evoke children's manipulative efforts, and thus would not seem to raise the dual representation problem to the same degree as the object replica. Secondly, children's understanding of the symbolic nature of gestures is an interesting question in its own right that is closely related to their understanding of objects as symbols. Thus Acredolo & Goodwyn (1988) have claimed that such things as a child flapping its arms like a bird is a symbolic gesture representing a bird. However, as in the case of symbolic play with objects, it may be the case that the child does not flap

his or her arms as an iconic representation of a bird flapping its wings, but only as an imitation of Mum's flapping of her arms in the presence of a bird. The child then flaps his or her arms to signal recognition of the bird, but the gesture could have been anything; the iconicity is in the eyes of the adult, not the child (i.e. it is a kind of recognitory gesture of the same type that children use early in the second year: Bates, 1979; Petitto, 1988). As in the case of objects as symbols, there are also experimental studies in which young children have great difficulties interpreting gestures symbolically. Thus, Boyatzis & Watson (1993) and O'Reilly (1995) found that it was not until they were nearly 4 years old that children were able to verbally identify the real action an adult was pantomiming, or else perform a pantomime on the basis of an adult's verbal request. The huge age discrepancy with Acredolo & Goodwyn's findings is presumably because the children in these studies had to provide or respond to explicit verbal descriptions, arguably a different level of understanding than spontaneous comprehension and use (Karmiloff-Smith, 1992).

The second study consisted of a three-phase production task in which the child was initially left to his or her own devices and then provided with some action models and verbal scripts—but ones that still left room for creative action. Thus, the child was first confronted with some objects with no adult demonstrations; then the audlt symbolically transformed one object into another (e.g. a stuffed sock was rocked like a baby) and gave the child the opportunity to perform novel symbolic actions (e.g. a hairbrush was present for brushing the sock-doll's hair, even though the adult had never used the brush in that way); finally the adult provided a verbal script to help scaffold the child's symbolic activities with these materials.

The main hypothesis was that children are neither as competent with symbols as naturalistic observation of gestures and object play might suggest (because these are heavily supported by imitation and language), nor are they as poor with gestural and object-based symbols as some of the experimental literature might suggest. It was thus expected the 18-month-olds would show few signs of symbolic skills, since their normal social supports were removed in the experiment. The 35-month-olds were expected to be very competent in all of the tasks since they have shown skills in many other experimental settings requiring similar skills. The authors were not sure what to expect of the 26-month-olds, except that they should be better at the more concrete symbolic tasks than at the more abstract symbolic tasks. For all children, it was expected that gestures as symbols should be easier to deal with than objects as symbols since they do not evoke to the same degree problems of dual representation.

STUDY 1: COMPREHENSION

The first study tested children's comprehension of gestures and objects as symbols. After a control task in which they learned how to play the game, in Phase I each child was asked by an adult experimenter (E) to push one of four objects down a chute. E asked by either (a) gesturing the action appropriate for the desired object, or (b) holding up a toy replica of the object. In Phase II, E and the child first pretended non-linguistically that one object was another, for example a box was a shoe, and subsequently E asked for the box from among other alternatives by (a) gesturing the act of putting on a shoe, or (b) holding up a real shoe. In Phase III, E and the child also pretended non-linguistically that one object

was another, for example a rolled-up piece of paper was a ball by throwing it in the air. But in this case E then asked for the paper by (a) gesturing the action of rolling (as for a ball)—which had not been modelled with the paper originally, or (b) holding up a real ball. Overall, the basic idea was that the tasks became more abstract across phases in the sense that children had to ignore the perceptual properties and affordances of the real object in front of them (e.g. the box or the rolled-up paper) to discern the pretend properties and affordances relevant to E's request.

Methods

Participants

Forty participants were recruited by telephone from a list of parents and children who had volunteered for studies of child development. There were 8 children at 18 months of age (7 females and 1 male; M = 17.9 months, range = 17.3–19.1); 16 children at 2 years of age (6 females and 10 males; M = 26.3 months, range = 23.1–29.0); and 16 children of 3 years of age (7 females and 9 males; M = 35.4 months, range = 34.0–37.1). Participants were mostly white and middle class and received a small gift for their participation. Twelve additional children (eight at 18 months, three at 26 months and one at 35 months) were excluded from the study either because they failed the warm-up control task (see below) or were uncooperative.

Materials

The apparatus was a colorful cardboard chute with a 10in in by 16in in aperture at both ends, inclined to about 25°. The higher end, the child's end, was about 18in above the floor and had attached to it a small platform on which objects could be placed. The lower end, E's end, led to a plastic tray on the floor. The child's task in all phases of the experiment was to assess which one of four objects on the platform E wanted, and then to push it down the chute to her. The child could see the object go down the chute and into the plastic tray (a seemingly highly motivating activity for most children).

The objects used in this game are shown in Figure 1. For the control tasks, four objects were used: toothbrush, cup, ball and toy tree. For Phase I, four real objects and four corresponding small toy replicas were used: hammer, hairbrush, book and baby bottle. For Phase II there were four objects used symbolically as other objects (and so testing used exemplars of those other objects): a stick (used as a crayon), a box (used as a shoe), a cup (used as a hat) and a ball (used as an apple). In the same manner, in Phase III E used playdough and a bowl (as cereal) and rolled-up paper (as a ball).

Testing procedure

Testing was done in a child psychology laboratory. Each child was tested individually and accompanied by a parent throughout, with both seated on the floor (parent behind child or child in parent's lap). Parents were told that they could encourage their children to play the game, but were not to help them in any way. The single testing session consisted of a control task, followed by test phases I, II and III. Testing was identical for all children, except that because most 18-month-olds had difficulties in completing Phase II, they were for the most part not run in Phase III. Across all trials for a given child the location of the target object was randomly determined, with the restriction that it would never appear in the same location more than twice in a row. Which symbol condition, gesture or object was presented first for a given child (the same for each child across phases) was counterbalanced within age groups. For each trial, a child was 'asked' for an object, and if he or she failed to respond for 60 s (with the 'asking' being repeated twice during that 60 s, the trial was repeated—after which E then proceeded to the next trial.

Control task.   E introduced the child to the chute, calling it a 'slide game', and showed him or her how objects could be pushed or thrown down it into the tray at the lower end. The child was verbally instructed
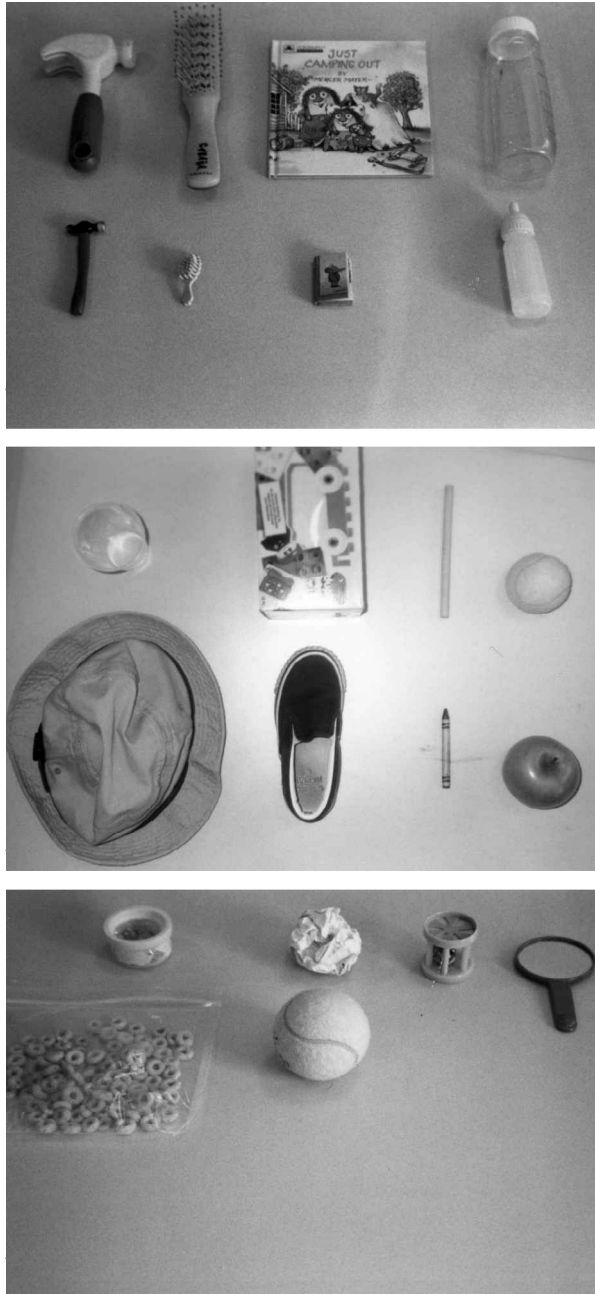
Figure 1. Object used in Study 1, Phases I, II and III.

to send down only objects that E asked for. He or she was then presented with four objects on the platform, and E asked for them each in turn by name: 'toothbrush', 'cup', 'ball' and 'tree' (toy). Mothers could assist their children during this control task to help them understand that they were to throw only one object down the chute, the one E asked for. A child was deemed to be ready for the test phases when he or she was correct for three objects in a row without help from the mother. Eight 18-month-olds (no children from the other two ages) never reached this criterion and so were not tested further. The purpose of this control task was to make sure that children understood E's communicative intentions in the context of this game.

Phase I.   E began testing by introducing the child to the four target objects that would be her choices momentarily. In turn, E held up each of the four objects, used it in its conventional fashion, and then placed it in a shallow box in front of her (out of the child's reach). The four target objects and their associated actions were: toy hammer (hammering the floor), book (reading), brush (brushing own hair) and baby bottle (drinking).
    The box containing the four target objects was then placed on the platform at the high end of the chute, in front of the child. E then asked the child for an object by either gesturing its associated action (Gesture condition) or by holding up a small, toy replica of the object (Object condition), depending on the child's pre-assigned order. For a given child E asked for each of the four target objects in one condition, and then each of the four target objects a second time in the other condition. On each trial, for both conditions, E asked the child to 'Push me the . . .' or 'Can you give me the . . .' For the Gesture condition she performed the appropriate gesture as she uttered these words, in each case using the Body Part as object technique (O'Reilly, 1995). That is, for the hammer E hammered the floor with her fist, for the brush she brushed her own hair with her fingers, for the book she opened her cupped hands like the pages of a book and 'read' them, and for the baby bottle she put her thumb in her mouth and sucked (with head leaning back and with other fingers closed). For the Object condition E held up a small replica object that was similar to, but not identical with, the target object; that is, the replicas were made for doll houses and thus of the same overall shape, but of a different size and colour, from the target objects. Thus, for the hammer E held up a very small (doll-sized) hammer, for the brush a small (doll-sized) brush, for the book a small (doll-sized) book, and for the bottle a small (doll-sized) baby bottle.

Phase II.   E began Phase II testing by introducing the child to the four target objects that would be her choices in this phase. In turn, E held up each of the four objects, used it in a symbolic fashion (i.e. something other than its conventional use), and then placed it in a shallow box in front of her (out of the child's reach). The four target objects and their symbolic actions were a stick (used as a crayon by 'drawing' on the floor), a box (used as a shoe by putting it on her own foot), a cup (used as a hat by putting it on her own head) and a ball (used as an apple by 'biting' and 'eating' it).
    The box containing the four target objects was then placed on the platform in front of the child. E then asked for each of the four objects in one condition, and then each of the four objects a second time in the other condition (same order as in Phase I for a given child). On each trial, for both conditions, E asked the child to 'Push me the . . .' or 'Can you give me the . . .' For the Gesture condition she performed the symbolic gesture from before as she uttered her words. That is, for the stick she pretended to draw on the floor with her finger, for the box she pretended to put a shoe on her foot, for the cup she pretended to put a hat on her head, and for the ball she pretended to bite and eat an apple. The crucial feature of the Phase II gestures was that E behaved *not* in a way functionally appropriate for the target object the child saw in front of her (e.g. the box), but in a way functionally appropriate to the object for which the target object had previously been symbolically used (e.g. a shoe). For the Object condition E held up a real object, which the child was seeing for the first time. For the stick she held up a crayon, for the box she held up a shoe, for the cup she held up a hat, and for the ball she held up an apple. The crucial feature of the Phase II objects was that E held up *not* a replica of the target object the child saw in front of her (e.g. a cup), but a real object that exemplified what the target object had previously been used to symbolically indicate (e.g. a hat).

Phase III.   In the Gesture condition of both Phases I and II, the gesture used to ask for the target object was the same gesture the child had seen E use previously as that object was introduced—leaving open the possibility that they had simply learned associatively which gestures went with which target objects. The

idea of Phase III was to use a target object as a symbol for another pretend object by using one action (e.g. a rolled-up piece of paper thrown in the air as a ball), and then to ask for that target object using a different action typically associated with the pretend object (e.g. an act of rolling). This procedure was meant to rule out any associative learning possibilities.

Only two target objects were used in this phase. E first introduced the child to the two objects, placing them in the shallow box as she finished with them. She introduced the child to some play dough, which she placed in a bowl, stirred with her finger, and said 'Mmmm!' (as food). She also introduced the child to a rolled-up piece of paper, which she rolled and then bounced (as a ball). E then put two other foil objects in the shallow box (a bell which she first shook and a mirror which she first used to examine her face). Using the same language as in the other phases, E then asked for each of the two target objects first in one condition, and then in the other condition (same order as in other phases for a given child). In the Gesture condition she asked for the playdough by cupping her hand (as a bowl) and dipping her finger into it (as a spoon) and bringing it to her mouth and 'eating'; she asked for the rolled-up paper by gesturing a throwing action. In the Object condition, as in Phase II, she asked for each target object with the real object it had been used to symbolically indicate: for the playdough some cereal, and for the paper a ball.

Observational and coding procedure

An observer (O) was present throughout all testing and helped E to manage the various object sets (each set put away when not in use) and operated a video camera. O also recorded the child's object choice on each trial, operationalized as the first object the child sent down the chute (touching and other preliminary actions were not scored; only the object that actually went down the chute). If the child refused to choose an object for 60 s (for both the original and secondary presentations), he or she was scored as incorrect for that trial. On the very few trials in which the child sent more than one object down the chute simultaneously, E simply repeated the trial and that re-trial was the one scored and used for analysis. Given these provisos, there was almost no potential for ambiguity in the scoring, and so inter-observer reliability between two independent observers using the videotapes of 20% of the children (equally distributed among ages) showed 100% agreement on which object was first sent down the chute.

As subsidiary measures, latency of response and number of reaching attempts (i.e. the child reaching for the object E was using as a symbol) were measured from the videotapes. Latency began with E's first word of the request ('Can you . . .') and ended when the child first touched the object that eventually went down the chute. If the child touched one object, then another, then returned and sent the first object down the chute, latency was still gauged by that second touch of the chosen object (i.e. when she touched it for purposes of sending it down the chute). Inter-observer reliability for latency was calculated by correlating the latencies determined by two independent observers for each trial. The Pearson Product–Moment correlation obtained was .99, with 99.5% of the latency determinations by the two coders being within 1 s of one another (83.8% being identical). Reaching was defined as one or both of the child's arms coming forward toward the object E was holding up. In this case as well reliability was estimated by correlating the number of reaches for a given trial observed by two independent observers on the videotapes. The correlation was 1.0.

Results

The 18-month-olds clearly related to the task differently from the older two groups of children. Their performance is therefore reported first, and then that of the two other groups of children in a second analysis. For neither of these sets of analyses was the order in which tasks were administered a significant factor (both Fs = n.s.).

Performance of 18-month-olds

Half of the 18-month-olds tested (8 of 16) did not pass the control test—that is, they did not understand that E's intention in the game was for them to slide an asked-for object down a chute to her. In addition, of the eight children of this age who did pass the control

test, none of them made it through all three phases of testing. Although the reason for this is not known explicitly, it seems that they knew that a specific object was being asked for and they were upset that they did not know which one.

In any case, the performance of these eight children is shown in Figure 2. First, their performance in each of the four conditions (Phase I Gesture, Phase I Object, Phase II Gesture, Phase II Object) was compared to chance performance of .25 (since there were four choices available on every trial), using one-sample t tests. The only condition above chance was Phase I Gestures ($t(7) = 3.67, p < .01$). A 2 (Phase I or II) $\times$ 2(condition: Gesture or Object) ANOVA revealed no significant effects, most likely because there were only eight participants of this age and they had great difficulties at Phase II—not exceeding chance in either condition. However, there was a trend for an effect of condition ($p < .10$) such that the Gesture condition was easier, which is consistent with the finding that these children were above chance in the Gesture but not the Object condition during Phase I.
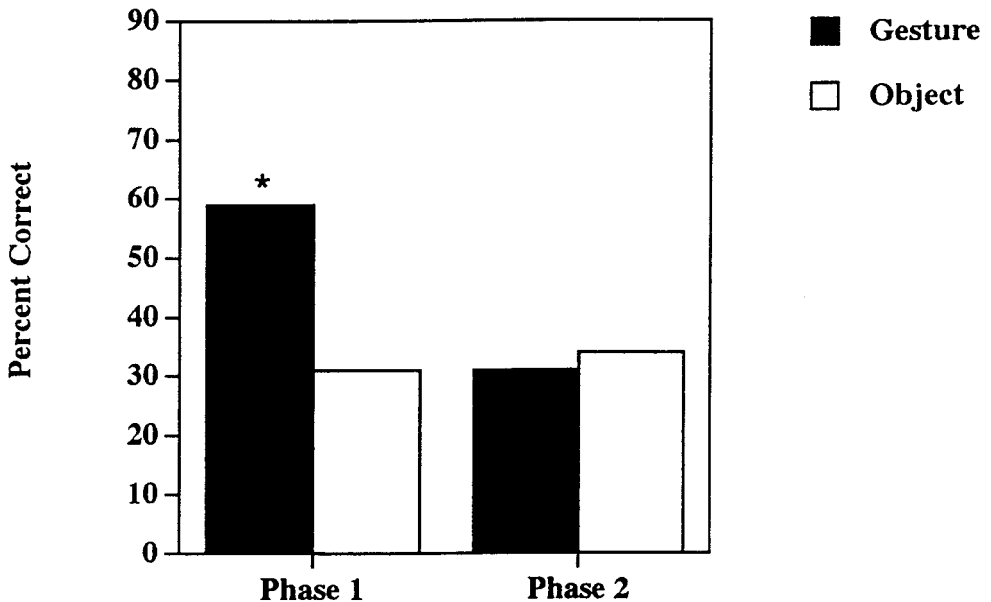

Figure 2. Per cent correct in Study 1 for 18-month-olds as a function of phase and condition.
* above chance, $p < .05$

Performance of 2 and 3-year-olds

Figure 3 presents older children's performance across the three phases of the comprehension task, as a function of age and condition (Gesture, Object). As the simplest analysis, the performance of each of the two age groups on each of the six tasks (Phase I, II and III Object and Gesture) was compared to chance performance using one-sample t tests. This analysis revealed that during Phase I, both the 26- and the 35-month-olds were significantly above chance in both the Gesture and Object conditions ($p < .01$ in all four

cases: t values ranging from 4.39 to 9.00). At Phase II, 35-month-olds were again above chance in both conditions ($p < .01$ in both cases; ts = 4.11 and 6.67). The 26-month-olds, however, were above chance only in the Gesture condition ($t(15) = 4.04, p < .01$). Finally, in Phase III, the 26-month-olds were at chance in both conditions, whereas the 35-month-olds were above chance only in the Gesture condition ($t(15) = 2.82, p < .05$). The ANOVA for these two older age groups confirmed this general trend in a 2 (Age) × 2 (Condition) × 3 (Phase) design. The older children performed significantly better than the younger children ($F(1,30) = 8.57, p < .01$). There was also a main effect of Phase ($F(2,60) = 16.17, p < .001$), but this must be interpreted within the context of the Phase × Condition interaction ($F(2,60) = 3.81, p < .05$). This interaction is the result of the fact that Condition mattered only in Phase II, where Gestures were easier than Objects (simple effects $F(1,30) = 8.78, p < .01$).
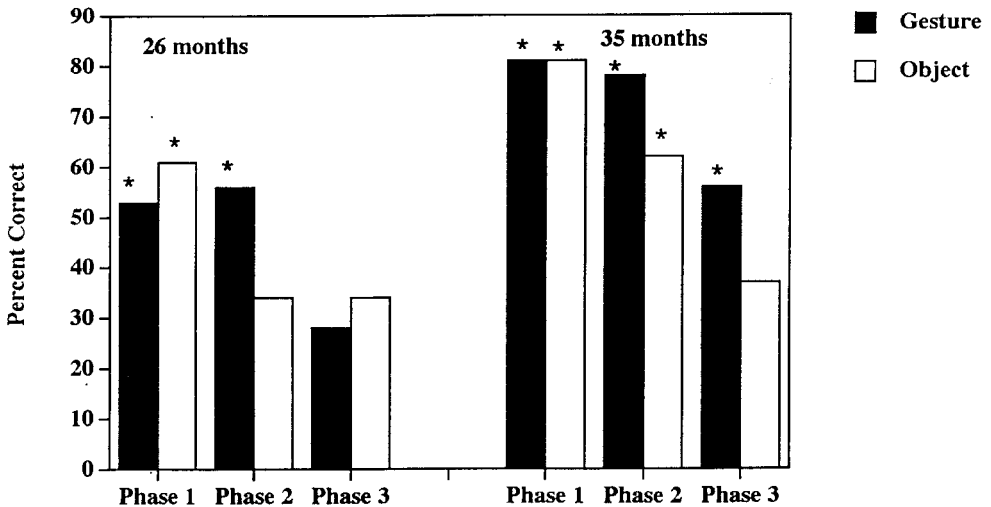

Figure 3. Per cent correct in Study 1 for 26- and 35-month-olds as a function of phase and condition. * above chance, $p < .05$

These analyses of all the children's performance demonstrate very clearly the effect of Age (older children do better) and Phase (earlier phases are easier) on children's ability to use gestures and objects as communicative symbols. The effect of Condition is a bit more complex, but a pattern apparent in Figures 2 and 3, and implicit in the ANOVAs is that when children were faced with problems on the edge of their competence, the Gestures condition was easier than the Object condition. Thus, at Phase I only the 18-month-olds struggled (the other two had a very easy time with it), but they were still above chance with Gestures. At Phase II only the 26-month-olds were inconsistent (35-month-olds were very good and 18-month-olds were very poor), but they were still above chance with Gestures. At Phase III only the 35-month-olds struggled (the 26-month-olds were very poor), but they were still above chance with Gestures. It may thus be said that the Gesture condition was not easier for children who had mastered a task or who did not understand it at all, but when they had some limited comprehension it seems that symbolic gestures were easier for them to interpret than symbolic objects.

Latency and reaching

Analysis of latency and reaching data were aimed at discerning some hints about why children were behaving as they were in the various conditions. A 2 (Condition) $\times$ 2 (Phase) ANOVA of latencies to respond for the 18-month-olds by themselves (because they participated in only the first two phases) showed no significant effects (see Figure 4). However, a 2 (Age) $\times$ 2 (Condition) $\times$ 3 (Phase) ANOVA for the older two groups of children revealed a very interesting pattern. Expectedly, 35-month-olds were faster than 26-month-olds ($F(1,28) = 19.74, p < .001$). More interestingly, children were faster to respond in the Gesture than in the Object condition ($F(1,28) = 10.78, p < .01$), but this effect must be interpreted in light of the significant Condition $\times$ Phase interaction ($F(2,56) = 4.10, p < .05$) and the marginally significant three-way interaction ($F(2,56) = 2.96, p < .06$). As can be seen in Figure 5, the one really discrepant value is the latency for 26-month-olds in the Object condition of Phase I, which represents a much slower response time than any other condition. The simple effects for the Condition $\times$ Phase interaction revealed that condition mattered at Phase I ($F(1,28) = 12.95, p < .001$) and at Phase II ($F(1,28) = 8.14, p < .05$), but not at Phase III.
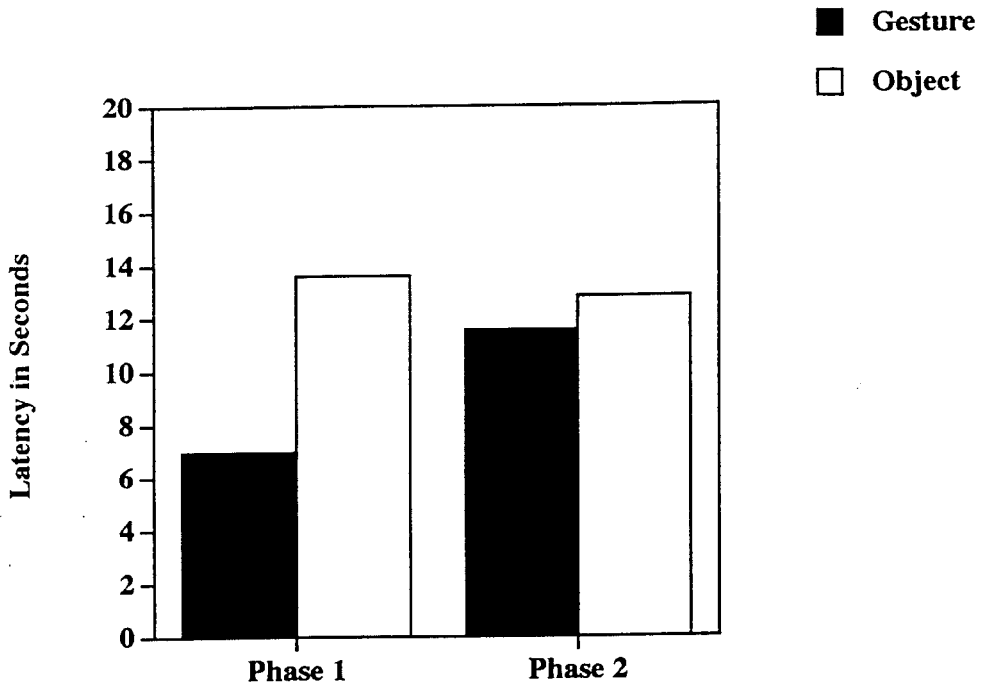

Figure 4. Latency to respond in Study 1 for 18-month-olds as a function of phase and condition.

All of children's reaching occurred in the Object condition; children never reached toward E when she was demonstrating gestures. Using the data from the Object condition, there was an interaction between age and phase ($F(2, 37) = 3.76, p < .05$). The one value leading to this interaction was the 18-month-olds at Phase I; they reached on 84% of the trials at this initial phase, whereas the 26- and 35-month-olds reached on

45% and 53% of the trials respectively (18-month-olds differed from the other two ages ($p < .05$) in both cases using Tukey procedure). At Phase II all three ages reached only about 25% of the time. Presumably the reason the children reached less at Phase II is that they learned during Phase I that it was useless to reach (E was not going to give the object). Also of interest was the fact that even though the 26-month-olds were quite slow in the Object condition of Phase II (see above), it was not because they were reaching more often than in other phases.

Discussion

Children of all ages were skillful in Phase I of the current study at interpreting a gesture as indicating the object the adult wanted. This finding places in context the findings of O'Reilly (1995) and others that children have difficulty talking about gestures representationally until fairly late in the preschool period. When they are not talking about gestures, but acting on their meaning, children are quite knowledgeable about gestures from at least 18 months of age. This does not mean that they understand gestures iconically, however, as implied by Acredolo & Goodwyn (1988) and as studied by Petitto (1988). The gestures in the present study were the actions normally associated with objects, and so they were of the same type as children's early recognitory gestures in which they do such things as put their hand to their hair when seeing a comb. One might therefore think of these as a kind of metonymic gesture in which a part of an activity scheme stands for the whole—where the whole includes both an object and the action
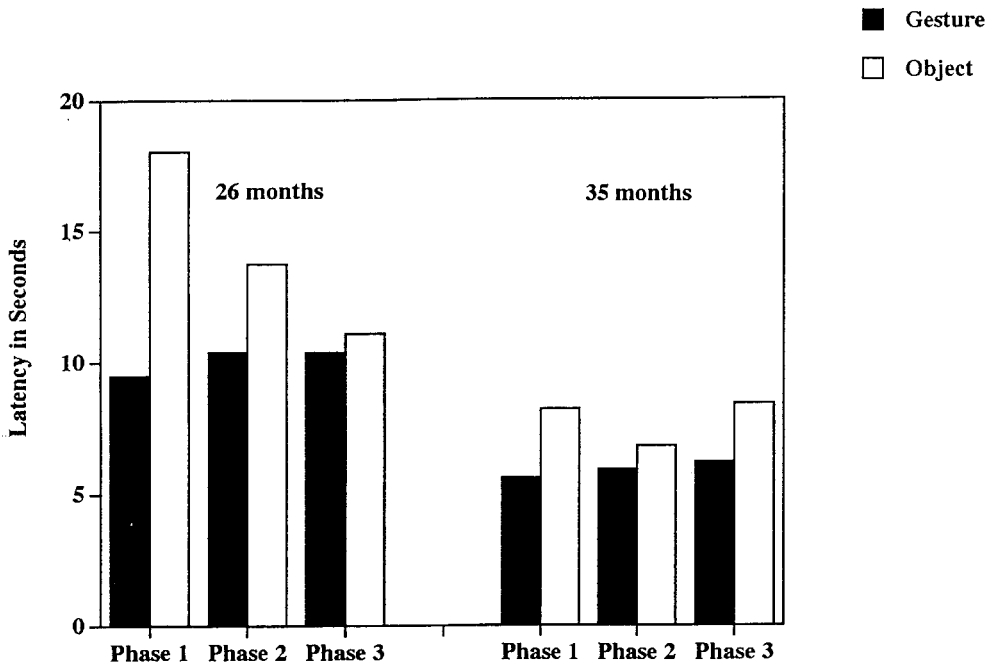

Figure 5. Latency to respond in Study 1 for 26- and 35-month-olds as a function of phase and condition.

typically performed with it—not as icons for the objects in any sense. Noted, in this regard, that Bonvillian, Orlansky & Folven (1990) found that sign language signs iconically related to their referents are not easier for children of this age than signs that have no such iconic relation, implying that they do not understand and profit from iconicity.

Only the older two groups of children were good at Phase II gestures in which they saw the gesture for a hat, for example, and then had to choose a cup (which had previously been used as a hat). Presumably the 18-month-old children had difficulties in this task because they had to disregard what they knew about the perceptually present object (the cup) and recall that it was used as a hat earlier. Another way to conceptualize this problem is as a variant form of dual representation, since in making a choice the child must see the cup (which he or she presumably knows is a cup) as a hat. Note, however, that children could conceivably perform well in this task by treating it as a task of the type in Phase I: they simply give the adult the object on which she had performed the depicted action previously (i.e. they interpret E as saying: 'I want the thing I did "like this" with'). Some evidence for this interpretation is the fact that in the Phase III gesture task, which did not allow this non-symbolic strategy, only the 35-month-olds performed at above chance levels. Before concluding that 2-year-olds do not have the required symbolic skills, however, note that the Phase III task has some additional requirements of memory and information integration over and above that of Phase II. In any case, at very least these findings demonstrate that from 18 months of age children can associate gestures with objects and understand that the gestures stand for the objects in acts of communication, although they may have some difficulties when the perceptual and functional properties of symbol and referent are especially discrepant.

Children of all ages were less skillful in using objects as symbols. The 18-month-olds showed basically no skills, not even in Phase I where the representational relation was most straightforward. Given the simplicity of this task (and their skillful performance in the control task with words and in the gesture condition), one potential implication of this finding is that the object play of children at this age is not truly symbolic, but might instead involve imitation of adult actions on objects (that the adult sees as symbolic). Problems of dual representation of the traditional kind are very likely involved here, as evidenced by the 18-month-olds' large amount of reaching for the displayed replica objects, perhaps indicating that the sensory-motor affordances of the display objects were especially salient. On the other hand, 26-month-old children were quite good at Phase I objects, and so they would seem to be capable of using objects symbolically for other objects. This finding pushes the age for children's understanding of objects as symbols below that found in any of DeLoache's (1995) studies using other types of tasks. Presumably, the fact that the authors had a very simple communicative situation with a very simple representational problem is what made the difference; DeLoache's tasks all involve fairly complex spatial mapping involving multiple objects. Note also that the 26-month-olds took a relatively long time to decide on their responses for Phase I objects—almost twice as long as for gestures in Phase I—implying that this task was a difficult one for them.

Only the 35-month-olds were good with objects in Phase II. This accords with previous research showing the difficulty young children have in using objects with conventional uses as symbols for other objects that have other conventional uses (e.g. using a book for

a hat; see McCune-Nicolich, 1981, for a review). This task might thus be thought of as involving a further kind of dual representation problem—indeed it would seem to involve a kind of 'triune representation' problem. For example, in this task the child must consider the cup as (1) a manipulable object, (2) an object with which certain conventional actions are habitually performed (drinking), and (3) a hat when the adult deems it so through her actions. The 35-month-old children were able to do well even on this task, although they had difficulty in its Phase III version, thus demonstrating that it was not an easy task even at this age.

DeLoache's dual representation model thus receives two kinds of support from this study. First, for most children of all ages gestures used as symbols were easier than objects used as symbols. Secondly, when the objects used as symbols had other conventional uses (e.g. a cup used as a hat), children had even greater difficulties, perhaps because in these problems there was yet a third level of representation entering the picture. Therefore, even though the present study found children dealing skillfully with objects as symbols at an earlier age than DeLoache in her more demanding spatial mapping tasks, the present findings are consistent with her theoretical account of the process of learning to use objects as symbols. One further implication is that children's so-called symbolic play with objects before 2 years of age may not be symbolic at all (while their use of language and gesture, which do not create dual representation problems, may be symbolic). This interpretation is at least broadly consistent with recent findings of Harris, Kavanaugh & Dowson (1997) on pre-2-year-old children's difficulties in the comprehension of pretend actions on objects (see also Lillard, 1993), as well as with Namy & Waxman's (1998) findings that children this young are still very good with symbolic gestures.

STUDY 2: PRODUCTION

Most of the children from Study 1 also participated in a production study of symbolic play. The basic idea was to give children the opportunity to play with two different toys symbolically in a situation in which the authors could distinguish those symbolic actions that had been modelled for them and those symbolic actions that they produced creatively for themselves. For example, they took a stuffed sock and rocked it like a baby and put it to bed. They then gave it to the child to see if he or she would reproduce these symbolic actions, but also present was a toy spoon and brush to see if the child would use these to feed the sock-doll or to brush its hair; any other creative symbolic acts they might have used were also noted. In this way the aim was to make some assessment, at least for the two toys in this one context, of the degree to which young children's symbolic actions represent truly creative symbolic acts, as opposed to duplications of adult action on objects that may or may not be symbolic for the child (although they may have used spoons to feed dolls previously). After this phase the children were given a verbal script to help scaffold their symbolic activities.

Methods

Participants

Thirty-eight of the children from Study 1 participated in Study 2—always after Study 1 was completed. There were seven of the original 18-month-olds, fifteen of the original 26-month-olds, and all sixteen of

the original 35-month-olds. In addition, there were some children who for one reason or another would not cooperate in the slide game of Study 1, but who nevertheless were happy to play the pretend games of Study 2. There were thus four additional 18-month-olds, one additional 26-month-old and one additional 35-month-old who participated in this second study only. The final sample was thus eleven 18-month-olds, sixteen 26-month-olds, and seventeen 35-month-olds.

Materials

Materials for this study were two pretend sets, given to different children in counterbalanced order. The first set consisted of a stuffed sock (to be symbolically made into a doll), a doll's bed, a doll's brush, and a small plastic spoon. The second set consisted of three attached Lego blocks that made a pyramidal shape (to be symbolically made into a car), a lego man that could be placed in/on the 'car', a plastic bridge/tunnel, and a piece of plastic road.

Testing procedure

Testing was done in the same room as Study 1, with the same adults present and playing the same basic roles. The child had a total of 6 mins of playtime in this study, comprising three 2 min phases. First, in the freeplay phase E introduced the child to her first object set by simply giving her the toys for freeplay for 2 min. Then, in the demonstration phase E demonstrated two actions. For the sock-doll, she rocked it like a baby (looking down and smiling at it), and carefully put it to bed (pulling covers up over it). For the block-car, she put the man on top of the block configuration and pushed it along the floor, saying 'Vroom! Vroom!' E then undid her actions (took sock-doll out of bed, took man out of block-car) and gave the child the entire object set for an additional 2 min play period. Finally, in the verbal phase E created a verbal script with the first toy set. She repeated her two actions from before, but added some language to help the child to see the pretence: for the sock-doll, she said, 'My dolly is tired; she's going to bed' as she rocked it and put it into the bed; for the block-car, she said, 'The man is going for a ride in the car' as she placed the man on the block-car and pushed it with a 'Vroom!' sound. After the child had experienced these three phases for the first object set, the entire procedure was repeated with the remaining object set.

Observational and coding procedure

Videotapes were scored for child symbolic actions. Sensory-motor actions on the objects (e.g. banging, mouthing, throwing) were not scored. Symbolic actions were written in English (e.g. 'Spoon to doll'), with only one instance of a given symbolic act being scored for a given phase (i.e. in freeplay, demonstration, or verbal phase). Note that the main operationalizations of the symbolic acts were particular acts defined ahead of time: spoon to doll, brush to doll, car to road, car under tunnel. This undoubtedly led to some 'false positives' in those cases in which children were simply relating two toys on a sensory-motor level— perhaps especially in the case of the younger children. A random sample of 20% of the children (equally distributed across age) were scored by an independent observer. Agreement was defined as one match (objects and action described with virtually identical English words) of the specific act involved during a phase (since repetitions of the same act in the same phase were not scored). Using this method, inter-observer reliability was 100%.

Note that any symbolic act produced during the freeplay was considered 'unmodelled' since it came before any modelling was done. After demonstration, the child could produce either modelled or unmodelled actions. After the verbal script, the child could produce post-verbal modelled or post-verbal unmodelled actions. Thus, with each object set the child had 4 min before the verbal script in which to produce unmodelled actions (freeplay period for all actions, demonstration period for unmodelled actions) and 2 min in which to produce modelled actions (demonstration period for modelled actions). There were 2 additional mins after the verbal script in which the child could produce both post-verbal modelled and post-verbal unmodelled actions.

Results

Figure 6 summarizes the main results of the study. One one-way ANOVA was performed on number of novel symbolic acts produced (i.e. not counting any reproductions of acts modelled by E) before the verbal script as a function of child age, and another was performed that included the novel symbolic acts produced after the verbal script. Analysis of the period before the verbal script revealed that more novel symbolic actions were produced with increasing age ($F(2,41) = 11.1, p < .01$), with Tukey's HSD indicating that the 3-year-olds produced more novel symbolic acts ($M = 2.7$) than either of the younger two ages ($Ms = .36$ for 18-month-olds and 1.4 for 26-month-olds; $p < .05$ in both cases), who did not differ from one another. The same trend emerged when novel symbolic acts following the verbal script were added in ($F(2,41) = 12.67, p < .01$), with Tukey contrasts revealing that again the 3-year-olds ($M = 4.2$) were higher than either of the younger two groups ($Ms = .64$ for 18-month-olds and 1.9 for 26-month-olds, $p < .01$ in both cases), who did not differ from one another.
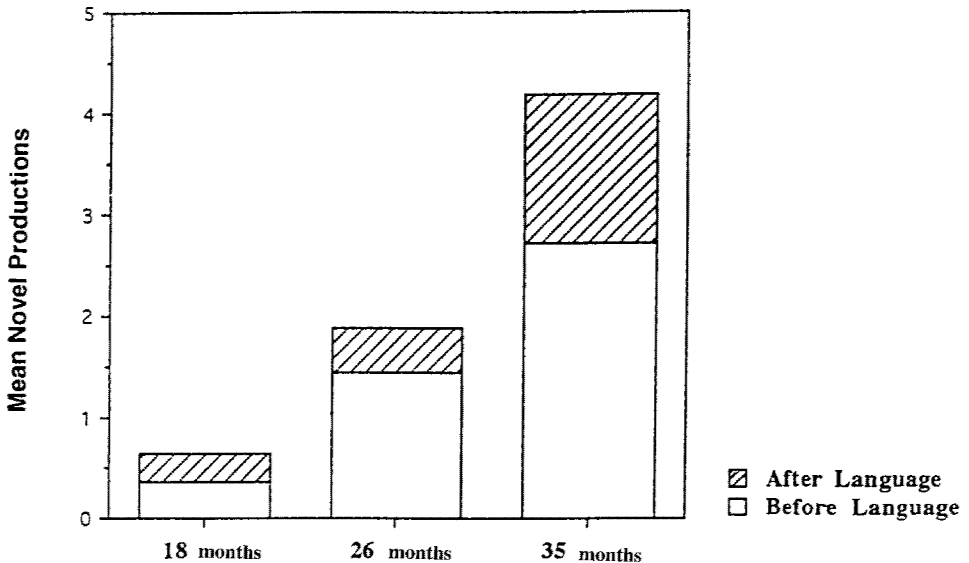

Figure 6. Production of novel symbolic acts in Study 2 as a function of age (shaded area represents symbolic acts performed after the introduction of a verbal script).

The effect of the verbal script was apparent in the fact that each of the three age groups produced a significantly greater number of additional symbolic acts after (rather than before) the verbal script was given: for 18-month-olds $t(10) = 1.95, p < .05$ (one-tailed); for 26-month-olds $t(15) = 3.41, p < .01$; and for 35-months-olds $t(16) = 5.14, p < .001$. The effect of the action modelling could not be assessed directly because the modelled acts were always the same two for each object (and the unmodelled acts were a different two for each object), and so modelling was confounded with specific acts. However, one interesting finding is that when the number of modelled acts produced by children in the pre-test and in the modelling phases are compared (i.e. the production of

such things as putting the man in the car before and after they had seen it done by E), a very strong age effect is achieved. The 18-month-olds increased their modelled actions fivefold after the model was given, the 26-month-olds increased threefold, and the 35-month-olds increased only twofold. The clear implication is that the older children were less dependent on adult models in performing these actions.

One other set of observations concerned the qualitative nature of the creative symbolic acts produced by children of the three age groups. The general observation was that although some 18- and 26-month-olds performed novel symbolic actions, their responses were often fleeting and difficult to interpret (e.g. generally poking the sock-doll with the spoon, which was counted as 'feeding'). Also, children in these younger age groups were never observed using the same object in functionally diverse ways, such as using the same object as a different symbol on different occasions. In contrast, the 35-month-olds were observed doing the following kinds of things: (1) gingerly placing the brush and spoon side by side in the bed next to the doll, as if they were dolls, and then later using the brush as a brush; (2) using the blanket on the bed to cover the sock-doll and then later using that same blanket to wipe the sock's mouth after 'feeding'; and (3) putting the doll to sleep in the bed and then using the bed as a bowl from which 'food' was taken with a spoon and then given to the doll. In each of these acts, the 35-month-old child demonstrated the capacity to override not only the sensory-motor affordances of the object, but also its other, sometimes symbolic, affordances that he or she had already exploited previously.

Discussion

The major finding of this study was the large increase in creative symbolic acts produced by children across the 18–35-month age period. There was almost a fourfold increase from 18 to 26 months, and almost a doubling from 26 to 35 months. These age relationships are fairly similar when the authors add in the creative acts that occurred only after the verbal script was introduced. The very low number of creative symbolic acts produced by the younger children, especially the 18-month-olds, is perhaps surprising—especially given that if they could perceive the sock as a doll or the blocks as a car. The acts considered creative were in actuality acts that were very likely familiar to them and strongly suggested by physical props (e.g. feeding the sock-doll with a spoon, or making the block-car go on a road). Also, as alluded to previously, the authors were very generous in crediting the younger children with symbolic acts when, for example, they touched the sock-doll with the spoon. The current study thus provides further evidence that children below age 2 years are not inclined to use, or possibly not able to use, objects as symbolic representations of other objects in the absence of adult models and/or verbal scaffolding. From both a quantitative and qualitative point of view, even the 26-month-olds were not nearly as flexible as the older children in using the provided objects in novel symbolic acts.

COMBINING THE RESULTS OF THE TWO STUDIES

There were seven 18-month-olds, fifteen 26-month-olds and sixteen 35-month-olds who participated in both studies. One may thus look at each of these individuals across the two studies and assess their combined performance in symbolic comprehension and symbolic

production—with a focus on their treatment of objects. Of the seven 18-month-olds, three showed basically no skills whatsoever; two had one production each in Study 2 (generously scored) but were not above chance at comprehension in either Phase of Study 1; and two had one production each in Study 2 (generously scored) and showed some signs of comprehension ($\frac{3}{4}$ correct) in Phase I of Study 1. Of the fifteen 26-month-olds, six showed some production skills but were not very skillful at comprehension; three showed some comprehension skills ($\frac{3}{4}$ correct in Phase I or II of Study 1) but did not produce any novel symbolic acts; and six were skillful at both comprehension and production. Of the sixteen 35-month-olds, two showed some production skills but were not very skillful at comprehension; one showed some comprehension skills $\frac{3}{4}$ correct in Phase I or II of Study 1) but did not produce any novel symbolic acts; and twelve were skillful at both comprehension and production.

General discussion

In the current studies there are four factors that affected children's comprehension and production of non-linguistic symbols. First is age. The 35-month-olds in these two studies showed in all kinds of ways that they were able to use objects and gestures as symbols. Of these children, 75% showed solid skills in both the comprehension and production of play symbols—even when the normal social supports were not available and the symbolic relationships were very indirect. In contrast, the 18-month-olds showed very few skills in using objects as symbols, in either comprehension or production. As a group they were not above chance on any comprehension task with objects, and in production they produced only a few marginal actions that could be considered symbolic. They did show some skills in using gestures as symbols, however (see below). The 26-month-olds present a mixed profile. In Study 1, they were very good with gestures when the gestures were ones they had seen associated with the correct object previously (i.e. Phases I and II), but not when the gesture was one they had never before seen associated with the correct object (i.e. Phase III). They comprehended the use of objects as symbols in Phase I of Study 1, but not in Phase II or III; that is, they comprehended when E asked for the real shoe with a toy shoe, but not when she asked for the real shoe with the box (which had been used as a shoe previously). In Study 2, the 26-month-olds produced about half the number of symbolic acts as the 35-month-olds, and none of the most flexible types of symbolic acts in which the same object was used as a symbol in two different ways. Clearly the study has identified an ontogenetic period in which much important development in the understanding of symbols takes place.

The second factor is the modality of the symbol: gesture vs. object. A striking pattern of results emerged in Study 1. At Phase I, the 18-month-olds were good at gestures but not objects. At Phase II, the 26-month-olds were good at gestures but not objects (and with both gestures and objects in Phase I). At Phase III, the 35-month-olds were good at gestures but not objects (and with both gestures and objects in Phases I and II). Combined with the overall analysis showing that gestures were easier than objects, this pattern of results demonstrates quite clearly that as children became able to apply their symbolic skills in more indirect ways, they were first able to do so using gestures. This finding would seem to lend support to DeLoache's dual representation model since a major difference between gestures and objects used as symbols is the degree to which they evoke

modes of sensory-motor action from the child. Indeed, and not surprisingly, this study found that the (especially younger) children quite often reached for the object being used as a symbol, but they never reached for the gesture being used as a symbol—an overt manifestation of the dual representation effect (see also Diamond, 1991, on infants' problems in inhibiting reaching). One possible implication of these findings, therefore, is that because of issues of dual representation, children below age 2 years are not able to use objects as symbols, even though they may quite often manipulate objects that adults see as symbolic in ways that adults have previously manipulated them.

How young children understand gestures used as symbols is a difficult issue. It must not be forgotten that the 18- and 26-month-old children performed well only when the adult used a gesture to ask for an object that was identical to a gesture she had used with that object previously. The question is whether the children understood this gesture as simply 'associated' with the object, or as somehow 'standing for' the object. It is believed that in the communicative game created here they saw the gestures as standing for the objects, but probably not in an iconic manner, that is, not in the way that flapping the arms stands for a bird. The issue is that children at this age are used to attending to adult behaviour for purposes of imitating it, and so when they initially observed the adult using a hammer, for instance, they saw how to use it. When the adult then performed that action in the absence of the requisite object the child knew to choose the 'missing object'—a kind of recognitory gesture of the type Piaget (1945/1951) first observed. The difference in cases like flapping the arms for a bird is that there is no human action scheme involved, and so the child must effect some kind of iconic mapping of wings to arms in the absence of the social involvement typical of adult actions schemes on objects that children observe and reproduce. Whether young children can create these kinds of iconic mappings, as implied by Acredolo & Goodwyn (1988), or whether they produce various actions in imitation of adult behaviours without understanding their iconicity, as the present authors would hypothesize, is a question for future research.

The third factor is the nature of the connection between the object being used as a symbol and its intended referent. That is, children of all ages had more difficulties in Study 1 when the object being used as a symbol had other conventional uses—for instance, when the adult used a cup as a hat. The 18- and 26-month-olds did not seem to comprehend these kinds of symbols at all (nor did they use any of the objects in Study 2 for more than one conventional or symbolic function), and other studies have documented that young children have a much easier time using 'appropriate' objects as symbols than 'inappropriate' objects (see McCune-Nicolich, 1981, for a review). The authors' interpretation of these findings is that, over and above the dual representation problem, children have a kind of 'triune representation problem'. The child who sees an adult use a cup as a hat knows the cup as: (1) a physical object that can be grasped, sucked, and manipulated; (2) an artefact conventionally used to hold and convey liquids to the mouth; and (3) a hat on this one occasion because the adult used it in this way. The hypothesis is thus that as children learn the intentional/conventional affordances of objects, to go along with the sensory-motor affordances they have understood for some time, this leads to special difficulties because there is another set of affordances to inhibit in seeing or using an object symbolically (see Tomasello, 1999, for a discussion of intentional affordances). The fact that children in modern cultures also encounter many objects for which only intentional affordances are symbolic (i.e. representational toys created exclusively to

symbolically represent other objects in play) only makes the interpretation of symbolic play more difficult.

The final factor is social interaction in the form of symbolic action models and verbal scripts as instantiated in Study 2. Although the study did not test these factors systematically, consistent with many other studies it was found that children reproduced actions on objects that adults modelled for them with great frequency, and they also produced many symbolic acts consistent with adult verbal scripts in which a pretend theme was established (in the manner of Harris & Kavanaugh, 1993). One interpretation of these results, and others like them, is thus that young children's early 'symbolic play' is in many cases heavily scaffolded either by concurrent adult language, or else by the symbolic action models that adults have provided in interacting with specific objects in the past that children then attempt to imitate. The present study raises more questions than it answers with respect to these issues, however, and more direct tests of the role of social factors in early symbolic play are needed.

Overall, then, it is believed that these results, as well as children's early symbolic development as a whole, are best explained by some of the insights of the dual representation model. First, at some point in the first half of their second year of life, infants learn to behave symbolically in a number of ways. They begin to comprehend and use some linguistic symbols on the basis of their skills of social cognition and cultural learning (Tomasello, in press), and at around this same age they begin to comprehend and use symbolic gestures as well. Whether these gestures are iconic representations for children, or whether they are learned by imitating adults and so stand for their referents by convention in the same way as words, is at this point an open question (see Namy & Waxman, 1998). Children also may perform some pretend actions at this age as further evidence of their emerging symbolic capacities, but these tend to be simply actions used out of their normal context without objects (e.g. 'eating' from an empty spoon). But using one object to stand for another is not a possibility for children this young because they cannot inhibit their sensory-motor schemes that activate whenever a manipulable object enters prehensile space. Additional difficulties are created when children attempt to comprehend and use an object with a known intentional affordance to symbolically represent another object in an unconventional way (e.g. a pencil is a hammer)—what is called here the 'triune representation' problem. Also, as the symbol and its referent become more complex—as in DeLoache's with scale models and real rooms—children may have increasing difficulties for cognitive-processing reasons as well. It is possible that children have more symbolic skills with objects than the authors were able to elicit in their tasks, but the children's generally very good performance in both the control and gesture tasks argues against this possibility.

The authors thus believe that through these studies they have helped to clarify something of a discrepancy in current research on children's early symbolic skills. On the one hand, the studies of O'Reilly (1995) and Lillard (1993) concern children's explicit, verbal understanding of symbolic gestures and pretence actions. However, on the implicit level, the level of use in action, children know much more than they displayed in these studies. On the other hand, before their second birthdays infants are not as symbolically skilled, particularly with objects, as many developmentalists believe. One-year-olds imitate adult actions on objects quite readily, and some of these are actions that for adults depend on perceiving and using objects symbolically. But this does not mean that when

children perform these actions they understand and intend them in this same way as adults. That kind of understanding seems to first emerge only in the 2–3 year age period, with further developments in the use of more complex symbolic media, such as maps and scale models, awaiting the child's mastery of various kinds of spatial complexities.

The role of social interaction in this process is not well understood at this point, and indeed it may be that some kind of Vygotskian internalization—children make attempts to imitate adult behaviour or to comprehend adult language—is crucial to the development of some kinds of symbolic understandings and uses. Children then go on to use these socially acquired symbols in all kinds of individually creative ways, and even to invent new symbols for themselves. Thus, the process of symbolic play development, as other cultural skills such as language development, may be seen as a delicate interplay between children's emerging skills to interact with the world in culturally conventional ways, and their emerging skills to use these cultural conventions in individually creative ways.

Acknowledgements

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