

Chapter 12. Is there an iconic gesture spurt at 26 months?

 **Şeyda Özçalışkan** | Georgia State University
Susan Goldin-Meadow | University of Chicago

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Integrating Gestures: The interdisciplinary nature of gesture

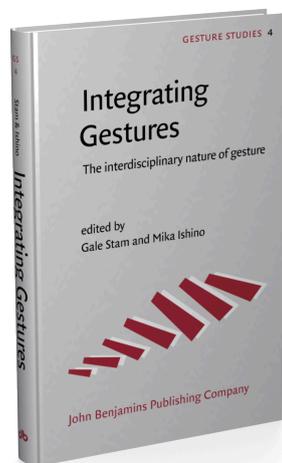
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Is there an iconic gesture spurt at 26 months?

Şeyda Özçalışkan¹ and Susan Goldin-Meadow²
Georgia State University¹ and University of Chicago²

Previous research has shown that children understand the iconicity of a gesture at 26 months. Here we ask when children begin to display an appreciation of iconicity in the gestures they produce. We observed spontaneous gesture in 40 children interacting with their parents from 14 to 34 months of age and found that children increased their production of iconic gestures over time. At 26 months, they not only produced significantly more iconic gestures (tokens) than at any previous time point, but they also conveyed significantly more different meanings with those iconic gestures (types). We found similar increases in the iconic gestures that the children's parents produced, suggesting that parents either were sensitive to changes in their children's iconic gestures or perhaps were responsible for those changes. Overall, the results suggest that the 26-month age period is a turning point for children's grasp of the iconicity of a symbol.

1. Introduction

One of the milestones of early language learning is mastering the ability to map a symbol onto a referent. Iconicity (the resemblance between a symbol and a referent) could play an important role in this mapping process. Previous research has shown that, although children can associate iconic gestures with objects at 18 months, it is not until 26 months of age that they truly understand the iconic relation between gesture and object (Namy & Waxman 1998; Namy 2001; Namy, Campbell, & Tomasello 2004), a step that may be important in understanding symbols. We ask here whether this sensitivity to iconicity can be found in children's production, as well as their comprehension, of gestures. In other words, do children increase their spontaneous production of iconic gestures during the period when they have been shown to increase their understanding of iconic gestures? And if so, can this productive surge be traced back to the gestural input children receive from their parents? More specifically, we ask whether the gestures that parents produce have the potential to play a role in children's production of iconic gestures.

2. Children's early iconic gesture production and comprehension

Young children rely on gesture to communicate before they produce their first words (Bates 1976, Bates, Benigni, Bretherton, Camaioni & Volterra 1979; Greenfield & Smith 1976). Children's earliest gestures, produced around 10 months, are *deictic* gestures, gestures whose referential meaning is given entirely by the context and not by the form of the gesture; for example pointing at a bottle to indicate a BOTTLE (Bates 1976). While deictic gestures are the most commonly used gesture type at the early ages, other types of gestures, most notably *iconic* gestures, can also be found in children's early gesture repertoires. Children use iconic gestures to convey actions or attributes associated with an object; for example flapping arms to depict a bird FLYING or holding cupped hands in the air to depict the ROUNDNESS of a ball (Acredolo & Goodwyn 1985). There is, in fact, evidence that very young children can produce a range of iconic gestures – known as *baby signs* – that indicate actions or attributes associated with objects when those gestures are deliberately taught to them by their parents (touching their index fingers to their thumbs and rotating them to convey a spider CRAWLING, raising and extending arms to indicate BIG; Acredolo & Goodwyn 1985, 1988, 2002; Goodwyn, Acredolo & Brown 2000).

Although there has been ample research on the iconic gestures explicitly taught to children, we know much less about the iconic gestures that children spontaneously produce on their own. Previous work suggests that the incidence of spontaneous iconic gestures is rare, accounting for roughly 1 to 5% of the gestures that young children produce (Iverson, Capirci & Caselli 1994; Nicoladis, Mayberry & Genesee 1999; Özçalışkan & Goldin-Meadow 2005a, 2009).¹ But why are iconic gestures so infrequent in children's early gesture repertoires? One explanation could be that iconic gestures are conceptually harder than deictic gestures, as they convey relational information rather than merely pointing out objects and people in the world (Özçalışkan, Gentner & Goldin-Meadow 2011). Indeed, there is evidence that, early in development, children find it difficult to grasp the relation between an iconic gesture and its intended referent (Namy & Waxman 1998, Namy 2001, Namy et al. 2004). At 18 months, children are equally likely to associate an iconic gesture (e.g., hopping two fingers up and down to represent the rabbit's ears as it hops) or an arbitrary gesture (holding a hand shaped in an arbitrary configuration to represent a rabbit) with an object, thus displaying a lack of sensitivity to iconicity. But by 26 months, they are more likely to associate an iconic gesture than an arbitrary gesture with an object (Namy et al. 2004). These findings suggest that, prior to 26 months, children merely associate gestures with objects and thus do not treat gestures as symbols. At 26 months,

1. Interestingly, iconic gestures constitute a relatively large proportion of the gestures produced in adult-adult interactions, accounting for roughly 30% of the gestures produced (McNeill 1992).

however, they begin to discover the iconic relation between gesture and object, which may herald important changes in their understanding of symbols.

3. Do comprehension and production of iconic gestures go hand-in-hand?

Children's sensitivity to iconicity, as measured by gesture comprehension, thus appears to be a late emerging skill, beginning at approximately 26 months. The question we ask here is whether we see evidence of iconicity in the gestures that children produce at around the same time. It is possible that children undergo a shift at 26 months, not only in their *understanding* of iconicity in gesture, but also in their *production* of iconicity in gesture. If so, we should see marked increases in both the number and the diversity of iconic gestures that children produce in their everyday interactions at around 26 months.

We investigated this possibility in a sample of 40 typically developing American children (22 girls, 18 boys), who were being raised as monolingual English speakers. The children were videotaped for 90 minutes in their homes every four months from 14 to 34 months of age while interacting with their parents in their everyday routines (see Özçalışkan & Goldin-Meadow 2005b for details on the sample).

We first looked at changes in children's overall use of gesture over the six observation sessions, from 14 to 34 months. During this time, children increased their gesture production, $F(5, 170) = 10.82, p < .001$, from an average of 54 (SD = 36) gestures at 14 months to 122 (SD = 112) gestures at 34 months, with production peaking at 26 months, $M = 131$ (SD = 90); row 1, Table 1). During this time, children produced three different types of gestures: Deictic gestures (points or hold-ups) were used to indicate objects, people or places. Conventional gestures were forms prescribed by the culture to convey particular meanings (e.g., nodding the head to mean YES, shaking the head sideways to mean NO). Iconic gestures were spontaneously generated forms used to convey actions or attribute meanings (e.g., moving the fist forcefully in air to indicate HIT, holding the hand above head to indicate TALL). The children produced these three types of gestures at different rates, $F(2, 78) = 115.71, p < .001$, and iconic gestures were produced significantly less often than either conventional or deictic gestures, p 's < .001, *Bonferroni* (Figure 1A).

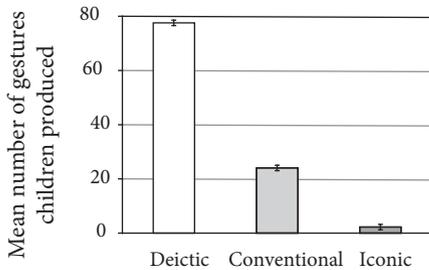
Nonetheless, as can be seen in Table 1, children increased production of iconic gestures over time, $F(5,170) = 6.56, p < .001$ (Figure 2A, solid line). The children also increased production of deictic gestures, $F(5,170) = 11.63, p < .001$, but their production of conventional gestures remained flat during this time period, $F(5,170) = 0.6, ns$ (Table 1, Rows 2, 3). Importantly, abrupt increases were found at different moments for iconic vs. deictic gestures: at 26 months for iconic gestures, $p < .05, LSD$; at 18 months for deictic gestures, $p < .001, Bonferroni$. The number of children who produced iconic gestures also increased over time. There were only 3 children (8%) who produced iconic gestures at 14 months, but this number increased to 70% (28/40) at

Table 1. Summary of children's and parents' gesture production by child age^a

	14- months	18- months	22- months	26- months	30- months	34- months
Children						
Mean number of gesture tokens (SD)	54 (36)	91 (64)	119 (75)	131 (90)	123 (68)	112 (65)
Mean number of deictic gestures (SD)	32 (24)	67 (57)	93 (65)	102 (82)	92 (51)	85 (51)
Mean number of conventional gestures (SD)	22 (20)	24 (19)	23 (20)	26 (23)	24 (21)	23 (24)
Mean number of iconic gestures (SD)	<1 (2)	1 (1)	1 (2)	4 (7)	4 (7)	4 (4)
Parents						
Mean number of gesture tokens (SD)	102 (82)	95 (67)	105 (90)	123 (117)	119 (102)	97 (94)
Mean number of deictic gestures (SD)	72 (68)	67 (53)	74 (75)	81 (81)	82 (75)	64 (61)
Mean number of conventional gestures (SD)	28 (21)	26 (20)	28 (26)	38 (40)	32 (38)	28 (36)
Mean number of iconic gestures (SD)	2 (5)	2 (3)	2 (3)	5 (6)	5 (8)	5 (7)

a. SD = standard deviation; the numbers are rounded up to the closest whole number. Each child-parent dyad was observed for approximately 90 minutes at each observation session.

1A. Children



1B. Parents

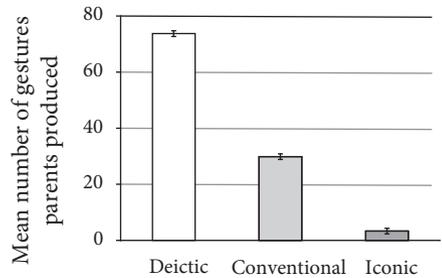


Figure 1. Mean number of deictic (white bars), conventional (gray bars) and iconic gestures (black bars) produced by children (Panel A) and their parents (Panel B) across child ages 14 to 34 months.

26 months and, by 34 months, 98% (39/40) of the children in our sample had produced at least one instance of an iconic gesture in their communications.² The pattern was the same for the *types* of meanings children conveyed in their iconic gestures. Children conveyed more different meanings in their iconic gestures with increasing age, $F(5,170) = 9.32, p < .001$, with a significant increase again at 26 months of age, $p < .05, LSD$ (Figure 2A, dotted line).³

The children in our study thus displayed a reliable increase in the number and types of iconic gestures they spontaneously produced at 26 months, the age at which children have been shown to be sensitive to iconicity in their comprehension of gesture. As such, 26 months might be a turning point in terms of children's grasp of the iconicity of a symbol.

2A. Children

2B. Parents

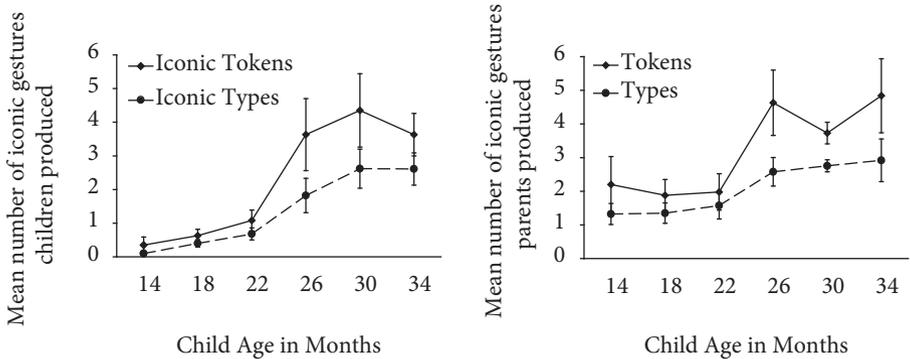


Figure 2. Mean number of iconic gesture tokens (solid lines) and iconic gesture types (dotted lines) produced by children (Panel A) and their parents (Panel B).

4. How do parents use iconic gestures when they talk to their children?

Our analysis shows a steep increase in the token and type frequencies of iconic gestures children produce at 26 months. But why do children show such an increase in their use of iconic gestures around this age? One possibility is that changes in children's use of iconic gestures reflect cognitive or communicative changes within the child. An

2. In contrast to the few children ($N = 3$) who produced iconic gestures at 14 months, all 40 children produced both *deictic* and *conventional* gestures at 14 months.
3. We used LSD rather than Bonferroni as a posthoc statistic because the change between 22 and 26 months in iconic gesture production (both tokens and types) was a planned comparison, and therefore did not require the Bonferroni correction for unplanned multiple comparisons.

alternative possibility is that changes in children's gestures reflect changes in the gestures that their parents use with them (cf. Rowe & Goldin-Meadow 2009).

At early ages children in the United States spend much of their time with adults, typically their parents. And parents gesture frequently when they speak to their children (Özçalışkan & Goldin-Meadow 2005a; Rowe, Özçalışkan & Goldin-Meadow 2008). There is, moreover, evidence that, as early as 12 months of age, typically developing children understand the deictic gestures that others produce. For example, one-year-old children can easily follow an adult's pointing gesture to a target object (Butterworth & Grover 1988). There is also evidence that parents modify their gestures to accommodate the communicative needs of their young children (Iverson et al. 1999, Özçalışkan & Goldin-Meadow 2005a). For example, parents produce fewer and simpler gestures (e.g., points at concrete objects) when they address young children as opposed to an adult (Bekken 1989). In addition to deictic gestures, parents also provide models for iconic gestures. In fact, the gestures that adults produce during interactive routines with their children can be the basis for the iconic gestures that children first produce (Acredolo & Goodwyn 1985). For example, Goodwyn and colleagues (2000) found that when parents were instructed to use iconic gestures along with their words, their children developed a larger repertoire of iconic gestures (see also LeBarton & Goldin-Meadow 2010).

To explore the effect that parent gesture might have on the child's production of iconic gestures, we analyzed the gestures produced by the parents of the 40 children in our sample during the same time period. The parents represented a heterogeneous mix in terms of both ethnic background and family income. The mother was the primary caregiver in 35 of the 40 families; the father was the primary caregiver in two families; both parents shared the caregiver role in another three families.

We first looked at parents' overall use of gesture over the six observation sessions, from child age 14 to 34 months. Like the children, parents gestured frequently in their interactions with their children. However, unlike the children, the rate at which parents gestured remained essentially unchanged across the entire observation period, $F(5, 170) = 1.12, ns$. As can be seen in Table 1 (row 5), parents produced gestures at average rates that ranged between $M = 97$ ($SD = 94$) and $M = 123$ ($SD = 117$) across the six observation sessions, with a peak in production at the 26-month period. At 14 months, children produced significantly fewer gestures than their parents, $M_{\text{child}} = 53.83$ ($SD = 36.12$) vs. $M_{\text{parent}} = 101.85$ ($SD = 81.63$), $t(39) = 3.74, p < .001$. However, by 18 months, the children had caught up, $M_{\text{child}} = 91.27$ ($SD = 64.46$) vs. $M_{\text{parent}} = 94.97$ ($SD = 67.19$), $t(39) = 0.32, ns$, and gestured as frequently as their parents throughout the remainder of the observations, with no reliable differences between them.

Parents also used the same three types of gestures as their children used (*deictic, conventional, iconic*) and, like their children, produced them at significantly different rates, $F(2, 78) = 78.68, p < .001$ (Figure 1B). Like the children, parents produced iconic gestures significantly less often than either conventional or deictic gestures, p 's $< .001$, *Bonferroni*. Indeed, parents' overall use of each gesture type was almost identical to

their children's use, with no reliable differences for either deictic, $t(39) = .57$, *ns*, conventional, $t(39) = 1.58$, *ns*, or iconic, $t(39) = 1.77$, *ns*, gestures.

Parents showed no change in their production of either *deictic*, $F(5,170) = 0.68$, *ns*, or *conventional*, $F(5,170) = 0.18$, *ns*, gestures over the six observation sessions (see Table 1). Interestingly, however, they increased their production of iconic gestures over time, $F(5,170) = 2.70$, $p = .02$, with a significant increase at the 26-month observation session, *LSD*, $p = .01$ (Figure 2B, solid line), thus mirroring the pattern we observed in the children. Parents were also similar to the children with respect to change in types of iconic gestures. They conveyed more different meanings in their iconic gestures with increasing child age, $F(5,170) = 9.32$, $p < .001$, with a marginally significant increase at 26 months, *LSD*, $p = .09$ (Figure 2B, dotted line).

One important difference between parents and children was that, unlike their children, the parents produced iconic gestures at the first observation session: 50% (20/40) of parents produced at least one iconic gesture at the 14-month session, in contrast to only 8% (3/40) of children. Parents did, however, increase their use of iconic gestures over time, from a mean number of 2.20 (SD = 5.22) gestures at 14 months to 4.63 (SD = 5.97) at 26 months; by 26 months all but two of the 40 parents (98%) had produced at least one instance of an iconic gesture in their communications with their children, compared to 28 (70%) of the 40 children. Moreover, there was a positive correlation between parents and children for both mean number of iconic tokens, Spearman's $\rho = .36$, $p < .05$, and mean number of iconic types, Spearman's $\rho = .30$, $p = .06$, across the six observation sessions.

5. Types of meanings conveyed in child and parent iconic gestures

Children and parents produced approximately the same number of iconic gestures, and they displayed a marked increase at the 26-month age period in both tokens and types of iconic gestures. To further explore the relation between the iconic gestures produced by parent and child, we asked whether the particular meanings that the children conveyed in their iconic gestures overlapped with the meanings that their parents conveyed. To do so, we characterized the meaning of the iconic gestures in three different ways.

In the first analysis, we categorized iconic gestures according to whether the form of the gesture depicted an *action* associated with an object (e.g., flapping arms to convey FLYING) or a perceptual *attribute* characteristic of an object (e.g., pinching fingers to indicate SMALL SIZE). As has been reported in the literature (Acredolo & Goodwyn 1988), we found that the children used iconic gestures to convey action information more than the static perceptual attributes of an object (77% vs. 23%). We also found the same pattern for parents (76% vs. 24%; Figure 3). There were no reliable differences between parent and child in the numbers of action, $M_{\text{parent}} = 13.95$ [SD = 16.56] vs. $M_{\text{child}} = 9.38$ [SD = 8.48], $t(39) = 1.69$, *ns*, or attribute, $M_{\text{parent}} = 4.63$ [SD = 5.41] vs. $M_{\text{child}} = 3.58$ [SD = 5.09] vs. $t(39) = 1.22$, *ns*, gestures produced.

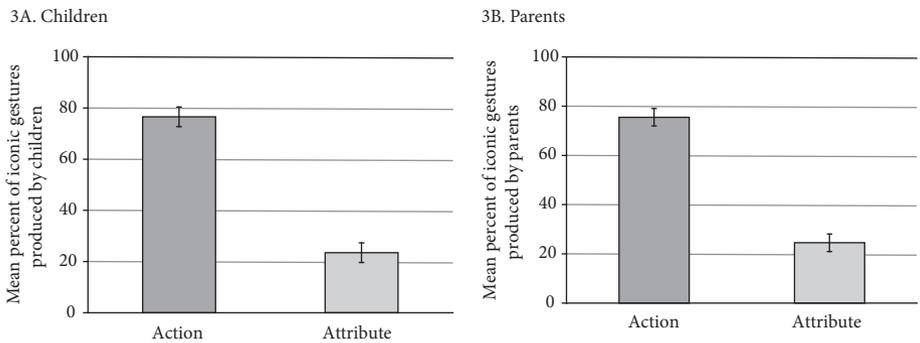


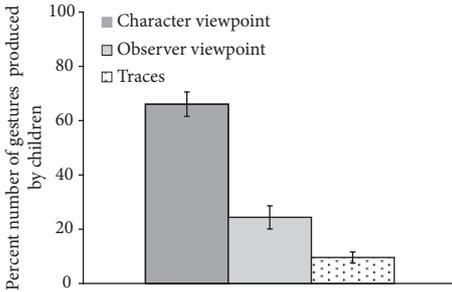
Figure 3. Mean percent of iconic gestures conveying information about the actions (black bars) or attributes (gray bars) associated with an object produced by children (Panel A) and their parents (Panel B).

In the second analysis, we categorized iconic gestures according to whether the gesturer assumed the point of view of an object, animal or person (*character viewpoint*, e.g., the gesturer turned her whole body in circles to represent a mixer); whether the gesturer used her hand to represent an object, animal or person (*observer viewpoint*, e.g., the gesturer used a V-shaped hand to represent rabbit ears); or whether the gesturer used her hand to outline the shape or trajectory of an object, animal or person (*trace gestures*, e.g., the gesturer traced a circle in air to represent the circular path a horse follows). McNeill (1992) reports a predominance of character viewpoint in children's early iconic gestures. As can be seen in Figure 4A, we replicated this pattern in our sample. There was a significant effect of *viewpoint* in children's early iconic gestures, $F(2,78) = 22.71$, $p < .001$: children used *character* viewpoint gestures (66%) significantly more often than *observer* viewpoint gestures (24%), $p < .001$, which, in turn, were used more often than *trace* gestures (10%), $p < .05$. Parents, however, displayed a different pattern. Unlike the children, the parents did not differ in their use of different viewpoints, Figure 4B, $F(2,78) = 0.97$, *ns*. Parents used *character* (36%), *observer* (28%), and *trace* (36%) gestures equally often. When compared to their children, parents produced significantly more *observer* gestures, $t(39) = 2.37$, $p = .02$, and *trace* gestures, $t(39) = 5.42$, $p < .001$.

In the third analysis, we classified each iconic gesture according to the particular meaning conveyed (RUNNING, THROWING, BIG, SMALL). We then examined the overlap of meaning glosses for parent and child in each dyad. Based on previous work suggesting that children learn iconic gestures in interactive routines with parents (Acredolo & Goodwyn 1993), we expected that many of the child's iconic gestures could be found in the parent's gestural repertoire. Surprisingly, however, we found minimal overlap between child and parent iconic gestures. The proportion of meanings found in the children's iconic gestures that were also found in their parents' gestures was under 20% throughout the observation sessions (Figure 5).⁴

4. This percentage could not be calculated at 14 months as only three children produced iconic gestures during this session.

4A. Children



4B. Parents

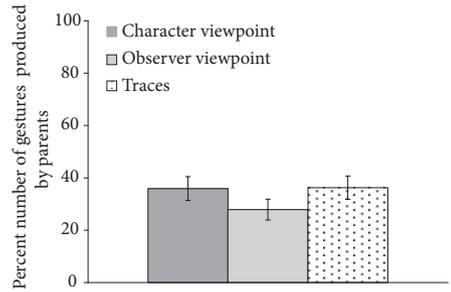


Figure 4. Mean percent of character viewpoints (black bars), observer viewpoints (gray bars) and traces conveyed in the iconic gestures of children (Panel A) and their parents (Panel B).

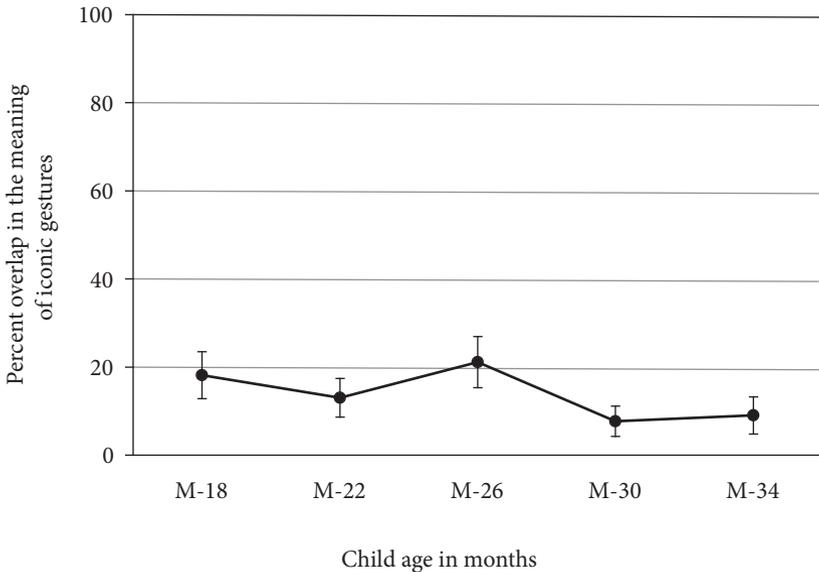


Figure 5. Mean percentage of meanings conveyed in a child's iconic gestures that were also found in the parent's gestures during that session.

5. Conclusions

Previous research has found that understanding the iconicity of a gesture is a relatively late achievement, beginning as late as 26 months (Namy & Waxman 1998, Namy 2001, Namy et al. 2004). Here we explored whether 26 months marks a similar turning point

in children's production of iconic gestures. We found that children did indeed display a significant increase at 26 months in the number and types of iconic gestures that they produced during spontaneous interactions with their parents.

Why do we see a surge in iconic gestures at 26 months? One possible explanation for the relatively late occurrence of iconic gestures is that children are modeling their gestures after their parents' gestures. The parents in our study not only produced the same number and types of iconic gestures as their children, they also displayed an increase in iconic gestures at the same time as their children. However, the fact that parents produced iconic gestures during the earliest sessions means that children had a model for iconic gestures at 14 months but didn't appear to use it until 26 months, suggesting that the newly found interest in iconic gestures may have come from the children rather than the parents. Moreover, although both parents and children showed a similar pattern with respect to action and attribute iconic gestures (Figure 3), there was very little overlap in the particular iconic gestures that parents and children produced (Figure 5) and children showed a different distribution of *character* vs. *observer* gestures than their parents (Figure 4). These differences lend weight to the hypothesis that the increase in iconic gestures in parents at child-age 26 months reflects, rather than causes, the increase in iconic gestures in children.

The relatively late occurrence of iconic gestures, particularly in relation to deictic gestures, may stem from the fact that the mapping between symbol and referent is less straightforward, and therefore more cognitively demanding, for iconic gestures than for deictic gestures. Deictic gestures map onto the perceptual world in a direct way; they are used to indicate objects, people or locations that are perceptually cohesive and easily parsed out of the scene. In contrast, iconic gestures select their referents from a diffuse set of relational concepts, and may depend on the language one speaks (Kita & Özyürek 2003, Özçalışkan et al. 2011). In fact, deictic gestures routinely precede children's first nouns (Iverson & Goldin-Meadow 2005), whereas iconic gestures conveying action meanings typically follow children's first verbs (Özçalışkan et al. 2011), further reinforcing the idea that iconic gestures might be conceptually harder than deictic gestures. Iconic gestures may emerge as an outcome of related spoken language achievements, rather than being a precursor to such abilities.

In summary, we have shown that children begin to produce iconic gestures in earnest at around 26 months of age. Although parents also increase their production of iconic gestures at this same time, there is reason to believe that their gestures reflect, rather than cause, changes in the child. Indeed, the fact that children begin to produce iconic gestures at just the moment that they seem to understand iconicity in gesture suggests that this moment may be a turning point in the child's grasp of the iconicity of a symbol.

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