

Infants can create different types of iconic gestures, with and without parental scaffolding

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Abstract

Despite the early emergence of pointing, children are generally not documented to produce iconic gestures until later in development. Although research has described this developmental trajectory and the types of iconic gestures that emerge first, there has been limited focus on iconic gestures within interactional contexts. This study identified the first 10 iconic gestures produced by five monolingual English-speaking children in a naturalistic longitudinal video corpus and analysed the interactional contexts. We found children produced their first iconic gesture between 12 and 20 months and that gestural types varied. Although 34% of gestures could have been imitated or derived from adult or child actions in the preceding context, the majority were produced independently of any observed model. In these cases, adults often led the interaction in a direction where iconic gesture was an appropriate response. Overall, we find infants can represent a referent symbolically and possess a greater capacity for innovation than previously assumed. In order to develop our understanding of how children learn to produce iconic gestures, it is important to consider the immediate interactional context. Conducting naturalistic corpus analyses could be a more ecologically valid approach to understanding how children learn to produce iconic gestures in real life contexts.

Index Terms: language development, iconic gesture, interaction

1. Introduction

‘Iconic gestures’ are a type of co-speech gesture that bear a similarity-based semantic connection between the form of the gesture and the referent (e.g., McNeill, 1992), i.e., the specific handshape or movement bears some similarity to the shape or movement of the referent. An example of an iconic gesture that depicts shape is holding the fingers of both hands together in a circle-shape to depict a ball, while an example of a gesture that depicts the movement of a referent is rolling the hands over each other to represent a barrel rolling down a hill.

Despite broad consensus on this basic definition, different studies have operationalised definitions of iconic gestures in different ways. Typically, researchers – especially in developmental studies where researchers often want to distinguish communicative gestures from pretend play – stipulate that iconic gestures must be performed without an object-in-hand (Acredolo & Goodwyn 1985, 1988; Capirci et al., 2005; Namy et al. 2008; Özçalışkan & Goldin Meadow, 2011; Furman et al., 2012; Marentette et al., 2016; Cartmill et al., 2017). Justifications tend to cite ambiguity concerning whether actions performed with objects have communicative intent. Conversely, Clark (2016) suggests that it does not make

sense to stipulate that for an action to be considered an iconic gesture, it must be performed without an object. He argues that gesturing to a waiter that you wish to sign the bill by writing in the air with an actual pen is no less communicative than performing the same action with an imaginary pen. In such examples, an action with an object is intended to have a communicative outcome, rather than (or not just) a physical outcome. In addition, Quinn and Kidd (2019) make a case for counting iconic gestures with objects so long as they constitute ‘truly symbolic actions’, by which they mean the user is behaving ‘as-if’ in some way, i.e., they are stirring a spoon in an empty saucepan *as if* it contains food. Previous researchers have drawn a sharp distinction between pretend actions and communicative gestures (e.g., Bates et al., 1979; Acredolo & Goodwyn, 1985), while Quinn and Kidd acknowledge that they may be blurring the distinction between symbolic play and communicative gesture. However, they argue that pretend actions with objects can be just as communicative as empty-hand gestures. This perspective is supported by Caselli (1983, 1990) who argues that many actions typically designated ‘symbolic play’ (such as a hand to the ear to represent a telephone) should be considered gestures since they are frequently used, communicate in various situations, denote a precise referent and contain semantic content that remains relative stable across contexts (Capirci et al., 2005).

Developmentally, studies to date indicate the production of iconic gesture emerges relatively late compared to pointing and children’s first words. Pointing tends to precede the onset of first words around 11 months, and despite large variation in the reported onset of iconic gesture, most studies agree it occurs after children begin producing their first words from 12-13 months, with many studies reporting significantly later (Bates, 1976; Bates et al., 1979; Acredolo & Goodwyn 1985, 1988, Iverson et al., 1994; Nicoladis et al., 1999; Özçalışkan & Goldin-Meadow, 2005, Furman et al., 2012). To some, this is surprising since the use of iconic gestures may seem simpler as it does not require children to have learnt the conventions of a communication system. However, noticing similarity between form and referent requires the ability to use abstraction and analogical reasoning that infants do not fully possess (Calbris, 2011). Indeed, children’s understanding of iconic gestures comes later than their production of them (Namy, 2008). If infants do not understand the similarity-based mapping between form and referent, then iconic gestures produced before the age of two years may not be truly iconic. Infants might simply be reproducing routines or conventional gestures that have been taught to them, e.g., they may have learned that wiggling your fingers is part of singing ‘incy wincy spider’ without understanding that such wiggling fingers depict the movement of a spider’s legs (Acredolo & Goodwyn, 1985, 1988). Iconic gestures may also be conceptually challenging because they

convey relational information rather than simply indicating referents like deictic gestures (Özçalışkan et al., 2011), which could explain their later onset.

To better understand the development of the underlying cognitive processes that enable the production of iconic gestures, some studies have investigated the forms of children's earliest iconic productions. For example, some experimental studies observed differences in children's iconic gestures at different ages: whereas three to four-year-olds tended to favour body-part-as-object gestures, six to eight-year-olds tended to favour imaginary-object gestures (Overton & Jackson, 1973; Boyatzis & Watson, 1993; Mizuguchi & Sugai, 2002). Body-part-as-object gestures refer to gestures where the child uses a body-part, usually the hand, to represent some aspect of the referent they are depicting, e.g., gesturing with fingers spread out and bent to represent the teeth of a comb while the hand is moved from the top to the bottom of the hair in a combing gesture. Conversely, with imaginary-object gestures, the hand typically takes the shape it would if it were manipulating an imagined object, e.g., holding the hand in a fist shape as if holding a comb to the side of the hair while performing a combing gesture. Arguably, imaginary-object gestures are more conceptually challenging than body-part-as-object gestures since using a body-part as a mental placeholder for the referent could require less imagination. However, this developmental sequence could be an artifact of the experimental paradigm leading to a more conservative estimate of the onset ages for imaginary-object gestures. In a naturalistic context where the child is interacting with their primary caregiver, we might expect more advanced iconic gestures to emerge sooner. Indeed, some studies that have investigated spontaneous gesture production do not report an early preference for the body-part-as-object strategy (e.g., Marentette et al., 2016).

If younger children prefer using body-part-as-object gestures, this could be seen as part of the bigger developmental process of symbolic distancing (Werner & Kaplan, 1963). That is, as children develop, the distance between the four principal components in communication (the addressor, the addressee, the referent and the symbolic vehicle) becomes larger. Early symbols tend to be "mimetic facsimile[s]" of the referent with decreasing "tangible "likeness"" between form and referent over time (Werner & Kaplan, 1963, p. 47-8). It seems plausible that children first produce gestures with less symbolic distance between form and referent, such as gestures performed with a conventional object in-hand or using a body-part-as-object strategy, where the referent does not need to be entirely imagined. Then, they later produce iconic gestures which are arguably more symbolically distant – such as object-in-hand gestures using a differently-shaped object to the referent or empty-hand imaginary-object gestures.

In attempting to explain how infants first learn to produce iconic gestures, there has been some focus on the relationship between parents' and children's gestures. One notable finding is that iconic gestures, at least as they are traditionally defined, are rare in the input children receive, suggesting that children do not predominantly learn to produce iconic gestures through imitation (Iverson et al., 1999; Namy et al., 2008). Alternatively, symbolic play research suggests that children might derive iconic gestures from adults' symbolic action-patterns within play interactions (Quinn & Kidd, 2019). Adults and children typically produce more gestures, especially object-in-hand iconic gestures, during symbolic play than during functional play (Quinn & Kidd, 2019). A study involving 16 to

22-month-olds found that the more parents engaged in pretend play with objects in hand, the more gestures children produced both during play and according to parental report of their gesture vocabulary (Namy et al., 2008). However, there was no direct link found between parents' empty-hand gestures and children's empty-hand gestures, which led Namy et al., (2008) to argue that children derive gestures from adult behaviours they observe, made possible by the ability of children to understand the symbolic potential of gestures.

In summary, infants produce their first iconic gestures later than deictic gestures and it is unclear whether they understand the connection between the form and referent of their earliest iconic gestures. Some forms of iconic gesture might be expected to emerge sooner than others based on the degree of symbolic distancing required. Children probably do not learn to produce iconic gestures purely via imitation, but they may instead derive them from other behaviours they observe. The current study aimed to develop a better understanding of what children's earliest iconic gestures are like and how they might emerge within the immediate interactional context. We were interested in whether we could find empirical support for the symbolic distancing hypothesis or whether children's capacity for innovating iconic gestures might be present early on. Adults might provide materials from which children can derive gestural forms or create a verbal context in which there is interactional pressure for infants to produce an iconic gesture. Using data from a longitudinal corpus, we investigated these questions based on close analysis of children's first iconic gestures within their interactional context.

2. Method

2.1 Data

The data were taken from the Providence corpus (Demuth et al., 2006), part of CHILDES (MacWhinney 2000), a corpus of spontaneous video-recorded and transcribed interactions from five pairs of American English-speaking parents and children in their homes. Recordings were made fortnightly from the onset of children's first words (Alex: 1;04.27; Lily: 1;01.02; Naima: 0;11.26; Violet: 1;02.00; William: 1;04.12) until they reached approximately three-years-old and typically consisted of mother and child dyads participating in everyday activities.

We watched all videos from the beginning of the corpus until 10 iconic gestures were identified for each child (mean: 26 recordings; range: 18-33). 10 gestures was a predetermined target due to time constraints.

2.2 Operational definition of iconic gestures

Our search for iconic gestures included both those that the child performed without an object (*empty-hand*) and with one (*object-in-hand*) (in line with Clark, 2016 and Quinn & Kidd, 2019). Gestures without objects were subcategorized as *body-part-as-object* - where a body-part depicted the object, such as an extended finger representing a toothbrush, *imaginary object* - where the hand typically mimed using an imaginary object, such as a fist to the side of the mouth moved up and down to signify brushing teeth with an imaginary toothbrush, tracing gestures and *no-object gestures* - where the hand depicted an action typically without an object such as tickling.

Object-in-hand gestures included a physical object as an integral part of the gesture. The child had to be deliberately using the object, and not coincidentally holding it. For example, an iconic object-in-hand gesture would be pretending to write something with a pen in the air. Thus, in line with Quinn and

Kidd’s (2019) argument, our data includes examples that might traditionally have been designated as ‘pretend actions’.

It was generally important to distinguish all gestures from practical actions. For example, if a child put their arms out to catch a ball, this would not be considered a gesture, but the same action outside of this context – such as if the child were requesting to play catch – might be. Thus, gestures had to be *communicative*. This was determined by the presence of the communication partner within the scene, direction of child and caregiver’s gaze and how the gesture functioned in response to preceding utterances and/or was responded to.

Finally, in order to ensure the gestures analysed were truly iconic, gestures were also excluded if produced as part of any learned song or routine (such as *incy wincy spider*) (Acredolo & Goodwyn, 1988).

2.3 Categorizing interactional contexts

Interactional contexts of gestures were categorized first according to whether or not there were any action precedents (alongside potential verbal triggers since all gestures occurred within conversational contexts) i.e., whether the adult produced a gesture the child could have imitated, an action they could have modified or whether the child’s own actions may have formed the basis of a subsequent gesture. When no action precedent occurred, the way gestures related to the verbal context was categorized i.e., was the gesture in response to an adult’s request, in response to a label or was it semantically related to the conversation or not?

3. Results and discussion

Children produced their first iconic gesture between the ages of 12 and 20 months (median = 18 months) and their 10th iconic gesture between the ages of 21 and 28 months (median = 25 months).

3.1 Formal and semiotic characteristics of gestures

The formal and semiotic characteristics of the gestures children produced are described in Table 1.

Children mostly produced gestures conveying information about actions (90%) rather than the shape of referents. 54% of all iconic gestures were categorized as object-in-hand. Of those, a large majority (74%) used a conventional object. Of the empty-hand gestures, no-object gesture was most frequent (39%), and imaginary object gestures were more common (35%) than body-part-as-object gestures (17%).

The finding that children’s earliest iconic gestures tend to represent actions is in line with the literature. Acredolo and Goodwyn (1988) note that the vast majority of symbolic gestures children developed outside of interactive routines were imitations of actions associated with objects and this finding was replicated by Ozçaliskan and Goldin Meadow (2011) who reported that 77% of iconic gestures observed in their study conveyed action information.

However, the relatively even proportions of empty-hand and object-in-hand gestures is surprising in light of the symbolic distancing hypothesis (Werner & Kaplan, 1963) which would predict that the less symbolically-distant object-in-hand gestures would dominate at this early stage of development. Where children did use object-in-hand gestures, although there was a greater tendency (20 out of 27) for them to use conventional objects to perform their associated actions (e.g., holding a telephone to the ear and pretending to speak into it), they sometimes acted as if another object were the depicted

Table 1: *Formal/semiotic characteristics of gestures produced by frequency and percentage*

Formal/Semiotic Characteristic	Frequency (Percentage)
gestures representing shape	5 (10%)
gestures representing action	45 (90%)
empty-hand gestures	23 (46%)
object-in-hand gestures	27 (54%)
Empty-hand	
No-object	9 (39%)
body-part-as-object	4 (17%)
imaginary-object	8 (35%)
tracing	2 (9%)
Object-in-hand	
conventional	20 (74%)
similarly-shaped	5 (19%)
differently-shaped	2 (7%)

referent (sometimes with a similar-shape e.g., pretending a long thin train track was a telephone, sometimes very different e.g., pretending a cuddly horse was a hair brush). Such creative use of objects indicates that these infants may have more representational ability than expected under the symbolic distancing theory. Regarding empty-hand gestures, we found no early preference for the body-part-as-object strategy, in line with studies of spontaneous gesture production (e.g., Marentette et al., 2016), rather than the experimental studies that did find an early preference (Overton & Jackson, 1973; Boyatzis & Watson, 1993; Mizuguchi & Sugai, 2002). Strategies used when producing empty-hand gestures were varied and there was no clear progression from presumably less cognitively demanding strategies such as no-object gestures and body-part-as-object gestures to more demanding imaginary-object gestures.

3.2 Interactional context of gestures

To further explore how iconic gestures emerge, we analysed the context in which they were produced. Table 2 presents the context of each gesture.

We found only a minority of children’s gestures had action precedents within the recording session (34%), with imitation being the most frequently occurring context (20%), and the rest derived from parents’ or children’s practical actions or parents’ gestures. Infants’ gestures derived from adult gestures typically involved the same action with either a different object or directed towards a different agent.

Most children’s gestures did not have any action precedent in the preceding context (66%). In such cases, the conversational context may have created interactional pressure to use an iconic gesture. Children offered an iconic gesture in response to the caregiver’s request to provide a label or perform a specific action in 12% of these instances, perhaps because they did not know the verbal label or preferred the gestural modality. Children produced iconic gestures to demonstrate understanding of a word in 18% of cases (e.g., adult says ‘horse’; child makes toy ‘gallop’). Furthermore, children produced iconic gestures that extended a topic by introducing related semantic content (24%). Finally, children sometimes produced iconic gestures that bore no relation to the conversational context (12%).

To illustrate our findings, we now explore a few examples of gestures that typify some of the categories we have defined.

3.2.1 Action precedent; imitated from parent’s gesture

As in previous studies (Iverson et al., 1999; Namy et al., 2008),

Table 2: *Interactional context of gestures*

	Alex	Lily	Naima	Violet	William	Freq (%)
Action Precedent						17 (34%)
Imitation of adult gesture	G2, G4, G8	G1	G2, G10	G2, G6, G8	G5	10 (20%)
Derived from adult practical action	G6	G9				2 (4%)
Derived from child practical action	G5	G8				2 (4%)
Derived from adult gesture				G4	G7, G10	3 (6%)
No Action Precedent						33 (66%)
Response to request		G2, G3	G3, G8	G10	G2	6 (12%)
Response to verbal label	G3, G7, G9	G10	G1, G5		G3, G4, G9	9 (18%)
Related to conversation		G4, G5, G6, G7	G6, G7	G1, G3, G5, G9	G6, G8	12 (24%)
Unrelated to conversation	G1, G10		G4, G9	G7	G1	6 (12%)

adults rarely provided children the opportunity to directly imitate iconic gestures, but we did find some instances of imitation. Example 1 represents a typical case of a child directly imitating his mother's empty-hand gesture.

Example 1: William (01;10.12)

William's mother produced an iconic gesture depicting the shape of a triangle and asked him, "What is this?" William was able to provide the correct verbal response and received positive reinforcement, "Yes, it is a triangle," which encouraged him to also imitate the iconic gesture to elicit further reinforcement. Interestingly, William demonstrated later that this imitated gesture had become—or already was—part of his gestural repertoire by producing the same iconic gesture spontaneously after the conversation had moved on. William bid for his mother's attention, "Watch" and then performed the triangle gesture along with the verbal label.

3.2.2 Action precedent; derived from parent's action

Previous research has found that parents' pretend actions with objects predict children's production of empty-hand iconic gestures (Namy et al., 2008). We also found examples of children's apparent ability to derive iconic gestures from their parents' actions. In the following example, there was a clear relationship between an action performed by the mother in the immediately preceding context and the child's gestural form.

Example 2: Lily (02;01.15)

Lily's mother initiated a playful interaction, performing the action of tickling Lily on her belly. Lily associated being tickled and a "tickly" blanket, saying "I want the tickle blankie", whilst performing an iconic gesture, depicting the action of tickling where her mother had just tickled her. Here, her mother's preceding action (tickling) scaffolded the iconic gesture Lily produced: the action was the same, but Lily performed the gesture on herself, and its meaning had been abstracted, used to signify a displaced referent.

3.2.3 Action precedent; derived from child's action

Children's early iconic gestures are often action-based enactments of events (Quinn & Kidd, 2019). It has also been found that children often produce a corresponding action prior to producing a specific representational gesture, e.g., they hold a toy phone to their ear before they gesture about talking on the phone, suggesting a potential continuity from the child's own actions to their production of iconic gestures (Capirci et al., 2005; Pettenati et al., 2009; see also Caselli et al., 2012). The next example illustrates how a child's own action might scaffold their production of a related iconic gesture.

Example 3: Alex (02;03.00)

Alex was playing with playdough when he broke the piece he was holding and threw it away. His mother asked, "Did it break?" Alex performed an empty-hand gesture where he moved his hands towards each other and then apart, representing something being broken in two, "Oh no [...] broke". Although the connection between his practical action and iconic gesture is apparent, the gesture also contained an innovative element as the representation of breaking is not the same as the action. In the practical action, Alex was holding the play dough, a long-thin tube, in one hand when the bottom part of it broke off. The two-handed iconic gesture perhaps indicated Alex had a conceptual schema for the conventional representation of something breaking. Alternatively, his use of two hands. For this gesture might be explained by the intervening two-handed conventional gesture for "where" he produced (two hands held palm upwards + shoulder shrug) in between the action and 'broke' gesture. Either way, there was increased distance between his practical action and iconic gesture that indicates a deeper level of understanding.

3.2.4 Action precedent; derived from adult gesture

When caregivers model gestures with objects in-hand, in some cases it is possible for the child to imitate the gesture with the same object. In other cases where the child does not have access to that object, they may perform a similar action on an alternative object showing a degree of innovation in their ability to transfer the mental representation onto a new object.

Example 4: William (02;04.16)

William asked, "Where's the guitar?" whilst holding a baseball bat. His mother responded, "Over there, in your hand" and subsequently clarified, "You can pretend this is a guitar". She modelled this action, performing a strumming action on another similarly shaped object, as if it were a guitar. William then acted on his mother's verbal directive, imitating her action on the alternative object (baseball bat) that he was already holding. This shows a degree of innovation in transferring the representation his mother was modelling onto a new object when scaffolded by both a physical model and verbal directive.

3.2.5 No action precedent; response to request

The remaining categories were all produced without reliance on any model observed here (although it is possible that children were exposed to the gestures at some point before the recording of the corpus); however, the verbal contexts provided differing degrees of support. In Example 5, a gesture was produced in response to a request for a label. Some researchers have found that, at the earliest stages of development, children consider both gestures and words equally valid object names (Capirci et al., 2005). Children might use gestures as substitutes for words if they do not know the verbal equivalent. This does not account

for the majority of gestures here as children produce both the gesture and word in 68% of cases. However, there were some examples where gesture did seem to substitute for an unknown word.

Example 5: Violet (01;10.27)

In a picture-naming activity, Violet successfully labelled a heart shape but seemed unsure when she accompanied her next label “Moon?” (articulated with rising intonation) with an iconic gesture where she traced a crescent-shape in the air with an extended index finger. Her mother rewarded the attempt but offered the alternative label “Moon, yeah, or crescent-shape.” The fact that Violet used the iconic gesture alongside a verbal label she was demonstrably unsure of indicated that she was trying to communicate to her mother that she knew her verbal label was inadequate and that her gestural label was a better representation of her conceptual knowledge of the shape.

3.2.6 No action precedent; response to verbal label

Children often produced an iconic gesture in response to a specific verbal label. In these instances, the gesture typically demonstrated the child’s knowledge of the meaning of the adult’s speech.

Example 6: Naima (01;00.26)

In response to her mother reading from a book, “Splash” and “That penguin is splashing”, Naima produced a two-handed gesture, raising her arms up and bringing them down onto the open book quickly, as though the book represented the surface of some water, and she was splashing her hands in it. This gesture is the earliest iconic gesture observed in the corpus; Naima was only 12-months-old when she produced it. It seems likely that the source of the gesture might be an action that the child regularly performed, perhaps in the bath and so this may count as an action-based enactment of an event (Quinn & Kidd, 2019). Naima may have learnt to associate such an action with the verbal label “Splash” habitually, so we cannot be sure that this example represents true understanding of an iconic mapping. However, the fact that she produced this action in this novel context applied to an alternative agent (the penguin rather than herself) arguably showed an advanced level of representational ability. So too did her ability to behave as if the open book in her mother’s lap was the surface of water.

3.2.7 No action precedent; related to conversational context

Sometimes, children produced iconic gestures that were semantically related to the topic of conversation, going beyond a simple demonstration of their understanding of a key word.

Example 7: Lily (02;00.23)

Lily and her mother were reading a book with a repetitive syntactic structure (too + adjective) e.g., “Too leafy”, “Too wrinkly”. Lily’s mother read several in a row before leaving one incomplete for Lily to fill in with an appropriate adjective Lily fills in “scratchy”, and then she spontaneously extended the topic by saying, “Daddy’s very scratchy.” At the same time, she produced an iconic gesture where she raised her hand to stroke her own chin as if she had a scratchy beard, disambiguating her meaning for her mother who responded, “His face is scratchy, right?”. Thus, Lily’s iconic gesture appeared to be a comment on her father’s beard and was therefore semantically related to the topic “scratchy” without being a representation of the exact concept.

3.2.8 No Action Precedent; Unrelated to Conversational Context

It is argued that children cannot spontaneously produce iconic gestures before a certain age (Quinn & Kidd, 2019). For example, one experimental study found that 27-month-olds could use spontaneously created iconic gestures, while 21-month-olds could not consistently invent their own iconic gestures (Behne et al., 2014). While our findings somewhat supported this, there were examples of iconic gestures with neither action precedent nor any relation to the conversational context.

Example 8: Naima (01;03.12)

Between spoonfuls of Oatios, unprompted by anything in the immediate environment, Naima lifted two arms into the air and said “Giraffe”; the verbal label clarifying the intended depiction of the long, tall form of the giraffe expressed by the gesture. Naima’s mother responded, “Are you being tall like a giraffe?” This question scaffolded Naima’s vocabulary development as when she repeated the gesture later, she said “Tall giraffe”, highlighting the addition of new vocabulary. She then repeated the iconic gesture whilst saying the word “Tall”, perhaps indicating generalization of the gesture to anything tall. Although Naima’s mother’s contingent responses were clearly enriching for Naima’s language development, there was nothing in the preceding interactional context that suggested this was anything other than a spontaneously generated gesture on Naima’s part, occurring at the notably young age of 15-months old. However, given that our data is limited to one-hour fortnightly recordings, and so we cannot know whether Naima’s mother had modelled this gesture at another uncaptured time.

4. General discussion

Our results indicate that children’s iconic gestures took a variety of forms from our earliest observations. There were only slightly more object-in-hand gestures than empty-hand gestures (54% vs. 46%). Similarly, although most object-in-hand gestures were produced with the conventional object, children also created iconic gestures with similarly-shaped and differently-shaped objects. A larger proportion of empty-hand gestures that depicted transitive actions employed an imaginary-object strategy and depicted the characteristic action of the referent, rather than its shape.

For the most part, infants’ earliest iconic gestures did not appear to be imitations of adult gestures or derived from actions. Although some gestures were likely modelled at an uncaptured time, our data suggests that rather than simply reproducing learned behaviours, children may be able to innovate new iconic forms. Even gestures that were derived from actions often provided evidence of children’s creativity. Where there was no action precedent, caregivers sometimes created interactional pressure to produce an iconic gesture through the conversational context. However, there were also instances where children’s iconic gestures bore no relation to the semantic context of the conversation.

Our findings lend weight to the hypothesis that infants do understand the form-meaning mapping underlying their earliest iconic gestures, since they are potentially able to create iconic gestures without relying on—or in some cases, expanding on—a model. Infants’ understanding of the iconic relationship between form and referent in gestures they produce before 26-months has been previously called into question (Ozcaliskan &

Goldin Meadow, 2011; Namy, 2008), and some have argued that iconic gestures produced prior to this are either simple imitations or derived from interactive routines (Acredolo & Goodwyn, 1985, 1988). However, we identified examples of infants producing iconic gestures seemingly outside of routines and that did not seem to have been imitated.

According to the symbolic distancing hypothesis (Werner & Kaplan, 1963), one would expect children's earliest iconic gestures to be comprised of forms with minimal symbolic distance from the referent. This view predicts a developmental trajectory not evidenced in our data, whereby conventional object-in-hand gestures emerge first, progressing towards empty-hand gestures, scaffolded by a body-part representing some feature of the imagined object, before the child is able to produce an empty-hand imaginary-object gesture. Our results also contrasted with experimental studies that found younger children tended to prefer body-part-as-object iconic gestures (Overton & Jackson, 1973; Boyatzis & Watson, 1993; Mizuguchi & Sugai, 2002). Because we used naturalistic data, our findings arguably have more ecological validity and may better reflect how children actually learn to produce iconic gestures in real life contexts. Early gestural forms are varied and can be produced with and without parental scaffolding within the immediate interactional context.

5. Conclusions

Infants may be able to create their own iconic gestures during their second year. These gestures take a variety of forms from the beginning and do not progress linearly from "easier" imitated gestures to more difficult innovated forms. Sometimes, infants rely on action precedents, and, at other times, the conversational context is key, but the examples described here did not show any clear developmental progression from one type of gesture to another. Gestures serve a variety of communicative goals and infants' earliest iconic gestures already demonstrate impressive representational abilities.

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