CHAPTER 8

Sentences and conversations before speech?

Gestures of preverbal children reveal cognitive and social skills that do not wait for words

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Before first words, children use gestures to communicate and represent concepts. This study investigated two questions: Can infants pair gestures together to create two-gesture *sentences*? Further, can preverbal children engage in conceptually focused gesturing *conversations*? I observed 10 infants for 8 months during interactions with caregivers and coded all gesturing behavior. I used longitudinal growth modeling to analyze the developmental trajectories of gesturing sentence and conversation length. Infants formed 2-gesture sentences as early as 9 months and 3-gesture sentences at 1 year. Infants engaged in 4-turn conversations as early as 11 months; maximum gesture conversation length was 16 turns. Infants' early gesturing frequency and variety predicted later sentence length; however, caregivers' gesturing sentence length suppressed child's sentence length.

Keywords/phrases: child development, gesture, symbolic gesture, communication, representation, infant sign

Gesture as a window into preverbal cognitive and social skills

Sabrina (11.67 months) and her caregiver sat in the infant classroom of the UC Davis child development laboratory, where the university students who care for the children are taught to use a variety of gestures with the children. Sabrina crawled to the family picture board and pointed to the picture of her family. She pulled it off the board. Her caregiver

said, "You found a picture of your family." As Sabrina pointed to each of her family members, her caregiver said, "I see you are thinking about .... (named family member)." Then Sabrina pointed to the picture of another child's family. Her caregiver pulled that photo down, and again the caregiver talked about all family members, following Sabrina's pointing. Sabrina continued to pull down and point at every family picture; the caregiver talked about each until all the pictures were on the floor, then said, "There are no more pictures." Sabrina picked up the picture of her own family, and smiled.[1]

In this observation, the preverbal child successfully engaged her caregiver in a kind of dialogue about her family and those of her peers. Sabrina demonstrates skilled and intentional communication using the flexible *point* gesture to engage and draw language from her caregiver. How will this type of interaction change as Sabrina gains a diversity of more referent-specific gestures? Will she string gestures together to make gesturing *sentences* representing more complex ideas? Will she engage in conceptually focused gestural turn-taking, or *conversations,* with her caregiver?

Before speaking their first words, children develop many communication and representation skills seen in their use of gestures. From a child development perspective, gestures reveal cognitive and social capacities in preverbal children that scientists and caregivers would miss if they waited for children to speak. This study investigates two such capacities: the cognitive capacity to string symbols together to represent more complex concepts and the social capacity to engage in meaningful and mutual dialogue. Both capacities are apparent shortly after children begin to use words. However, I contend that they are present earlier in development and revealed through children's gesturing behavior in gesture-rich environments.

Development of combining symbolic representations

The ability to represent a concept using a symbol is critical not only for language but also for cognition in general. In early childhood, representations can be seen in symbolic play, gestures, and eventually words. These representations become more complex as they are combined and elaborated into symbolic play scenarios and increasingly longer sentences. Symbolic gestures are those used to represent a referent in its absence. They are built out of actions that are either performed on the referent (e.g. throwing motion represents *ball*), by the referent (e.g. flapping arms represents *bird*), or in routines related to the referent (e.g. hands creating circle overhead represents *sun,* learned in song routine). Gestures learned in particular contexts are slowly de-contextualized to represent a concept in its absence (Bates et al. 1980, Werner & Kaplan 1963).

1. Observed by a student caregiver in the UC Davis laboratory school and recorded as an "anecdotal note," systematic participant observations used in training.

Typically developing children begin combining two words around 18 months when they have a vocabulary of 20 to 40 words; deaf children exposed to a signed language begin combining two signs around this same age and with the same vocabulary (20–40 signs) (Caselli 1983). Caselli never observed hearing children combining two gestures nor young deaf children combining two vocal words and concluded that the ability to combine symbols in the same modality depends on the modality of input (1983). However, just prior to producing two-word sentences, typical children will combine a single gesture, usually *point*, with a single word creating a two-concept cross-modal sentence (Goldin-Meadow & Butcher 2003).

Given that hearing children can combine a gesture with a word and that they are capable of learning many symbolic gestures prior to speech, will a child who regularly uses symbolic gestures combine them to form gestural sentences? Will they do this at an age before we expect them to combine words (18 months)?

Development of turn-taking in communication

The ability to engage in turn-taking with another person is a critical skill for successful communication. As early as two months old infants respond contingently to caregivers in face-to-face interactions (Murray & Trevarthen 1986). By 6 months infants intentionally communicate with adults, drawing adults' attention to themselves, and will persist in their attempts until they know they have the adult's attention (Wagner 2006). Infants' communicative skills grow as they incorporate more behaviors into their repertoire of communication tools, including a variety of gestures (Crais, Douglas, & Campbell 2004). By nine months infants interpret adults' gestures as intentional acts indicating the adult's focus of attention and use gaze-following, pointing, and imitation to join in the adults' attentional focus (Tomasello 1999). Around one year infants not only follow another's gaze and pointing but use pointing gestures to share both attention (Liszkowski et al. 2004) and information (Liszkowski, Carpenter, Striano, & Tomasello 2006). In the daily life of a one year old these pointing gestures, often accompanied by vocalizations, are clear attempts to communicate and usually set off an interactional sequence with the adult that may include sharing attentional foci, information, and meaning (Jones & Zimmerman 2003).

Rutter and Durkin (1987) documented the development of vocal turn-taking; they found that the number of turns babies took during interactions with mothers more than doubled between 12 and 24 months. However, they did not assess the number of turns focused on a given topic or during a distinct interchange one might call a *conversation*. Examining infants' use of eye contact to cue a change in turn and their interruptions of mothers' turns, the authors concluded that between 12 and 18 months the coordination of turn-taking relies upon the mother; after 18 months infants began to interrupt less and use gaze more regularly indicating that it is mother's turn (Rutter

& Durkin 1987). These findings seem to indicate that infants under 18 months may not be able to engage in reciprocal turn-taking in any modality, gestural or verbal.

Symbols expand the scope of conversational topics because they enable dialogue about things beyond the here and now. By two years old, children engage in coordinated *verbal* turn-taking with mothers, though mothers still produce more responses. Importantly, when mothers produce a greater number of responses, children produce fewer, perhaps as if they can't get a word in edgewise (Kaye & Charney 1981). The point gesture is an integral part of the development of communicative turn-taking *about* something, an object that is the focus of attention for child and adult. However, pointing is typically limited to communication about proximal objects. If preverbal children had a variety of symbolic gestures to initiate and sustain interactions about a variety of concepts, could they engage in conceptually focused symbolic turn-taking? That is, can preverbal children have *conversations* in the gesture modality in which the child and interaction partner take repeated conversational turns using gestures? Further, would a greater number of adult gestures result in fewer initiations or responses by the child, shortening the number of turns in a conversation?

Current study: Development of gestural sentences and conversations in preverbal children

Given that preverbal children are capable of using a variety of symbolic gestures prior to speech (Acredolo & Goodwyn 1988), I examined whether they could use these gestures in the cognitively and socially complex ways that they would use words in early language development. Specifically I asked:

1. Can infants combine gestures to create gestural *sentences*?
   a. At what age do infants use 2-gesture and 3-gesture combinations?
   b. Does adult modeling of gesture sentences promote infants' gesture sentences?
2. Can preverbal children engage in conceptually focused gestural *conversations*?
   a. At what age do children reply to adult gestures with their own gestures?
   b. When do infants engage in 4-turn gestural turn-taking?
   c. Does adult gesturing behavior support or suppress infants' gestural turn-taking?

Methods

Gesture-rich environment

I documented the development of gestures in 10 hearing infants who were in the infant classroom at the UC Davis Center for Child and Family Studies. In this classroom, adult caregivers modeled the use of specific gestures to represent salient concepts from

the children's environment, for example, tapping fingers against mouth to represent *eat* or tracing index finger from eye down cheek to represent *sad*. Adults were explicitly taught to use a set of symbolic gestures and were instructed to pay attention and respond to infants' gestures. Infants were not explicitly taught to use gestures, but learned them from the adults. This gesture-rich environment provided a unique opportunity to investigate complex uses of gestures by preverbal children.

Participants

The 10 infants were between 4 and 12 months old at the start of the study and 12 to 20 months by the end of the 8 months of data collection. Adult participants were 24 university students studying child development and serving as the infants' caregivers as part of a required internship experience. Student caregivers spent two days each week in the class; there were typically 5 student caregivers and one head teacher in the classroom.

Data collection

Infants and caregivers were videotaped in spontaneous interactions during normal program routines. Each interaction was filmed for 5 minutes; infants were filmed an average of 40 times each over the 8 months. On average, infants were filmed a total of 200 minutes, or approximately 1% of their 360 hours in the classroom.

Coding and transcription

I used microanalytic coding – coding every relevant change in behavior through every second recorded – to capture all gestures by children and caregivers. For the purpose of coding, gestures were defined as intentional, communicative motor behaviors performed in the context of an interaction; markers of interaction context included body orientation or eye gaze towards an interaction partner. For each gesture recorded, coding captured which gesture was performed, who performed it, and when it occurred within the episode. Thus, it was possible to derive a sequence of gestures for one person or a sequence of gestures between two people. Gestures were subsequently coded as serving one of four conversational purposes: (1) Initiation: gesture not preceded by another gesture within 5 seconds[2] (e.g. Infant gestures *bird*); (2) Continuation: gesture

2. Five seconds was used as a conservative yet somewhat arbitrary marker of conversational timing. Through a review of gesturing episodes it was determined that if a child or caregiver were to respond to another's gesture, it would happen within 5 seconds, and those behaviors occurring after 5 seconds were not responses as indicated by changes in attention and gesture content.

preceded by a gesture by same individual within 5 seconds (e.g. Infant gestures *bird* then *points*); (3) Imitation: gesture preceded by same gesture by different person within 5 seconds (e.g. Infant *points* then caregiver *points*); (4) Reply: gesture preceded by different gesture by different person within 5 seconds (e.g. Caregiver *points* then infant gestures *bird*). I used these conversational context codes to determine whether infants or caregivers performed a gestural sentence and how long each sentence was (initiation followed by one or more continuations); and whether there was a gestural conversation (at least one reply or imitation after an initiation) and how many turns were in each conversation.

Coder training and reliability. Coders were naïve to the hypotheses of the current study. They were taught to recognize the gestures through written descriptions and visual demonstrations. Inter-coder reliability was assessed using Cohen's (1960) Kappa. Coders obtained a Kappa of .75 or above on five consecutive episodes before coding independently. Agreement was reassessed on 15% of episodes; Kappa was greater than .82 across all observations.

Variables

Time-invariant. For each infant, there is a variable describing the following:

- Age of entry into the classroom
- Early gesture frequency and variety (average per episode between 10 and 12 months)

Time-varying. For each interaction observed, there is a variable describing the following:

- Infant age
- Infants' and adults' average gestural sentence length
- Infants' and adults' longest sentence length
- Average number of turns per conversation (each turn within 5 seconds of previous)
- Longest conversation

Because so many of the observations included no gesturing by the children, the numerical data are erratic. To smooth the data for statistical modeling, I created running averages for each of the time-varying gesturing variables by averaging three observations together; for example, values in episodes A, B, and C were averaged to create observation 1; values in episodes B,C, and D were averaged to create observation 2; and so on. Further, I created *lagged* running averages for caregiver gesturing variables to capture infants' prior exposure to gestures from adult models. For example, the average caregiver gesturing frequency in observation 1 (average from episodes A, B, and C) was used to predict the level of gesturing in observation 4 (average of episodes D, E, and F).

Analysis

I used multi-level growth models (Singer & Willett 2003) with observations nested within children over time to describe the average developmental trajectories of the length of gestural sentences and conversations from 6 to 20 months of age and to test effects of both child's and caregiver's prior gesturing behavior on those trajectories. I used qualitative transcripts from observations to illustrate the content and context of gesturing interactions between preverbal children and caregivers.

Growth modeling allows me to describe the shape of development of gesture use over time. For both sentence length and conversation length I began with an unconditional baseline model, then added specifications of child age – first just linear, then linear and quadratic, then linear, quadratic, and quartic, etc – until I found the most parsimonious model that explained the most variance just by using child age. After establishing the shape of growth, I added variables for prior and current child and caregiver gesturing behavior, examining their main effects and testing their interactions with child age.

Results

Sentences

The quantitative coding and transcripts created from the videos revealed that infants do indeed combine different gestures to create gestural sentences. Infants begin to form 2-gesture sentences as early as 9 months, but do so more consistently around 11 months. Examples of 2-gesture sentences from the transcripts are the following:

Female, 11.8 months:
Time 00:02:01: *point* (index finger extended toward visual focus)
Time 00:02:03: *star* (fingers apart, extending then retracting repeatedly)

Female, 12 months:
Time 00:01:45: *snack/eat* (closed fingers of one hand tapping mouth)
Time 00:01:50: *more* (closed fingers of both hands tapping each other)

Infants begin to create 3-gesture sentences at around 1 year of age, but this stays a rare occurrence compared to 2-gesture sentences. Examples of 3-gesture sentences are the following:

Male, 11.7 months:
Time 00:02:14: *point*
Time 00:02:15: *wave* (fingers together, extending and closing toward palm repeatedly)
Time 00:02:16: *point*

Female, 12.6 months:
Time 00:00:08: *point*
Time 00:00:10: *bird* (both arms flapping)
Time 00:00:13: *where* (palms turned up at shoulders)

Most gestural sentences included a *point*, and many of the 3-gesture sentences involved a sequence in which the first gesture was repeated after a point, such as *bird, point, bird*.

Figure 1 shows a scatterplot of the length of infants' gestural sentences by age. The overlaid trajectory shows the results of Model B in Table 1. This trajectory reveals a steady increase in gestural sentence length between 9 and 15 months, a flattening between 15 and 18 months, followed by another increase after 18 months. Infant age alone explained only 8% of the within- and between-child variance in sentence length, indicating that other child characteristics or experiences may be important predictors.

As seen in Model C, the younger infants were when they entered the classroom, the longer their gestural sentences were; further, infants' early gesturing frequency and variety, measured between 10 and 12 months, was positively associated with later gestural sentence length. These predictors explained 85% of between-child variance in sentence length.

Caregivers' use of gestural sentences had a negative impact on length of children's sentences (Model D). Controlling for caregivers' current gestural frequency and sentence length, caregivers' prior gestural sentence length was negatively related to children's sentence length. Together these predictors explained 8% of within-child variation and 45% of between-child variation in sentence length.

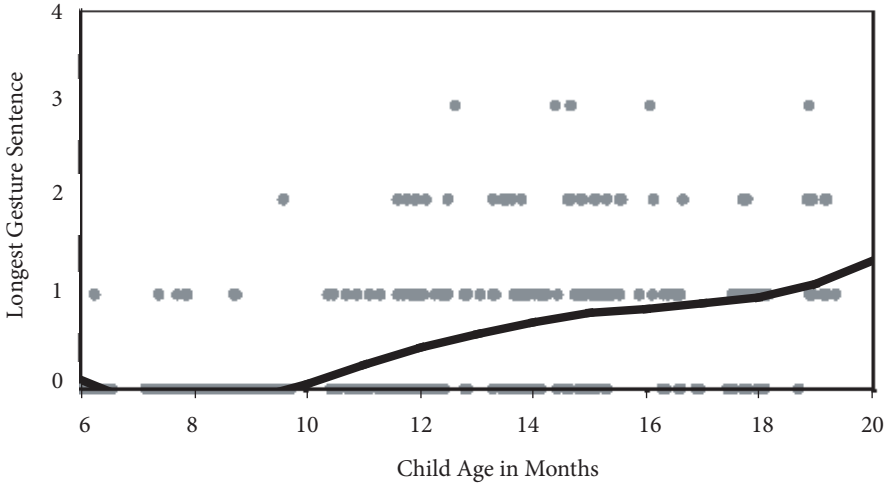

Figure 1. *Scatterplot of infants' longest continuous gestural sentence from 6 to 20 months of age, overlaid with fitted quartic growth model.* NOTE: Height of trajectory is truncated by inclusion of episodes in which children did not gesture.

Table 1. Growth models for the development of children's gesturing sentence length (longest sentence) in a population of 10 infants observed over 8 months

	A. Average means model	B. Average growth	C. Effects of child's early gesturing	D. Effects of caregiver gesturing	E. Effects of child and caregiver gesturing
Fixed Effects					
Initial Status at 6 Months					
Intercept	0.52640***	0.09311	0.61520~	0.05672	0.39730
	(0.07487)	(0.24970)	(0.27960)	(0.24510)	(0.26050)
Age at entry			–0.10180***		-0.06965**
			(0.02721)		(0.02362)
Early gesture frequency			0.31240*		0.28810*
			(0.14410)		(0.12060)
Early gesture variety			0.36780~		0.33720~
			(0.21710)		(0.18550)
Growth over time					
Linear (AGE)		–0.35300~	–0.37370~	–0.26250	–0.31340
		(0.20590)	(0.20360)	(0.19740)	(0.19380)
Quadratic $(AGE)^2$		0.13340*	0.14160*	0.11150*	0.12670*
		(0.0585)0	(0.05776)	(0.05604)	(0.54950)
Cubic $(AGE)^3$		–0.01351*	–0.01456*	–0.01219*	–0.01387*
		(0.00643)	(0.00634)	(0.00614)	(0.00603)
Quartic $(Age)^4$		0.00045~	0.00049*	0.00042~	0.00049*
		(0.00024)	(0.00024)	(0.00023)	(0.00022)
Time-varying effects of caregiver gesturing					
Caregiver prior sentence length				–0.06911**	–0.06934**
				(0.02560)	(0.02559)
Caregiver current sentence length				–0.07743	–0.08294
				(0.06157)	(0.06115)
Caregiver current gesture frequency				.05645***	0.05539***
				(0.01118)	(0.01095)
Variance Components					
Within-child	0.4524***	0.3487***	0.3488***	0.3201***	0.3200***
Between-child	0.0412*	0.0694*	0.0108	0.0385*	0.0042
Fit Statistics: –2LL	754.1	666.1	653.3	631.0	618.6

~ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Conversations

As early as 7 months, infants responded to a caregiver gesture with their own gesture; however, at this age the infants' gestures were the same as the caregivers' gestures. Therefore, they could be motoric imitations rather than conceptual replies to the caregivers' conversational turns. As early as 10 months, but much more regularly at 11 months, infants replied to caregivers' gestures with different gestures related to the same topic. For example, a caregiver gestures "*more, snack*", and the child replies with the "*all done*" gesture.

Episodes with 4 turns are an important marker of true conversation because in these the infant has replied at least once to the caregivers' gestures and has sustained the conceptual focus through at least 3 turns. Infants engaged in 4-turn gestural conversations as early as 11 months.

Below are examples of conversations between children and caregivers. Horizontal alignment of words, gestures, and actions within each turn represent their sequence.

1. *Discussing another's feelings.* Ellen (11.7 months) is sitting on the classroom floor, another child (Brian) is crying nearby.

   Ellen: *waves* <at Brian>
   looking at Brian

   Caregiver: "Ellen, you are waving at Brian."

   Ellen: *cry/sad* (traces finger from eye down cheek)
   looks at caregiver, then looks at Brian,

   Caregiver: "Yes, Ellen, Brian is crying."
   cry/sad

   Ellen: *snack/eat* (fingers of one hand tap mouth)
   looks at caregiver, at Brian, back at caregiver

   Caregiver: "Ellen, you think Brian is hungry?"
   snack/eat

   Ellen: *sleepy/nap* (palms together, under cheek)
   looks at caregiver

   Caregiver: "Ellen, you're thinking Brian is ready for his nap?"
   sleepy/nap

   Ellen: *sleepy/nap*
   crawls away from caregiver and Brian

2. *Finding comfort after mom's departure.* Cindy (13.3 months) is in her caregiver's arms; her mother has just left the classroom.

   Cindy: *point*
   Looks toward the door, extends arm toward door

Caregiver: "Your mom went out that door when she went bye-bye."
w*ave*

Cindy: *wave*
looking at door

Caregiver: "That's right. Mom went bye-bye."
mother (fist running along jaw) *wave*
"You'll see her later at Popsicle Time"
Popsicle (fist tapping chin)

Cindy: *mom*
looks at caregiver

Caregiver: "Yah, you'll see mom at Pops time, later at Pops time."
Mom *Popsicle* *later*

3. *Negotiating play and snack.* Tony (13.5 months) sits at the snack table with his caregiver.

Caregiver: "Do you want more crackers, or are you all done?"
more *all done*
"Do you want more?"
more

Tony: looks outside, then back to caregiver
outside (fingers in loose claw, twisting at wrist)

Caregiver: "You can go play outside when you're all done eating."
play (thumb and pinky extended, middle fingers closed, rotating wrist)
"Do you want more, or all you all done?"
more *all done* (palms down, waving back and forth in front of torso)

Tony: looks at caregiver

Caregiver: "Do you want more snack?"
more

Tony: *all done*
looking at caregiver

Caregiver: "O.k., you're all done. Let's clean up so we can go play."
all done

4. *Clarifying which fish.* Ellen (18.9 months) sits in the book-reading area with her caregiver.

Ellen: *fish* (lips puckered, smacking together)
looks at caregiver

Caregiver: "Do you want to go see the fish in the fish tank?"
fish *point* <across room at tank> *fish*

Ellen: *more* (fingers of each hand together, tapping)
looking at caregiver

Caregiver: "You want more. More of what, Ellen?"
more

Ellen: *point* *yes* (head nods)
looks toward books on the floor

Caregiver: "Oh, you want to read the fish book again?"
"Where is the book?"
where book (palms together, opening out)

Ellen: *point* <at pile of books> *yes*
looks at caregiver, looks back at books

Figure 2 is a scatterplot of the gestural conversation length infants engaged in between 6 and 20 months of age; the overlaid trajectory shows the results of Model B in Table 2. The maximum gesture conversation length observed was 16 turns, though most conversations were less than half that length. Children's age explained 27% of variation in conversation length, indicating that other child or caregiver factors may also predict a dyad's gestural conversation length.

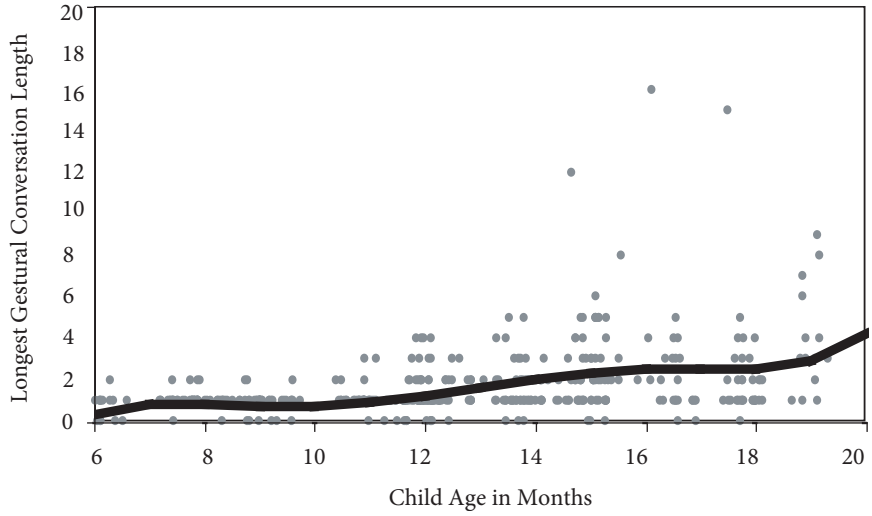

Figure 2. Length of gestural conversation between caregivers and infants from 6 to 20 months of age, overlaid with fitted quintic growth model.

Table 2. Growth models for development of gesturing conversations between children and caregivers for10 infants from 6 to 20 months of age

	A. Average means model	B. Average growth	C. Effects of child's early gesturing	D. Effects of child sentence length	E. Effects of caregiver sentence length
Fixed Effects					
Initial Status at 6 Months					
Intercept	1.61710***	0.17400	1.0757	0.5686~	–0.1646
	(0.17660)	(0.41550)	(0.63850)	(0.2753)	(0.3749)
Age at entry			–0.1568*		
			(0.0730)		
Early gesture frequency			0.7072~		
			(0.3727)		
Growth over time					
Linear (AGE)		1.04250*	1.0355*	0.6930*	0.7373~
		(0.48070)	(0.4793)	(0.3511)	(0.4204)
Quadratic $(AGE)^2$		–0.56710*	–0.5616**	–0.3689*	–0.3554~
		(0.21040)	(0.2098)	(0.1541)	(0.1846)
Cubic $(AGE)^3$		0.12000**	0.1189**	0.07414**	0.07221*
		(0.03892)	(0.0388)	(0.02859)	(0.0345)
Quartic $(AGE)^4$		–0.01013**	–0.01003**	–0.00617	–0.00597*
		(0.00317)	(0.00317)	(0.00234)	(0.00280)
Quintic $(AGE)^5$		0.00030**	0.00030**	0.00018**	0.00017*
		(0.00009)	(0.00009)	(0.00007)	(0.00008)
Time-varying effects of child gesturing					
Current gesture frequency				0.3318***	
				(0.0198)	
Current average sentence length				0.1678*	
				(0.0705)	
Time-varying effects of caregiver gesturing					
Caregiver current gesture frequency					0.09696***
					(0.00908)
Caregiver current avereage sentence length					–0.01449
					(0.04810)
Variance Components					
Within-child	1.0124***	0.6473***	0.6471***	0.3611***	0.4934***
Between-child	0.2772*	0.2997*	0.1767*	0.0244~	0.2004*
Fit Statistics: – 2LL	1054.7	897.6	892.7	670.3	798.1

~ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

As seen in Model C of Table 2, the younger children were when they entered the infant classroom, the longer their later gesturing conversations were. Also, children's early symbolic gesture frequency predicted longer conversations. These two variables accounted for 41% of between-child variance in conversation length. Further, controlling for infants' current gesture frequency, their sentence length was also positively related to conversation length (Model D). In contrast, caregivers' gestural sentence length was unrelated to dyad conversation length when controlling for caregivers' gesturing frequency (Model E).

Discussion and conclusion

Preverbal infants are capable of combining gestures to represent and communicate complex ideas. Infants' early symbolic repertoires predict their later ability to combine symbolic representations in the gestural mode. While adult modeling of symbolic gestures (as measured by gesturing frequency) supports children's gestural combinations, caregivers' own combinations actually suppress children's sentence length. It is as if when adults combine many gestures in sequence, the infants could not get a gesture in edgewise.

Infants can also use gestures to converse with adults who are using both words and gestures. It appears that the earlier children are exposed to gestures and the more representational skills they exhibit through gesture (early gesturing frequency and longer gestural sentences), the more they are able to engage in conceptually focused gestural turn-taking, or conversation. However, aside from a natural association between adults' gesturing frequency and the length of conversations, adults' gesturing behavior does not affect dyad conversations.

Future studies should examine the relationship between gestural combinations and the gesture-word combinations documented by Goldin-Meadow and colleagues (Iverson & Goldin-Meadow 2005, Ozçaliskan & Goldin-Meadow 2005) as spoken language emerges. Since use of symbolic gestures with children is associated with earlier vocabulary production (Goodwyn, Acredolo, & Brown 2000), we may hypothesize that symbolic gesture use predicts children's earlier use of gesture-gesture and gesture-word combinations. This should be tested experimentally. Further, since children's gesture--speech combinations elicit more complex language from adults (Goldin-Meadow, Goodrich, Sauer, & Iverson 2007), we may ask whether children's gesture-gesture combinations also elicit more responsive language from adults. This may in part explain the relationship between symbolic gesture use and advanced language development.

In conclusion, given a rich gesture environment, infants can create gestural sentences and converse in the gestural mode. They make use of gestures to negotiate requests, describe observations, and even discuss abstract concepts such as future events and the internal states of others. Children's symbolic gestures reveal the representational and communicative capacities that do not wait for words.

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