

## GESTURING IN MOTHER–CHILD INTERACTIONS

**Jana M. Iverson**  
Indiana University

**Olga Capirci**  
Italian National Council of Research (CNR)

**Emiddia Longobardi**  
University of Rome “La Sapienza”

**M. Cristina Caselli**  
Italian National Council of Research (CNR)

Numerous studies have indicated that when adults interact with very young children, they modify their speech in a consistent fashion. Although the characteristics of these modifications have been well documented, relatively little is known about the frequency and types of gestures that accompany adults' speech to young children. The present study was designed to provide data on maternal use of gesture during mother–toddler interactions and to assess whether maternal use of gestures changes as children's speech becomes progressively more complex. Twelve upper-middle-class Italian mother–child dyads were videotaped in their homes for 45 min when children were 16 and 20 months of age. Results indicated that mothers made use of a “gestural motherese” characterized by the relatively infrequent use of concrete gestures redundant with and reinforcing the message conveyed in speech. In addition, individual differences in maternal gesture and speech production were highly stable over time despite substantial changes in children's use of

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Direct all correspondence to: Jana M. Iverson, Dept. of Psychology, Indiana University, Bloomington, IN 47405 <jiverson@indiana.edu>.

gesture and speech, and there was some evidence for positive relations between maternal gesture production and children's verbal and gestural production and vocabulary size within and across observations. Findings are discussed in terms of the functions that maternal gesture may serve for young language learners.

Numerous studies have indicated that when adults interact with very young children, they modify their speech in a consistent fashion. Various terms have been used to describe this speech register, including "motherese," "baby talk," or "child-directed speech," characteristics of this speech register include the use of relatively simple words embedded in short phrases and sentences and highly variable patterns of intonation (see Snow, 1995, for a review). Research has indicated that these qualities are not specific to adults' speech to children: similar modifications have been observed in children's speech to their younger siblings (Shatz & Gelman, 1973; see Barton & Tomasello, 1994, for a review) and in speech to older but less proficient speakers (e.g., "foreigner talk"). And although the use of infant-directed speech is not culturally universal (e.g., Ochs & Schieffelin, 1984; Pye, 1986), the nature of the modifications made in speech to young children appears to be similar across a variety of different European and Asian languages (Fernald et al., 1989; Grieser & Kuhl, 1988; Masataka, 1992).

To date, the majority of research on children's communicative input has focused on speech, and little attention has been paid to other aspects of adults' communications with children. Thus, for example, whereas there is now a relatively large literature describing adults' use of gesture in interactions with other adults (e.g., Kendon, 1992, 1995; McNeill, 1992) and serious interest has focused recently on young children's production of gestures (e.g., see the chapters collected in Iverson & Goldin-Meadow, 1998), relatively little is known about the frequency and types of gestures produced in the context of adult-child interactions or the relation between gestural input and children's communicative development. The present study was designed to provide data on maternal use of gesture during mother-toddler interactions and to describe how maternal use of gestures changes as children's speech becomes progressively more complex. A further goal was to provide preliminary data on links between maternal gesture and children's use of gesture and speech.

Only two prior studies have looked at maternal gesture use in the context of mother-child interaction. In one such study, Bekken (1989) asked mothers to interact with their 18-month-old daughters in an everyday play situation and examined the extent to which mothers altered their gestures when interacting with their children by including another adult in the interactional triad. She found that relative to adult-adult conversations, mothers gestured less frequently, used fewer of the fluid hand-waving gestures that are characteristic of adult interactions, and produced a larger number of conceptually simple gestures such as

POINTING when speaking to their children.<sup>1</sup> These findings are consistent with results previously reported by Shatz (1982, p. 112), who noted that "... the set of physical gestures used with children [...] can be described as a simple one, with a small number of discrete gesture types distributed in a one-to-one relationship with utterances."

The present study was designed to extend the findings reported by Bekken (1989) and Shatz (1982) in two ways. First, both studies examined maternal gesture use in the context of interaction between American mothers and their children. Because recent research has revealed large cultural differences in the way in which gestures are used in adult interactions (Kendon, 1992, 1995), one aim of the present research was to provide information on gesturing in Italian mothers, who come from a "gesture-rich" culture (Kendon, 1992). Specifically, we wished to determine whether the features of maternal gesture production described by Bekken and Shatz were also characteristic of gestures that Italian mothers produced when interacting with their Italian-learning children.

Second, both Bekken (1989) and Shatz (1982) sampled maternal gesture at only one child age point and were thus unable to describe whether and how maternal gesture changes with children's linguistic abilities. In the present study, we analyzed data from longitudinal observations of Italian mothers and their children conducted when the children were 16 and 20 months of age. These age points were selected because children typically reach the transition from one- to two-word speech at some point between these two ages.<sup>2</sup> By examining maternal gesture production during the time of this transition, we hoped to explore the extent to which maternal gesture varies as a function of children's age and growing communicative competence.

Finally, this study was also designed to explore potential links between maternal gesture and children's use of gesture and speech. Although there is now a large body of research reporting strong relations between maternal speech input and children's language development (e.g., Hampson & Nelson, 1993; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991), we do not yet know whether similar relations might obtain between maternal gesture production and children's use of gesture and speech. Although Shatz (1982) has argued that gestures cannot provide children with consistent information about syntactic and pragmatic aspects of the language they hear, potential links between maternal gesture and other domains of language learning have not yet been explored. In the present research, we examine the extent to which maternal gesture may be related to early lexical acquisition. We reasoned that children's vocabulary development may be

<sup>1</sup> Gestures described in this paper will be denoted in small capitals.

<sup>2</sup> This was the case, for example, with most of the children in our sample. Whereas only 5 two-word combinations were produced *in toto* at 16 months and by only 4 children, 157 two-word combinations were produced by 10 children at 20 months.

influenced by maternal gesture use because gestures (particularly deictic gestures) can single out a referent from other objects in the context and make its relation to accompanying speech more salient, thereby providing a young listener with additional sources of information about word-referent links.

In sum, the aim of this study was threefold: (a) to examine the quantity and types of gestures produced by Italian mothers and the informational contribution made by gesture to messages conveyed in maternal speech; (b) to evaluate differences in maternal gesture as a function of children's age; and (c) to determine whether maternal gesturing is related to aspects of children's communicative and early language development.

## METHOD

### Participants

Twelve upper-middle-class Italian mother-child dyads living in the Rome area served as subjects for the present study. Participants were selected randomly from a larger group of 23 mother-child pairs observed as part of a study evaluating the efficacy of a structured parental questionnaire assessing children's communicative and linguistic development at 12, 16, and 20 months (Camaioni, Caselli, Longobardi, & Volterra, 1991). All of the mothers had completed at least some post-high school education (6 had professional diplomas and 6 had university degrees), and nine worked at least part-time outside the home. The children (6 males and 6 females) were all developing normally. Of the 12 children, 5 were first-born, 6 were second-born, and 1 was third-born. Five children attended day care outside the home on a regular basis.

### Procedure

Two videorecorded observations were made for each dyad: one when the child was 16 months of age and the other at 20 months. Two researchers divided the families between them for single-researcher visits. Sessions were videotaped in the home and lasted approximately 45 min. Mothers were encouraged to play and interact with their child as they normally would, while the experimenter carefully avoided interfering with mother-child interaction. Observations were divided equally into three 15-min segments, so that the dyads were filmed in three different contexts: play with new examples of familiar objects (a set of toys provided by the experimenter), play with familiar objects, and meal or snack time. For purposes of the analyses reported here, data from the observations were collapsed across contexts.

### Coding and Analysis

**Utterances in Speech and Gesture.** All intelligible speech and gesture produced by the mothers was transcribed from the videotapes. Transcripts of mater-

nal speech and gesture were then divided into utterances based on criteria described by Devescovi and Pizzuto (1995; see also Crystal, 1985). An utterance was defined as any sequence of words and/or gestures (which may or may not be grammatically structured) that is preceded and followed by silence, a change of conversational turns, or a change in intonational patterns. In addition, the total number of words produced by each mother was calculated for the two sessions separately.

After utterances were identified, they were grouped into three categories on the basis of whether they consisted of speech only, gesture only, or both spoken and gestured elements. *Speech only* utterances were those in which no gestures were executed. Utterances were classified as *gesture only* if they consisted of a gesture that was produced without any accompanying speech. Any utterance in which a gesture co-occurred with speech was included in the *speech + gesture* category regardless of the temporal nature of their overlap.<sup>3</sup> Thus, utterances in the speech + gesture category consisted of one gesture + one word, one gesture + one multiword utterance, two or more gestures + one multiword utterance, or one gesture + two or more multiword utterances. Examples of each utterance type are given in the coding scheme presented in Table 1.

**Types of Gestures.** All maternal gestures were classified into one of four categories. *Deictic gestures* indicate only the occurrence of an event or the existence of an object. Because the form of the gesture bears no direct resemblance to its referent, deictic gestures express communicative intent by presenting objects for another's attention.

Three types of deictic gestures were coded: SHOWING, INDICATING, and POINTING. A gesture was coded as SHOWING when an object was held up in the center of the gesture space and oriented toward the interactive partner. The category of INDICATING gestures consisted of gestures that served to single out a person, object, location, or event through movements of the whole hand, the head, or direct contact with the object or location being indicated (e.g., taps on objects, touches on objects). Finally, gestures were classified as POINTING when a finger (usually the index) was extended toward a specific person, object, location, or event.

<sup>3</sup> The decision to collapse all maternal speech + gesture utterances into a single category was made on the basis of preliminary analyses of the timing relationship between maternal gestures and speech. Although mothers could, in principle, start by speaking and then add a gesture, or say a word and then produce a gesture, we found that a majority of mothers' gestures (70% at 16 months and 60% at 20 months) co-occurred with complete utterances; that is, the gesture was executed as an utterance was begun and was held until the utterance was completed (e.g., POINTING while saying, ["That's a yellow flower."]); the square brackets indicate the execution and hold phase of the gesture). At both ages, the remaining 30% and 40% of speech + gesture utterances consisted of instances in which the gesture was executed with a portion of the spoken utterance (e.g., "Look at the [big brown bear].")

**Table 1. Coding Scheme with Illustrative Examples of the Structure and Information Conveyed in Maternal Gesture/Speech Utterances**

	Examples
(a) Structures	
1 gesture + 1 word	YES + 'carota' <carrot> POINT (to a picture) + 'vedi' <see>
1 gesture + 1 multiword utterance	NO + 'non si scrive suo soldi' <we don't write on money> SHOW (a cookie) + 'questo chi lo mangia?' <who will eat this?>
1 gesture + 2 or more multiword utterance	ALL GONE + 'l'altra macchina? Io la vedo. Dov'è?' <The other car? I see it. Where is it?> YES + 'cacca? Adesso ci cambiamo' <Dirty? Let's change you now.>
2 or more gestures + 1 multiword utterance	POINT (to photo of child), POINT (to his cap) + 'il bimbo col cappello' <the boy with the hat> YES, EMPHATIC (palm raised) + 'è come un bau bau' <it's like a doggy>
(b) Information conveyed	
Reinforce	EMPHATIC (hand moves horizontally) + 'abbiamo chiuso' <we're done> NO + 'no in bocca' <not in your mouth> SHOW (a banana) + 'la banana' <the banana>
Disambiguate	POINT (at toy bag) + 'guarda' <look> POINT (to a toy car) + 'questa' <this one>
Add	POINT (to toy telephone) + 'bello' <beautiful> POINT (to dad's photo) + 'a chi somiglia?' <who does this look like?>

*Note.* Gestures in the table are indicated in small capitals with their referents in parentheses. Italian words are given in lower case letters in single quotes, followed by their English translations in angle brackets.

*Conventional gestures* are gestures whose form and meaning is culturally defined. Such gestures may be specific to the Italian repertoire (e.g., rotating the index finger on the cheek for GOOD; repeatedly opening and closing four fingers, thumb extended and palm facing the body for CIAO; index finger extended upward moving side to side for NO) or less culturally specific (e.g., shaking the head NO; nodding the head YES; turning and raising the palms upward for ALL GONE).

*Representational gestures* (referred to by others as "iconic" or "pictographic" gestures; McNeill, 1992; Poggi & Magno Caldognetto, 1996) refer to objects, persons, locations, or events through hand movements, body movements, or facial expressions. Such gestures differ from deictic gestures in that they represent attributes or actions of specific referents and their meaning does not change appreciably across different contexts (e.g., opening and closing the mouth for

FISHIE; holding hands formed as circles in front of eyes for BINOCULARS; extending and retracting the index finger for SNAIL).<sup>4</sup>

Finally, all nonrepresentational gestures that do not have specific semantic content, do not refer to precise referents, and are not linked to specific hand-shapes were classified as *emphatic gestures*. Such gestures serve to highlight aspects of discourse structure and/or the content of accompanying speech (e.g., moving a flat hand downward; extending the arms outward; making a circling motion with a flat hand) and are often executed during speech in a rhythmic fashion (e.g., McNeill, 1992; Poggi & Magno Caldognetto, in press).

**Informational Relation Between Gesture and Speech.** All utterances consisting of both speech and gesture were categorized according to the informational contribution made by the gestured portion of the utterance to the overall message conveyed in speech. Utterances were thus grouped into three different categories. Examples of utterances from each category are presented in Table 1.

In the first category, gesture emphasized or conveyed the same semantic information as elements in the verbal portion of the utterance. Gesture, in other words, reinforced the message conveyed in speech. This category included all instances of utterances that incorporated an emphatic gesture, utterances containing a conventional gesture and its verbal equivalent (e.g., ALL GONE + "all gone"), and utterances in which an object or event was named in speech and indicated with a deictic gesture (SHOWING, INDICATING, or POINTING).

The second category consisted of utterances in which gesture *disambiguated* the message conveyed in speech. In these instances, gesture served to identify the precise referent of the verbal portion of the utterance. Included in this class were utterances pairing a deictic gesture with demonstrative and locative expressions (e.g., "this," "that," "here," "there"), personal and possessive pronouns (e.g., "my," "mine"), or attention-directing expressions (e.g., "Look!"; "See!").

The third category contained utterances in which gesture *added* information to the message that was not explicitly communicated in speech. The majority of utterances within this category consisted of instances in which the gestured portion of the utterance (usually a deictic gesture) indicated the referent of the utterance, whereas the verbal portion described an attribute of the referent.

**Measures of Children's Speech and Gesture Production.** All of the children's communicative and intelligible gestures and words were also transcribed from the videotapes. Gestures and words were considered to be communicative if

<sup>4</sup>In previous work on children's use of communicative gestures, we included conventional gestures in the broader category of representational gestures because they contain relatively fixed semantic content that does not vary with context. In this study, however, conventional gestures were classified into a separate category because they are conventional routines with uncertain symbolic status even in adult language and culture and thus are not truly representational in the way that iconic gestures are.

they were accompanied by eye contact with an interactive partner, vocalization, or other clear evidence of an effort to direct the attention of another person present in the room. Only gestures and words meeting these criteria were included for analysis (see Capirci, Iverson, Pizzuto, & Volterra, 1996; Iverson, Capirci, & Caselli, 1994, for further details).

In the present study, four measures of children's communicative production were employed. The first two, *word types* and *gesture types*, were obtained by respectively totaling the number of different words and number of different gestures produced by each child during each of the observations. This measure reflects the size of children's vocabularies in each modality. The remaining two measures, *word tokens* and *gesture tokens*, focused on children's overall productivity during the observations and were obtained by respectively summing the total number of words and total number of gestures (including repetitions) produced by each child during each observation.

**Reliability.** Interobserver reliability was assessed by having a second trained observer independently transcribe maternal gestures produced during three randomly selected observations (i.e., 10% of the total observations). Using the formula two times the number of agreements divided by the total number of observations made by Coder 1 plus the total number of observations made by Coder 2 (Kratonchwill & Wetzel, 1977; Sears, Rau, & Alpert, 1965), interobserver agreement was 92% ( $N = 372$ ) for identifying instances of maternal gestures and 99% ( $N = 172$ ) for identifying maternal gesture types (i.e., classifying gestures as either deictic, conventional, representational, or emphatic).

## RESULTS

The aim of this study was to describe maternal gesture production in the context of Italian mother-child interactions at two age points and to explore whether maternal gesturing is related to children's communicative development. To provide a context for the analysis of maternal gesture, we begin by briefly describing the verbal and gestural production of the children in our dyads. In examining maternal gesture production, we then focus on the amount and types of gestures produced by mothers and the informational relation between maternal gestures and speech. Finally, we assess the relation between maternal and child gesture and speech production within and across observations.

### Children's Production of Gesture and Speech

Our first analyses focused on children's production of gesture and speech in terms of both types and tokens. With respect to types, the number of different gestures in children's gestural repertoires remained almost unchanged between 16 ( $M = 9.58$ ,  $SD = 2.87$ ) and 20 months ( $M = 10.0$ ,  $SD = 4.55$ ; Wilcoxon  $T = 30.5$ ,  $ns$ ). As expected, there was tremendous growth in vocabulary size across

observations. At 16 months, children produced an average of about 25 different words ( $SD = 78.71$ ), and by 20 months, the average size of children's vocabularies had more than doubled ( $M = 64.08$ ,  $SD = 79.47$ ), an increase that was statistically significant ( $T = 0$ ,  $p < .01$ ).

With respect to tokens, mean gesture production increased between 16 and 20 months, although the difference was not statistically reliable ( $M_{16} = 49.75$ ,  $SD = 28.09$ ;  $M_{20} = 73.5$ ,  $SD = 40.61$ ;  $T = 17$ ,  $ns$ ). Whereas the absolute number of gestures increased over time, children's relative use of gesture and speech changed between 16 and 20 months, with gesture accounting for approximately 42% ( $SD = .29$ ) and 27% ( $SD = .23$ ) of total communication at 16 and 20 months, respectively. The proportionate decline in gesture production was due to a sharp and significant increase in word production during this time ( $M_{16} = 67.08$ ,  $SD = 78.71$ ;  $M_{20} = 197.08$ ,  $SD = 136.8$ ;  $T = 0$ ,  $p < .01$ ), an increase that was also evident in the production of 11 of 12 individual children.

### Mothers' Production of Gesture and Speech

**Amount of Gesture.** We first examined mothers' production of gesture in terms of the number of utterances consisting of speech alone, speech with gesture, and gesture alone. At both observations, the majority of maternal utterances consisted of speech alone ( $M_{16} = 452.92$ ,  $SD = 91.74$ ;  $M_{20} = 464.75$ ,  $SD = 135.46$ ). Utterances containing both speech and gesture were the next most frequent ( $M_{16} = 73.92$ ,  $SD = 33.03$ ;  $M_{20} = 78.67$ ,  $SD = 39.76$ ), whereas utterances consisting of gesture alone occurred rarely ( $M_{16} = 3.92$ ,  $SD = 3.84$ ;  $M_{20} = 4.16$ ,  $SD = 2.4$ ). Taken together, these latter two categories (i.e., utterances with gesture) accounted for only about 15% of all maternal utterances. At both observations, in other words, children's production of gesture was much higher than that of mothers.

Within the category of maternal utterances containing both speech and gesture, the vast majority at both 16 and 20 months consisted of a multiword utterance accompanied by a gesture ( $M_{16} = 74\%$ ,  $SD = .08$ ;  $M_{20} = 72\%$ ,  $SD = .07$ ). Single words accompanied by a gesture were next most frequent ( $M_{16} = 18\%$ ,  $SD = .08$ ;  $M_{20} = 18\%$ ,  $SD = .06$ ), whereas single utterances with multiple gestures ( $M_{16} = 2\%$ ,  $SD = .02$ ;  $M_{20} = 4\%$ ,  $SD = .03$ ) and multiple utterances accompanied by a single gesture ( $M_{16} = 6\%$ ,  $SD = .06$ ;  $M_{20} = 6\%$ ,  $SD = .06$ ) were relatively uncommon.

In comparing maternal gesture production across the two observations, no significant differences were observed in the distribution of utterance types across the two observations (Wilcoxon  $T_{s \text{ alone}} = 34.5$ ,  $ns$ ;  $T_{s + g} = 33.5$ ,  $ns$ ;  $T_{g \text{ alone}} = 34.5$ ,  $ns$ ). However, large individual differences in overall speech and gesture production were observed among mothers at the two observations. Spearman rank-order correlations indicated a high degree of stability in these differences, both for the production of utterances consisting of speech alone ( $r_s = .54$ ,  $p < .05$ ) and for utterances with gesture ( $r_s = .81$ ,  $p < .007$ ).

**Types of Gestures.** As previously discussed, gestures were classified as deictic (SHOWING, INDICATING, and POINTING), conventional (e.g., CLAO), representational (e.g., SPIN), or emphatic (e.g., moving the head from side to side in time with accompanying speech). The distributions of maternal gesture types at both observations are presented in Figure 1.

As is evident in the figure, the majority of gestures produced by mothers at both observations were deictic ( $M_{16} = 41.0$ ,  $SD = 15.8$ ;  $M_{20} = 39.67$ ,  $SD = 25.2$ ), or conventional ( $M_{16} = 29.17$ ,  $SD = 18.09$ ;  $M_{20} = 34.5$ ,  $SD = 18.21$ ). Among deictic gestures, POINTING ( $M_{16} = 77\%$ ;  $M_{20} = 72\%$ ) was most common, with SHOWING ( $M_{16} = 17\%$ ;  $M_{20} = 20\%$ ) and INDICATING ( $M_{16} = 6\%$ ;  $M_{20} = 9\%$ ) following in that order. Representational ( $M_{16} = 4.25$ ,  $SD = 3.89$ ;  $M_{20} = 6.33$ ,  $SD = 5.65$ ) and emphatic gestures ( $M_{16} = 6.16$ ,  $SD = 6.08$ ;  $M_{20} = 7.16$ ,  $SD = 4.97$ ) were much less common. These distributions are different from those that have

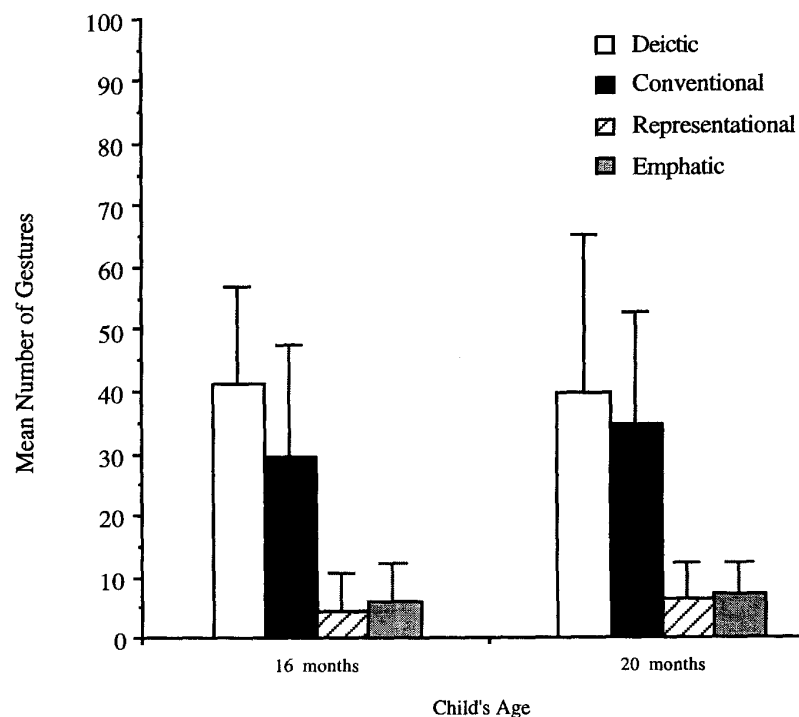


Figure 1. Mean number of deictic, conventional, representational, and emphatic gestures produced by mothers at the two observations.

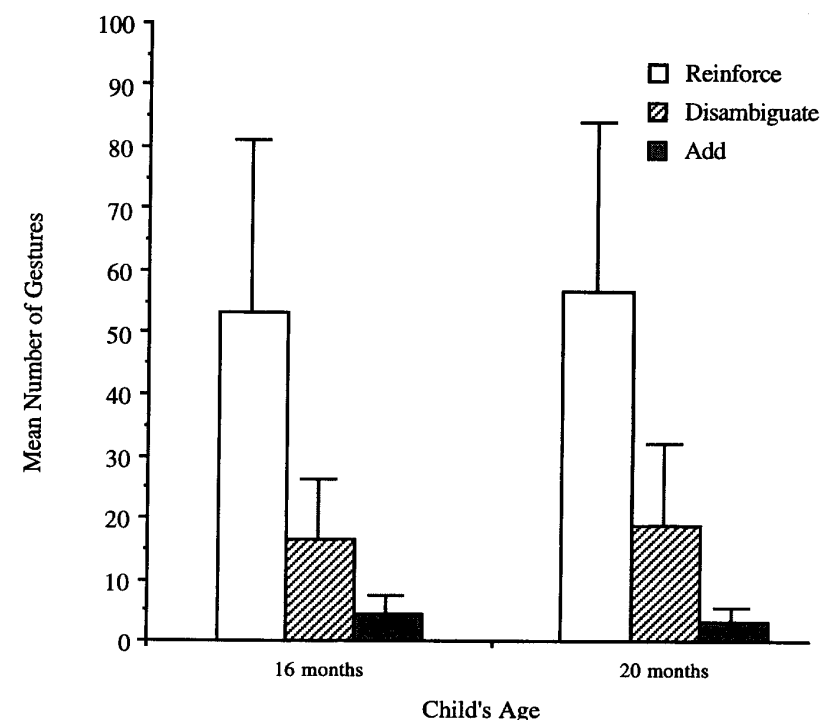


Figure 2. Mean number of maternal gestures that reinforced, disambiguated, and added information to speech at the two observations.

been reported for mother–adult conversations (Bekken, 1989), in which deictic and metaphoric (included in our emphatic category<sup>5</sup>) gestures were produced with roughly equal frequency (32% and 28% of total gestures respectively). Comparison of maternal gesture patterns at 16 months with those at 20 months revealed no significant differences in the production of any of the 4 gesture types over time (Wilcoxon  $T_{\text{deictic}} = 33.5$ ,  $ns$ ;  $T_{\text{conventional}} = 17$ ,  $ns$ ;  $T_{\text{representational}} = 13.5$ ,  $ns$ ;  $T_{\text{emphatic}} = 23.5$ ,  $ns$ ).

**Informational Relation Between Gestures and Speech.** As noted earlier, all utterances containing both speech and gesture were categorized as *reinforce* (e.g., YES + “Yes, I know that Mommy is ugly.”), *disambiguate* (e.g., POINT to

<sup>5</sup> Because metaphoric and emphatic gestures were produced relatively infrequently by the mothers in this sample, we collapsed these two gesture types into a single category.

floor + "Put it over there."), or *add* (e.g., POINT to toy telephone + "pretty") according to the informational role played by gesture with respect to speech (see Table 1 for additional examples). These distributions are presented in Figure 2.

As is apparent in the figure, at both observations a majority of maternal gestures served to reinforce the message conveyed in speech ( $M_{16} = 53.25$ ,  $SD = 27.75$ ;  $M_{20} = 56.67$ ,  $SD = 27.82$ ). Utterances in which gesture disambiguated the verbal message were somewhat less frequent ( $M_{16} = 16.5$ ,  $SD = 9.81$ ;  $M_{20} = 19.0$ ,  $SD = 13.09$ ), whereas utterances in which gesture added information to that conveyed in speech were relatively uncommon ( $M_{16} = 4.17$ ,  $SD = 3.63$ ;  $M_{20} = 3.0$ ,  $SD = 2.83$ ). No significant differences were found in the number of utterances in each of the three categories across observations (Wilcoxon  $T_{reinforce} = 32.5$ , *ns*;  $T_{disambiguate} = 30.9$ , *ns*;  $T_{add} = 16.5$ , *ns*).

In summary, analyses of maternal gesture production revealed that when mothers gestured, their gestures tended to co-occur with speech, consisted primarily of deictic gestures that served to indicate referents in the immediate context, and were redundant with information conveyed in speech. Moreover, although mothers varied widely in production of speech and gesture, these individual differences as well as overall productivity remained stable across the two observations.

#### Relations Between Maternal and Child Speech and Gesture Production

Given the large individual differences that existed in both maternal and child production of speech and gesture, our final set of analyses focused on the extent to which maternal and child speech and gesture production were related. To ex-

**Table 2. Spearman Rank-Order Correlations Between Maternal and Child Speech and Gesture Measures**

Mother	Child		
	Gesture Production	Vocabulary Size	Word Production
16 months			
Verbal Production	.52*	.55*	.56*
Gesture Production	.51*	.47	.42
Pointing Gesture Production	.34	.54*	.47
20 months			
Verbal Production	.56*	.52*	.57*
Gesture Production	.46	.11	.18
Pointing Gesture Production	.60*	.24	.29
Predictive Relations <sup>a</sup>			
16 Months			
Verbal Production	.52*	.19	.48
Gesture Production	.58*	.34	.53*
Pointing Gesture Production	.13	.38	.32

Note. <sup>a</sup>Child at 20 months.

\* $p < .05$ .

plore these relations, two sets of rank-order correlations were computed. The first set of analyses assessed relations between mothers' overall production of speech and gesture and children's overall production of words, gestures, and vocabulary size both within and between the 16- and 20-month sessions. The second set of analyses was parallel to the first, except that individual differences in overall volubility were statistically controlled via the use of partial rank correlations. For these analyses, *total verbal production* was defined for both mothers and children as the total number of word tokens produced in a session, *total gesture production* as the total number of gesture tokens produced in a session, and children's *vocabulary size* as the total number of word types (i.e., number of different words) produced in a session. These data are presented in Table 2.

Looking first at relations within each of the two observation times, total maternal verbal production at 16 months was significantly correlated with children's gesture production, vocabulary size, and total verbal production, and total maternal gesture production was significantly correlated with children's total gesture production. In addition, mothers' production of POINTING gestures<sup>6</sup> was significantly correlated with children's vocabulary size.

At 20 months, the positive relations between maternal verbal production and children's gesture production, vocabulary size, and verbal production remained significant. Maternal and child gesture production continued to be positively (although not significantly) related, and maternal POINTING was now significantly related to children's gesture production. Correlations between maternal production of POINTING gestures and children's verbal production and vocabulary size were smaller and no longer significant.

Across observations, overall maternal gesture production at 16 months was found to be positively and significantly related to both children's overall verbal production and overall gesture production, but not to vocabulary size at 20 months. Overall maternal verbal production at 16 months was also significantly related to children's gesture production at 20 months. Whereas maternal verbal production at 16 months was positively correlated with children's verbal production and vocabulary size at 20 months, and maternal use of POINTING gestures at 16 months was positively correlated with both children's verbal production and vocabulary size at 20 months, none of these relations was statistically significant.

Because correlations between maternal and child speech and gesture production may reflect the overall communicativeness of the mother (i.e., mothers who gesture extensively may do so because they talk more and thus have more oppor-

<sup>6</sup>The referential status of gestures that are produced with an object in hand (such as SHOWING and INDICATING) is a topic of considerable debate (e.g., Petitto, 1988). Although we believe that SHOWING and INDICATING are gestures inasmuch as they communicate information to a listener, we have excluded them from our correlational analyses to ensure that our measure of the relationship between maternal gesture and children's communication is a conservative one.

tunities to gesture relative to mothers who are less communicative), Kendall partial-rank correlations were computed for each of the five significant raw correlations between maternal gesture and child speech and gesture measures reported above. With total maternal verbal production partialled out, all of the resulting partial correlations were positive, ranging between .19 and .31, but none was statistically reliable.

### DISCUSSION

In this study, we examined the nature and content of gestures produced by Italian mothers as they interacted with their children when the children were 16 and 20 months of age, respectively. The goals of the research were to describe maternal gestures, evaluate differences in maternal gesture as a function of children's age, and relate maternal gesture and speech production to communicative development in children.

The study had two main sets of findings: (a) although mothers gestured relatively infrequently when talking to their children, when mothers did gesture, their gestures tended to co-occur with speech, to be conceptually simple, to refer to the immediate context, and to reinforce the message conveyed in speech; and (b) mothers varied widely in overall production of gesture and speech, and overall productivity levels as well as these individual differences were highly stable over time despite striking proportionate changes in children's use of gesture and speech. In addition, we obtained some evidence for the existence of positive relations between maternal gesture production and children's verbal and gestural production and vocabulary size both within and across observations. We consider each of these findings in turn.

#### How Mothers Gesture When Interacting with Their Children

Previous work on the use of gesture by American mothers interacting with their young children has indicated that maternal gesture is sensitive to the developmental level of the interlocutor. When mothers talk to young children, for example, they gesture proportionately less and make less use of abstract metaphoric and beat gestures than when they talk with other adults (Bekken, 1989). Our results with Italian mother-child dyads replicate these findings and extend them to mothers from a gesture-rich culture. Although almost all maternal gestures occurred with multiword utterances, only about 15% of utterances were accompanied by gesture. This result is strikingly similar to those reported by Shatz (1982) and Bekken (1989) for American mothers, both of whom also found that gesture co-occurred with only about 15% of maternal utterances.

Whereas we did not specifically observe the mothers in our study in interaction with another adult, the fact that rate of maternal gesture production in our Italian mother-child interactions (15% of all utterances) was much lower than that previously obtained for American mothers interacting with other adults

(24% of all utterances; Bekken, 1989) suggests that Italian mothers are also gesturing less with their children than they would with another adult. This is particularly striking in light of the fact that at both observations, the proportion of maternal utterances containing gesture was much lower than that for children. The relatively low rate of maternal gesture was not, in other words, a simple reflection of low gesture rates in the children with whom they were speaking.

Most maternal gestures were either deictic or conventional; the emphatic gestures that are characteristic of adult conversations were observed infrequently. This result is also consistent with those of Bekken (1989; see also Shatz, 1982), who reported a sharp reduction in production of metaphoric and beat gestures (gestures that were included in our emphatic gesture category) in mother-child relative to mother-adult interactions. The finding that emphatic gestures were produced so infrequently in this sample is especially interesting given the large repertoire and extensive use of such gestures in Italian culture (Kendon, 1995; Magno Caldognetto & Poggi, 1995).

We also found that the vast majority of maternal gestures functioned to reinforce the message conveyed in speech. Mothers' gestures, in other words, rarely provided information that was not already present in the verbal message. This is in marked contrast to what is typically reported for adult-adult interactions, in which gesture generally complements or supplements information conveyed in speech (McNeill, 1992).

Given that gesture and speech frequently provide such complementary information in adult interactions, why doesn't this happen in mother-child communication? One possibility is that the enhanced use of gestures to reinforce or disambiguate, rather than supplement, portions of the verbal utterance reflects an effort on the part of the mother to accommodate the needs of a young listener. Because young children may have difficulty processing information conveyed uniquely in gesture, mothers may shift the burden of information communication to speech and use gestures primarily to highlight and reinforce aspects of their verbal message. Support for this view is provided by data from experimental studies of children's gesture comprehension. Although children under the age of 2 readily comprehend POINTING and other deictic gestures, they give little evidence of understanding representational gestures (either when presented alone or with speech), even when the gestures are among those in their productive repertoires (Morford & Goldin-Meadow, 1992; Petitto, 1988).<sup>7</sup>

Taken together, our results on maternal gesture production suggest that moth-

<sup>7</sup> Note, however, that this argument cannot be generalized to children who are exposed to sign language. This study was conducted with hearing children never exposed to sign language input, for whom gestures are an *accompaniment* to the primary message conveyed in the speech stream. Children who are acquiring a manual language readily comprehend representational gestures and signs and do so from an early age.



ers modify their gestures in consistent and unique ways when talking to their children. In effect, mothers appear to be using a kind of gestural motherese characterized by fewer and more concrete gestures redundant with and reinforcing the message conveyed in speech. Not only are mothers' gestures tightly linked to the immediate linguistic and extralinguistic context, but they appear to be used with the goal of underscoring, highlighting, and attracting attention to particular words and/or objects. Gestures that cannot be used for this purpose such as the emphatic gestures widely used by Italian adults when speaking to other adults are virtually eliminated from the communicative repertoire when mothers speak to their children.

### Individual Differences and Stability in Maternal Input

The present study provides data indicating that just as there are large individual differences in the amount of speech that mothers produce with their children (see Pine, 1994; Snow, 1995) and relative stability in maternal speech production over time (e.g., Huttenlocher et al., 1991), so too are there large individual differences and relative stability in the extent to which mothers gesture during mother-child interaction. That we observed such a high degree of consistency in gesture production among mothers is somewhat surprising in light of the tremendous changes occurring in children's relative use of gesture and speech over this same period. It is now well established that the relation between gesture and speech in children's communicative systems is reorganized sometime between the ages of 16 and 20 months, just prior to the transition to two-word speech (e.g., Caselli, 1990; Goldin-Meadow, 1998; see Iverson & Thal, 1998, for a review). As the verbal system begins to emerge as the primary mode of linguistic communication, gesture shifts from a position of relative communicative equivalence with respect to speech to one of secondary support system integrated with speech. The finding that maternal gesture production does not mirror developmental changes in children's communication suggests at the very least that these radical changes in children's developing communicative systems are not simply a direct reflection of changes in maternal gestural input. Indeed, maternal gestural input seems remarkably insensitive to these changes.

### Relations Between Maternal and Child Gesture and Speech

The existence of several positive and significant relations between maternal gesture production at 16 months and measures of children's gesture and speech production within and across the two periods of observation suggests the possibility that the nature and the frequency of maternal gesture influence the development of children's communicative repertoires. There is, however, another potential interpretation for these findings. The size of the correlations we obtained may be attributed to maternal interactional style and overall communicativeness rather than to gesture per se. Mothers who communicate a great deal, in other words, may simply elicit a great deal of communication from their children (and vice versa).

Some support for this argument is provided by the finding that correlations between maternal gesture and measures of children's communication with overall maternal communicativeness partialled out were, although still positive, nonsignificant and weaker than the corresponding raw correlations. Clearly, overall maternal communicativeness would appear to be a mediating factor in the relation between maternal gesture and child gesture and speech. On the other hand, given the small size of our sample, the relatively low power of this analysis, and the fact that none of the 5 partial correlations were zero, it is at least possible that maternal gesture may account for some of the variance in children's gesture and speech, even when overall maternal productivity is statistically controlled.

In sum, we have found that Italian mothers gesture in relatively simplified, concrete ways when interacting with their young children, a finding that is especially striking in light of the fact that the frequent use of a large repertoire of relatively abstract gestures appears to be typical of interactions among Italian adults. Although patterns of gesture production varied widely among individual mothers, they were highly stable over time. Moreover, we have found preliminary evidence for positive relations between maternal gesture production and children's use of gesture and speech. Taken as a whole, our results suggest that the modifications observed in speech to children are accompanied by modifications to the co-occurring gestural stream, and that the use of gestural motherese may be a consistent feature of maternal communications to young children even across wide cultural variations in adult gesture use.

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