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From Communication to Language in Two Modalities

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This study explores the interplay between gestures and words in the early vocabularies of 12 normally developing Italian children at 16 and 20 months of age. Focusing on spontaneous production of verbal and gestural types and tokens, we assessed the diversity and semantic content of the verbal and gestural vocabularies. Results indicated that the gestural modality was utilized extensively by all subjects. Whereas only half the group had more gesture than word types in their repertoires at 16 months, eight of the 12 subjects exhibited a clear preference for communication in the gestural modality, employing a larger number of gestural than verbal tokens. By 20 months, almost all of the subjects had many more word types and used words more frequently than gestures. By providing some sensorimotor components of an object-referent, gestures may lessen the demand on developing symbolic skills and aid the child in the transition to highly abstract word-referent relationships.

Over the past 20 years, two lines of research have underscored the important role of gesture in the first stages of communicative development. One body of work (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Bates, Camaioni, &

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Volterra, 1975; Lock, Young, Service, & Chandler, 1990; Masur, 1990) has indicated that the onset of intentional communication between the ages of 9 and 13 months is marked in part by the emergence of a series of gestures—GIVING, SHOWING, POINTING, and RITUALIZED REQUESTS—that precede the appearance of first words. These gestures, called *performatives,* or more recently, *deictic gestures,* are used to refer to external objects or events and express only communicative intent on the part of the child. The precise referent of these gestures can only be interpreted by referring to the extralinguistic context in which communication occurs. Some researchers have attributed a special role to pointing, which Bruner (1975) described as an important way of establishing the joint attention situations within which language will eventually emerge (e.g., Lock, 1980; Lock et al., 1990).

A second line of work (Bates et al., 1979; Nicolich, 1977; Nokony, 1978; Piaget, 1945; Shore, Bates, Bretherton, Beeghly, & O'Connell, 1990; Volterra, Camaioni, Benigni, & Bates, 1981), looking at children in approximately the same age range, has reported striking parallels between early vocal production and gestural schemes of symbolic play. Many of the referential meanings expressed by these symbolic gestural schemes (e.g., EAT) were equivalent to those conveyed by first words (e.g., "*pappa*" <lunch>; Volterra et al., 1981; Volterra, Caselli, Longobardi, & Camaioni, 1993). In addition, both the production of first words and the representation of symbols in the gestural modality have been shown to undergo a similar process of progressive decontextualization. Children's first gestures and words are initially found as parts of routines from which they are progressively detached until they are used in a referential manner to name new objects or events independent of a specific context (Caselli, 1983, 1990; Folven & Bonvillian, 1991).

Taken together, these findings highlight the remarkable similarities between production in the gestural and the vocal modalities during the first stages of language acquisition. They also raise an interesting issue with regard to the communicative and linguistic value of early words and gestures. Symbolic actions produced in the gestural modality have often been considered noncommunicative or nonreferential despite reports that these gestural schemes can be used productively to communicate about a specific referent in a decontextualized, symbolic manner (Volterra, Bates, Benigni, Bretherton, & Camaioni, 1979). Consequently, they have been referred to and analyzed separately from verbal production as "symbolic play" regardless of their level of decontextualization. In contrast, words in general have been considered to be communicative or referential irrespective of the context or contexts in which they are used. However, such a distinction is highly problematic, because it implies that only signals produced in the vocal modality can potentially become referential and be used to name new objects or events in a variety of different contexts.

This issue was addressed by Caselli (1983, 1990) in a longitudinal diary study of one Italian infant. She reported findings which demonstrated that many of the

gestures usually set aside as "schemes of symbolic play" (e.g., holding the empty fist to the ear for TELEPHONE, waving the hand BYE-BYE, or raising the arms for ALL GONE) were in fact used frequently by the child to communicate in a variety of situations and contexts similar to those in which first words were produced. These gestures, which we will call *representational gestures,* differ from deictic gestures in that they denote a precise referent and their basic semantic content remains relatively stable across different situations. The form and meaning of these gestures seem to be the result of a particular agreement established in the context of child–adult interaction. The communicative use of representational gestures has been confirmed more recently by Zinober and Martlew (1985) and Acredolo and Goodwyn (1985, 1990) in findings reported from studies of larger groups of British and American children.

Thus there is strong evidence to indicate that representational gestures are used frequently and in a highly communicative manner by young children who are not systematically exposed to a gestural linguistic input such as a sign language. In addition, some recent analyses of young hearing children's vocabularies suggest that representational gestures account for a large portion of children's early communicative repertoires. Results from a study of 20 Italian children revealed that, at 1 year of age, these normally developing, hearing children made extensive use of both the gestural and the vocal modalities in their efforts to communicate, and that it was only in a subsequent phase that the vocal modality became the predominant mode of communication (Volterra et al., 1993). In a related investigation of children's early vocabularies, Casadio and Caselli (1989) noted that their 14-month-old subjects had larger numbers of different gestures than different words in their repertoires. The gestural and vocal systems of the individual subjects were also found to be highly distinct in the sense that there were few examples of children who had words and gestures with corresponding meanings.

Although these studies have provided a valuable developmental description of the composition of children's early gestural and verbal vocabularies, a more detailed longitudinal investigation of the interaction between gestural communication and speech during the second year is clearly warranted. Whereas previous studies have tended to explore either the composition of children's vocabularies or the overall production of words and gestures, our goal is to combine these two approaches, analyzing both the contents of early gestural and verbal vocabularies and the use of these words and gestures by children as they communicate. To this end, the present study investigates the production of gestures and words in a group of Italian children observed at 16 and 20 months of age. The quantitative content of the verbal and gestural vocabularies and the frequencies with which words and gestures are used in communication are examined. In addition, we analyze gestures and words from a more qualitative perspective by considering the diversity and the semantic content of the gestural and verbal vocabularies. Our aim is to extend the findings of prior studies of the early communicative

repertoire by examining both vocabulary content and patterns of production, to shed further light on the interaction of the gestural and vocal modalities in early communicative development, and to explore the ways in which this relationship changes over time.

METHOD

Subjects

Subjects were 12 children (6 boys, 6 girls) from upper-middle-class families. All families lived in Rome and were native speakers of Italian. The subjects were selected randomly from a larger group of children observed as part of a study assessing the efficacy of a structured questionnaire in evaluating communicative and linguistic development at 12, 16, and 20 months of age (Camaioni, Caselli, Longobardi, & Volterra, 1991; Volterra et al., 1993). Five of the children were first-born, 6 were second-born, and 1 was third-born. Nine children had mothers who worked at least part-time outside the home, and 3 attended day care on a regular basis.

Procedure

Two observations were conducted for each child: one at 16 months and the other at 20 months of age. Each session was videotaped and lasted approximately 45 min, during which mothers were instructed to interact and play with their child as they normally would. The observations were divided equally into three 15-min segments so that the children were filmed in three different contexts: play with new examples of familiar objects, play with familiar objects, and during a meal or snacktime. The new objects were a set of toys provided by the experimenter: a toy telephone, a plate, a cup, a toy glass, two animal picture books, a spoon, a teddy bear, two small cars, a ball, and two combs. Familiar objects varied with each child and included, for example, books, toy cars, tricycles, toy animals, and blocks. Data are reported from the observation collapsed across all three contexts.

Coding

All communicative and intelligible gestures and words were transcribed from the videotapes. Gestures and words were considered to be communicative if they were accompanied by eye contact with another person, vocalization, or other clear evidence of an effort to direct the attention of another person present in the room (Thal & Tobias, 1992). Only gestures and words meeting these criteria were considered in our analysis. Because children's first gestures and words tend to be idiosyncratic forms that may have no conventional meaning or that may have a different meaning than in adult language and culture, we were necessarily broad in our definition of what constituted a gesture and a word. Moreover, the meaning of these early signals is often established in the context of child–

caregiver interaction (Bates et al., 1979). Therefore, words used or pronounced and gestures formed in a manner different from Italian adult usage were also included for analysis as long as they were used to refer consistently to the same referent throughout the observation.

Gesture Types.[1] All gestures were classified as deictic or representational. Deictic gestures are those gestures that refer to an object or event by directly touching or indicating the referent. In the case of deictic gestures, the form of the gesture bears no direct resemblance to its referent and thus expresses only the child's communicative intent. The meaning of these gestures can only be determined through reference to the context in which communication occurs. Three types of deictic gestures were coded: SHOWING, POINTING, and RITUALIZED REQUESTS such as reaching. A gesture was recorded as *showing* when the child held up an object in the adult's line of sight. Gestures were classified as *pointing* if there was clear evidence of an extension of the index finger directed toward a specific object or event. Following Thal and Tobias (1992), instances of patting a location or object were also coded as pointing. *Ritualized requests* consisted of an extension of the arm, sometimes with repeated opening and closing of the hand.

The representational gesture category included all gestures referring to an object, person, location, or event through hand movement, body movement, or facial expression. These gestures differ from deictic gestures in that they represent specific referents, and their basic semantic content does not change appreciably with the context. Representational gestures were then assigned to one of three categories according to the semantic meaning they seemed to contain. *Conventional gestures* are nonobject-related, culturally defined signs, such as shaking the head NO, waving BYE-BYE, and raising the palms ALL GONE. Gestures used in the context of songs and games were also included in this category as long as they were used communicatively and outside of their original context. *Predicates* describe qualities or characteristics of an object or situation (e.g., raising the arms high for TALL or waving the hands for TOO HOT). *Nominal gestures* are gestures that seemed to provide a label for a specific object. Nominal gestures could act as labels for objects in one of two ways: (1) by replicating the *action performed by an agent* with the object-referent (e.g., drinking from a cup or combing with a comb) or (2) by copying the *movement performed by the object-referent itself* (e.g., opening and closing the mouth for FISH or flapping the hands for BIRDIE).

Within nominal and predicate gesture categories, we included both gestures made with the object-referent in hand as well as those that were empty-handed. In order to distinguish object-in-hand gestures from instances of functional object usage or play, gestures produced with the object-referent in hand were included

[1] All gestures described in this article will be denoted in capital letters.

only when *all* of the previously cited criteria for coding of communicative gestures were satisfied (i.e., eye contact, vocalization, clear evidence of effort to attract adult's attention). In addition, we considered only the first occurrence of such gestures because subsequent productions often tended to become repetitive and play-like. It is important to note here that other investigators (e.g., Acredolo & Goodwyn, 1988, 1990; Goldin-Meadow & Morford, 1985, 1990) have excluded gestures made with an object in the hand. Because many of the words used in the first year are pronounced with the object-referent in hand (Nelson, 1973), the effect of this exclusion procedure is to underestimate the production of communicative gestures. Therefore, in order to employ comparable criteria for communicative words and gestures, we included gestures produced with an object in the hand in our analysis as long as they appeared to be truly communicative.

Word Types.[2] Words were classified as deictic or representational according to the same criteria used for gestures. The deictic word category included personal, possessive, and demonstrative pronouns and adjectives and locative expressions (e.g., "I," "yours," "this," "there"). Like deictic gestures, the precise referent of these words can only be established by making reference to the context in which they are used. All other word types (e.g., nouns, verbs, adjectives, adverbs, closed-class words) were classified as representational words.

Representational words were further classified as either *nouns, predicates, function words,* or *conventional words and routines* according to the roles that these words play in the adult language system. Nouns were defined as words naming persons, places, things, or ideas (e.g., "macchina" <car>, "palla" <ball>, "bimbo" <baby>). Proper nouns, or names of people, were classified separately within the noun category. All adjectives, adverbs, and verbs were categorized as predicates (e.g., "freddo" <cold>, "verde" <green>, "piano" <slow>). Conventional words and routines are words that serve a social purpose (e.g., "sì" <yes>, "no" <no>, "ciao" <bye-bye>, and "cucù sette" <peekaboo>). Finally, articles, interrogative pronouns, conjunctions, and prepositions were classified as function words (e.g., "e" <and>, "chi" <who>, "dentro" <inside>).

It is important to note here that the classification of gestures and words as nominal, predicate, conventional, or function is not based on the assumption that young children have mental representations that correspond directly to these categories. This point has been made by other investigators (Maratsos & Chalkley, 1980; Mervis & Mervis, 1988). Along the same lines, we would argue that, at this stage, the organization of the gestural and verbal lexicons is different from that of adults, and that the formation of more adult-like lexical categories occurs during the gradual process of development. Although children's lexical catego-

[2] All words in the corpus will be indicated in lowercase letters.

ries and usage of lexical items may vary from that of adults, we adopted this classification procedure in order to employ a consistent standard for comparison across children at different ages (see Bates et al., 1992, for further discussion of this issue).

In order to provide a more accurate estimate of communication in the gestural and vocal modalities, we included all communicative words and gestures produced by the children in our analysis, regardless of whether they occurred in combination with other vocal or gestural elements. Type (number of different lexical items) and token (total number of lexical items produced including repetitions) analyses were then carried out for overall words and gestures and within the deictic and representational word and gesture categories.

Reliability

In order to assess the reliability of the coding procedure, all videotapes were coded independently by two trained coders. After independent coding the location of each disagreement was identified and the two primary coders jointly reviewed the behavior segments in question. Upon review, some observations were classified as uncodable and eliminated from further analyses. The remaining disagreements were then viewed by a third coder and resolved by adopting the classification given by the majority of the coders. Thus, only communicative gestures and words which at least two trained transcribers agreed upon were included for further analysis. Multiplying the number of agreements by two and dividing by the total number of observations (Kratochwill & Wetzel, 1977; Sears, Rau, & Alpert, 1965), a mean agreement of 75% (range 63%–90%) was obtained for initial coding of communicative gestures and words. Following elimination of those observations that were subsequently classified as uncodable, mean agreement for coding of occurrence of communicative gestures and words was 80% (range 66%–93%). Mean agreement for word and gesture type was 95%.

RESULTS

Extensive communication in both the gestural and vocal modalities was observed in all subjects, although a substantial amount of variability among individual children was also evident. At both 16 and 20 months of age, children produced single signals in the spoken and gestural modalities and combinations of two or more elements within and across modalities (see Iverson, Volterra, Pizzuto, & Capirci, 1994, for a detailed analysis of early two-element combinations).

We will begin by describing the data from the 16-month observations, focusing first on results reflecting patterns of type and token production of gestures and words. This will in turn be followed by analyses of the diversity and semantic content of gestural and vocal vocabularies. A similar format will be followed for the presentation of the 20-month-old data.

16-Month-Olds

Production of Words and Gestures. In order to provide an accurate representation of word and gesture production observed at 16 months and to highlight individual differences in word and gesture usage, we report the data in terms of patterns exhibited by individual children. Figure 1A presents the total number of different word and gesture types (both deictic and representational) produced by each subject at 16 months.

As shown in Figure 1A, at 16 months two subgroups of subjects can be distinguished. Five children had more extensive gestural than verbal vocabularies, 6 children had more words than gesture types, and 1 subject (#6) had exactly the same number of word and gesture types. Whereas the numbers of different gesture types within the repertoires of the various children were fairly similar (range 5–14), variability in the production of words was much more apparent (range 1–73) and highly significant ($F = 83.53$, $df = 11,11$, $p < .0005$).

The nature of the pattern of individual production of different word and gesture types may be further clarified by looking at the production of word and gesture tokens. As illustrated in Figure 1B, a high degree of individual variability was evident with respect to production of both word (range 1–248) and gesture (range 17–127) tokens. In general, children displayed a clear preference for communication in either the gestural or the vocal modality, with a significantly higher proportion of subjects (8 of 12, $z = 3.46$, $p < .005$) demonstrating a preference for gestural communication at 16 months. Of these eight subjects, three (#6, #7, #8) had as many or more word than gesture types, yet they still showed a clear preference for communication in the gestural modality (cf. Figure 1A). Only four children, all of whom had relatively large verbal vocabularies, produced many more words than gestures.

An interesting difference was observed with respect to the categories of words and gestures produced. In the vocal modality, all subjects produced a significantly higher (Wilcoxon $T = 0$, $p < .01$) proportion of representational ($M = 95\%$) than deictic word tokens ($M = 5\%$). In the gestural modality, however, this pattern was reversed: Significantly more deictic ($M = 68\%$) than representational gestures ($M = 32\%$) were observed (Wilcoxon $T = 6$, $p < .02$). Furthermore, this pattern held true for each of the individual subjects. Within the deictic gesture category, POINTING accounted for a substantial proportion (59%) of total deictic gestures produced and was employed significantly more often than either SHOWING (Wilcoxon $T = 13.5$, $p < .05$) or REQUESTING (Wilcoxon $T = 4.5$, $p < .02$).

Diversity of Gestural and Verbal Vocabularies. In order to assess the diversity of the gestural and spoken vocabularies, type-token ratios (Carroll, 1964) were calculated for overall words and gestures for each child. Type-token ratios are obtained by dividing the total number of different lexical items produced by the child by the absolute number of lexical items produced, including repetitions.

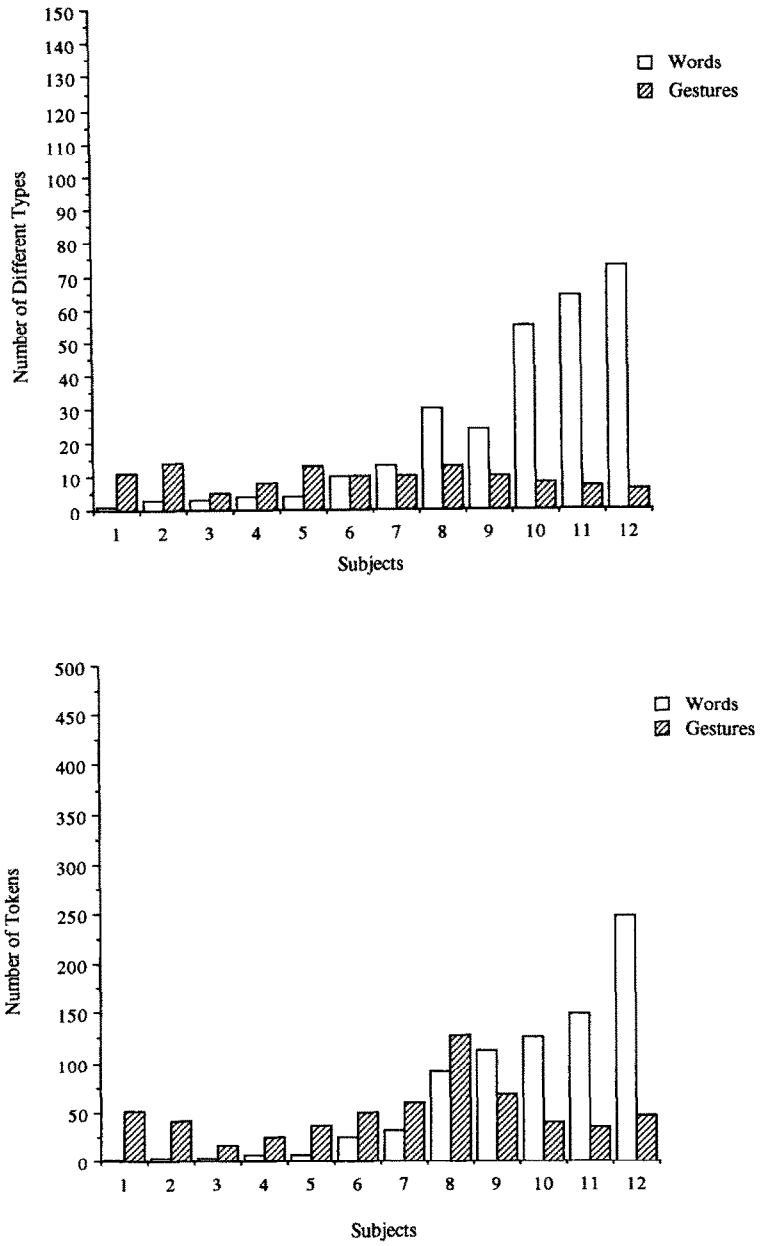

Figure 1. **(A) Number of different word and gesture types produced by each subject at 16 months; (B) Total number of word and gesture tokens produced by each subject at 16 months.**

A higher type-token ratio is generally assumed to reflect a richer and more diverse vocabulary. At 16 months, the mean type-token ratios were .53 for words and .28 for gestures. In general, this suggests that relative to word use, there was a higher level of redundancy in gesture use. Fewer different gesture types were used more frequently. This was especially true of deictic gestures. When deictic gestures were excluded from this analysis, the type-token ratio for gestures increased to .48, a level approximately equal to that for words.

Semantic Content of Words and Gestures. Because representational words and gestures accounted for a substantial proportion of total word and gesture types produced, we further analyzed words and gestures in this category in order to examine the semantic content of the gestural and vocal vocabularies. Representational gestures were categorized as either nominal, predicate, or conventional/routine gestures, and representational words were classified as nouns, proper names, predicates, conventional words, or function words. The results of this analysis are presented in Table 1.

Looking first at the 16-month gesture categories, it is apparent that representational gestures were broadly distributed across all three categories. Nominals were marginally more frequent than conventional and routine gestures, and pred-

Table 1. Percentage of Representational Words and Gestures In Each Semantic Category at 16 and 20 Months

	Representational Gestures	
	16 Months	**20 Months**
Nominals	39%	21%
Predicates	22%	41%
Conventional and Routine	39%	38%
	$N = 36$	$N = 53$
	Representational Words	
	16 Months	**20 Months**
Nouns	50%	44%
Predicates	26%	29%
Conventional	10%	8%
Proper Names	11%	12%
Functors	3%	7%
	$N = 169$	$N = 424$

Note. N = total number of different words and gestures produced by 12 children; some words and gestures may be produced by more than one child.

icates were least common. Among nominal gestures, a majority (64%) copied the *action performed **with** the object.* Although such gestures could in theory be produced either with or without the support of the object referent (e.g., holding the receiver of a toy telephone to the ear, or holding the empty fist to the ear), most (seven of nine) were produced with the object in hand and were strictly object-bound (e.g., eating with a spoon, drinking from a toy cup, making a toy airplane fly). Gestures that replicated the *form of the referent or the action performed **by** it* accounted for 36% of nominal gestures observed, and all were produced empty-handed (e.g., wiggling the nose for RABBIT, repeatedly extending and retracting the index finger for SNAIL). Among predicate gestures (e.g., APRIRE <OPEN> a toy box, SPREMERE <SQUEEZE> a lemon), exactly half were produced with the referent in hand. By definition, conventional gestures and routines (e.g., clapping hands BRAVA <GOOD GIRL>, putting finger to the lips for SILENZIO <QUIET>) do not involve the use of a specific object-referent.

In the vocal modality, nouns accounted for exactly half and predicates for about one fourth of total representational words produced at 16 months. Most nouns were names of small objects (e.g., "macchina" <car>, "cucchiaio" <spoon>, "bicchiere" <cup>) that can be easily manipulated by the child (cf. Bates et al., 1979; Nelson, 1973). Conventional words (e.g., "ciao," "sì," "no") and proper names each accounted for relatively small and roughly equal portions of the total, and a very small proportion of representational words were classified as function words (e.g., "il" <the>, "di" <of>).

Finally, we calculated the proportion of different representational gestural and vocal items in the repertoire of each child that had identical meanings. On average, less than 10% of gestures and words in the vocabulary of each child were equivalent in meaning at 16 months. It is of interest that this finding parallels observations of language development of bilingual children. In the earliest stages of language development, children exposed to two languages from birth seem to use a single lexical system which includes words from both languages. A word in one language often does not have a corresponding word with the same meaning in the other language (Taeschner, 1983; Volterra & Taeschner, 1978). Although some degree of individual variation was observed, the contents of the gestural and vocal systems, in other words, appeared to be highly distinct for all subjects at this age.

20-Month-Olds

Production of Words and Gestures. The number of different word and gesture types (both deictic and representational) produced by individual subjects at 20 months is presented in Figure 2A.

As is evident in Figure 2A, the composition of the two subgroups observed at 16 months shifted dramatically at 20 months. A significantly larger proportion of subjects had more different communicative signals in the vocal than in the ges-

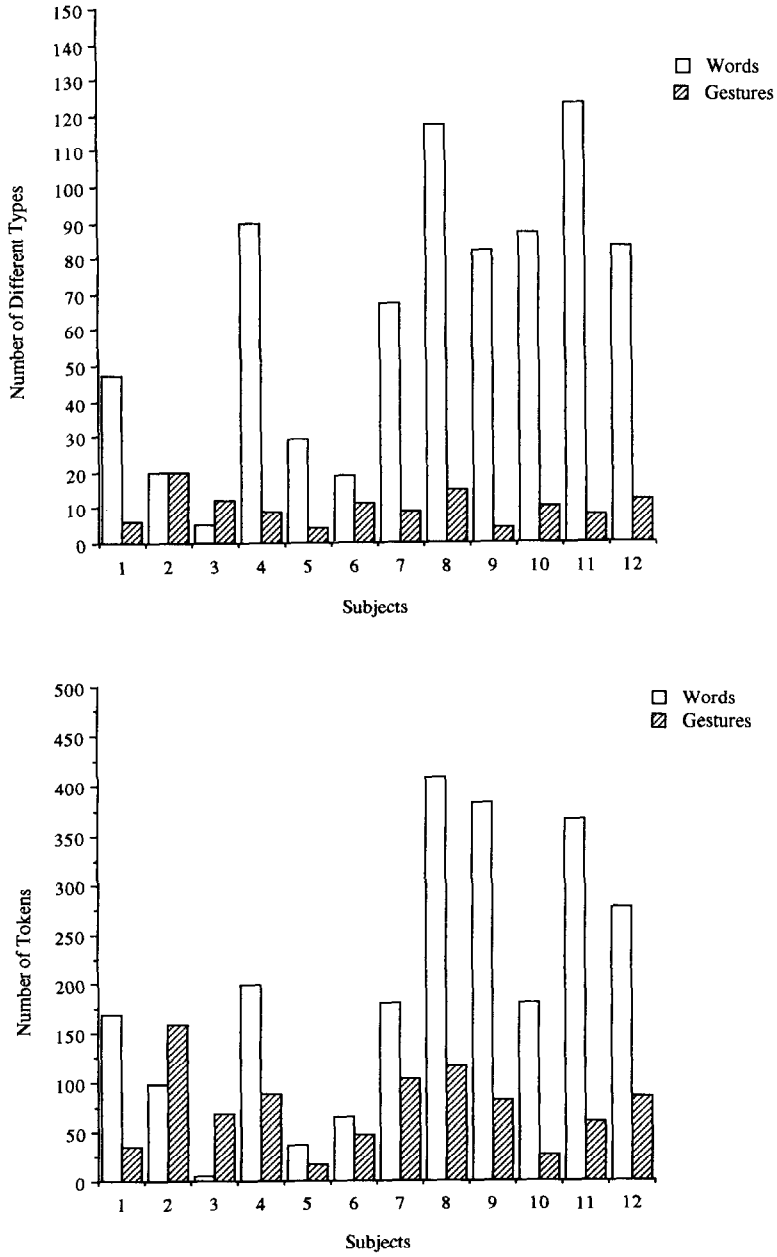

Figure 2. (A) Number of different word and gesture types produced by each subject at 20 months; (B) Total number of word and gesture tokens produced by each subject at 20 months.

tural modality ($z = -1.89$, $p < .05$). Two children (#2, #3) had the same number or fewer words than gestures. Although individual variability increased somewhat ($F = 78.96$, $df = 11,11$, $p < .0005$), the number of different gesture types in the communicative repertoire of each child remained relatively low and unchanged at 20 months (range 4–20, Wilcoxon $T = 30.5$, n.s.). The number of word types, on the other hand, increased sharply from 16 to 20 months (Wilcoxon $T = 0$, $p < .005$), and remained widely variable across children (range 5–123). Finally, although the number of different words produced at 16 months was significantly correlated with the number of different words produced at 20 months (Kendall tau = .52, $p < .01$), gesture types produced at 16 months were uncorrelated with both word (Kendall tau = −.11, n.s.) and gesture (Kendall tau = −.08, n.s.) types at 20 months.

The nature of the change in the pattern of production of different word and gesture types is further clarified by a look at individual production of word and gesture tokens. As illustrated in Figure 2B, the clear preference for communication in the vocal over the gestural modality at 20 months was also evident in the analysis of tokens ($z = -2.5$, $p < .005$). Ten children produced words more frequently than gestures, and only two children (#2, #3) continued to use more gestures than words in their communication. A high degree of individual variability with respect to production of both words (range 5–382) and gestures (range 17–159) remained evident at 20 months. Comparing individual patterns of production at 16 and 20 months, a substantial increase in the overall number of communicative (verbal or gestural) acts (Wilcoxon $T = 0$, $p < .005$) and production of words was observed in all subjects (Wilcoxon $T = 0$, $p < .005$). Although the use of gesture increased in most children (9 of 12) at 20 months, this difference was not statistically significant.

Whereas the overall token level of gesture production increased somewhat from 16 to 20 months, it is interesting to note that there was a proportionate decline in the production of gesture relative to speech at 20 months. Gesture accounted for 42% and 27% of the total communication (verbal, gestural) at 16 and 20 months, respectively. In contrast, the proportion of communication consisting of speech increased substantially, from 58% at 16 months to 73% at 20 months.

Within the word and gesture categories, a statistically significant increase was noted in the production of deictic words, from 5% of all words produced at 16 months to 13% at 20 months (Wilcoxon $T = 0$, $p < .005$), and deictic gestures, from 68% of all gestures produced at 16 months to 80% at 20 months (Wilcoxon $T = 12.5$, $p < .05$). On the other hand, production of representational gestures declined significantly over time (from 32% at 16 months to 20% at 20 months; Wilcoxon $T = 7$, $p < .01$).

Because deictic gestures accounted for a substantial proportion of the total number of gestures produced at both 16 and 20 months, and because their production increased at 20 months whereas production of representational gestures

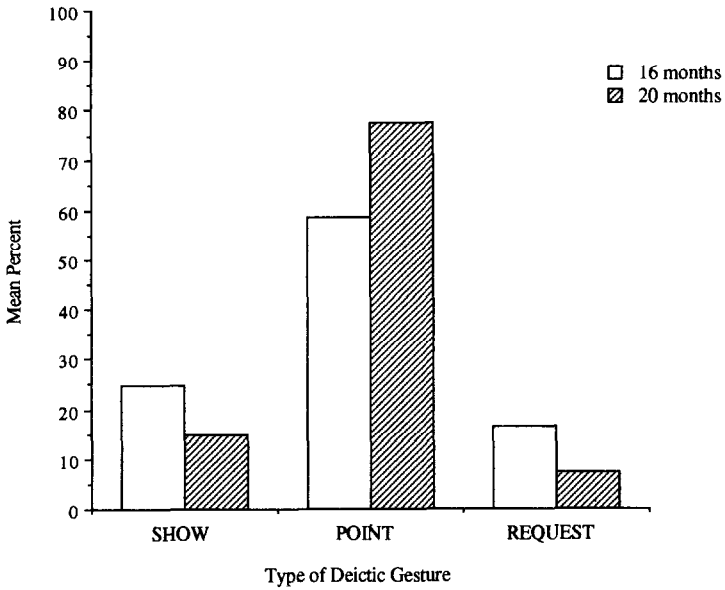

Figure 3. Mean percent of different deictic gesture types produced at 16 and 20 months.

decreased, we looked within this category to examine the patterns of usage of the three types of deictic gestures. The percentage distributions of the production of different deictic gesture types are displayed in Figure 3.

As is evident in Figure 3, SHOWING and REQUESTING were all used regularly by the children at 16 and 20 months. These two gestures accounted for relatively low proportions of total deictic gestures produced, with SHOWING being employed to a somewhat greater extent than REQUESTING. A decline in their use is evident at 20 months, although the difference was not statistically reliable. Despite this overall decline, POINTING, the deictic gesture utilized most frequently at 20 months (Wilcoxon $T = 2, p < .01$) as it was at 16 months, underwent a significant increase (Wilcoxon $T = 11, p < .05$).

Diversity of Gestural and Verbal Vocabularies. At 20 months, the mean type-token ratios were .38 for words and .17 for gestures. The slight decline in the type-token ratio for words from 16 months suggests that the use of words increased at a faster rate relative to the number of words in the children's vocabularies. In other words, the children talked a great deal more at 20 months than they did at 16 months, but their vocabularies were still fairly limited. The difference between the type-token ratios for words and for gestures remained fairly

stable, suggesting again that, relative to word use, there was a higher level of redundancy in gesture use. The extent to which this redundancy is a function of deictic gestures at 20 months is evident when all deictic gestures are excluded from the analysis. With this constraint, the type-token ratio increased to .51, a proportion that is much higher than that for words. Twenty-month-olds, in other words, made frequent use of a small number of deictic gestures and relatively less frequent use of a larger number of representational gestures.

Semantic Content of Words and Gestures. The results of the analysis of different classes of representational gestures and words at 20 months are also presented in Table 1. Considering the gesture categories first, it is evident that there was a decline in production of nominal gestures at 20 months, but the difference did not reach statistical significance (Wilcoxon $T = 26$, n.s.). Within this category, there was an increase in the production of gestures replicating the *form or movement of the referent* itself (from 36%, as already reported at 16 months, to 54% of all nominal gestures), and all were produced empty-handed (e.g., flapping the hands for UCCELLINO <BIRD>). Gestures copying the *action performed with the referent* (e.g., brushing the hair with a brush) declined notably, from the previously reported 64% of all nominal gestures at 16 months to 46% at 20 months. Because the majority (4 of 5) of these action-by-agent gestures were produced with the object-referent in hand, this decline may represent a more general decrease in the production of gestures with the support of an object. Predicate gestures (e.g., rubbing the tummy for BUA <OWIE>, holding up two fingers for DUE <TWO>) increased markedly and now accounted for the largest proportion of all representational gestures, although the difference was not statistically reliable (Wilcoxon $T = 10$, n.s.). This increase represents a clear change from the predominance of nominals reflected in the distribution of gestures at 16 months. The proportion of predicate gestures produced empty-handed also increased substantially, from the previously reported 50% at 16 months to 82% at 20 months. In addition, whereas the distributions of gestures and words across semantic categories were very similar at 16 months, the distribution of gestures now differed notably from that of words. Production of conventional gestures (e.g., shaking the finger NO, turning the finger on the cheek for BUONO <GOOD>) remained relatively unchanged at 20 months.

In the vocal modality, an overall increase was observed in the number of words in all categories, but there was relatively little change in the distribution of words across semantic classes. As was true at 16 months, the majority of representational words produced at 20 months were nouns (e.g., "sasso" <rock>, "biscotti" <cookies>, "casa" <house>). Little proportionate change was observed in the predicate category (e.g., "rompere" <to break>, "rosso" <red>, "scotta" <too hot>) despite the marked increase in the number of words within this category. The proportions of conventional words (e.g., "cucù sette"

<peekaboo>, "grazie" <thank you>) and proper names remained relatively unchanged, and more function words (e.g., "per" <for>, "a" <to>, "da" <from>) were produced at 20 months than at 16 months.

DISCUSSION

Results of the study are discussed in terms of four issues surrounding the nature of gesture in children's early communication: the extent of individual differences in gesture use, the role of gesture in enhancing early communicative competence, the place of gesture in the transition to a verbal linguistic system, and the relationship between gesture and development in the cognitive and symbolic domains.

Individual Differences

All of the children in the present study produced gestures and, at 16 months, almost half of our subjects had a larger number of different gestures than different words in their repertoires. This is consonant with Casadio and Caselli's (1989) finding that a large part of the child's early communicative repertoire can consist of gestures and that very young children may even have more gestures than words in their vocabularies. However, in addition, the extent to which the gestural modality was utilized as an avenue of communication varied widely from child to child. Although four of our 16-month-olds preferred speech to gesture, though gestures were very much present in their communication, a majority of these younger subjects manifested a clear preference for gestural communication. Indeed, such a gestural preference was even present in three children who had a greater number of different words than different gestures in their vocabularies. This observation is consistent with results from studies of early communicative gesture use in American children (e.g., Acredolo & Goodwyn, 1990; Goodwyn & Acredolo, 1993).

Early Communicative Competence

At 16 months, children's use of gesture appears to enhance overall communicative potential by supplying communicative elements that are not yet available verbally. This seems to occur in two ways. First, the functional use of gesture in the expression of deictic and representational elements clearly differs from that of speech. Whereas children tended to prefer the vocal modality when producing representational elements, they relied more heavily on the gestural modality for deixis. Second, lexical overlap between gesture and speech was minimal. Even though words and gestures tapped the same general semantic domains, children's gestural vocabularies served to complement rather than reduplicate their verbal lexicons. It may be that the central role of gesture in children's early communication can be ascribed in part to the notion that the production of gesture reduces the demand on developing vocal skills. Gestures may allow children who do not

yet possess the complex phonological and articulatory mechanisms necessary for the production of comprehensible words to be more readily understood by parents and caregivers and thus more successful in their communicative efforts.

This finding of minimal overlap between early words and gestures also parallels descriptions of the early lexicons of children simultaneously acquiring two spoken language (e.g., Volterra & Taeschner, 1978) or one spoken and one signed language (e.g., Prinz & Prinz, 1979, 1981). Such children initially develop a single semantic system represented by separate lexical entries from each language with minimal duplication between the two languages. It should be noted, however, that this parallelism holds only for the earliest period of acquisition. Whereas bilingual children go on to acquire two distinct lexicons (verbal for children acquiring two spoken languages, gestural and verbal for children exposed simultaneously to a signed and a spoken language; Prinz & Prinz, 1979, 1981), the early verbal/gestural communicative system of the hearing child exposed to a single spoken language does not become two distinct languages. When this system begins to evolve in a differentiated manner, verbal communication is elaborated into a linguistic system, but gesture never acquires any of the properties that are characteristic of language.

Transition to a Verbal Linguistic System

The observation of a proportionate decline in the production of gesture relative to speech at 20 months is consistent with the notion that gesture fails to develop into a full-fledged linguistic system in hearing children exposed only to speech. This decline, however, cannot be interpreted as the beginning of the demise of gesture because the overall token level of gesture production actually increased at this age. We would like to suggest that the change in gestural production between 16 and 20 months was not due to a decline in the absolute level of gesture production, but rather to a change in the way gesture was used. Some evidence for this hypothesis is provided by the finding that the increase in gesture production was qualitatively different than that observed for word tokens. Neither acquisition of new gestural lexical items nor enhanced use of representational gestures were responsible for the rise in production of gesture tokens. Rather, the observed increase was primarily the result of substantial growth in the use of pointing. In fact, pointing was the deictic gesture used most often at both 16 and 20 months; a result that supports suggestions that pointing, which helps establish situations of joint attention, plays a special role in the course of initial lexical acquisition (Bruner, 1975; Lock et al., 1990) and also in later stages of linguistic development such as the period of transition to two-word speech (Iverson et al., 1994).

As children develop a preference for speech as the principal mode of linguistic communication, the function of gesture in communication appears to undergo radical revision. This revision is reflected in a variety of phenomena. First, whereas we observed relative lexical continuity in the verbal domain (number of different words at 16 months was highly predictive of number of words at 20

months), there was significant discontinuity for gesture (number of different items in the gestural repertoire at 16 months was unrelated either to number of words or number of gestures at 20 months). In other words, as the verbal system was becoming the preferred channel of communication, the gestural system was apparently being reorganized, shifting from a position of relative communicative equivalence with respect to speech to a new role as a secondary, nonlinguistic support system (McNeill, 1985, 1992).

Second, the significant decrease in production of representational gestures suggests that these gestures, which refer to fixed referents and thus can substitute for words when necessary, were gradually being abandoned in favor of their verbal counterparts. This is very much in line with results from an experimental study of gestural and verbal naming in young children carried out by Bretherton et al. (1981). Bretherton and her colleagues reported a switchover between 13 and 20 months in the preferred production modality for recognizing familiar objects. At 13 months, gestural schemes were more readily available than verbal labels for purposes of object categorization and recognition. By 20 months, however, children were much more likely to use verbal object names, and production of gestural labeling schemes decreased.

In their classic discussion of symbol formation, Werner and Kaplan (1963) predicted just such a decline in the use of representational gestures, and this has now been substantiated by results from a number of studies of both Italian (Casadio & Caselli, 1989) and American (Acredolo & Goodwyn, 1988, 1990; Butcher, 1992; Goldin-Meadow & Morford, 1985, 1990; Petitto, 1988) children. As Werner and Kaplan suggested, gesture appears to play a central role during the period in which the child is "working out" the problem of employing articulation in the form of abstract symbolic representations. Once these difficulties are resolved, the vocal modality then becomes the dominant mode for representational communication.

Gesture and Development in the Cognitive and Symbolic Domains

An interesting aspect of our data is that they also illustrate the gradual process of decontextualization that occurs in the course of symbolic development. For example, we observed a decline from 16 to 20 months in the use of action-by-agent nominal gestures (e.g., drinking from a toy cup) produced with the object-referent in hand and a concurrent increase in the production of form or movement-of-object nominal (e.g., opening and closing the mouth for FISH) and predicate gestures (e.g., holding the thumb and index fingers close together for PICCOLINE <tiny>), all of which were empty-handed. This finding supports Werner and Kaplan's (1963) argument that, with the passage of time and growth in the cognitive and representational domains, the child's communication becomes progressively less bound to specific contexts. Action on the object may no longer be necessary as the child is now capable of representing the object in a symbolic fashion and distancing the symbolic vehicle (i.e., gestures or words)

from the referent. Viewed from this perspective, our data reinforce the notion that gestures are transitional forms that ease the child through the "distancing" process, from communication which is strictly object-bound, to gradually less object-related gestures, and finally to the highly abstract and symbolic relationships between referent and symbol that characterize most words (Acredolo & Goodwyn, 1988, 1990; Werner & Kaplan, 1963).

A second, related sign of cognitive and symbolic development at 20 months seems to be evidenced by the substantial growth observed in the number of items contained in the predicate word and gesture categories. This finding agrees with other reports of the later appearance of predicates in early vocabulary (Bates et al., 1992; Fenson et al., 1991). Predication is a two-concept idea: It requires not only the capacity to represent and name the object-referent, but also the ability to describe certain characteristics and qualities of the referent. This, in turn, presumably entails greater cognitive and representational flexibility. At 20 months, our subjects exhibited this flexibility frequently, not only naming objects but also communicating about their various aspects.

Taken together, the results of the present study indicate that both the gestural and the vocal modalities must be considered in any analysis of early communication designed to provide an accurate picture of the richness of the child's early vocabulary. In this regard, two important issues remain to be explored in further research. First, a comparative study of gestures produced by parents and those produced by their children is needed in order to determine the effect of parental gestural input on children's production of gesture. Second, deaf children acquiring a sign language are exposed to a linguistic input that is transmitted entirely in the gestural modality. A comparison of communicative gestures produced by deaf children acquiring a sign language and those produced by hearing children acquiring a spoken language and receiving less extensive gestural input is necessary in order to explore potential qualitative and quantitative differences in the use of communicative gesture as a function of modality of linguistic input. Studies of this nature will shed further light on the relevance of linguistic input in early communication and on processes underlying both symbolic and linguistic development.

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