

Symbolic Gesture versus Word: Is There a Modality Advantage for Onset of Symbol Use?

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GOODWYN, SUSAN W., and ACREDOLO, LINDA P. *Symbolic Gesture versus Word: Is There a Modality Advantage for Onset of Symbol Use?* CHILD DEVELOPMENT, 1993, 64, 688–701. Researchers have hypothesized in the past that children learning sign languages develop signs at an earlier age than is typically expected for vocal words. This assumption, however, has recently been questioned on the grounds that researchers have not always guaranteed that words and gestures are being used in a comparable fashion. The present study was designed to shed light on this controversy by comparing the onset of symbolic use of signs and words in a group of 22 hearing children exposed to symbolic gestures from 11 months onward. Bimonthly interviews emphasizing contexts of use of gestures and vocal words indicated a smaller modality difference than early research had predicted, thus providing support for the hypothesis that strides in cognitive abilities such as memory, categorization, and symbolization underlie this milestone in both modalities. At the same time, however, the data also indicated that the small difference in onset time was reliable, thus providing support for the notion that the gestural modality is, in fact, easier for many infants to master once the requisite cognitive skills are in place.

Clues to the puzzle of how language and cognition interact are now being sought in comparisons between development of vocal and gestural language (e.g., Abrahamson, Lamb, Brown-Williams, & McCarthy, in press; Acredolo & Goodwyn, 1990b; Meier & Newport, 1990). The logic behind such comparisons is the idea that traditional views of language as synonymous with speech may have resulted in inaccurate perceptions of relations between cognitive and language milestones. For example, data showing that a specific cognitive skill immediately precedes a specific milestone in vocal language may be conceptualized as causative. Such a conclusion, however, would presumably need to be reevaluated if the same language milestone were achieved significantly earlier in the gestural modality. Given the long history of attention to language as exclusively vocal in nature, many such reevaluations might be required. Thus, the empirical question of whether or not development of language proceeds differently in the two modalities is of pressing theoretical import.

children exposed to both vocal and nonvocal language systems are of particular interest for at least two reasons. First, one can be more confident than for deaf children that the developmental experience of the child approximates the experience of most language learners—the group whose language acquisition is the focus of our theoretical inquiries. Second, the use of children exposed to both systems allows within-subject comparisons (i.e., first gesture vs. first word within the same child), thus enabling the researcher to control for the individual differences in rate of maturation that abound in the language domain. Without such comparisons, one cannot be sure whether the gesturing of Group A differs from the vocal language of Group B because there really is a modality effect or because the individual children in Group A were simply developing at a different rate from those in Group B due to factors independent of modality. Given the small sample sizes typical of language development research, across-group comparisons like this are especially problematic.

In answering this question, hearing

Among the earliest and most frequently

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cited studies of hearing children exposed to gesture and vocal language are two case studies (Holmes & Holmes, 1980; Prinz & Prinz, 1979) and a study of a group of 12 hearing children of deaf parents (Bonvillian, Orlansky, Novack, & Folven, 1983). In all three studies, the children were exposed to a formal sign language such as ASL (American Sign Language) on a regular basis. Although the details in each report differ, the conclusion that was typically drawn from this body of data was that expressive language milestones were achieved earlier in gesture than vocal language. For example, Bonvillian et al. (1983) reported that on average their 12 subjects began using gestures at 8.6 months—about 3.5 months earlier than the typical 12–13-month data commonly cited for vocal language. They concluded that “the children typically attained milestones (in sign language) several months in advance of what would have been expected for children relying solely on speech” (p. 209).

However, as Bonvillian and his colleagues noted even in this early study, “It is difficult to determine precisely when a subject first used a sign in a truly symbolic fashion” (p. 211), and they urged caution in interpreting their results. This warning was echoed more recently by Petitto (1988) and Volterra and Caselli (1985), who questioned whether early signs reported by parents in such studies are really being used in symbolic ways or might instead be direct imitations of parental models, overinterpretations by parents of excitatory gesturing (e.g., open-close fist interpreted as ASL signs for milk, give, want, come), or gestures produced solely within well-rehearsed routines. Building on Bonvillian and his colleagues’ earlier caveat, they stressed that what is needed is more detailed information about the context in which an infant’s gestures appear and the application of well-reasoned criteria for assigning symbolic sta-

tus to *both* early gestures and early words. The specific hypothesis advanced by Petitto (1988) and Volterra and Caselli (1985) was that the use of gestures as symbols will be shown to depend strongly on the child’s cognitive maturity (i.e., the onset of the symbolic function) and thus probably would not predate early symbolic words by very much, if at all.

To date, at least three attempts have been made to gather detailed contextual information, and the conclusion drawn in all three cases is that, in contrast to the earlier presumption, no gestural advantage exists for the onset of symbol use. Petitto herself, based on monthly videotaping of three hearing children exposed to ASL, reported no symbolic use of a word or gesture before 12 months (Petitto, 1988). It has been argued, however, that Petitto’s reliance on videotaping alone without reference to any parental records of language within the home may have underestimated the infants’ linguistic knowledge (Meier & Newport, 1990), thus leaving the question more unresolved than Petitto had hoped.

A second attempt exists in the report by Volterra and Caselli (1985) of the gestural and vocal development of two hearing children exposed to ASL. In both cases the transition from nonsymbolic to symbolic usage occurred within the same month for gestures and words, although more precise age-of-onset information is not provided. In one case, the age was 12 months; in the other—where more stringent criteria for symbolic status were applied—the age was 18 months. Moreover, in commenting on their use of different criteria in the two cases, they point out that it is more important that the same criteria be applied to both signs and vocal words within a given child than that any particular set of criteria be used to designate “symbolic status.”¹

¹ Opinions as to what constitutes a “true symbol” vary, with Piaget’s insistence on use of the word in the referent’s absence among the most conservative (Piaget, 1952, p. 243). Others have been willing to eschew this criterion for a definition focused more on the flexible use of the word to label multiple exemplars, sometimes creating new labels for the behavior, as in Nelson’s use of the adjective “lexical” (e.g., Nelson & Lucariello, 1985), Snyder, Bates, and Bretherton’s (1981) use of “context-flexible,” or Folven and Bonvillian’s (1991) use of “referential.” But even when a different term is used, the underlying presumption is that something significant is happening when a child can take a label learned in a constrained context and apply it elsewhere. Nelson and Lucariello express this well: “It is important to note here that the evidence that children can learn names for generalizable object concepts, that is, extend words to novel exemplars . . . indicates that words have become symbolic of something more abstract than the concrete objects themselves” (p. 64). Whatever set of criteria or label one uses, the most important point is to apply the rules in the same way across modalities and across children, a point Volterra and Casselli (1985) stressed.

The third attempt to address the concerns raised by Bonvillian et al. (1983), Petitto (1988), and Volterra and Caselli (1985) is provided by Folven and Bonvillian (1987, 1991), who asked deaf parents of one deaf and eight hearing infants exposed regularly to ASL to record in diary form the details of their child's gestural and vocal development, including information about the contexts in which signs and words occurred. These diaries were reviewed with parents at monthly meetings, at which time gaps were filled in. Based on these parental reports, the researchers determined the age at which signs and words first appeared in any form in each child's repertoire (e.g., in imitation of a parental model) and then the point at which usage became "referential" (i.e., to name new instances of a concept).

The results reported by Folven and Bonvillian indicate a mean age of 8.2 months for the onset of recognizable signing and a mean age of 12.6 months ($N = 8$, range 10.1–16.2, median 12.2) for the appearance of the first referential use of a sign. In discussing these data, Folven and Bonvillian point out that this latter age is reasonably close to the typical age of 13 months reported by Bates, Benigni, Bretherton, Camaioni, and Volterra (1979) for the onset of symbolic use of spoken words. In general support of Folven and Bonvillian's conclusion about the 13-month point one can also cite (a) a study by Snyder et al. (1981), who report that their 32 hearing infants had developed a mean of 4.84 "context-flexible" words (as opposed to "context-restricted") by 13 months, and (b) an additional report by Bates, O'Connell, and Shore (1987) that most of the 25 children in their laboratory's longitudinal study of infant language had developed at least a few truly referential vocal labels by this age. Thus, Folven and Bonvillian's conclusion that on the average their infants were developing referential signs *about the same age as one would expect vocal symbols to appear* seems reasonable.

Folven and Bonvillian have clearly made a contribution in this regard. It is important to know that hearing children exposed to ASL on average develop context-flexible signs *about the same time* as other children develop context-flexible words. However, of necessity their focus on hearing children of deaf parents created difficulties that leave several important aspects of the issue unresolved. First, although Folven and Bonvillian report data on each child's development of vocal symbols in order to contrast

this milestone with the onset of symbolic signing, the fact that the deaf parents were less likely to be good providers of vocal input and good reporters of the child's vocal progress makes any direct comparison between the two modalities problematic. In other words, the type of within-subject comparison between modalities called for by Petitto (1988) Volterra and Caselli (1985) is difficult here. Simply put, it is hard to judge the accuracy of the vocal data gathered on these children. Perhaps had these children been exposed to more normal levels of vocal input or had the parents been more able observers, the data would have shown earlier development in the vocal modality.

A second limitation of the Folven and Bonvillian study is its relatively small sample size due to the fact that such subjects simply are not very common. The problem here is with drawing any conclusions from the fact that the mean age of onset of symbolizing with signs for these subjects did not differ significantly from the mean age of onset of symbolizing with vocal words. The questions become whether a gestural advantage might not be uncovered with larger samples, or whether a vocal advantage might not be uncovered with a different population (i.e., hearing subjects of hearing parents).

The present study satisfies both these conditions—large sample size and lots of vocal language input. These changes are the result of a focus solely on hearing infants of hearing rather than deaf parents, and on a shift in the nature of the sign language to which infants were exposed. In contrast to earlier studies, exposure to the gestural modality in this case did not require parents to master a formalized gestural language such as ASL. Instead, the present study represents an extension of the work of Acredolo and Goodwyn (1985, 1988, 1990a, 1990b), who have reported the development of symbolic gestures ("signs") based on easily performed actions that are recruited by parents and infants for the purpose of communication within the home. In their earlier studies, Acredolo and Goodwyn have focused on the spontaneous development of such gestures by infants. In contrast, in the present study parents were trained to model such gestures systematically and encourage their infants to use them for their own symbolic communication. As a result, when viewed in conjunction with data provided by Folven and Bonvillian, it will be shown that the present study provides interesting information relevant to the question at hand: Is

there a gestural advantage for the onset of symbolic language?

Method

Subjects

Subjects included a total of 22 infants (12 males and 10 females, 2 Black and 20 Caucasian) from a predominantly middle-class area of northern California. Income levels data confirmed a middle income status for the majority of families: 68% between \$20,000 and \$40,000; 5% under \$20,000; 23% over \$50,000. Education levels, measured on a 4-point scale from "high school or less" to "postgraduate," indicated a mean of 2.96 for mothers (just shy of "college degree") and 2.82 for fathers. With the exception of one female incorporated at 8 months and one male at 10 months, participation in the study began at 11 months.² These 22 subjects represent a subgroup drawn from a larger sample of 37 infants incorporated into a large-scale longitudinal study of the impact of symbolic gesturing on development during the second year of life and from the pilot study ($N = 6$) on which the large-scale study was based. Selection of infants for the present study was based on the absence of any vocal word functioning as a true symbol at the time of entry into the study. This selection rule was motivated by our desire to compare directly the onset of symbolic usage in the two modalities once systematic exposure to the gestural modality had begun at 11 months.³

Procedures

Gestural training.—At the beginning of each subject's participation, the infant's mother was oriented to the goals of the study in an individual session in which the phenomenon of symbolic gesturing was described and illustrated with a videotape. Parents were encouraged to begin exposing

their infants to a set of eight "target" gestures by pairing the vocal word with the gesture any time an opportunity arose (i.e., lip-smacking for "fish," arm-flapping for "bird," sniffing for "flower," open-close hand for "frog," a hand swoop for "airplane," index-finger tapping for "more," hand-waving horizontally for "all gone," and palms-up for "Where is it?"). In order to help ensure exposure to the gestures on a daily basis, toys representing each of gestures with an object referent were sent home with the instruction that they be incorporated into daily routines (e.g., plastic fish in the bathtub, plastic flowers on the changing table, etc.). A videotape showing a mother modeling each gesture with its vocal word as she and her infant interacted with the toys was shown. Mothers were also encouraged, once they felt comfortable with the target gestures, to add other gestures they felt would be fun for their baby. Finally, each family was provided a large, colorful picture book with examples of many objects, including the target objects, in order to help them find multiple examples of each referent category.

Data collection.—The data on which the present study is based were collected during biweekly (approximately) audiotaped interviews with mothers conducted by phone.⁴ Interviews were structured to collect information about the frequency with which parents were modeling the gestures, the comprehension and production of any gestures by the infants, and the development of any vocal words. In regard to both gesture and vocal production, specific questions were asked regarding form (i.e., physical action or sound pattern) and context of usage. In clarifying the contexts in which a word or gesture had occurred during the past 2 weeks, the interviewers gathered three types of information. First, the specific referent or referents were recorded (e.g., "pant-

² The need to keep so many parents motivated dictated starting relatively close to the expected age for onset of symbolic communication. The disadvantage to this starting date—that starting earlier might have revealed larger gesture-word gaps—is discussed following description of the patterns revealed in the data.

³ The need to eliminate subjects who had already developed a symbolic word by the start of the study at 11 months leaves open the possibility that the results would have been different had such presumably "precocious" language users been included as well. Reassurance that this was probably not the case is provided by 15-month data from the Sequenced Inventory of Communicative Development (Hedrick, Prather, & Tobin, 1984) indicating that those excluded were not significantly more precocious in terms of either expressive or receptive language.

⁴ Although the vast majority of calls occurred at biweekly intervals, family vacations, illness, and other emergencies sometimes resulted in longer intervals. Such problems are inevitable in longitudinal research of this sort. Since we did not feel we could consistently trust a mother's estimate of when in an interval between calls a particular advance had occurred, the decision was made to use only the calls themselves as data entry points.

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ing" to refer to the family dog, pictures of dogs, various real dogs, dogs heard barking, etc.; "hot" to refer to hot coffee, the oven, bath water, etc.). Second, the interviewer probed to find out whether the word or gesture had been produced (a) in direct imitation of the parent, (b) in response to an elicitation by the parent such as "What's that?" or (c) completely spontaneously. Third, in the case of nouns, the mother was asked whether the child was using the word/gesture as a request or as a label or as both.

Whenever parental reports constitute the primary data source on language development, it behooves researchers to make every effort possible to maximize the accuracy of those reports. In the present case, these efforts included the following: (a) During the orientation sessions, mothers were informed in detail about the questions to be asked during the interviews, simple definitions (e.g., "spontaneous use," "imitation") and multiple examples were provided, and printed material containing all this information, along with a sample interview format, were sent home. (b) Mothers were *strongly* encouraged to keep notes between phone calls, and were each given a magnetic refrigerator note pad and pen to facilitate this process. (c) At the end of the orientation, mothers were asked to take home and complete the MacArthur Communicative Development Inventory: Infant (Fenson et al., 1989) a checklist designed to assess both comprehension and production by presenting possible vocabulary items broken down by common categories. This questionnaire functioned both to provide standardized information about the infant at 11 months and to further familiarize the mothers with the type of information that would be requested during the biweekly interviews. (d) The initial interview was scheduled within a week of the orientation visit in order to make sure that the mothers knew what was expected of them. (e) During the interviews themselves, part of the routine consisted of suggesting categories in order to provide retrieval cues for the mothers. (f) In an attempt to motivate the mothers to keep good records and remember specific examples, they were promised copies of the computer records for insertion in a "baby book" provided by the project. Although these efforts obviously cannot ensure absolute accuracy, their incorporation does increase our faith in the data obtained. It is also reassuring to note that these interviews lasted on the average about

40 min (range 20–90), additional testimony to the amount of information obtained.

Interviews were conducted using a speaker phone by two-person teams, each team assigned to a case load of families. During the interview, one team member had primary responsibility for asking questions of the mother, using the information gained in the previous interview as a guide (i.e., any specific words or gestures that had been reported). The other team member entered the mother's answers directly into the computer, interjecting his or her own questions when necessary information had been overlooked. At the end of each interview, the team members reviewed the information entered into the computer, added any missing information, and resolved discrepancies through reference to the audiotape. In the week preceding the next call, one of the two authors reviewed the printout from the previous call, adding suggestions for the interviewer and the mother, providing answers to any questions, and making decisions about which words and gestures were well enough entrenched in the baby's repertoire to be omitted from subsequent calls.

The developmental history of the earliest vocal and gestural entries reported by mothers provided the data for the present study. The age of the baby at each interview date (rounded to the nearest .25 month) was determined. Next, using the criteria specified below, two coders independently reviewed interview data from five infants (23% of the sample), the basic goal being to decide at which interview (and corresponding age) each word or gesture had achieved symbolic status. Use of the formula "number of agreements plus disagreements" yielded a reliability figure of 92% for these subjects. Data from the remaining subjects were assessed by both coders, with disagreements resolved through discussion.

Criteria for assigning symbolic status.—The goal of the present study was to determine whether communication with true symbols occurs earlier in the gestural modality than the vocal modality. As a consequence, it was very important that a precise set of rules be constructed for deciding when a word or gesture had reached the point of development where it was functioning for the infant as a true symbol. To this end, a set of rules was developed, with the first requirement being *spontaneous* use of

the gesture or word (rather than imitation or in response to an elicitation by the parent). One reason for eliminating elicited words/gestures from consideration was the increased chance that an elicited label would really be part of a well-rehearsed routine ("What does the cow say?") rather than clearly symbolic of a category or concept. A second requirement was that the word appear in at least three interviews, with no gap of greater than two phone calls occurring. This rule was designed to increase our confidence that the words were in fact substantial additions to vocabulary. This rule, however, did not preclude the possibility of a word or gesture sometimes achieving symbolic status the first time it appeared. Such a word/gesture simply had to continue to appear during the next two interviews.

Additional decision rules were based on definitions of symbolic words, requiring that they be applied beyond their specific context of origin (i.e., to a category of objects or conditions) or, in the case of nouns, that they be applied in the absence of the referent. Specific guidance was taken from Snyder et al. (1981), whose rules were designed to differentiate "context-restricted" (CR) vocal words from "context-flexible" (CF), and from criteria used in our earlier studies of symbolic gesturing (Acredolo & Goodwyn, 1985, 1988). The specific rules used within the present study are listed in Table 1.

Results

Grouped Data

Presented in Table 2 are the ages at which individual subjects first achieved symbol usage in each modality. Mean age at first symbol was 11.94 months ($SD = 1.05$) for gestures and 12.64 months ($SD = 1.24$) for vocal words. An analysis of the length of the time gap between each of these milestones for each subject yielded a mean gestural advantage of .69 months ($SD = .84$). This difference in mean age of onset for gestures and words was significant, $t(21) = 3.881$, $p = .0009$, a pattern also revealed in a Wilcoxon signed-rank test ($p = .008$) comparing the number of infants showing a gesture advantage ($n = 17$) to the number showing a vocal advantage ($n = 2$, plus 3 ties). A subsequent analysis with the traditionally controversial words "mama" and "dada" omitted from consideration as vocal symbols (e.g., Capute et al., 1986; Gesell & Thomp-

son, 1934) yielded the same pattern of results: mean age at first word = 13.05 months ($SD = 1.74$), mean gestural advantage = 1.102 months ($SD = .84$), $t(21) = 3.979$, $p = .0007$. Thus, with or without "mama" and "dada" included, these analyses indicate a small but reliable tendency for symbol use to begin earlier in the gestural modality.

It can be argued that the very first symbol is not a strong indication that symbol use is really under way. With this in mind, comparisons were made of the ages at which subjects reached the five gesture and five vocal symbol point. All but two infants, who did not end up developing five symbolic gestures, were included in this analysis. These data are also presented in Table 2. The mean age for this milestone was 13.55 months ($SD = 1.56$) for gestures and 14.28 months ($SD = 2.079$) for vocal words ("mama" and "dada" included). The mean difference between the two modalities was .58 month, again favoring gesturing. This value approached significance with a two-tailed test, $t(19) = -1.865$, $p = .0778$, and reached it when a one-tailed test was used ($p = .039$). A Wilcoxon signed-rank test indicated a similar pattern, with 13 subjects showing a sign advantage, 5 showing a word advantage, and 2 showing no difference between the two ($p = .078$). One final set of analyses involving age at five gestures/words was conducted with "mama" and "dada" removed from consideration as vocal words. In this case, a significant gestural advantage emerged again: mean age at fifth word = 14.5 months ($SD = 2.08$), mean gestural advantage = .79 months ($SD = 1.22$), $t(19) = 2.88$, $p = .01$. A Wilcoxon signed-rank test confirmed this pattern ($p = .009$) in a comparison of the number of infants showing a gestural advantage ($n = 14$) to the number showing a vocal advantage ($n = 5$, plus 1 tie).

An additional analysis of the concepts represented in these first symbols indicated that the vast majority of the very first symbolic gestures (95%) and the first five symbolic gestures (85%) were labels for common objects (i.e., common nouns), presumably because much of the training given the parents emphasized such gestures. In contrast, the first vocal words were much more likely to represent a mixture of proper nouns, nouns, requests, and pragmatic expressions (e.g., thank you).⁵

⁵ Exact proportions are impossible to report because the use of biweekly calls did not provide the *exact* sequence in which individual words were added. In other words, the interview

A final set of analyses of the grouped data were focused on relations between age at the six relevant milestones (two gestural and four vocal) and demographic variables (i.e., sex, birth order, hours per week of day-care, mother's education, father's education, and frequency of gestural modeling). Analyses revealed interesting results for only one of these variables—hours per week of day-care. As the amount of time in day-care increased, so did the age at first gesture ($r = .40, p < .05$) and the age at first word, including mama and dada ($r = .41, p < .05$). Of course, it is impossible based on these data alone to explain this relation. Although it is consistent with the hypothesis that adult-child interactions are more facilitative of language than are child-child interactions, it is also possible that at this earliest stage of language development, parents who are away from their children for longer time periods simply do not have the same opportunities to observe the initial steps in symbol acquisition. Given the purpose of the present study, however, it is interesting to note that the pattern was the same for both modalities.

Individual Differences

As important as grouped data are, the well-recognized role of individual differences in early language development mandates an evaluation of modality advantage on a case-by-case basis as well. (See Acredolo & Goodwyn, 1990b, for extensive discussion of this point.) To this end, additional analyses were aimed at detecting ways in which those infants showing a gestural advantage (GA) in their individual records differed from those showing either a speech advantage (SA) or no modality advantage at all (NA). Six different definitions of "advantage" were used, three based on a gap between the modalities ≥ 1 month and three based on a gap > 1 month. The first and most liberal definition counted an infant as showing a gestural or speech advantage if a gap of the criterial size appeared in *any* of the following comparisons: (a) age at first word versus age at first gesture; (b) age at first word (mama/dada) versus age at first gesture; (c) age at fifth word versus age at fifth gesture; (d) age at fifth word (mama/

dada) versus age at fifth gesture. This liberal definition yielded 13 GA subjects, two SA subjects, and seven NA subjects when the required gap was ≥ 1 month, and nine GA subjects, two SA subjects, and 11 NA subjects when the required gap was > 1 month. A second definition was designed to focus on the first hints of symbol usage. To this end, only the age at first gesture and age at first word were compared, with a subject given credit for a gestural or speech advantage if one occurred either with or without "mama" and "dada" included as words. This definition yielded nine GA, no SA, and 13 NA subjects for gaps ≥ 1 month and six GA, no SA, and 16 NA subjects for gaps > 1 month. The third definition was a refinement of the second, simply limiting consideration to a comparison of age at first gesture minus age at first word with "mama" and "dada" included. This definition yielded 9 GA, no SA, and 13 NA subjects for ≥ 1 month, 3 GA subjects, no SA, and 18 NA subjects for gaps > 1 month.

In general, then, a speech advantage was rare—only one male and one female so categorized, and then only under the most liberal definition of "advantage." In contrast, a gestural advantage occurred with enough frequency that subsequent analyses designed to compare these subjects to the rest of the sample were conducted. Once subjects were categorized as showing or not showing a gestural advantage based on a particular definition, the two groups (designated GA and non-GA) were compared on a number of variables. These included sex, birth order (first- vs. later-born), mother's education, father's education, number of hours per week in day-care, and mean frequency with which mothers modeled the target gestures. With the exception of mother's education, the comparisons yielded nothing of interest despite all the different ways in which gestural advantage was defined. Specifically, GA infants were no more or less likely to be male than female or to be firstborn than later-born, fathers of the GA infants had no higher levels of education, the mothers of GA infants did not model gestures more frequently than mothers of non-GA infants, and

at which the first or fifth word milestone was achieved often contained reports of multiple symbols, often a mixture of nouns and non-nouns. This problem presented less of an obstacle for the gestures because the vast majority of the gestures were common nouns. Interestingly, those few subjects ($n = 5$) who did develop more than one non-noun among their first five gestural symbols were no more or less likely to be among subjects defined as showing a gestural advantage according to the criteria described in the next set of analyses.

TABLE 1

GENERAL RULES FOR ASSIGNING SYMBOLIC STATUS TO GESTURES AND WORDS

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1. General rules:
 - a. Nonsymbolic:
 - If only used in imitation or in response to an elicitation
 - If only used within well-rehearsed routines (e.g., songs, games, “What does the doggie say?”)
 - If only used within specific single situations (e.g., only when going to bed, only when getting down from high chair, only when daddy leaves for work)
 - If only used in reference to a single exemplar (e.g., one specific dog, own nose)
 - b. Symbolic:
 - If used to refer to multiple exemplars (e.g., various dogs, various noses)
 - If used in absence of the referent as well as in its presence
 - If used in response to picture as well as real exemplar
 2. Subrules for common nouns:
 - a. In those cases where individual exemplars of the category are not easily distinguished (e.g., cheese, milk, diapers), then symbolic:
 - If used in more than a single situation (e.g., “milk” when at dinner and in bed)
 - If used to request in object’s absence as well as presence
 - If used to label picture as well as real exemplar
 - If used to label as well as request the item.
 - b. If overgeneralization of the word/gesture is consistent (e.g., “Rover” to all dogs, “ball” to various round things), then qualifies as a symbol even though the child’s underlying concept does not match the adult’s.
 3. Subrules for proper names:
 - a. If child uses name only as a general request, then nonsymbolic (e.g., “mama” when wants attention)
 - b. If child uses name in ways that indicate appropriate understanding of name without explicit contextual restrictions, then symbolic. Such usage must include at least two of the following uses:
 - To label the real person (e.g., in greeting)
 - To label picture
 - To label person in that person’s absence
 - To request some specific attention from the person
 - To label an item belonging to the person
 - c. Occasionally a common noun will be treated as a proper name by both baby and parents, other exemplars being labeled differently (e.g., Blankie, Teddie). In these cases the label is treated as a proper name and decisions regarding status are those applied to proper names.
 4. Subrules for adjectives, requests, events:
 - a. Adjectives (e.g., hot, dirty, all gone):
 - If used to describe multiple referents within a class where individual exemplars are easily distinguished, then symbolic (e.g., “hot” for various foods)
 - If used to describe a class where individual exemplars are not easily distinguished, then symbolic if more than one class described (e.g., “all gone” for milk and juice)
 - b. Request labels:
 - More, please: If used for more than one item within a category (e.g., more than one food or book) or more than one category, then symbolic
 - Up, out: If used in more than one setting (e.g., “up” from high chair and floor, “out” of high chair and door), then symbolic^a
 - c. Event labels (Where is it? bye-bye, hi, uh-oh, nite nite):
 - If used in connection with more than one object or person, then symbolic (e.g., “Where is it?” to bird and shoe)
 - If used to one object or person, then symbolic if situation varies (e.g., “bye-bye” to daddy when he leaves house and leaves bedroom; “uh-oh” when infant drops something and when falls down)
 5. Words omitted from consideration:
 - “mmm” in reference to eating
 - “That” to accompany pointing
 - Number and letter names
 6. Gestures omitted from consideration:
 - Bye-bye
 - Yes and no
 - Give me (open-close fist)
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^a As explained in detail in Acredolo and Goodwyn (1988), in order for an “up” or “out” *gesture* to be considered symbolic, the gesture must not simply be “instrumental” (i.e., an attempt by the infant to reach up into the mother’s arms or to force a door open). In contrast, the gestures must have the potential of achieving success *only* because they convey information to another person.

TABLE 2
AGE IN MONTHS AT FIRST AND FIFTH GESTURAL SYMBOL AND FIRST AND
FIFTH VERBAL SYMBOL IN 22 INFANTS WITHOUT SYMBOL USE AT FIRST
OBSERVATION (11 Months).

SUBJECTS	FIRST SYMBOL			FIFTH SYMBOL		
	Gestural	Verbal	Verbal ^a	Gestural	Verbal	Verbal ^a
Males:						
1	11.75	13.00	13.00	12.25	16.25	16.25
2	11.75	12.25	12.25	13.25	14.50	14.50
3	13.75	13.75	14.00	15.50	16.25	16.25
4	11.25	12.25	12.25	12.75	12.75	12.75
5	11.75	13.00	13.50	12.50	14.00	14.00
6	13.00	13.00	13.50	14.75	14.25	14.25
7	12.00	13.00	13.00	14.00	14.75	14.75
8	12.00	13.00	14.00	13.50	14.00	14.25
9	12.50	12.75	12.75	13.25	14.00	14.00
10	11.25	11.75	11.75	15.75	15.75	15.25
11	12.00	11.50	11.50	13.25	11.25	12.00
12	11.00	11.50	11.50	11.50	12.00	12.00
Females:						
1	8.75	9.25	9.25	10.00	10.75	10.75
2	12.00	15.25	15.25	14.25	16.00	16.00
3	11.50	12.00	12.00	13.25	13.75	14.25
4	12.50	12.00	12.00	13.00	12.00	12.50
5	11.50	12.00	12.50	12.50	14.00	14.00
6	11.25	11.75	11.75	13.50	11.75	12.50
7	12.25	14.50	14.50	16.00	15.75	15.75
8	12.00	13.00	17.00	16.25	18.75	18.75
9	13.75	14.25	16.50	^b	18.00	18.50
10	13.25	13.25	13.25	^b	13.75	13.75

^a Verbal symbols, excluding "mama" and "dada."
^b Subject did not acquire five gestural symbols.

the GA infants spent no more or less time in day-care.

One factor, however, did distinguish the two groups of infants when a gap of at least 1 month (≥ 1 month) was required. In that case, the application of definition number 1 yielded an ANOVA showing significantly higher education levels for mothers of the GA infants than the non-GA infants, $F(1, 20) = 4.605, p = .04$. This same relation held when definition 2 was applied, $F(1, 20) = 7.862, p = .01$, and approached significance for definition 3, $F(1, 20) = 4.058, p = .058$. In each of these cases, the mean education level for the mothers of the GA mothers fell within the "college degree or greater" category, while the mean for the non-GA mothers fell within the "some college" category. Thus, a fairly consistent pattern was obtained indicating that infants with a gestural advantage of at least 1 month tended to have mothers with higher education levels. How might this relation be explained? One might hypothesize that more highly educated mothers would be more heavily invested in

the study and therefore more likely to model the gestures. The modeling data, however, do not support such an explanation. As reported above, mothers of the GA infants did not differ from mothers of non-GA infants (defined in any way) in frequency of modeling. In addition, the correlation between modeling frequency and mothers' education was very low ($r = .075$). Thus, modeling frequency does not seem to be the operative variable behind the relation between gestural advantage and maternal education. Another possibility, the evidence for which comes from outside our own data, will be addressed in the Discussion section.

One additional set of analyses was applied to a subset of the GA and non-GA subjects who had been tested at 15 months with a standardized language instrument called the Sequenced Inventory of Communicative Development (Hedrick et al., 1984). The SICD yields both a measure of language comprehension (Receptive Communicative Age: RCA) and a measure of language production (Expressive Communicative Age:

ECA). The GA and non-GA infants (defined in any way) did not differ on either of these two language measures.

Discussion

In evaluating the patterns uncovered in the present study, it is important to keep in mind the divergent hypotheses about the relation between gestural and vocal communication that motivated the research. Recall that early attempts to compare development in the two modalities had led some to hypothesize the existence of a substantial gestural advantage. The rationale given was eminently reasonable, including such factors as (a) the greater visibility of gestures, (b) the feasibility of physically guiding the infant's attempts to produce the gesture, (c) their growth out of well-rehearsed sensorimotor behaviors, and (d) the greater iconicity of gestures (i.e., resemblance to properties of the referent). Despite the intuitive appeal of this early interpretation of the data, researchers have more recently sounded the warning that one must be careful not to credit these early gestures with communicative properties of which they are not worthy (i.e., spontaneous and symbolic use). It was this warning that motivated us to use our longitudinal study of symbolic gesturing to take a closer look at the issue by directly comparing the ages of onset of the symbolic use of gestures and words. And what have we found? We believe that the results of the present study, especially in combination with recent data from hearing children exposed to signs from even younger ages (Folven & Bonvillian, 1991), support the conclusion that there both *is and is not* a gestural advantage for the onset of symbol use within communication. This statement is not as inconclusive as it at first may sound; what matters, we will argue, is which literature concerning gestural advantage you take as your measure.

There is NO Gestural Advantage

Let us take the latter conclusion first—that our data point to the absence of a gestural advantage. As described above, one hypothesis has been that gestural language is not just easier for infants to master, but so much easier that communication with sign language could be expected to begin in earnest at remarkably young ages. Our data,

taken in combination with Folven and Bonvillian's (1987, 1991) parallel work with eight hearing children of deaf parents, do not support such a conclusion. Two facets of our results are pertinent here. First, when one takes advantage of the within-subject comparisons possible with these 22 subjects—comparing the ages at first symbol and fifth symbol for the two modalities—one finds much smaller average time lags between these milestones than predicted by earlier researchers (i.e., mean time lags for the various comparisons ranging from .58 months to 1.1 months). In short, the reality is that on average our babies developed symbols about the same time in both modalities.

However, one could quite justifiably argue that since exposure to "signs" did not begin for our babies (with two exceptions) until 11 months, we have not adequately tested the lower limits. In other words, it is possible that greater gaps in favor of symbolic gesturing might have occurred had the modeling of gestures begun earlier. This is where consideration of our data in combination with the recent work of Folven and Bonvillian (1991) becomes instructive. Recall that their eight hearing infants of deaf parents had been exposed to ASL from birth, with the result that the vocal environment rather than the gestural environment was the weaker of the two. And yet, despite the emphasis by their parents on signing, the average age of first symbolic use of a sign was 12.6 months—a figure quite close to our own average of 11.9 months for first symbolic gesture. The close correspondence between these two figures, despite the great differences in length of exposure to signs in the two studies, lends additional credibility to the hypothesis that something happens at about 1 year, on the average, which enables an infant to recruit gestures to serve a representative function for purposes of communication. Such a hypothesis is made even more credible when one in turn compares the dates for symbolic gesturing in the present study and the Folven and Bonvillian study with the period of 12 to 13 months frequently cited for the advent of early symbolic vocal words (e.g., Bates et al., 1979; Snyder et al., 1981). Thus, the data from the present study, both in terms of the narrow gap between the milestones in the two modalities⁶ and in terms of the average ac-

⁶ Data are also now available on a third infant for whom modeling of gestures began at 6 months. This child's first symbolic gesture (circling index finger for "fan") was reported at 9.25 months, only 2 weeks before his first symbolic vocal word ("ball"), thus reinforcing our conclusion.

tual ages at which these milestones were achieved, support the hypothesis advanced by both Petitto (1988) and Volterra and Caselli (1985) that some underlying cognitive abilities are coming together at this critical junction to enable infants to create communicative symbols out of whatever medium their environments provide.

Of course, this conclusion leaves unanswered just what these underlying cognitive skills might be. Perhaps the candidate most frequently cited, beginning with Piaget (1952), is "the symbolic function"—the ability to call forth purposefully one entity to stand for/represent another. Given the centrality of such a process to language, there can be no doubt that Piaget was correct. However, more recent research suggests that the "symbolic function," at least as manifest in communication with others about the world, may itself be a product of the complex interweaving of a multitude of basic cognitive skills, many of which show impressive improvements at the end of the first year. For example, the ability to recruit a gesture or word as a linguistic label requires that an infant be able to *recall* both the potential symbol and its association with a category of referents. In this regard, we can point to the work of Diamond (1985) and Kagan and Hamburg (1981), who document significant strides in the 11–12-month period in the ability to retain new information in memory across delays. That is not to suggest that memory capacity is absent before this point (see Meltzoff, 1990), only that it seems to us significant that the period in which we see symbols emerging for the first time also seems to be a time of improvement on memory tasks. A second cognitive capacity surely at play here is the capacity to categorize objects and events based on overlapping features. After all, the use of a gesture or word to label "cats" reflects the recognition by the infant of the existence of a category in need of labeling—a point made especially persuasively by Nelson and her colleagues (e.g., Nelson, 1985; Nelson & Lucariello, 1985). In this regard, we can point to a report by Cohen (1988) documenting strides at the end of the first year in the ability to form perceptual categories based on arbitrary (i.e., experimenter determined) sets of *correlated* attributes. Finally, we can point to the work of Bates and her colleagues on the emergence of nonsymbolic but communicative gesturing, such as giving, showing, and pointing. Such gestures routinely appear at the close of the first year, preceding both

symbolic gestures and symbolic words (Folven & Bonvillian, 1991). For the purposes of the present discussion, what these gestures represent is an important step in the development of the infant's understanding of the communicative enterprise as a two-way channel in which the infant can play an active, rather than simply a reactive, part. Such knowledge, of course, is critical to the intentional use of symbols to name and request. Taken together, then, the progress made in all these areas around the end of the first year lends credence to the argument that the emergence of linguistic symbols at this point—of whatever modality—is predictable. Rather than occurring in isolation, symbolic language owes its advent to developments on a variety of cognitive fronts.

There IS a Gestural Advantage

Now let us turn our attention to the other side of the coin—the fact that our data also support the conclusion that there IS a gestural advantage for early symbol development. Our focus here is on the fact that, even though the time lag was small in an absolute sense (i.e., ≤ 1.1 month), the onset of symbol use in the gestural modality very, very reliably preceded the onset of symbolic use of words. Up to now the small sample sizes used in studies of sign language development in hearing children have precluded precise evaluations of such small discrepancies in age. With these data, however, we can see for the first time the reality of what those early researchers (e.g., Prinz & Prinz, 1979) were suggesting, namely, that recruiting gestures to label and request items in the world does seem easier for babies than figuring out appropriate acoustic forms. This is true, however, only once the requisite cognitive skills mentioned above are in place.

But why are gestural symbols easier to master? The factors cited above that were suggested by the early proponents of the gestural advantage idea (e.g., greater visibility, growth from sensorimotor schemes, etc.) probably do contribute, with the exception that iconicity has not been found to be as prevalent in early signs as had been assumed (Folven & Bonvillian, 1991). In fact, one of these arguments—that gestures have a visibility advantage—has garnered support from an unexpected source. In evaluating infants' early *vocal* repertoires, Vihman (in press) notes that over one-third of the first 50 words attempted by her subjects contained labials, a finding she attributes to the fact that infants can easily see the articulatory

movement involved in producing labials (like the "b" in baby and bottle), and therefore may find it easier to gain control of their production. Interestingly, she reports that this preponderance of labials is *not* seen in the early vocal repertoires of blind babies, a group for whom the visibility of a movement would be totally irrelevant. Vihman's observations, therefore, lend credence to the hypothesis that the gestural advantage documented among our infants is at least partially a product of the ease with which the infants can see the specific movements necessary to reproduce the symbol.

In summary, our data provide evidence of the existence, on the average, of a small but statistically significant and theoretically important sign language advantage. However, as every language researcher knows full well, no theory of language development is complete without acknowledgment and understanding of individual differences in acquisition patterns. The issue of a gestural advantage for early symbolizing is no exception.

Individual Differences

Note our use of the phrase "on the average" in the preceding summation. As has been noted in a number of recent reviews of symbolic gesturing (e.g., Acredolo & Goodwyn, 1990b; Meier & Newport, 1990), the degree of gestural advantage will vary from child to child. The present data support this assumption. The lag between the onset of the first symbolic gesture and the first symbolic word ranged from a gestural advantage of 3.5 months to a vocal advantage of .5 month. A comparable comparison for the fifth gesture and fifth word milestone yielded a range from a gestural advantage of 4 months to a vocal advantage of 1.75 months. Clearly there are individual differences which need to be explained.

In an effort to begin the search, six different definitions were used of what degree of difference constituted a gestural advantage. Once the subjects were divided according to these criteria into those showing a gestural advantage and those not showing a gestural advantage, the two groups were compared on a number of dimensions such as sex, birth order, maternal and paternal education, etc. These comparisons yielded only one clue: those infants showing a gestural advantage had mothers with higher education levels than those infants not showing such an advantage. The hypothesis that this relation might be mediated by more

modeling of the gestures by mothers with more education was not supported: The frequency of modeling (as indicated by maternal report in all cases) did not differ between the groups.

What are we to make of the relation, then? What specific dynamics might be at play here? An important clue is provided in a recent study by Pederson et al. (1991), the focus of which was the relation between maternal sensitivity and infant attachment at 12 months. Two measures of maternal sensitivity were used, one the traditional rating scale devised by Ainsworth and the second a Q-sort technique designed by the authors. What is pertinent to the present study is the fact that *both* of these measures were positively correlated with maternal education. When one examines the specific characteristics considered reflective of sensitive mothering in these measures, one can quite readily sense their applicability to the present study. Take as examples the following: (a) notices when her infant smiles and vocalizes; (b) arranges her location so that she can perceive her infant's signals; (c) waits for her infant's response in interactions; (d) knows a lot about her infant, is a good informant; (e) interprets infant's cues correctly. Each of these, we would argue, could easily contribute to more gesturing by an infant, especially if one grants that the successful recruitment of a gesture for symbolic communication is as much dependent on recognition by the mother of the infant's efforts as it is on the infant his/herself. (See Acredolo & Goodwyn, 1988, for discussion of this point.) Thus, the relation between maternal education and gestural advantage uncovered in the present study may itself provide important insights into the mechanisms by which early gestures *and* words are developed.

Conclusions

In summary, the present study has allowed us to look at modality effects during the period when symbolizing first becomes possible. What that look reveals is the existence of a small and reliable tendency for gestural symbols to appear earlier than vocal symbols. However, the size of this gestural advantage for most children is not as great as had frequently been hypothesized. Based on these data, we find ourselves in agreement with those who have suggested that there are basic building blocks that must be in place before symbolizing of any type can be recruited for communicative purposes. Once these are operative—around the first

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birthday for many children—then gestural symbols can easily be acquired if parents encourage their development and read well their children's efforts. Verbal symbols, so much more commonly encouraged and recognized, follow rapidly as well.

The pattern revealed here is instructive. However, it is important to keep in mind that only one milestone of language development has been assessed in the present study. As Acredolo and Goodwyn (1990b) point out, it is entirely possible that different patterns will emerge when attention is focused on presymbolic behavior, vocabulary expansion, or the emergence of syntax. In other words, the question of whether or not there is a gestural advantage for language quite probably has no one answer.

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