Symbolic Gesturing in Normal Infants

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ACREDOLO, LINDA, and GOODWYN, SUSAN. *Symbolic Gesturing in Normal Infants.* CHILD DEVELOPMENT, 1988, **59**, 450–466. 2 studies are presented that document the spontaneous development by normal infants of nonverbal gestures to symbolically represent objects, needs, states, and qualities. These symbolic gestures are shown to be a typical rather than rare phenomenon of early development and to function in ways similar to early verbal symbols. Indeed, the case is made that these gestures and early words are both representative of common underlying mechanisms, in particular, the recognition that things have names. In the first study, mothers of 38 17-month-old infants were interviewed in regard to their infants' verbal and nonverbal development. The second study, designed to document with greater precision the findings of the interview study, is a longitudinal study of 16 infants who were followed from 11 to 24 months. Both studies provide evidence that symbolic gestures tend to develop in tandem with the child's early words, that girls tend to rely more heavily than boys on such gestures, that structured parent-child interactions are important to the development of these gestures, that the gestures tend to depict the function rather than the form of objects, and that the use of gestural labels is positively related to verbal vocabulary development. Implications of these findings for theories of language development and for speech pathology are discussed.

As recently as 15 years ago, a pervading assumption within the language-acquisition literature was that a discontinuity existed between the onset of language, as marked by the appearance of the first verbal "word," and everything that went before. What went before, presumably, was language "play" in the form of babbling rather than any type of communicative competence. Satisfaction with this discontinuity hypothesis began to decline as it became clear that the communicative function of language was far from totally dependent on vocal symbols but was instead an early product of a rich repertoire of nonverbal behaviors. For example, Bates and her associates showed quite conclusively that infants develop gestural pointing, giving, and showing in order to signal the desire for a specific item and/or joint attention to a specific object (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979).

The purpose of the present set of studies is to describe another form of nonverbal communication during the early stages of language development, namely, the use of nonverbal gestures (often referred to here as "signs") to *symbolically* represent objects, events, desires, and conditions in order to communicate with those around them. In addition, we will explore the manner by which such gestures arise, the degree to which they are grounded in interpersonal interactions with parents, and their relation to language development in the form of verbal acquisition. We will conclude that such gestures function for the young infant very much the same way that early verbal items do, and that, as a consequence, the evidence points to the existence of a common mechanism underlying both forms of early communication.

Theoretical Foundations and Existing Evidence

In their classic book on symbol formation, Werner and Kaplan (1963) suggested that one should expect young infants to recruit sensorimotor schemes in the service of early language. These schemes, developed originally within the context of "action on the world," would be adapted for use as symbols once the infant had grasped the underlying notion of representation. Such behavior, they contended, would constitute an excellent example of the developmental dictum that old forms (i.e., sensorimotor schemes) serve new functions (i.e., naming). These action-based symbols would have the advantage of containing within them a practiced association with the referent, even, in many cases, an iconic

The authors are extremely grateful to Nancy Herse and Curt Acredolo for their generous help and support in all phases of this research. Portions of this article were reported at the meetings of the Society for Research in Child Development in Toronto (April 1985) and the International Conference on Infant Studies in Beverly Hills (April 1986). Requests for reprints should be sent to Linda P. Acredolo, Psychology Department, University of California, Davis, CA 95616.

[*Child Development*, 1988, **59**, 450–466. 0009-3920/88/5902-0017$01.00]

association, thus easing memory load. Eventually, with the continued passage of time and experience in the symbolic realm, one would expect a shift toward a distancing of symbolic vehicle from referent, a process Werner and Kaplan called "decontextualization." The end result would be a tolerance of, and even a preference for, the type of arbitrary relation between vehicle and referent that characterizes most verbal words.

Although Werner and Kaplan pose an intriguing hypothesis, the question remains whether normal infants do in fact exhibit spontaneous gestural symbols early in the development of language. At first glance, a phenomenon labeled "gestural names" by Bates and her associates (Bates et al., 1979; Bates, Bretherton, Shore, & McNew, 1983; Bretherton, Bates, McNew, Shore, Williamson, & Beeghly-Smith, 1981) might seem to be a candidate. However, these gestures—such as pretending to feed a doll—were never reported as being used communicatively, nor were they abbreviated or consistent in their form from time to time. In short, these behaviors are more akin to symbolic play and, although interesting in their own right, do not provide the kind of evidence we seek in our efforts to validate Werner and Kaplan's hypothesis.

Other reports come much closer to proving Werner and Kaplan's contention that early naming is not modality specific. First, there are the provocative data provided by Goldin-Meadow and Feldman (1975) showing that congenitally deaf infants denied exposure to sign language will on their own develop stereotyped gestures to refer to objects around them. Such data are indicative of the flexibility of the symbolic system but leave unanswered whether such gestural symbols are resorted to only under the extreme conditions imposed by total inaccessibility of verbal symbols.

Complementing this milestone work with deaf infants are reports of success in exposing hearing infants to American Sign Language (ASL) during the first year of life (Bonvillian, Orlansky, & Novack, 1983; Holmes & Holmes, 1980; Prinz & Prinz, 1979). These studies are consistent in showing that hearing infants are quite capable of incorporating gestural symbols into their early vocabularies. Moreover, they even provide some evidence that such symbols actually predate verbal symbols in the repertoire of the infants. Overall, then, there does seem to be at least indirect support for Werner and Kaplan's contention that action in the service of representation is within the capacity of young infants.

However, by far the most promising evidence to date comes from a case study of our own involving an American infant who spontaneously developed a repertoire of 13 symbolic gestures (Acredolo & Goodwyn, 1985), and recent reports by two Italian co-workers who document the development of symbolic gestures by several Italian infants (Caselli, 1983; Volterra, 1981; Volterra & Caselli, 1983). Of additional interest is a recent report by Zinober and Martlew (1985) describing the general development of gestures in two children. Although they do not single out in any formal way the type of gestures of interest here, they do report that some gestures tended to become increasingly "flexible" in that they were extended beyond the context in which they developed and seemed to take on representational properties during communication.

As provocative as case study data are, however, they obviously cannot tell us how widespread a phenomenon symbolic gesturing is, the context within which it typically develops, or how it relates to language acquisition in general. The two studies presented here were designed to provide information relevant to these questions. The first, a study of 38 17-month-old infants, consisted of lengthy interviews with mothers concerning the nonverbal and verbal communication they had observed in their infants (Experiment 1). The purpose was to determine as quickly as possible if the phenomenon was pervasive enough to warrant long-term study. Based on the success of the interview study, a longitudinal study of 16 infants was conducted (Experiment 2). Throughout the description of both studies, the labels "symbolic gesture" and "sign" are used interchangeably, the latter deriving from an analogy to the symbolic gestures of ASL.

Experiment 1: Interview Study

Method

Subjects

Subjects included 38 16–18-month-old infants (M = 16.89), 21 males and 17 females, whose names were located through birth announcements in local newspapers. Forty-two percent of the infants (nine males, seven females) were firstborns. Eighty-two percent of the mothers and 92% of the fathers had had at least some college, indicating a primarily middle-class sample.

Procedure

An introductory letter alerted mothers to the types of nonverbal communication of interest to us. Interviews lasted about 1 hour and were audiotaped. In addition, two interviewers kept independent written records of the mothers' responses. During the initial phase, discussion centered around any nonverbal gesture the mother thought might qualify as symbolic. Once the mother had identified a potential gesture, information was elicited about its form, frequency, and age of appearance, the manner in which it had been acquired, the contexts in which it occurred, and the age at which synonymous vocalizations had appeared. Information relevant to the context of use included whether the gesture tended to occur spontaneously, in response to some kind of verbal prompt, and/or in response to modeling by the parent. The types of physical situations in which the gesture occurred were also recorded, and in the case of Object signs (i.e., gestures representing specific objects in the environment), this included whether the gesture was used to label real objects, pictures, and/or items resembling the referent in appearance or name (e.g., a "turkey" sign to label frozen turkeys). Demographic questions (e.g., birth order) and questions about verbal development followed. Mothers were also asked to report any words (including proper names) in their children's repertoires, with "word" defined as a sound pattern used consistently by a child to refer to an identifiable referent. In order to prompt their memory, the interviewer suggested categories (e.g., food items) within which early words are likely to fall. Although admittedly only an estimate of each child's verbal vocabulary, the measure was adequate for the types of correlational analyses planned.

Categorization

Each example of nonverbal communication described by a mother was judged symbolic or nonsymbolic using the criteria specified below. In order to be secure in our application of the label "symbolic," two coders independently reviewed all the materials. Use of the formula "number of agreements over the total number of agreements plus disagreements" yielded a reliability figure of 86%. Disagreements were resolved through discussion. Gestures were also placed into one of five categories based on the function served. These included Object signs, Requests, Attributes, Replies, and Events. Notably absent from our categorization scheme are the five nonverbal gestures whose occurrence during infancy has already been well documented: the deictic gestures of pointing to request and to comment, the replies "yes" and "no," and waving for "bye-bye." The relation between the gestures at issue in the present research and these more conventional gestures is a question for future research.

General criteria.—In order to be included in *any* category, a gesture had to meet the following two criteria: (1) Frequency: The gesture had to be described as occurring repeatedly in the same form, a criterion parallel to one of the classic requirements for identifying early verbal words. In addition, this criterion served to discriminate between true symbolic vehicles and one-time-only imitations of ongoing actions of objects. Our assumption was that behaviors of the latter sort quite likely represent an attempt by the child to mimic what is being seen rather than an attempt to attach a symbolic vehicle to it. (2) Gestural component: The behavior had to include at least one truly gestural component. In other words, when a gesture included a sound, a nonauditory component had to be clearly discernible were one unable to detect the sound.

Criteria for object gestures.—Included in this category were gestures used to denote the presence of specific objects (e.g., a panting gesture for "dog," a sniffing gesture for "flower"). They were often reported by the mother to be accompanied by pointing, and even more often by eye contact. In addition to meeting the general criteria, an Object sign also had to be generalized by the child beyond the specific situation in which it was first acquired. In 70% of the cases this criterion was met by use of the gesture to refer both to examples of the real object and to pictures of the object. In cases where such generalization was not seen (quite frequently due to lack of exposure to such pictures, or *only* exposure to pictures) the gesture had to occur in response to multiple examples of the object (e.g., to more than one dog or cat). The purpose of this criterion was in part to help rule out the type of one-time imitations described above. A second purpose was to eliminate gestures that had been learned within the contexts of specific songs, routines, or games (e.g., "spider" in "Eency Weency Spider") and were never spontaneously generalized beyond this context. Such gestures probably lack true symbolic meaning for the child and would more accurately be categorized as "prelexical" (Dore, 1985; Nelson & Lucariello, 1985).

Requests.—A nonverbal behavior was categorized as a Request sign if, in the mother's opinion, it served primarily to indicate something the child wanted or needed. These opinions were inevitably based on pairing of the gesture with looks to the parent and, often, on continuation of the sign until the parent responded. Sometimes the request signaled a desire for something quite specific, such as a popsicle (i.e., a knock on the refrigerator door) or an opportunity to play the piano (i.e., up-down movement of the hands). The temptation in these cases was to construe these gestures as Object signs since they occurred in relation to specified objects. However, we were careful not to do so because such behaviors lacked generalizability to other contexts. It should also be recognized, though, that this is essentially a conservative criterion and one that may lead to the incorrect categorization of some gestures. It seems quite conceivable that the failure to observe generalization of a Request gesture could result from factors other than the cognitive limitation being assumed. Opportunities may simply not arise, the child may not be motivated to gesture, or the parent may simply fail to notice or may misinterpret use of the gesture. It seemed to us, however, that in this initial investigation the advantages of a conservative criterion overrode the possible problems associated with it.

Request gestures also had to be symbolically representative of a desire rather than directly instrumental in attaining a goal. For example, infants who push or pull on the front door when they want to go out may well be signaling a desire to their mother. An alternative explanation, however, is that the infants are simply trying to get out by themselves and really have no notion that they are in fact signaling something. In other words, such behaviors are inherently ambiguous. Since it is impossible to determine the presence or absence of the intent to signal in cases like these, the decision was made to exclude all *potentially* instrumental actions from consideration as signs. In contrast, if an infant, as several did, goes to the door and makes a knob-turning gesture (without the knob), we felt justified in assuming the presence of an intent to communicate since there was no way that such a gesture could succeed in opening the door directly. Rather than being instrumental, the gesture is symbolic. The same distinction was frequently made in connection with requests to be lifted, where the raising of the arms was considered a necessary component of the desired goal and therefore instrumental rather than symbolic. In contrast, a child who opened and closed her fist to signal the desire to be lifted was credited with having a symbolic gesture.

Attributes.—In order to be categorized as an attribute, a sign had to function primarily to describe an object or objects. Included in this category were signs representative of such qualities as "hot," "all gone," and "big." As was the case with the Request gestures, the gesture had to be communicative rather than "instrumental." For example, in order to be counted, the gesture for "hot" could not be involved in actually cooling off the object being described.

Replies.—Included in this category were signs, other than "yes" and "no," that were used by the child specifically in response to a question. The most common of these by far was a shrug of the shoulders to symbolize "I don't know."

Events.—Included in this category were signs, other than "bye-bye," that were used by the child to comment on a specific type of event. For example, one child used a clapping sign in response to baseball games—real or pictured.

Results and Discussion

Frequency and Individual Differences

Overall, 148 gesture/referent pairs met our criteria (62 Object, 50 Request, 30 Attribute, 3 Reply, 3 Event), thus indicating that symbolic gesturing is far from rare (see Table 1 for examples). Signs tended to be used on a daily basis and to depict a great variety of objects, desires, and states. Among the most commonly observed were the Object signs "flower" (7), "dog" (4), and "horse" (4), the Request signs "out" (10) and "up" (6), and the Attribute signs "hot" (15) and "all gone" (11). It is instructive to note that these items are also frequently noted among infants' earliest words. Parents reported that signing was a phenomenon of the first half of the second year, with individual signs continuing only until a comparable verbal label was developed. In other words, just as Werner and Kaplan had predicted, the gestures seemed to be transitional forms that served to ease the infants into the symbolic function and substitute until the "distancing" process was complete and the articulation of specific words could be worked out.

Presented in Table 2 are the percentages of male, female, firstborn, and later-born subjects who produced signs of the five types

TABLE 1

SUMMARY DATA AND EXAMPLES OF THE FIVE CATEGORIES OF SYMBOLIC GESTURES OBSERVED AMONG 38 INFANTS IN EXPERIMENT 1

Category and Examples	Total Observed[a]	Onset Age[b]	Frequency[c]
Object:			
"Flower": sniff	44	13.47	1.68
"Dog": panting			
"Airplane": arms out			
Request:			
"Out": knob-turn gesture	41	12.88	2.55
"Nurse": pats M's chest			
"Food": smacks lips			
Attributes:			
"Hot": blow or wave hand	6	12.40	2.39
"Many": wave hand back/forth			
"Big": raise arms			
Reply:			
"I don't know": open palms	1	14.12	2.17
Event:			
"Baseball game": clapping	2	13.00	.50

[a] Number of different gestures observed, some exhibited by more than one subject.
[b] Mean age in months based on mothers' estimates.
[c] Mean frequency per day at height of use.

under investigation. Also presented are the mean number of signs in each category exhibited by these subject groups. Overall, 87% of the subjects had at least one sign in their repertoire, with the mean number of signs equal to 3.89 (range = 0–16). A 2 (sex) × 2 (sibs) analysis of variance applied to the total number of signs indicated a main effect for sex that was very close to significance, $F(1,34) = 4.049$, $p = .052$, with females producing more signs than males. No sibs main effect or interaction was found. Thus, these data suggest a trend in the direction of more signing by girls than boys. Such a possibility is bolstered by the results of a 2 (sex) × 2 (sib) analysis of variance applied to the subcategory of Object signs. This analysis revealed a significant main effect for sibs, firstborns > later-borns, $F(1,34) = 4.362$, $p = .044$, and a sex × sibs interaction which came very close to significance, $F(1,34) = 3.895$, $p = .057$, due to the fact that there was a significant difference ($p < .01$) between first- and later-born females (means = 3.86 and .90, respectively) but not males (means = 1.89 and 1.00, respectively). From this analysis it seems that Object signing was especially the province of firstborn infant girls. Nonparametric analyses of the proportions of subjects in each group producing Object signs supported this conclusion. The only significant difference in the propensity to use Object signs was between seven firstborn females (86%) and 10 later-born females (20%) (Fisher's exact probability test, $p = .015$, two-tailed). In addition, a subgroup of children who exhibited a particularly large number of signs included only females. Specifically, three females were credited with 12 gestures and one with 14. The next largest number among the remaining children was eight. Why there should be this apparent advantage for females is not clear. It may in part be due to the frequently documented advantage girls are found to have over boys in the rate of language development in general. In addition, a close look at the nature of parent-child interaction and its relation to symbolic gesturing could shed light on the issue. At the very least, the suggestion of a sex effect favoring females in this phenomenon deserves further attention.

In contrast, analyses applied to the Request and Attribute data indicated no significant differences based on sex, sibs, or the interaction between them. Both these types of signs occurred among the majority of infants and were evenly distributed across subgroups.

Relation to verbal development.—In order to explore the relation between the verbal and nonverbal symbolic domains, each child was assigned a score from 0 to 10 based on the number of words estimated to be in his or her vocabulary at the time of the interview (0 = 0–9 words, 1 = 10–19 words, 2 = 20–29 words, etc.). These scores were correlated with the number of (1) Object signs, (2) Re-

TABLE 2

PERCENTAGE OF SUBJECTS IN EXPERIMENTS 1 AND 2 PRODUCING SYMBOLIC GESTURES AND THE MEAN NUMBER OF GESTURES EXHIBITED IN EACH CATEGORY

SUBJECTS	TOTAL		OBJECTS		REQUESTS		ATTRIBUTES		REPLIES		EVENTS	
	%	*M*	%	*M*	%	*M*	%	*M*	%	*M*	%	*M*
Females:												
Firstborns (*N* = 7)	86	7.1	86	3.9	57	2.6	71	1.0	29	.3	29	.3
Later-borns (*N* = 10)	80	3.8	20	.9	60	2.6	50	1.0	0	.0	20	.2
Total (*N* = 17)	82	5.2	47	3.4	59	2.1	24	.2	24	.2	24	.2
Males:												
Firstborns (*N* = 9)	89	2.8	44	1.9	67	1.9	33	.3	0	.0	0	.0
Later-borns (*N* = 12)	92	2.9	50	1.0	83	1.0	75	.8	0	.0	8	.1
Total (*N* = 21)	90	2.9	48	1.4	76	1.1	57	.6	0	.0	5	.1
Total:												
Firstborns (*N* = 16)	88	4.7	63	2.4	63	1.4	50	.6	13	.1	13	.1
Later-borns (*N* = 22)	86	3.3	36	1.0	73	1.3	64	1.0	0	.0	14	.1
Total (*N* = 38)	87	3.9	47	1.6	68	1.4	59	.8	5	.1	13	.1

	EXPERIMENT 2									
	OBJECT		REQUEST		ATTRIBUTE		OTHER		TOTAL	
	%	*M*	%	*M*	%	*M*	%	*M*	%	*M*
Females (*N* = 10)	90	3.0	90	1.7	70	1.3	30	.4	100	6.3
Males (*N* = 6)	50	1.3	50	.7	67	.8	17	.2	100	3.0
Total (*N* = 16)	75	2.4	75	1.3	69	1.1	25	.3	100	5.1

quest signs, and (3) total number of signs exhibited by each child. The Pearson correlations were $r = .53$ ($p = .001$) between vocabulary and Object signs, $r = .03$ (N.S.) between vocabulary and Request, and $r = .42$ ($p = .009$) between vocabulary and total signs. These results suggest that it is the propensity to produce Object signs, not Request signs, despite the prevalence of both, that might be linked with vocal development.

The next step was to determine whether these correlations between vocabulary and signing behavior were simply reflections of relations between vocabulary and the subject variables of sex, sib status, and mother's education, all of which have repeatedly been acknowledged to be predictive of language development. To this end, three hierarchical multiple regression analyses were conducted with vocabulary as the dependent variable. Sib status (firstborn vs. later-born), sex, and level of mother's education were considered potential covariates and were entered as a set in the first step. The next variable entered in each regression was one of three signing variables: the number of Object signs, Request signs, or total signs. Results indicated that, as expected, both sex and sib status were each significantly related to vocabulary even when the two remaining subject variables in the set were partialed, sex: $F(1,34) = 4.139$, $p < .05$; sibs: $F(1,34) = 5.093$, $p < .05$. More important for our purposes, Object signs continued to be significantly correlated with vocabulary, even with all three subject variables partialed, $F(1,34) = 5.948$, $p < .025$. In terms of the amount of variance accounted for, the covariates accounted for 28% of the variance in 18-month vocabulary, while Object signs accounted for an additional 11%. Thus, the relation between Object signs and vocabulary appeared to be robust and to exist independent of sex, sib status, and mother's education. In contrast, neither the number of Request signs nor the total number of signs was related to vocabulary once the subject variables were partialed. It is our guess that the relation between Object signs and verbal vocabulary is indicative of a common denominator underlying development in both modalities. Specifically, those infants who have figured out that objects have names and that names can be used to represent objects to others have solved a significant portion of the mystery of language.

Acquisition of Object Signs

Because of their similarity to early words, as well as their apparent statistical association with vocal development, more detailed analysis of the source and form of Object signs was conducted. Two major categories were identified, both of which were further divided into subcategories. Two independent coders judged category membership and achieved a reliability figure of 93% based on the number of agreements over the total number of agreements plus disagreements. Disagreements were resolved through discussion.

Object signs first were designated as either arising within (59%) or outside (41%) of interactive routines. Within the former group, two subcategories were identified. The first included symbols *purposefully taught* in routines by parents but spontaneously generalized by the infant (20% of Object signs). For example, a child taught to clap wrists like a seal might then spontaneously use this gesture to label seals. The second subcategory included symbols *abstracted from routines by the child* (39% of Object signs). For example, several infants used bouncing of their torso as a sign for horse, an action stemming from being bounced on an adult's knee.

Among the 41% developed outside of interactive routines, the vast majority were developed by the child as imitations of actions associated with the object (36% of Object signs). This action might be *an action inherent in the object* (e.g., panting of a dog, flapping of a bird) or, even more frequently, *an action the child does or sees done with the object* (e.g., cord-pulling for "motor," kissing motion for "dog," rubbing tummy motion for "soap"). The remainder of those developed outside of interactive routines (5%) either *depicted the form* of the object (e.g., cupped hand held high for "moon") or were ambiguous.

What are we to make of these data? First, the fact that parent-established routines play a role is reminiscent of the ways in which early verbal words are thought to be acquired (Bruner, 1983; Camaioni & Laicardi, 1985), thus supporting the supposition of parallels between symbolization in the two modalities. By creating a predictable scenario within which the child's contribution is clearly structured, the parent is providing the optimum setting for the child to grasp the representative nature of names, as well as the motivation to do so (Dore, 1985). However, in some sense the Object signs arising outside of routines are the more interesting, given that the initiative seems to have arisen from within the child rather than as an element from a *well-rehearsed* interactive pattern. The stress on the term "well-rehearsed" is important.

What distinguishes those signs arising within routines from those arising outside of routines is not whether or not the child was imitating an action he or she had seen a parent perform. For many of the Object signs assigned to the latter category (i.e., outside of routines), imitation of an action done with the object was the form of the gesture, and it is presumed that the child's knowledge of such actions arose in part from having observed the use of the objects by those around them (e.g., fist to ear for "phone," wheel-turning for "tractor"). Instead, the crucial distinction is whether or not the child's observation of the action occurred primarily within a set formula of parent-child behavior or whether the child was abstracting the action from a loosely defined set of person-object interactions. The latter is quite often the case, and the implication is that interactive routines are not the sole source of early nonverbal names for things.

Finally, the manner-of-acquisition data also point to the importance of "function" to the child's concept of the object. In fact, these gestural names provide a unique window into the nature of the child's early concepts in that, unlike verbal names, the child is often responsible for choosing the form the gesture is going to take. Looking at the gestures arising outside of routines, we see a clear preference for depicting an action associated with the object rather than a static perceptual quality. Thus, as Nelson predicts, the function of the object for the child seems to take precedence over its form. Of course, as Nelson also predicts, the extension of the gestural "name" to new objects may well be based on perceptual qualities (Nelson & Lucariello, 1985).

Acquisition of Requests and Attributes

The same categories used to categorize the Object signs were not all applicable to the question of the origin of the other two large groups of signs—Requests and Attributes. Briefly, our analysis of Request signs indicated that 10% arose within interactive routines, while 90% did not. This 90% included 10% conventional gestures (e.g., wave for "want out"), 52% easily interpreted gestures (e.g., tug on clothes for "want up"), and 28% idiosyncratic gestures (e.g., lips on mother's lips for "nurse"). The Attribute gestures lent themselves to division into the following categories: 3% within routines, 73% imitations of adult gestures (e.g., blow for "hot"), and 7% idiosyncratic. From these data it would seem that routinized interactions between parent and child are less important for Requests and Attributes than they are for Objects, perhaps because parents are less likely to establish well-rehearsed routines with a request or attribute as a central, salient component. However, particularly for the Attributes, observation of gestures frequently modeled by one's parents remains important.

Experiment 2: Longitudinal Study

It would seem that Werner and Kaplan's prediction is correct. Nonverbal sensorimotor behaviors are indeed used in the service of the representative function of naming during language development. However, due to reliance on maternal memory for the data just described, it is difficult to assess accurately the age or manner of onset of these symbolic gestures or their relation to verbal development as it proceeds step by step. In order to obtain more accurate data, it seemed essential that a longitudinal study be conducted on as large a scale as possible.

Method

Subjects

Subjects included 16 11-month-old infants, six males (three firstborn) and 10 females (seven firstborn). Ninety-four percent of the mothers and 100% of the fathers reported having had at least some college, thus indicating a primarily middle-class sample.

Design

During the 9-month period from 11 to 20 months of age, mothers were asked to keep weekly records of both nonverbal and verbal behavior. In addition, at 17 months, the infants were seen in the laboratory to assess individual differences in the propensity to imitate gestures produced by an adult. At 20 months, a formal estimate of verbal vocabulary size was collected, and an interview regarding signing behavior was conducted to clarify the information contained in the weekly reports. Finally, at 24 months, verbal vocabulary size was estimated again, MLU was measured, and each infant was given the Mental Development Inventory (MDI) of the Bayley Scales of Infant Development. The whole study, then, covered the 13-month period from 11 to 24 months.

Procedure

Diary recordings (11–20 months).—All mothers attended an orientation session just prior to their infant's 11-month birthday. Mothers were asked to record details of both nonverbal and verbal communicatory behavior on a weekly basis using diary sheets. Emphasis in the former case was on behaviors the mothers felt might fit the definition of symbolic gestures, and questions on the

sheets included specific queries about form, derivation, and contexts of use. We stressed that they should describe any gesturing that even remotely seemed communicative and/or symbolic, and that it was our responsibility to determine which behaviors actually did or did not qualify. Space was also provided for recording any new verbal words occurring during the week, with "word" defined as a sound used consistently to refer to a particular referent or class of referents. This definition, along with a definition of "symbolic gesture," was included in a notebook containing diary sheets and general instructions. Finally, mothers were informed that an experimenter would visit once a month to pick up completed sheets and answer questions.

Seventeen-month assessment of gestural imitation.—A videotaped laboratory session at 17 months was designed to assess infants' propensity to imitate gestures modeled by an adult. The supposition was that the tendency to rely on gestures for communication might be related to a general tendency to attend to and imitate physical gestures of salient adults. The gestures chosen included representatives of each of the following categories of gestures, presented here in order of increasing difficulty (Uzgiris & Hunt, 1975): (*a*) familiar gestures with objects (i.e., stir cup with spoon, clap blocks together, put arm through ring); (*b*) unfamiliar gestures with objects (i.e., drink from shoe, wind beads around arm, clap doll's legs together); (*c*) visible gestures without objects (i.e., wiggle finger, pound fists together, flap arms like chicken); and (*d*) invisible (during execution by child) actions without objects (i.e., pat head, pull ear, poke puffed cheeks). Order of presentation of the 12 items was random, and each gesture was introduced with the phrase, "[Name], look at this." For those items involving objects, duplicate objects were available to experimenter and child. The gesture was modeled three times separated by approximately 10 sec, and the child was given credit if at least one imitation occurred before the next item was presented. Since the dimension of interest was the *propensity* to imitate rather than imitative skill per se, a perfect replication was not required in order to be credited for an item.

Twenty-month interview and language assessment.—As the diary recordings came to an end, each family was visited in order to clarify, where needed, the information supplied in the diaries. In addition, they were given a week to fill out a questionnaire designed to estimate verbal vocabulary. This questionnaire, modeled after a procedure used by Bates et al. (1979), consisted of a categorized list of potential words (including proper names) plus space for additional items.

Twenty-four-month follow-up.—At 24 months of age, infants were visited in their homes in order to assess MLU and cognitive maturity. The former was calculated from audiotapes of a play session lasting about 30 min and involving mother, child, experimenter, and a standard set of toys. At the close of this play session, the MDI portion of the Bayley Scales of Infant Development was administered. Finally, mothers were given 1 week to complete the same questionnaire used at 20 months to estimate vocal vocabulary size.

Results

Categorization of Gestures

The system used in Experiment 1 was applied here, except that Events were subsumed under Objects due to the rarity of Event gestures and their functional overlap with the larger group. In the present study, of those gestures that qualified as Object signs, 57% were used to refer to more than one of three types of referents: real objects, pictures, other representations. The remaining 43% were used to refer to more than one example of the same category of referent (e.g., more than one candle). Two coders reviewed all the materials independently, yielding a reliability figure of 86%. Disagreements were resolved through discussion.

Analyses

Frequency.—Presented at the bottom of Table 2 are the percentages of male and female subjects exhibiting symbolic gestures and the mean number exhibited for each of four gesture categories. As can be seen, an impressive degree of symbolic gesturing occurred, thus corroborating the results of the interview study. Overall, 81 gesture/referent pairs met our criteria. These included 38 Object signs, 21 Request signs, 18 Attribute signs, and 4 Other signs across the 16 children. The mean number of signs per child was 5.06 (range = 1–17), with Object signs being the most numerous (contributed by 75% of the subjects). Examples of Object signs, along with age and manner of acquisition information, are presented in Table 3.

Consistent with the trend observed in the interview study, a comparison of the total number of signs exhibited by males versus females indicated a significantly higher number among the females, $t(14) = -1.77$, $p < .05$. Females also exhibited more Request signs than males, $t(14) = -2.00$, $p < .05$. The

TABLE 3

EXAMPLES OF OBJECT GESTURES FROM THE LONGITUDINAL STUDY

Referent	Gesture	Age[a]	Acquisition[b]
Rabbit	Hops	14.8	Within/taught
Spider	Rubs index fingers	15.5	Within/taught
Bee/jet	Thumb to index, waved	17.0	Within/taught
Light switch	Wiggles finger	15.0	Within/abstracted
Horse	Bounces body	14.3	Within/abstracted
Sun	Finger pressing eye	18.0	Within/abstracted
Bird	Waves hands to side	14.0	Outside/inherent action
Horse	Raspberry motion	15.5	Outside/inherent action
Cookie monster	Fingers to mouth	19.0	Outside/inherent action
Swing	Rocks torso	17.3	Outside/child's action
Noise	Finger to ear	17.0	Outside/child's action
Ball	Throwing motion	16.0	Outside/child's action

[a] Age in months when symbolic use of gesture appeared.

[b] Manner of acquisition: (*a*) within interactive routine/purposefully taught by parents but spontaneously generalized by child; (*b*) within interactive routine/spontaneously abstracted by child; (*c*) outside interactive routine/imitation of action inherent in object; (*d*) outside interactive routine/action done by child with object.

number of Object signs, however, did not differ significantly between the sexes, nor did a 2 (sex) × 2 (birth order) analysis of variance applied to any of the gesturing measures reveal any differences attributable to birth order or interactions between sex and birth order. Given the relatively low numbers within each sex × birth order group (three later-born males and three later-born females), the failure to replicate the birth order effect for Object gestures found in the larger interview study is not surprising. However, consistent with the earlier study, these data revealed individual differences in use of symbolic gestures. Specifically, one firstborn female exhibited 17 different signs, eight more than the next highest total.

Age of onset.—As determined from the diary records, the average age of onset for Object gestures was 15.59 months, for Request gestures 14.16 months, and for Attribute gestures 15.27 months. In order to determine if the difference in age between Object and Request gestures was significant, we examined the age data from the subset of subjects (N = 9) who had exhibited gestures of both kinds. Mean age of onset for each type of sign for each subject was calculated, and both a sign test and a Wilcoxon matched-pairs signed-ranked test were applied to the data. Both indicated a significant tendency ($p < .05$, two-tailed) for Request gestures on the average to precede Object gestures for these subjects. Specifically, in only one out of nine cases did the average age of onset for Request gestures exceed that for Object gestures. Thus, Request gestures appear to be an earlier phenomenon than Object gestures.

Manner of acquisition of Object gestures.—The categorization system used in this study was the same as that used in the interview study. Object gestures were categorized as originating either within or outside of interactive routines. Moreover, those occurring within routines were subcategorized according to whether the gesture had been *purposefully taught* by an adult, or had been *spontaneously abstracted* by the child. Those acquired outside of interactive routines were subcategorized as either *imitations of actions inherent in the object, imitations of actions done with the object,* or *actions depicting a perceptual quality (form or sound) of the object.* Intercoder reliability of assignment to these categories was 87%. Disagreements were resolved through discussion.

The results indicated that 32% of the Object gestures, compared to 59% in the interview, were identified by mothers as arising *within* interactive routines. For example, an "airplane" gesture used by one little girl was purposefully taught as a response to the question, "What does Daddy do?" (He was a pilot). The child then spontaneously generalized the gesture to real airplanes, pictures, models, and the noise of a plane heard overhead. About half the signs originating within routines were described like this one, as purposefully taught (14% of the total). The remaining half (18% of the total) were spontaneously abstracted from a routine by the child, the parents having made no conscious effort to teach the child the gesture.

In comparison, 68% of the Object gestures, compared to 41% in the interview, were

identified as having arisen outside of interactive routines. These are perhaps the more interesting, given that we can ask what it is that the child chooses to use to represent an object. The results showed a clear preference for using an imitation of an action the child did with the object (45% of the total). An additional 13% of the total were imitations of actions inherent in the object, and 10% were depictions of some perceptual quality of the object.

Manner of acquisition of requests and attributes.—The same categories used for the interview data were used here. Among the 21 Request signs, 24% arose within interactive routines, while 76% did not. This latter 76% included 9.5% conventional gestures, 29% easily interpreted gestures, and 38% idiosyncratic. Of the 18 Attribute gestures, 5% arose within a routine, 55% were imitations of adult gestures, and 39% were idiosyncratic. Although not identical to the percentages observed in the interview study, these data also provide support for our earlier conclusion that well-rehearsed interactive routines are not as likely to give rise to Requests or Attributes as they are to Object signs.

Relation to verbal vocabulary.—Another question of interest is the relation of these nonverbal communication behaviors to verbal development. Three patterns relative to this question emerged from the data. First, it was once again clear that the gestures and early words were serving complementary functions. As had been found in the interview study, a child tended strongly to have either a gesture or a word to refer to a referent, not both. When the two did overlap, it was invariably due to the word being briefly added to the gesture before the gesture disappeared completely.

A second important gesture/vocalization question concerns the relative timing of these two types of communication in the development of the child's language capacity. Do such symbolic gestures precede vocal language, representing an earlier step in the development of the naming/symbolic function? Do they come later, beneficiaries of the learning that has preceded them in the verbal domain? Or do both develop simultaneously, as evidence, perhaps, of some common mechanism underlying them both? In order to answer this very important question, each child's verbal vocabulary development was broken down into five stages: 0 words, 1–10 words, 10–25 words, 25–50 words, 50+ words. Presented in Table 4 are the numbers (and percentages) of gestures that were acquired within each of these five stages of vocal development. As can be clearly seen from the Table, symbolic gesturing tends strongly to be a phenomenon of early language development, 80% of them having an age of onset before the child reaches the 25-word stage. Despite their later age of onset in general, this same relation with early vocabulary was found for the subset of Object gestures too, 71% being acquired during the 0–25-word stage. These data, then, would seem to argue for the "simultaneity" hypothesis. Analysis in terms of individual subjects is totally consistent with the group picture: Out of 16 subjects, 11 developed all their symbolic gestures before they hit the 25-word point. Five subjects developed gestures later than this, but even for them the majority of gestures (M = 66%) were developed in the 0–25-word period.

A second way to approach the question of whether or not these two communication modalities are the product of one underlying mechanism is to look for correlations between the rates of development within each. The

TABLE 4

NUMBER (and Percentage) OF SYMBOLIC GESTURES IN LONGITUDINAL STUDY FIRST OCCURRING WITHIN EACH OF FIVE LEVELS OF VOCAL VOCABULARY DEVELOPMENT

No. of Vocal Words[a]	Gesture Category				
	Object	Request	Attribute	Other	Total
0	3 (8)	2 (10)	3 (17)	0 (0)	8 (10)
1–10	10 (26)	9 (43)	6 (33)	1 (25)	26 (32)
10–25	14 (37)	8 (38)	7 (39)	2 (50)	31 (38)
25–50	10 (26)	1 (5)	2 (11)	1 (25)	14 (17)
50+	1 (3)	1 (5)	0 (0)	0 (0)	2 (2)

[a] Based on diary records.

presence of positive relations would suggest, although not prove, that both are fueled by some common developmental advancement that enables the child to grasp the general value of symbolic function for communication. The possibility that such a positive relation might exist was suggested by the results of the interview study in which a positive correlation was uncovered between the rate of vocal vocabulary development and the number of Object gestures in the child's repertoire. The search for similar correlations within the longitudinal data led us to examine the relations among three gesturing measures (i.e., total gestures, Object gestures, and Request gestures) and four measures of vocal development (i.e., age at 10 words, vocabulary at 20 months, vocabulary at 24 months, and MLU at 24 months). It is perhaps not surprising, given the small number of subjects included, that most of these correlations were neither large nor even approached statistical significance. The one exception was a correlation between number of Object gestures and age at 10 words ($r = -.48$, $p < .10$). The larger the number of Object gestures a child developed, the younger the child was when the 10-word milestone was reached. Although only marginally significant, this correlation is worth reporting since it was obtained with so few subjects, is consistent with the positive correlation found in the interview study for Object gestures, and is suggestive, as was the analysis described above, of a relation between symbolic gesturing and very early verbal development.

Subsidiary measures.—Four other measures were examined for any relation with symbolic gesturing. These included mother and father's education, the propensity to imitate an adult's gestures in the laboratory at 20 months, and cognitive development at 24 months (as assessed by the MDI scale of the Bayley). No correlation between these measures and any symbolic gesturing measure even approached significance. Although the presence of a relation between symbolic gesturing and imitation in the lab setting would have been interesting, its absence is really not all that surprising. It would seem to be a very different thing to imitate a stranger doing gestures on a one-time-only basis and to imitate a gesture one has seen a parent or an object perform many, many times. Moreover, the purpose of the symbolic gestures is "communication," something clearly absent from the imitation game played in the laboratory.

We also looked for intercorrelations among the four language measures (i.e., age at 10 words, vocabulary at 20 and 24 months, and MLU at 24 months), the logic being that strong intercorrelations across time and techniques would be indicative of having genuinely tapped an individual child's linguistic progress. The four language measures did in fact correlate significantly (r's from $+.45$ to $+.81$), the only exception being a nonsignificant relation between age at 10 words and MLU at 24 months. In addition, the children's scores on the Bayley exam at 24 months were positively related to vocabulary and MLU at 24 months and the propensity to imitate gestures at 17 months. These results lend credibility to the methods used to assess vocal development and show a predictable relation between language and cognitive development.

Discussion: Experiment 2

Overall, the results of the longitudinal study corroborate the findings of the interview study. First, a wide range of symbolic gestures were found, their occurrence being noted by all 16 mothers. Second, the nearly significant sex difference (favoring females) revealed in the interview study was bolstered by the presence in the longitudinal study of a significant sex difference also favoring females. In both studies, females produced more symbolic gestures than their male counterparts. Third, as was the case with the earlier data, striking individual differences were found, at least one child in the longitudinal sample relying much more heavily than her peers on this type of communication. Fourth, the mothers' reports of the ways in which these gestures were acquired were very similar to the retrospective reports of the mothers in the interview study. Specifically, many gestures seemed to grow out of interactive routines between parent and child, while others were products of the child's own association of an action with an object or event. Finally, the longitudinal study, as did the interview study, provided some correlational evidence that the production of Object gestures was related to verbal development, in this case in the form of a tendency for those with many Object signs to reach the 10-word verbal vocabulary level earlier. In addition, the longitudinal data support the conclusion advanced earlier that symbolic gestures play a complementary role to the child's verbal vocabulary, the typical course of development being the replacement of a gesture by a verbalization as language acquisition proceeds. Implicit in this finding is also the fact that symbolic gesturing has been revealed in the

longitudinal study to be a phenomenon of early linguistic development, one that in the main proceeds in tandem with acquisition of the child's early verbal vocabulary.

General Discussion

Taken together, these studies provide the first definitive evidence of the widespread use by infants of symbolic gesturing for the purpose of communication during the early stages of language development. Thus, it seems clear that Werner and Kaplan (1963) were right in their prediction that the discovery by the infant of the symbolic function could be expected to manifest itself in the transformation of actions *on* objects to actions in the service of *representations* of objects.

But merely stating that infants adapt sensorimotor schemes for communicative purposes does not explain why they do so, especially when it would seem that the more conventional verbal format is modeled so heavily around them. Although no definitive answer is possible, several suggestions can be made. It may be, for example, that division of the "sound stream" is harder for infants than division of the "action stream," perhaps due in part to the infants' accummulated familiarity and preoccupation with actions on objects during the first year of life. Thus, as a child experiences a given routine with a parent in which both actions and verbalizations are repeatedly used with reference to a particular object, it may be that the child finds it easier to isolate and remember the action. If in turn the parent cooperates by acknowledging the association the child is making, the stage is set for the development of a gestural vehicle rather than a verbal one. In fact, it may be that in some cases the parent also finds the action produced by the child easier to interpret than his or her sound, and therefore provides reinforcement for the action in the form of successful communication. Viewed in this way, it is easy to understand why actions enter the early lexical picture. It also makes somewhat more understandable why we might expect individual differences in reliance on this nonverbal mode of communication. As will be discussed in more detail below, the degree to which an infant develops symbolic gestures may turn out to be as much a function of the parents' behavior as the child's. It is to this topic we now turn.

Individual Differences

One of the most striking consistencies between the interview and longitudinal samples was the evidence of individual differences in the propensity to rely on this type of communication. For example, both studies revealed a stronger tendency for girls to engage in symbolic gesturing than boys, and Experiment 1, with its larger representation of later-born children, indicated that this tendency was particularly strong among firstborn girls. In addition, both samples included some children who were clearly much more likely to use gestures than their peers. These findings also corroborate those of Zinober and Martlew (1985) who, in their informal recognition of symbolic gesturing, noted that such behaviors were much more frequent in one of two children whose development they were chronicling. Interestingly, this child was also the more advanced of the two in verbal vocabulary development, a fact which fits well with our own discovery of some positive relations between symbolic gesturing and verbal development.

The question of why such striking individual differences exist is an intriguing one, but at this point all we have to offer are speculative answers. The fact that there was evidence of more gesturing by firstborns and by females, for example, may indicate that the degree or kind of parental interaction the child enjoys plays an important role. This possibility receives additional support from the fact that many of these behaviors arise within the context of interactive routines between parent and child. What such interactions apparently provide are clearly identifiable actions to which the child is encouraged to attend and often, even encouraged to repeat. Thus, one obvious hypothesis is that parents of firstborns (perhaps due to fewer demands) and parents of females (perhaps due to greater incentive) create more opportunities of this sort and are therefore more likely to have children who abstract nonverbal labels. In regard to birth order effects, it is also, of course, conceivable that parents of firstborns are simply more likely to remember nonverbal gestures than are parents of later-borns.

The importance of parental style to an explanation of individual differences in gesturing can also be viewed from the perspective of how the parent *responds* to gestural labels. After all, it takes two to communicate, and if a parent fails to interpret correctly the child's gesture, then the nonverbal behavior is quite likely to be abandoned as ineffective and replaced by more attention-inducing behaviors (e.g., verbalizations, grabbing). This may be particularly likely in the case of a later-born child who has to compete with other children

for parental attention. In summary, it may be that the tendency to try using gestures symbolically is fairly consistent across children, but that variations in parental reactions result in the individual differences eventually seen.

Manner of Acquisition

The question of how these symbolic gestures are acquired is important for the insights the acquisition data provide relative to an ongoing debate within the verbal development literature. This debate concerns the role of social interactions versus cognitive advances in providing the foundation for the acquisition of labels. Although at this point there is general agreement that both the social and cognitive domains have a role to play, theorists still differ on the relative importance of the two as "driving forces" in the achievement of the insight that objects can be named and the resulting vocabulary spurt generally seen midway through the second year.

Proponents of the social-interaction hypothesis (e.g., Bruner, 1983; Camaioni & Laicardi, 1985; McShane, 1979; Ninio & Bruner, 1978) argue that one way in which the child's social world facilitates language is through establishment of well-structured, frequently repeated "routines" between adult and child. The idea is that these routines provide frameworks that highlight the label-referent match. Because each player's part is well rehearsed, the child's memory capacity is not taxed and his or her attention can be more easily focused on the pairing of a certain word with a certain object. The adult player may then encourage the child's fledgling efforts to try out the label by having the two switch roles within the game or by having the child play out the routine alone. Although initially context bound and therefore prelexical rather than truly lexical, these early labeling experiences increase the child's attention to labeling as a means of communication and thereby lead to the "naming insight" and the vocabulary spurt. Thus, even though cognitive processes such as concept development and attention are undoubtedly involved, the recognition that things have names is more directly a function of the "scaffolding" provided by interactive routines and the labels learned within them.

In general, proponents of the cognitive hypothesis of language acquisition place more emphasis on cognitive insights as the driving force behind advances in language. When one focuses on the development of the recognition that objects have names, this emphasis translates into the theory that labeling is a natural extension of the cognitive insight that objects are identifiable entities, amenable to labeling, which can be separated from the wholistic scenarios in which they are routinely encountered. The grasping of a decontextualized concept of objects is essentially a cognitive milestone and, according to Nelson (Nelson, 1974; Nelson & Lucariello, 1985), one which grows directly out of the child's interactions with objects in the course of daily life. Whether social interactions are involved is relevant only to the extent that such interactions constitute additional structured experiences with objects. More important, these experiences are primarily ones in which the *function* of the object is highlighted. And for Nelson the term "function" includes "the actions of things, actions on things, reactions of things, and the conventional uses of things" (Nelson & Lucariello, 1985, p. 70). Once a concept of a given object has been developed, then—and only then—can a label be attached. Thus, in contrast to the social interaction view, social interactions are not of any particular importance, and the achievement of labeling is considered more a by-product of a cognitive advance than a milestone in its own right.

What makes it difficult to determine the exact role of social interactions versus more general child-object experiences in accounting for acquisition of a given verbal label in the "real world" is that the label itself is the same no matter how it was acquired. The word "doggie" is the end result of either path of development. That is not so, however, with the symbolic gestures described here. Unlike words, one can look at the specific gestural form the child adopts as his or her symbol for a particular referent and thereby gain some insight into the relative importance of routines versus general experience, or form versus function, or whatever other distinctions seem theoretically important. For example, the fact that the gesture adopted for "ball" is a throwing gesture instead of a depiction of "roundness" provides evidence for the importance of function over form, and the fact that a finger-rubbing gesture is adopted for "spider" provides evidence of the importance of a specific routine between parent and child. Thus, we feel that these symbolic gestures provide a unique window into the processes that underlie language development in general. In particular, these data provide support for the notion that both the cognitive and the social interaction scenarios operate during development and probably operate in tandem to bring about recognition by the child that

things have names. Our conclusion is based on the fact that about half of the Object gestures the mothers reported (over both studies) took a form that mirrored an action specific to a given interactive routine between parent and child (e.g., sniffing for "flower"). Thus, in these cases there is evidence that the highly structured experience offered repeatedly by the parent provided both the action "label" and the framework for identifying that action's "referent." In this sense, then, the data provide support for the social interaction model.

However, evidence in favor of the cognitive model is also clearly available in these data. Although many of the Object gestures arose within identifiable interactive routines, at least an equal number did not. (In addition, relatively few of the Request or Attribute gestures came about in this way.) Based once again on the form of the specific action adopted by the child to depict the referent, we feel justified in concluding that Nelson's emphasis on experientially derived knowledge of function is not misplaced. For the vast majority of the Object gestures developed outside of routines, the action chosen by the child depicted either actions of things (e.g., waving hands for "butterfly"), actions on things (e.g., blowing for "matches"), reactions of things (e.g., blowing in imitation of mother for "hot"), or conventional uses of things (e.g., fist to ear for "telephone")—in other words, the whole litany of possibilities suggested by Nelson.

In fact, the case for the cognitive model even receives some support from a few of the gestures developed *within* interactive routines. These are cases in which the referent was never actually present but instead was merely represented verbally by the parent. For example, no actual horse is involved in the bouncing game through which one child acquired a gesture for real horses, and no actual spider is ever encountered in the song that resulted in one child's finger-rubbing gesture for real spiders. Instead, the child's concept of horse or spider arose independent of the routine, and through the common link of the verbal label provided inside and outside of the routine, the child eventually saw the applicability of the gestural "label" provided within the routine. Thus, in these cases the contribution of cognitive processes is especially clear.

One final source of support for the cognitive model stems from the phenomenon of symbolic gesturing taken as a whole. After all, each gesture is eventually replaced by a verbal word or phrase. But the fact that a gesture was used initially indicates unequivocally that, in these cases at least, a concept of the object was well developed before the arrival of the verbal label. In summary, then, what these data yield is evidence that *both* the social interaction and the cognitive models supply pieces of the puzzle. This observation is not original with us, but these supporting data, we would argue, are.

Relation to Verbal Development and Practical Implication

Our belief that the phenomenon of symbolic gesturing is intimately connected to verbal language development is based on a number of patterns revealed in our data. First, there are significant parallels between development in the two modalities: gestures and early words appear about the same time, assume a similar range of functions (with requests tending to precede object labels in both domains; see Griffiths, 1985), they arise in similar contexts, and both achieve symbolic status after an initial period of context-bound usage. Second, verbal and gestural labels tend very strongly to complement each other, a child exhibiting one or the other for a given referent rather than both. It is as though the child's desire to communicate is supreme, with the choice of which modality to use depending on whatever works within his or her particular social environment. Third, there are positive correlations between Object gesturing and early verbal vocabulary. Although at this point mainly suggestive, these relations do lend support to the hypothesis that development in the two domains is underlaid by common mechanisms (e.g., the symbolic function). It may even be the case that successful communication with gestures as object labels adds to the child's overall conviction that he or she is "on to something" with this labeling business and thus speeds along the naming process in the verbal modality. Such a facilitating effect could account for the fact that infants with more Object signs tended to advance more quickly to the 10-word point. Finally, it is worth noting that at least one child created a sign + sign combination, analogous to a verbal two-word combination, in our presence at 17 months. Specifically, she combined her panting sign for "dog" with her knob-turning sign for "go out," whereupon her mother proceeded to the next room to let the dog out. Although not common (see Acredolo & Goodwyn, 1985, for another example), such cases do add to our conviction that these gestures are functioning like verbal labels.

This litany of similarities between symbolization in the two modalities is of more than academic interest. As noted by Johnston (1983), clinicians are relying increasingly on nonverbal behavior to inform their diagnoses of language-delayed children. The idea is that a child for whom all symbolic behavior is absent presents a different picture from the child for whom the verbal expression of symbols is the specific stumbling block. Up to this point, pretend play has provided the primary tool for assessing underlying symbolic competence. We would suggest that a search for symbolic gestures as an alternative measure of productive communication would also be of benefit. In conjunction with separate measures of comprehension, attention to the presence or absence of symbolic gestures would help discriminate children with overall language delays from those with more specific productive language/speech problems.

Shift to Verbal Symbols

Despite their apparent utility to the brand new language user, individual symbolic gestures are eventually replaced by verbal words, and the phenomenon itself disappears fairly completely. Why? What is it that makes the use of vocal labels eventually so much more attractive to the child? The answer is that vocalizations have many advantages over gestures, as any user of ASL could probably tell you. (*a*) Gestures must be seen by others to be understood. One cannot stand in one's bedroom and shout a gesture to one's mother in the kitchen. (*b*) Gestures often require hand movements, while vocalizations leave the hands free to engage in other activities. (*c*) The gestures used by infants tend to be understood only by a small group of adults around the child. Thus, their utility decreases as the social world of the infant expands. (*d*) Parents are generally very concerned about promoting verbalization, and probably both consciously and unconsciously gradually begin to discourage reliance on the gestural modality. For all these reasons, symbolic gesturing is eventually abandoned in favor of vocalization, but not before it has played an important role in establishing communication between parent and child and yielded researchers valuable insights into the processes underlying language development in general.

References

Acredolo, L. P., & Goodwyn, S. W. (1985). Symbolic gesturing in language development: A case study. *Human Development*, **28**, 40–49.

Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1979). *The emergence of symbols: Cognition and communication in infancy*. New York: Academic Press.

Bates, E., Bretherton, I., Shore, C., & McNew, S. (1983). Names, gestures and objects: The role of context in the emergence of symbols. In K. Nelson (Ed.), *Children's language* (Vol. 4, pp. 59–123). Hillsdale, NJ: LEA.

Bonvillian, J. D., Orlansky, M. D., & Novack, L. L. (1983). Developmental milestones: Sign language acquisition and motor development. *Child Development*, **54**, 1435–1445.

Bretherton, I., Bates, E., McNew, S., Shore, C., Williamson, C., & Beeghly-Smith, M. (1981). Comprehension and production of symbols in infancy: An experimental study. *Developmental Psychology*, **17**, 728–736.

Bruner, J. (1983). The acquisition of pragmatic commitments. In R. Golinkoff (Ed.), *The transition from prelinguistic to linguistic communication* (pp. 27–42). Hillsdale, NJ: LEA.

Camaioni, L., & Laicardi, C. (1985). Early social games and the acquisition of language. *British Journal of Developmental Psychology*, **3**, 31–39.

Caselli, M. C. (1983). Communication to language: Deaf children's and hearing children's development compared. *Sign Language Studies*, **39**, 113–143.

Dore, J. (1985). Holophrases revisited: Their "logical" development from dialog. In M. D. Barrett (Ed.), *Children's single-word speech* (pp. 23–58). New York: Wiley.

Goldin-Meadow, S., & Feldman, H. (1975). The creation of a communication system: A study of deaf children of hearing parents. *Sign Language Studies*, **8**, 225–234.

Griffiths, P. (1985). The communicative functions of children's single-word speech. In M. D. Barrett (Ed.), *Children's single-word speech* (pp. 87–112). New York: Wiley.

Holmes, K. M., & Holmes, D. W. (1980). Signed and spoken language development in a hearing child of hearing parents. *Sign Language Studies*, **28**, 239–254.

Johnston, J. R. (1983). The preverbal child: Lessons for intervention practice. In R. M. Golinkoff (Ed.), *The transition from prelinguistic to linguistic communication* (pp. 261–274). Hillsdale, NJ: LEA.

McShane, J. (1979). The development of naming. *Linguistics*, **17**, 879–905.

Nelson, K. (1974). Concept, word, and sentence: Interrelations in acquisition and development. *Psychological Review*, **81**, 267–285.

Nelson, K., & Lucariello, J. (1985). The development of meaning in first words. In M. D. Barrett (Ed.), *Children's single-word speech* (pp. 59–86). New York: Wiley.

Ninio, A., & Bruner, J. (1978). The achievements and antecedents of labelling. *Journal of Child Language*, **5**, 1–16.

Prinz, P. M., & Prinz, E. A. (1979). Simultaneous acquisition of ASL and spoken English in a hearing child of a deaf mother and hearing father: Phasel—early lexical development. *Sign Language Studies*, **25**, 282–296.

Uzgiris, I., & Hunt, J. McV. (1975). *Assessment in infancy*. Chicago: University of Illinois.

Volterra, V. (1981). Gestures, signs, and words at two years: When does communication become language? *Sign Language Studies*, 33, 351–362.

Volterra, V., & Caselli, M. C. (1983). From gestures and vocalizations to signs and words. In W. Stokoe & V. Volterra (Eds.), *SLR 1983, Proceedings of the III International Symposium on Sign Language Research*. Rome.

Werner, H., & Kaplan, B. (1963). *Symbol formation*. New York: Wiley.

Zinober, B., & Martlew, M. (1985). The development of communicative gestures. In M. D. Barrett (Ed.), *Children's single-word speech* (pp. 183–216). New York: Wiley.