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On the autonomy of language and gesture: Evidence from the acquisition of personal pronouns in American Sign Language*

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Abstract[1]

Two central assumptions of current models of language acquisition were addressed in this study: (1) knowledge of linguistic structure is "mapped onto" earlier forms of non-linguistic knowledge; and (2) acquiring a language involves a continuous learning sequence from early gestural communication to linguistic expression. The acquisition of the first and second person pronouns ME and YOU was investigated in a longitudinal study of two deaf children of deaf parents learning American Sign Language (ASL) as a first language. Personal pronouns in ASL are formed by pointing directly to the addressee (YOU) or self (I or ME), rather than by arbitrary symbols. Thus, personal pronouns in ASL resemble paralinguistic gestures that commonly accompany speech and are used prelinguistically by both hearing and deaf children beginning around 9 months. This provides a means for investigating the transition from prelinguistic gestural to linguistic expression when both gesture and language reside in the same modality.

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[1]The typographic conventions used in this paper were as follows: material appearing in capital letters represents American Sign Language (ASL) signs and/or sentences (as in YOU). Material in italics represents English words and/or sentences (as in *you*). Actual, quoted utterances in ASL or English appear with quotation marks (as in "YOU" or "*you*"). English translations of ASL signed utterances appear in quotes and are not in italics (as in "you"). Starred sequences (*) represent ungrammatical (incorrect) utterances.

The results indicate that deaf children acquired knowledge of personal pronouns over a period of time, displaying errors similar to those of hearing children despite the transparency of the pointing gestures. The children initially (ages 10 and 12 months) pointed to persons, objects, and locations. Both children then exhibited a long avoidance period, during which one function of the pointing gesture (pointing to self and others) dropped out completely. During this period their language and cognitive development were otherwise entirely normal, and they continued to use other types of pointing (e.g., to objects). When pointing to self and others returned, it was marked with errors typical of hearing children; one child exhibited consistent pronoun reversal errors, thinking the YOU point referred to herself, while the other child exhibited reversal errors inconsistently. Evidence from experimental tasks conducted with the first child revealed that pronoun errors occurred in comprehension as well. Full control of the ME and YOU pronouns was not achieved until 25–27 months, around the same time when hearing children master these forms. Thus, the study provides evidence for a discontinuity in the child's transition from prelinguistic to linguistic communication. It is argued that aspects of linguistic structure and its acquisition appear to involve distinct, language-specific knowledge.

1. Introduction

Models of language acquisition can be grouped into two general classes based on their assumptions concerning both **what** is learned in acquiring a language, and **how** it is learned. According to "interaction-based" models (e.g., Bruner, 1975a, b; Bruner & Sherwood, 1976; Lock, 1978; Zukow, Reilly & Greenfield, 1980), language is derivative of general cognitive capacities rather than a specific linguistic capacity. Language is "built up" out of pre-established forms of knowledge, through the child's interactions with caretakers, objects and events in the environment. Given the richness of the child's experiences, and the close relationship between linguistic and non-linguistic forms of knowledge, the child's own contribution is thought to be restricted to general learning mechanisms.

According to "child-based" models (e.g., Gleitman, 1981; Gleitman & Wanner, 1982; Pinker, 1979, 1984; Roeper, 1981; Shatz, 1982, 1985; Wexler & Culicover, 1980) language emerges from knowledge structures specific to language; these constitute a distinct, domain-specific mental capacity. The child is assumed to possess a biologically given linguistic capacity that constrains the range of structural hypotheses she will entertain during the acquisition process; her task is to infer the structure of the particular language to which she is exposed. This view emphasizes the child's contribution to the acquisition process through its biologically given linguistic capacity. The first

of these views was developed from the work of Jean Piaget (1951, 1954, 1955) and the second from the work of Noam Chomsky (1957, 1965).

In recent years much research has been conducted, in part, as rebuttal to the Chomskian view of language acquisition. Recent research has focused on the "natural" way in which children's knowledge of language is built up from non-linguistic variables, with a special emphasis on the central role of prelinguistic gestures. Many researchers have sought to demonstrate that infant gestural systems and other motoric activity serve as the prelinguistic foundation upon which verbal language forms are directly "mapped" (e.g., Bruner, 1975a, b; Clark, 1973, 1978; Escalona, 1973; Lock, 1978; Greenfield & Smith, 1976; Masur, 1983; Volterra, 1981; Werner & Kaplan, 1963; Zukow et al., 1980).

It follows from this view that the child's early gestures should exhibit properties often thought to be unique to language, as argued by Bates (1976) and others (e.g., Acredolo & Goodwyn, 1985a, b; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Bates, Bretherton, Shore, & McNew, 1983; Bates, Camaioni & Volterra, 1975; Werner & Kaplan, 1963). Bates et al. (1983) note that children around the age of 13 months produce manual gestures with common objects in hand (e.g., brushing motions with a brush), and suggest that the use of these gestures is like the child's early use of referential words (e.g., saying *brush* upon noticing a brush). Because of the similarities between these "symbolic" manual gestures and words, Bates et al. conclude that they derive from common underlying cognitive capacities. According to this view, the 13-month-old child's gestures are not **pre**-linguistic; rather they are regarded as gestural equivalents of **names**. Given that spoken words are assumed to belong to grammatical categories such as nouns, manual gestures must also be considered to be a kind of "noun or object name" (Bates et al., 1983). The authors offer this analysis in support of the claim that linguistic structures and functions are derivative of general cognitive capacities rather than language-specific knowledge.

The view that language represents an elaboration of gestural communication has also been developed in regard to the relationship between pointing behavior and deictic terms. Clark (1978) proposed that the child's verbal deictic words (context-bound indicating terms such as *here, there, you, me*), emerge directly out of early pointing gestures in a natural and continuous progression (see also Bates, 1976; Bates et al., 1975; Bruner, 1975a; Leopold, 1949; Werner & Kaplan, 1963). A hallmark of human development is the onset of pointing gestures around 9 months. Pointing is thought to be a complex behavior, itself built up from earlier gestures in the following stages: the child reaches and grasps (taking objects "inward"); "shows off" (e.g., imitative clapping in the patty-cake game); shows objects; gives objects (extending objects "outward"); points to objects without communicative intention (i.e., without seeking shared eye gaze with adults); and finally points to

objects with communicative intention (i.e., seeking shared eye gaze; Bates et al., 1975; Werner and Kaplan, 1963).[2]

Early, non-communicative pointing is said to represent the child's emerging ability to recognize and distinguish self from external, distant objects (Werner & Kaplan, 1963). Communicative pointing later serves as the foundation for referential behavior and the concept of reciprocity arising from mother and child's joint actions and shared visual regard (e.g., Bruner, 1975a; Werner & Kaplan, 1963). Bates (1976) has analyzed infants' pointing as "sensorimotor naming" (see also Ninio & Bruner, 1978). Bates et al. (1975) further analyze the illocutionary function of pointing gestures as protodeclaratives and protoimperatives because they function to direct the adult's attention to objects, events or people, and to convey requests. Finally, Clark (1978) analyzes pointing gestures as nascent markers of definite and indefinite reference (i.e., the precursors of *the* and *a*).

Once pointing gestures are firmly established, verbal deictic terms are said to be mapped onto these "prelinguistic placeholders" (Bruner, 1981) in the following sequence: The child points out an object; she then points and simultaneously uses a verbal deictic marker such as "Da" for *there*; the child combines the deictic word (e.g. "Da") plus another word (e.g., *ball*), plus the point; finally, the child speaks without pointing (Clark, 1978). The sequence is thought to reflect not only the degree of complexity, but also the order of acquisition of the spoken forms.

In sum, the fundamental claim linking the various interaction-based accounts is that language emerges out of non-linguistic forms of knowledge and experience. Specifically, "speech and gesture are [viewed as] continuous, rather than discrete, sources of information" (Thompson & Massaro, 1986, p. 144; see also McNeill, 1985). Linguistic structures are parasitic upon prelinguistic communicative competence. Language is not a formal system in its own right, but seen as "built up" from pre-language, "mapped onto" it, created by "analogy" to it (Bruner, 1975a), or learned entirely from environmental input. The essential continuity of language and other, non-linguistic forms of knowledge is stressed. Construed as a testable hypothesis about the language acquisition process, it implies that the transition from prelinguistic communication to linguistic competence should be relatively smooth. That

[2]Researchers vary in how they categorize the early gestures that precede explicit pointing. Werner and Kaplan, for example, view reaching and grasping as distinct from pointing in that the former involves taking things "in", the latter denoting "out" from the child to the environment. As such, they would not include them on the same continuum as pointing. Bates *et al.* found that "giving objects" and pointing (with communicative intent) can co-occur. The types of gestures and the sequence in which they develop are indisputable, however.

is, if linguistic structures are elaborated out of prelinguistic forms, there should be no abrupt discontinuity in the use of these differing forms.

The alternative view is that if language is a distinct formal system reflecting a particular mental capacity, not wholly built up from early communicative competence, the transition from prelinguistic to linguistic expression may be discontinuous, marked by evidence of the reorganization of knowledge regarding the function and use of linguistic forms once they become part of a formal grammatical system.

1.1. Objectives

The main objective of the present research was to obtain empirical evidence bearing on these alternatives. Two theoretical questions were considered: (1) is the child's knowledge of a language built up from, or "mapped" directly onto already existing prelinguistic knowledge of the world?, and (2) does acquiring a language involve a continuous learning sequence? The first question addresses the types of knowledge the child brings to bear in the acquisition process, the second question addresses how the acquisition process proceeds over time. These questions were addressed by examining the acquisition of personal pronouns in American Sign Language (ASL).

2. Background

2.1. Pronouns and their acquisition in spoken language

First and second person personal pronouns (i.e., *I* and *you*, respectively) encode the most basic aspect of a conversation between two people, the participants themselves (Charney, 1978). Personal pronouns are found in all languages, and have both lexical and deictic (indexical) functions. Lexically, they can be marked for case and have other morphological and syntactic functions; deictically, they point to actual relations in the speech context (Ingram, 1971). In this respect, personal pronouns differ from other words because their meanings can only be interpreted with respect to the speech event. That is, the meanings of the pronouns *I* and *you* shift depending upon who is speaking. The same holds for deictic terms denoting, for example, time (*now* or *yesterday*) and place (*here* or *there*), which can be understood only by understanding the perspective of the speaker at the time of the utterance. In contrast, the meanings of most other words do not shift with a change in speaker. Personal pronouns are said to have "unstable" or "shifting" referencing properties, while most other words have "stable" referencing properties (Jakobson, 1957; Jespersen, 1924; Lyons, 1977).

Three noteworthy features characterize the hearing child's acquisition of pronouns. First, productive knowledge and use of pronouns generally occur well after the child's first words and typically appear in a particular order: Beginning around 18–22 months the pronoun *me* enters, followed by *you* around 22 months, and then third person pronouns (e.g., Charney, 1978; Macnamara, 1982; Tanz, 1980), with the entire learning process ending around 30 months. Second, prior to acquiring this knowledge children use full proper nouns (e.g., "*Jane do X*" instead of "*I do X*"), rather than the pronouns *me* or *I*, and continue to do so during the time when control of pronouns is still evolving. Thus, pronouns are avoided (Charney, 1978, 1980; Chiat, 1981, 1982; Macnamara, 1982, 1986; McNeill, 1963; Strayer, 1977). Third, around the time when *you* enters the lexicon all children exhibit unstable knowledge and use of pronouns, with some engaging in systematic (productive and consistent) pronoun reversal errors. For example, mother might say to the child "*Do you want to go to the store?*" and the child's reply would be "**Yes, you go store*", where *you* refers to herself rather than to mother. Similarly, the child may understand and produce *me* in reference to the adult rather than to herself, although it is uncommon for symmetrical *you–me* errors to co-occur (Chiat, 1981, 1982).

2.1.1. Pronoun reversals

Although pronoun reversals were once viewed as evidence of childhood psychopathology (e.g., Kanner, 1949), more recently researchers have found that they occur in completely normal children and may be due to the complex coreferential and shifting functions of pronouns (e.g., Charney, 1978, 1980; Chiat, 1981, 1982; Oshima-Takane, 1985; Schiff-Myers, 1983). Clark (1978) hypothesized that pronoun reversals occur because the child erroneously considers them to be proper nouns. She observed that children may use first person pronouns without attending to their shifting nature, because their early pronoun use is formulaic. Once children begin to produce *you* they must decide on its relation to first person pronouns. From the perspective of the pronoun reversing child, the adult's *you* always refers to the child and is used in alternation with her name. Similarly, the adults' *I* is an alternative for their name (i.e., it replaces Mommy or Daddy). Thus, the child might formulate the erroneous hypothesis that pronouns are a type of name: *you* = child and *I* = mommy. Charney (1978, 1980) characterized pronoun reversing children as possessing a "person-referring" hypothesis because they learn all pronouns from their own perspective without regard for discourse roles. Because the child hears mother use *you* to refer to the child, the child will also use *you* to refer to herself. Likewise, the child hears mother use *me* to refer to herself (mother); thus, the child also produces *me* to refer to mother.

As in Clark's account, the child's representation of these forms is said to be that *you* = child and *I* = mommy.

These accounts share the central assumption that the child's errors derive from an inability to take the perspective of another person. The child cannot shift from her own perspective to that of the adult and therefore fails to grasp the reciprocal and relational nature of pronouns. Thus, the pronoun reversing child errs because she is egocentric. Piaget (1955) stated that "throughout the time when he is learning to speak, the child is constantly the victim of a confusion between his own point of view and that of other people" (p. 39). He further claimed that the young child's egocentricity prevented him from understanding and using the point of view of the listener in conversation (see also de Villiers & de Villiers, 1974). In both Clark's and Charney's accounts, the child, being egocentric, begins with no sensitivity to speech roles and, hence, no understanding of the reciprocal relations inherent to personal pronoun pairs. The prediction that follows is that the young child will initially use pronouns in a fixed, non-relational manner to refer to people regardless of the speech role they occupy and—as suggested by Clark—should regard pronouns as proper names. The strongest interpretation of the egocentric hypothesis is that the child should consistently produce full (symmetrical) pronoun reversals, calling herself, *you*, and an adult, *me*, since pronoun relations in speaking are retained exactly as they were experienced in listening. Furthermore, the child should misunderstand *me* when used by anyone other than mother, and not understand *you* to refer to anyone other than the child herself.

The inconsistent and partial pronoun reversal errors reported in the literature do not strongly support this version of the egocentric hypothesis. Nevertheless, it is clear that more detailed descriptions of the child's comprehension and production errors are needed before we can fully determine the adequacy of the egocentric account.

2.2. Pronouns and their acquisition in ASL

2.2.1. ASL as a tool for language acquisition research

Research on sign languages over the past 20 years has revealed that they exhibit formal linguistic organization at the same levels found in spoken languages (e.g., phonological, morphological, syntactic, discourse). The structure of ASL, which is used by most deaf people in the United States, has been most thoroughly studied (e.g., Klima & Bellugi, 1979; Padden, 1981, 1983; Stokoe, 1960; Supalla, 1982b; Wilbur, 1979; Wilbur & Petitto, 1983). This research yields the surprising conclusion that human languages are not restricted to the speech channel.

While signed and spoken languages share fundamental properties, it is also clear that they differ in important respects. Space and movement (including facial expressions) are the key means for conveying morphological and syntactic information in signed languages, while in spoken language they are not. The continuous, analogue, non-discrete properties of space and movement are used in ASL in systematic, rule-governed ways. These abstract spatial and movements units are analogous in function to discrete morphemes found in spoken language. The forms of some signs bear non-arbitrary relations to their meanings. In particular, indexical signs point to their referents while the forms of iconic signs physically resemble aspects of their meanings. Thus, the greater potential for non-arbitrary form-meaning correspondences afforded by the visual-gestural modality is in fact exploited in sign languages. Children learning spoken language, of course, are not faced with this situation; for the most part, the relationships between words and their referents are arbitrary.

A fruitful strategy, then, in exploring the types of knowledge involved in acquisition would be to investigate an area in which the difference in modality might yield the greatest effects on the acquisition processes—in particular, the transition from the earliest use of gestures to linguistic expression. It is in the deaf child's earliest entry into language that the formational properties of signs might facilitate acquisition: first, because gestures and linguistic units reside in a single modality and second, because formational properties of some signs resemble or index objects in the world.

In sum, modality differences provide a powerful way to examine the role of prelinguistic gestures in language acquisition and the types of knowledge involved in the acquisition process. Furthermore, signed languages provide a unique methodological advantage in early acquisition research. With a single modality, and external articulators, the developmental process can be directly observed over time. In spoken language, clearly, this is not the case; there are internal articulators and there appears to be a discontinuity between the primary use of prelinguistic, manual gestures to the primary use of linguistic, verbal communication; however, this apparent discontinuity could be an artifactual consequence of the shift in modality. A basic empirical question, then, is whether the acquisition of linguistic forms in ASL will (a) be facilitated by, (b) be continuous with, or (c) share important symbolic properties with the deaf child's knowledge of their extra-linguistic communicative functions.

2.2.2. The structure of personal pronouns in ASL

As mentioned above, a primary example of the differences between signed and spoken languages is provided by personal pronouns in ASL. First and second personal pronouns in ASL are not formed by arbitrary symbols, but

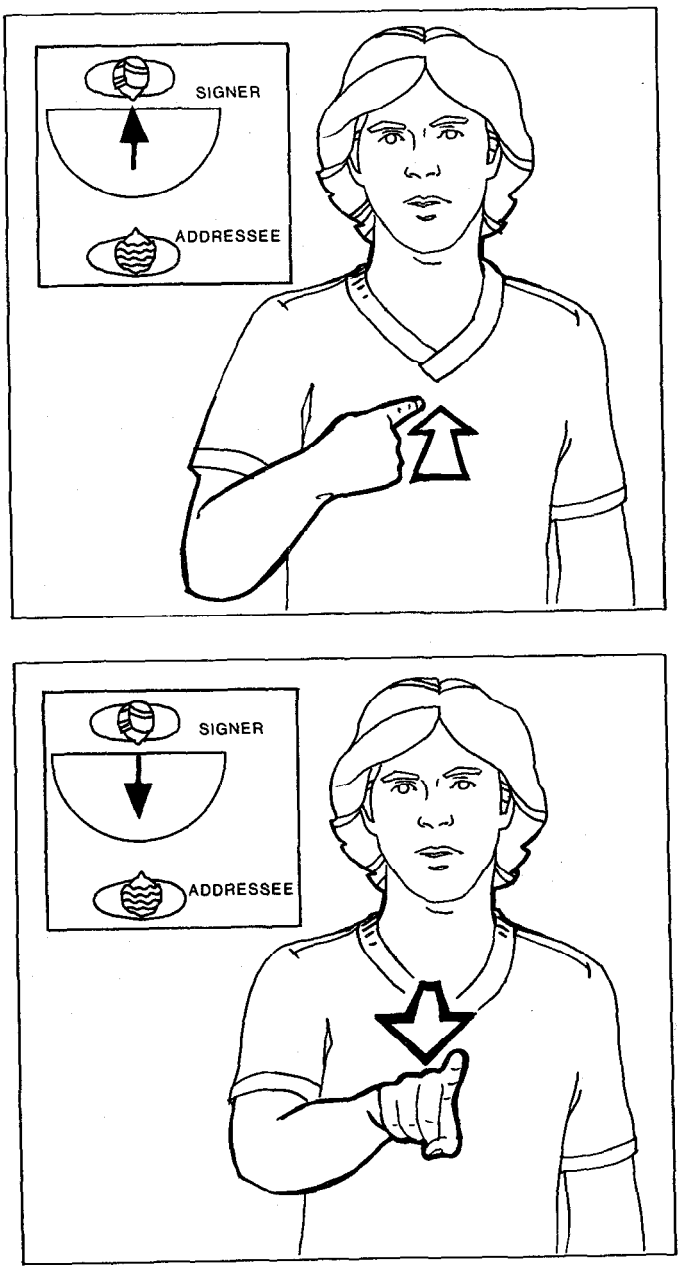
instead by pointing indexically to the intended referent. The first person pronoun ME is signed by the person in speaker role by pointing directly to his own chest. (First person pronouns are not case-marked in ASL; ME is the conventional gloss for this sign.) The second person pronoun YOU is signed by the person in speaker role by pointing directly towards the addressee (Figure 1).[3] Note the perspective boxes within each figure. The horizontal plane in front of the signer's body delineates the "signing space" within which all signs must occur. Space has multi-morphemic status in ASL. On the sublexical level, use of space is rule-governed and functions as a "phonological" (articulatory) constraint on ASL signs. For example, it would be wholly ungrammatical for a signer to reach out of her signing space and physically touch the addressee's chest (to indicate YOU) during a conversation. This topic will be returned to below.

As in spoken language, third person pronouns in ASL have complex deictic and anaphoric functions. Third person pronouns used to reference people who are present in the discourse context are signed by the signer in speaker role by pointing directly to the third person referent. In this way, third person referencing is formationally similar to first and second person referencing described above. However, when the referent is either not present or temporally distant, pointing is directed to arbitrary spatial loci along the horizontal plane in front of the signer's body. In this way pointing can be used to refer to noun phrases which denote not only people, but also objects and locations in space. Subsequent referencing (or anaphora) requires that the signer point (gaze or shift the body) to the previously established spatial locus. The establishment of spatial loci is an obligatory linguistic device that interacts in complex ways with the verb agreement system (Bellugi & Klima, 1981; Lillo-Martin, 1986; Padden, 1983; Petitto, 1981). Except for ASL's use of spatial devices to signal anaphora, the coreferential relations signaled between the head noun phrase and subsequent pronominal referencing are identical to anaphoric devices found in spoken language.

In ASL discourse, as in spoken language, the interpretation of these pointing forms depends upon their relational meanings which are understood by the addressee only after understanding the perspective of the signer. During a conversation between two people in ASL, YOU and ME personal pronouns are formed by pointing either directly to self or to the other person. Except for reaching out and touching the person in addressee role or grasping one's own chest in speaker role, the expression of YOU and ME pronouns in ASL

[3]The illustrations in this paper were traced directly from the videotape screen. They were made by the late sign-artist Frank Paul, whose beautiful drawings contributed greatly to the understanding of sign language structure.

Figure 1. *ME (top) and YOU (bottom) signs in American Sign Language*



appears to be the most unambiguous possible means of signaling these relations. That there exists a direct correspondence between the pointing form and its intended referent might lead to the prediction that the child's acquisition of YOU and ME personal pronouns should be nearly effortless. These pronoun forms are formationally nearly identical to the pointing gestures commonly used as prelinguistic indicators by hearing infants and as paralinguistic gestures accompanying speech. Because deaf infants also engage in prelinguistic communicative pointing (beginning around age 9 months; Petitto, 1983a), it might be expected that the child's acquisition of these pronoun forms should be straightforward.

However, a central difference between signed and spoken languages is revealed by considering other deictic terms. In English, for example, each class of relational deictic terms takes distinctly different forms. Relational deictic terms of place, for example, can be expressed by the forms *here* and *there*, demonstrative deictic pronouns can be expressed by the terms *this* and *that*. However, all deictic expressions of this nature are signaled with the pointing form, the same form used for first, second, and third personal pronouns and anaphoric referencing.

The fact that the pointing form has multiple linguistic functions may complicate the acquisition of pronouns in ASL (Petitto, 1983a). In addition to grammatical functions outlined above, the pointing form is also one of the primary "phonological" units in the language, occurring in full lexical signs such as the nouns CANDY and CHINESE, verbs such as GO and COME, and adjectives such as RED and UGLY. It also comprises one subset of the class of morphological forms called classifiers, which function in the language to represent some physical component of a previously specified noun. These pointing forms, having had their referents established, are subsequently used in the language in pronominal and verb-like ways to denote specific semantic information about the nature of the noun referent's size and shape, and/or movement and location (Supalla, 1982b). Finally, there is also limited use of pointing in paralinguistic gesturing. In this light, the child's task of sorting out the grammatical and semantic functions of the pointing form seems quite formidable. Thus, if the child does not attend to (or exploit) the indexical relationship between the pointing form and its referent, and instead focuses on how the form is used within the grammatical system of ASL, the plurifunctionality of pointing may make it difficult to bring person points under grammatical control.

2.2.3. Summary: studying pronoun acquisition in ASL

Hearing and deaf children acquiring the use of pronouns face somewhat different problems. The pronouns that largely supercede prelinguistic point-

ing gestures in spoken language involve a change in modality. In contrast, the deaf child's pronominal pointing is very similar in form to prelinguistic gestures; the child's task is to learn the grammatical rules governing the pointing form, and to integrate the use of pronominal pointing with other aspects of the language, and with paralinguistic deictic pointing.

In light of these considerations, the following questions can be addressed: First, how do early pointing gestures come under grammatical control? That is, how does the child move from the communicative use of pointing gestures to the use of pronominal pointing constrained by the grammatical rules of the language? Second, does the child actively construct hypotheses about the meaning of the pointing gestures, or are the meanings so transparent as to render them effortless to learn? Here the question is whether the indexical (and iconic) properties of some ASL signs facilitate the child's acquisition of these forms. Finally, given the seemingly transparent meaning of YOU and ME pronouns in ASL, will deaf children learn these relations at an accelerated rate? Some hearing children are still sorting out the meaning of the *you* and *me* forms as late as 2;6. The acquisition process may be truncated for deaf children because of the similarity between prelinguistic and pronominal pointing.

3. Method

3.1. Subjects

The subjects were two profoundly and congenitally deaf girls who were learning ASL as a first language from their deaf parents. The children were of normal intelligence and were free of other neurological and physical handicaps.

The parents of the first child attended Gallaudet College for the Deaf, and teach (in ASL) at a deaf high school in northern California. The parents of the second child graduated from residential high schools for the deaf. Both families were active members of their deaf communities and their children interacted with other deaf children. The children's communication with adults, including myself, were conducted exclusively in ASL. The children will be referred to by the pseudonyms Kate and Carla.

Two factors are noteworthy with respect to finding subjects for this type of research. First, the population of deaf children who are learning sign language from their deaf parents as a native language without interference from the spoken majority language is extremely small. Of the estimated 500,000 deaf people in the United States, only 9% were born to deaf parents

(Schein & Delk, 1974). Holding aside issues such as degree of hearing loss and age of onset, the percentage of this group of deaf people (born to deaf parents) who (a) are married to other deaf persons, (b) have profoundly deaf children (rather than hearing or hard-of-hearing children) and (c) use ASL in the home as the primary means of communication comprises an even smaller group (Schein & Delk, 1974). In fact, this population is quite rare and I was fortunate to gain access to the children in this study.[4] Second, there are cultural taboos within the deaf community about participating in research, further limiting access to these subjects.

3.2. Procedure

3.2.1. Data base

Both observational and experimental data were obtained in this study. For Kate, observational data were obtained from ages 6 months to 2;3 and experimental data from pronoun elicitation tasks at age 1;11. For Carla, observational data were obtained from ages 8 months to 2;3.

(1) Observational data for Kate and Carla: Kate was videotaped for 12 one-hour sessions in free conversation at home or in the laboratory playroom with a parent (typically mother). Carla was videotaped for 12 one-hour taping sessions in free conversation at home with her mother (and, at times, her sister).

(2) Experimental data for Kate: At age 1;11 Kate's production of personal pronouns was formally evaluated with a series of pronoun elicitation tasks. The goal was to establish a structured environment in which Kate would be likely to produce YOU, ME, and third person pronouns if she knew them. Conditions were also established in which Kate's comprehension of YOU and ME pronouns could be unambiguously evaluated. The tasks were adapted from those used with hearing children by Charney (1978) and Chiat (1981); Pizzuto and Williams (1980) used a version of Charney's tasks to test possessives in ASL. The child was first pre-tested with a series of pictures of common objects to establish her ability to recognize and identify them. The following three pronoun tasks were then administered (see also Petitto, 1983*a*).

(a) Picture identification task: The child was shown a picture (e.g., of herself) and asked in ASL "Who's this?" or "Where is this person?". Seven photos were shown to the child one at a time and were discussed by mother

[4] I am grateful to Ursula Bellugi for providing access to these subjects while I was a member of her laboratory.

or experimenter until Kate either succeeded or failed to identify the people in them.

(b) Action task: Kate was presented with 14 objects one at a time and asked to identify them. Next, the experimenter (or mother) would ask Kate, for example, "Whose brush is this?", instruct her to "Brush mommy's hair" ("Brush Kate/Laura's hair". "Give the brush to ME/HER", etc.), or playfully misattribute ownership so as to elicit pronouns and proper nouns.

(c) Hiding-box task: The task was designed to assess the child's comprehension of proper nouns and pronouns. Six trials (3 using proper nouns, 3 using pronouns) were crossed with 2 speaker conditions (Mother, and Laura) yielding 12 trials. On each trial three pictures (e.g., mother, child and experimenter) were taped onto boxes and placed in front of the child; a cloth was used to cover the pictures while a grape was placed under one of them. The child's task was to choose the correct picture after being instructed that the grape was under MOTHER, LAURA or KATE's picture, or under ME, YOU, or HER (where the referent of these pronouns varied depending on the speaker condition).

Tasks 1–3 yielded a corpus of utterances which were analyzed in terms of the frequency and distribution of Kate's production of proper nouns and pronouns; the child's comprehension of these forms as used by mother and experimenter was also assessed.

3.2.2. Transcription procedures

All the tapes between 6 months and 2;3 for Kate and 8 months and 2;3 for Carla, were viewed, and the data to be presented are from a subset of 8 tapes for each child. In addition, one videotape of the pronoun elicitation tasks conducted with Kate at age 1;11 was analyzed. Tape selection was governed exclusively by pragmatic considerations; transcription time for Kate's and Carla's videotapes was in excess of 1200 hours. Each tape transcription consisted of an analysis of both the adult's and child's signing and included detailed contextual information. Coding for signed utterances consisted of nine channels of information per frame per person; with mother and child always on screen that yielded 18 channels of encoding per frame. These channels included linguistically-relevant information concerning the nature of eye gaze; head movements; body shifts; manual signs; non-manual, grammatical facial markers including brow and mouth movements; spatial indexing; aspectual modulations of movement on signs; the path-movement of ASL verbs of motion (part of the verb-agreement system); and "phonological" (formational) sign variation. Further, reliability checks on the transcription of eight videotapes (four for Kate and four for Carla) were done by two native deaf signers whose judgments showed 95% agreement with my own.

General measures of discourse, cognitive, semantic and social development were also obtained for each child. Information concerning conversational turns, conversational topics, the child's topic-initiating and topic-terminating devices, symbolic play, and other information about the mother-child social interactions (e.g., child's distress at mother's departure and subsequent reaction upon mother's return) were also noted.

3.2.3. Coding procedures

Every utterance containing a pointing form was extracted from each child's corpus and classified in the following ways:

(1) Manner of deictic pointing to objects and locations: Recall that signs occur within a finite "signing space" in front of the signer's body. Petitto (1977, 1981) and Hoffmeister (1978) observed that young deaf children progress from pointing **on** objects (i.e., physically contacting objects and locations with the pointing finger)—typically going outside of the signing space to do so—to the grammatically correct means of pointing **towards** objects and locations with the hands remaining within the signing space. Although this study was not addressing the children's acquisition of demonstrative and locative pronouns, it appears that the ability to bring the pointing form within the signing space without contacting the referent is the critical feature in determining the shift from gesture to lexical status for these early deictic pointing gestures (Petitto, 1981). Once the child's pointing conforms to the strict "phonological" spatial constraints of the language (and undergoes other changes such as occurring in combination with other lexical items in a systematic manner), it appears that the form has lexical status for the child.

Therefore, +**contact** was used to code pointing on objects, while −**contact** was used to code pointing directed toward objects without physically contacting them. Special care was taken to indicate the direction of the child's eye gaze and whether the pointing form and arm extended outside the signing space or remained within it. This method of classification made it possible to observe changes in the frequency, distribution and form of the child's object and location pointing over time.

(2) Manner of pointing to self and others: The direction of the child's eye gaze and contextual information both before and after using the pointing form to self and others were noted. This was particularly important in the child's very early use of person pointing. Because the child's general deictic pointing forms (to objects and locations) resemble second and third person referencing, the formation and use of pointing to other people (and accompanying eye gaze) were examined closely. Whether the form of the child's YOU was identical to the child's general deictic pointing was also evaluated. This method made it possible to determine the frequency, distribution and

forms of the child's pronoun pointing. Both mothers' use of pointing were analyzed in the same manner.

Finally, general measures of the children's language development were obtained which included sign and combination growth, and MLU.

4. Results

4.1. Early period: Ages 6–12 months

During this period, reaching and grasping behaviors appeared first, followed by a rich variety of pointing gestures to people, places, objects and events. Initially, Kate and Carla did not point (ages 6 and 8 months, respectively), but did show the normal reaching and grasping behaviors that are typical of hearing children during this time. However, there was an explosion of pointing gestures of all sorts at 10 months for Kate and 12 months for Carla. All of the child-initiated communicative interactions with adults contained one or more pointing gestures. The children pointed to direct mother's attention to objects (Kate: $N = 57$; Carla: $N = 26$) and to distant objects and locations (Kate: $N = 19$; Carla: $N = 20$), moving their eye gaze from mother to the locus of their pointing form and back to mother. Kate also used the pointing gesture to poke at objects and investigate them ($N = 20$), moving her eye gaze from her own hand to the object rather than seeking mother's eye gaze; this pointing gesture typically disappears by age 12 months (Bates *et al.*, 1975; Werner & Kaplan, 1963), and was not observed in Carla (age 12 months). For Kate, there were 7 unambiguous points to other people (facial region or upper trunk); for Carla there were 6 such points. There were also 12 clear instances in which Kate pointed directly to herself (center chest). This yielded a total of 115 tokens of pointing gestures in one 45 minute videotape session for Kate, and 52 tokens of pointing gestures during Carla's 30 minute session.

Kate and Carla's use of pointing to other people was formationally similar to their other communicative pointing gestures to objects and locations. They pointed with an extended arm towards people in motion around the room or to salient objects on an adult's body (e.g., Laura's hat; mother's pin), with eye gaze generally fixed on the adult's eyes.

4.1.1. Kate's self-directed pointing

Kate's pointing gestures to herself are noteworthy and warrant further discussion.[5] Kate's 12 pointing gestures to herself occurred in combination

[5]That Carla does not point to herself (as in ME) during this early period is not indicative of a major developmental difference between the two children. Kate's use of pointing to herself occurred at 10 months—→

with other pointing gestures; 11 of these gestures were spontaneous. Kate typically (a) pointed at an object, (b) pointed to herself with eye gaze fixed on the object (rather than on the adult) and then (c) looked to the adult, often followed by some action to obtain the object. In some cases the order was reversed: she pointed to herself and then at an object. For example, while looking at her own image in a mirror, Kate pointed to the image and then pointed to her chest (as in ME). While playing alone, Kate tried to pull her toy dog loose from a pile of objects and failed; she then reached for her toy duck and failed again. Finally, with eyes fixed on the dog, Kate pointed to it, pointed to her own chest (as in ME) and turned her body around appearing to search for mother's aid. (Another participant noticed this event and quickly gave her the dog.) On another occasion, when two stuffed dogs were held out in front of her, she (a) moved her eyes from one to the other, (b) pointed to her own chest, as in ME, with eyes fixed on the dog to the right, (c) immediately contacted the dog on the right with a second pointing gesture, and (d) looked to the researcher holding the dogs. Thus it appeared that Kate was indicating which dog she preferred of the two that were offered to her. A final example involved pointing to a body part rather than self. Although this gesture was not included within the "pointing to self" count, it is noteworthy nonetheless. A Big Bird puppet was held out in front of the child. She laughed and grasped at it and seemed captivated by its nose. After several moments of fixed eye gaze, Kate pointed to Big Bird's nose and then pointed at her own nose.

Exactly what the child intended by her pointing gestures to self and other people, or what the child knew when she used these early pointing gestures are unknown. The examples suggest, however, that Kate recognized herself as distinct from others; moreover, Kate's pointing gestures had powerful pragmatic consequences in that mother and other adults immediately supplied the name of the referents that the child pointed towards. However, Kate did not always look to adults at these times, which suggests that the child had not yet fully made the connection between her own pointing form and its naming function. What the child did do quite reliably, however, was to respond appropriately to adults' deictic pointing; Kate almost always looked to the exact locus of an adult's pointing form. There was one noteworthy exception: when adults pointed to Kate (as in YOU) or to themselves (as in ME)

precisely 6 days after her deictic pointing first emerged—and was within the age range when pointing gestures first appear in hearing children (around 7 to 12 months). It was impossible to determine whether this was also the case for Carla at 10 months because videotaping did not occur between ages 8 and 12 months. Although the occurrence of self-pointing could not be determined for Carla, its prolonged absence—during the second, "middle" period (section 4.2) when the child potentially could have used the pointing form in this manner—remains the important puzzle to be solved.

she looked directly at the adult's hand itself; Carla behaved in this manner as well. This contrasts with adult ASL in which eye gaze is fixed on the signer's face. Finally, the deaf children pointed to themselves at an age when hearing children have been observed to point to themselves, particularly during routinized games.

4.1.2. Babbling in sign language

One fascinating example of the children's gestures involved their use of the indexical (pointing) form in combination with a particular non-indexical gesture: an opening/closing/clasping hand movement. The children used this gesture (and formationally related variants) as if they were lexical items in particular syntactic frames. For example, while looking through a book, Carla (age 12 months) first pointed to a referent on the page and then produced the open-close hand gesture as if she was producing the referent's name; she repeated this exact sequence many times to "name" different referents in the book. The gestures were not iconic; that is, no aspect of their form represented aspects of the referent. Nor were they real signs in ASL; instead, they were phonologically possible forms that seemed to function as fillers of lexical "slots" in these rudimentary sign "sentences". Thus, they were examples of early sign babbling (Petitto, in preparation). The forms maintained the rhythm and duration of phrasal units in ASL. The deaf children's quasi-lexical and quasi-syntactic use of these gestures distinguishes them from young hearing children's use of similar gestures at this age (see Petitto, in press), and is revealing for two reasons. First, it suggests that the children had knowledge of a naming schema, before they had acquired actual referent names. Second, Carla's sign-like jargon appears to be similar in kind to the hearing child's use of suprasegmental prosodic features such as intonation. It has been suggested that hearing children learn aspects of the intonational patterns of their language before they are able to utter recognizable words (e.g., Bever, Fodor, & Weksel, 1965; Fernald, 1984; Hirsh-Pasek, Kemler Nelson, Jusczyk, Cassidy, Druss, & Kennedy, 1987; Mehler, Lambertz, Jusczyk, & Amiel-Tison, 1986). In similar vein, it appears that this child was acquiring knowledge of the prosodic features of ASL (as represented by rhythmic and temporal properties of ASL signs), before she had mastered the ability to produce recognizable signs in this context. This phenomenon has not been described in previous studies of deaf children's acquisition of sign language; this behavior was also observed in Kate at 12 months. Moreover, a comparative study of early and late babbling in two distinct sign languages (ASL and "Langue des Signes Québécoise", LSQ, the language used by deaf French Canadians) revealed that the babbling phenomenon exists cross-linguistically. Similar sign babbling forms were observed in ASL

and LSQ, but not in hearing children acquiring spoken languages; there was also sign language-specific variation in babbling forms between the ASL and LSQ deaf infants (Petitto, in preparation).

4.1.3. Summary: early period

Kate and Carla did not use pointing gestures at 6 and 8 months (respectively), producing reaching and grasping behaviors instead. Soon after this, however, Kate (age 10 months) and Carla (age 12 months) used pointing gestures in a rich and communicative fashion, pointing to objects, places, and people.

4.2. Middle period: Ages 12–18 months

A surprising change in the children's use of pointing occurred during this period: they stopped pointing to people, but continued to use pointing for general deictic referencing.

Beginning around 12 months for Kate, and 15 months for Carla, and continuing through 18 months, one semantic function of the children's pointing gestures disappeared completely: they stopped pointing to other people (mother, father, other adults). Additionally, Kate's use of pointing to herself ceased; neither she nor Carla produced self-referencing points during this entire period. At the same time, they continued to point to objects, locations and events in the world around them.

Figure 2 represents the percentage of Kate and Carla's total number of

Figure 2. *Percent of Kate and Carla's total number of pointing forms directed to self and addressee.*

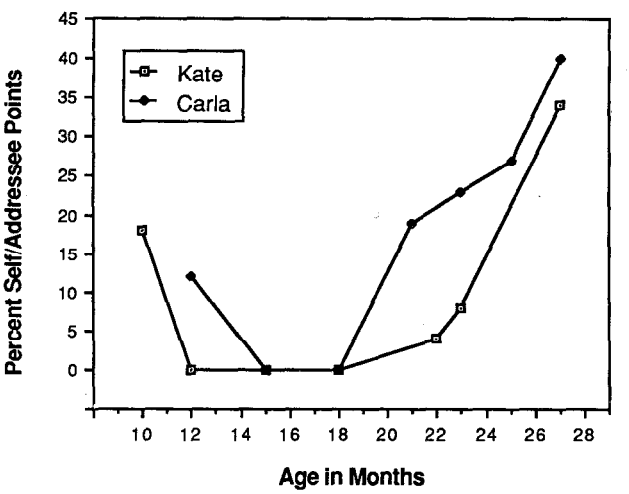
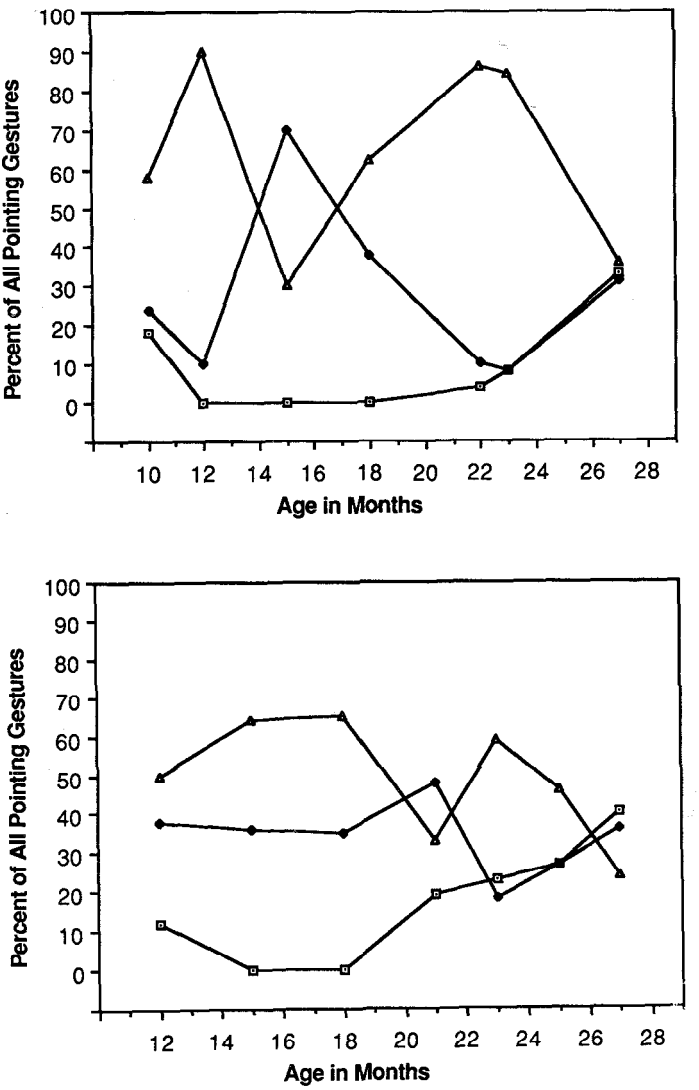


Figure 3. *Relationship between the children's pointing to objects and non-objects and pointing to self and addressee (Top: Kate; Bottom: Carla); conventions in figure:* △—△: *object points;* ◆—◆: *non-object points;* ⊡—⊡: *self/addressee points.*



pointing forms per session that were directed to themselves and to other people (labelled "self" and "addressee").

Figure 3 represents the relationship between Kate and Carla's use of pointing to self or addressee and their use of general deictic pointing to denote objects and locations (labelled "non-objects") over time. As this figure indicates, during the period when Kate and Carla stopped pointing to people, their use of other deictic pointing remained abundant and varied.[6]

Upon noticing Kate and Carla's seemingly selective avoidance of a particular function of the pointing form, several types of data were obtained to determine if the absence of self-other pointing resulted from a more general language or cognitive deficit. Several standard measures of language development were taken and suggested that the girls' language was developing normally compared to that of other hearing and deaf children. One index of language development compared the number of signs used alone versus those used in combination. If the children were acquiring the language in a normal manner, the number of signs occurring alone should decrease, while the number of signs occurring in combination should increase, which was observed (Figure 4).

In addition, the children's sign and combination types increased over time (Figure 5).

Mean Length of Utterance steadily increased during the 12 to 18 month period for both girls (see Table 1).[7]

Four additional aspects of Kate and Carla's language and cognitive development were evaluated: vocabulary development, discourse development, symbolic play and social interactions. The children were developing normally in each of these domains. For example, Kate and Carla's early sign vo-

[6]At 15 months, there was one exception to Carla's general avoidance of pointing to herself as in ME. Mother and child were playing a routinized question-answer game in which mother repeatedly asked and answered the following question in ASL: "Where's mother? I'm mother! Where's mother?". Carla's response to this question-answer game was to point to her own chest, copying the exact form (i.e., mother's sign ME) as she had just observed mother producing. Carla's mother, who apparently regarded the child's ME point as an error, attempted to correct her child by physically molding Carla's hand into a sign, which, from Carla's perspective, could be interpreted as YOU, but from mother's perspective represented ME; unfortunately, mother's molding does not always make things clearer. As is discussed later in the text, Kate's mother had attempted to mold her child's linguistic errors with a similar lack of success. It is not likely that Carla was making a productive ME = YOU pronoun reversal error. Instead, it seems more likely that in the give and take of the game, Carla imitated exactly what she saw mother doing when it was her turn to "answer" mother's question. Carla's behavior suggests that the meaning of the simple pointing form was not transparent to the child at this age.

[7]Because the MLU was developed for spoken rather than signed language, this measure should be regarded only as a very approximate index of the children's linguistic development. Further, in an attempt to be conservative, signed combinations containing the pointing form were excluded from the MLU analysis.

Figure 4. *Kate and Carla's single signs versus multi-sign combinations (Top: Kate; Bottom: Carla). Note change in scale on Carla's figure.*

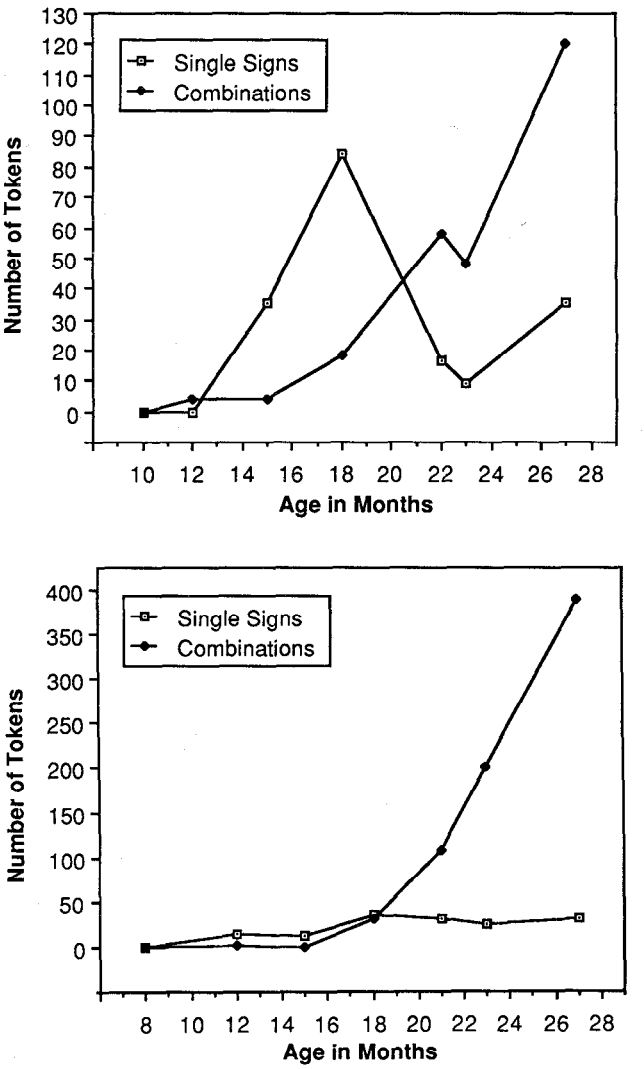


Figure 5. *Kate and Carla's increase in sign and combination types (Top: Kate; Bottom: Carla).*

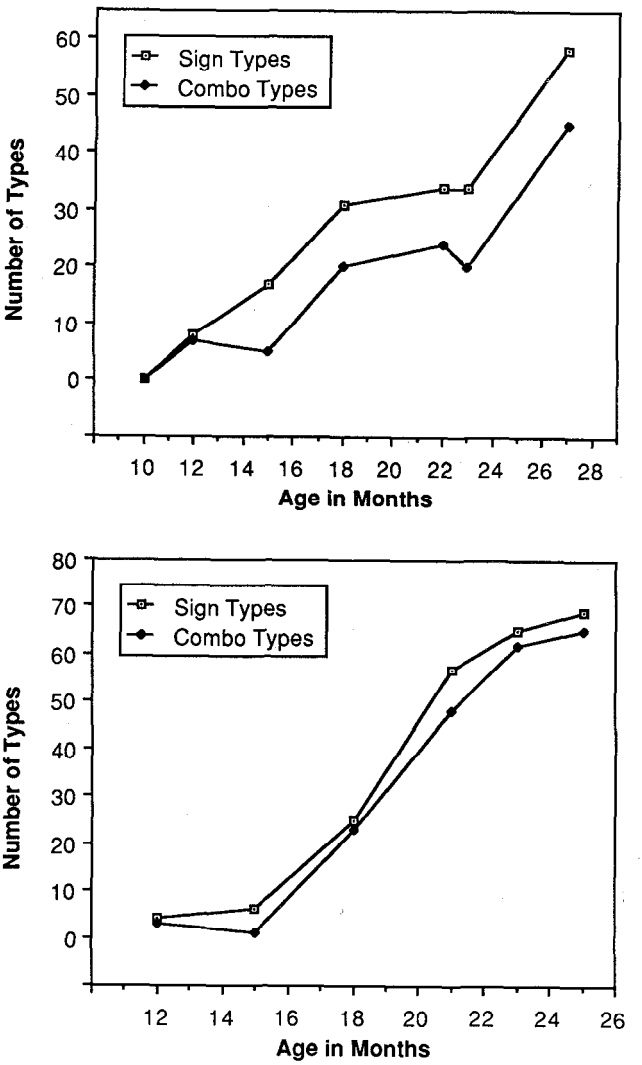


Table 1. *Mean length of utterance containing two or more signs*

Kate

Age in months	Number of combinations	MLU	S.D.	Maximum length
15	5	2.00	0.00	2
18	6	2.50	0.55	3
22	20	3.65	1.53	7
23	15	3.86	1.55	8
27	40	3.40	1.37	7

Carla

Age in months	Number of combinations	MLU	S.D.	Maximum length
18	24	2.18	0.52	4
21	48	2.92	1.34	8
23	75	3.04	1.64	10
25	114	3.68	1.70	9

Note: MLU = Mean Length Utterance; S.D. = Standard Deviation.

cabularies were compared to the early word vocabularies reported in the literature for hearing children (e.g., Bloom, 1973; Brown, 1973; Brown, Cazden & Bellugi, 1968; Nelson, 1973) and found to be similar; vocabulary and type frequencies between ages 12–18 months are presented in Table 2. Note, however, that English glosses for the child's deictic pointing forms to indicate objects and locations are not included here, and as a result, this table provides a conservative account of the girls' vocabulary development.

Nor was the children's failure to point to people and to themselves due to a general inability to recognize, and refer to, self versus other. Like hearing children during this period, both Kate and Carla referred to people and to themselves by using proper nouns. Kate used MOTHER (N = 7) and FATHER (N = 6) in contexts that required the second person pronoun YOU or a third person pronoun form (gender is not marked in ASL). Similarly, Carla used MOTHER (N = 4) and FATHER (N = 2) in contexts where YOU or third person pronouns were required. Finally, Kate referred to herself twice during this period by using the sign GIRL. On several occasions Carla attempted to refer to herself by producing the hand movements that

Table 2. *Comparison of deaf (Kate and Carla) and hearing (Allison) children's vocabulary samples*

Kate				Allison (Bloom, 1973, p. 68)	
12 months	15 months	18 months		16 months	
bird	boy	alligator	lips	all gone	horse
cow	cow	baby	lipstick	away	Mama
dog	ceral	bear	milk	baby	mess
duck	car/drive	blush	monkey	car	more
eat	dog	candy	no	chair	no
father	drink	comb	nose	cookie	oh
girl	ear	cry	phone	cow	pig
mother	father	drink	quiet	Dada	sit
	goodbye	ears	rabbit	dirty	stop
	hello	eyes	shoe	down	there
	light	father	sleep	girl	turn
	milk	giraffe	want	gone	uh
	mother	girl	what	here	uh oh
	no	hair	wrong		up
	want	home			wida
	where	hiss			
	wristwatch	lion			

Carla			
12 months	15 months	18 months	
cat	yes	yes	gimme
dog	eat	animal	hey
eat	finish	bed	mother
gimme	hat	bird	neghead
thank you	hey	book	no
	what	candy	pillow
		car	put
		cat	rabbit
		close-eyes	shoe
		come	sleep
		eat	what
		father	where

represented her fingerspelled name in ASL; however, she simply could not form the letters properly at this young age.[8]

Finally, the mothers' utterances were examined to determine whether they avoided using YOU and ME pronouns in an attempt to simplify their utterances to the children. This was not the case. Instead, the mothers used full YOU and ME pronouns in syntactic contexts that permitted these to be optionally marked on ASL verbs of motion. When signed to an adult, pronoun pointing forms are generally incorporated into the path movement of the verb in front of the signer's body. For example, the English utterance "*I give to you*" is signed in ASL by moving the verb GIVE from the space in front of the signer towards the direction of the addressee. Here the path of the sign's movement conveys the grammatical arguments of first and second person. If both first and second pronouns were to be added to the verb's path movement, the utterance would be ungrammatical ("*ME, ME-GIVE-YOU, YOU"). However, in certain syntactic contexts, it is permissible to add one pronoun, resulting in a redundant, verbose, but nonetheless grammatical utterance. This was how the mothers signed. Thus, while engaging in a form of "motherese", the mothers actually signed YOU and ME pronouns **more** than usual during this period.

4.2.1. Summary: middle period

Out of the 308 utterances signed by Kate during the taped sessions between 12 and 18 months, there was not a single occurrence of the YOU or ME pronoun points. Similarly, out of Carla's 101 sign utterances recorded between 15 and 18 months, there were no occurrences of the YOU or ME pronouns. A selective function of the pointing form had dropped out, while

[8]The fingerspelling of name signs in ASL merits further explanation. Fingerspelling is a system of twenty-six hand configurations which represent each of the letters of the English alphabet in a one-to-one correspondence. Less than 15% of a given ASL conversation may involve fingerspelling (Wilbur, 1979; Wilbur & Petitto, 1983), as it is largely restricted to the introduction of proper names that are previously unknown to the addressee during discourse. Once fingerspelled, proper names in ASL become incorporated into its phonological system in much the same way that, for example, certain French loan words take on English pronunciations once incorporated into the English language (e.g., Battison, 1978); Supalla (1982a) has described the phonological rules governing the production of proper names in ASL. Both Carla and Kate's name signs (as produced by adults) were fingerspelled in accordance with these rules. That deaf children acquire the rules for producing fingerspelling over an extended period of time, and do not produce or comprehend fingerspelled letters of English at this young age, has been well documented by Maxwell (1980), Padden and LeMaster (1985), and others. Initially, children treat the fingerspelled word as an unanalyzed whole, extracting out salient movement patterns and/or hand contours, but are not yet aware that they are producing individual letters in the English language. Thus, they initially view the letter patterns as if they were true signs in ASL, and produce them with the mis-articulations and articulatory errors that occur in early signing.

deictic points remained. Although the frequency of deictic pointing decreased over time, the functions of general deictic pointing actually increased during this period, from a purely denotative, communicative function to use in requesting the names of objects or places in her environment.

4.3. Error period: Ages 21–23 months

Kate produced pronouns for the first time at 22 months and Carla at 21 months; pronouns also first appear in the speech of hearing children between the ages of 18–22 months (e.g., Charney, 1978, 1980; Macnamara, 1982, 1986; Strayer, 1977; Tanz, 1980). Also like hearing children, both Kate and Carla's initial use of pronouns was unstable. Surprisingly, both children made pronoun reversal errors even though they continued to freely and correctly use deictic pointing to objects, locations and events. The primary difference between the children was that Kate produced consistent reversal errors, while Carla produced inconsistent errors. Hearing children's pronoun errors vary in a similar way. Some children are reported to make consistent, systematic pronoun reversals (e.g., Chiat, 1981, 1982; Halliday, 1975; Leopold, 1949; Oshima-Takane, 1985; Schiff-Meyers, 1983), while others make inconsistent errors (e.g., Charney, 1978, 1980; Macnamara, 1982; see Clark, 1978, for a review of reversal errors in several languages spanning over 70 years of diary studies). Because of the differences in the patterns of errors, Kate and Carla's pronoun use will be discussed in turn.

4.3.1. Kate

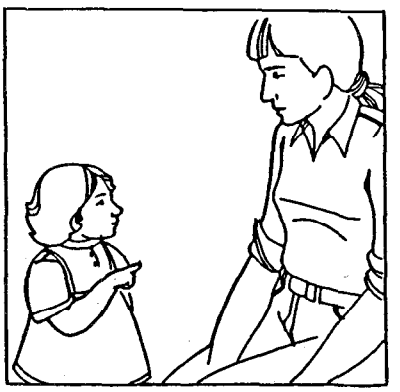
For the first time since 10 months, Kate was observed to point to people, as in YOU, but its use was most unusual: she produced the YOU sign, but appeared to intend to refer to herself ($N = 5$). This interpretation is based on three types of evidence:

(1) the formational difference between the YOU form and general deictic pointing (the former was formed within the signing space with a bent elbow and eye gaze fixed on the addressee and thus, was formationally similar to her other lexical signs; the latter was signed outside of the signing space with a straight elbow and eye gaze directed to the point's locus; Figure 6);

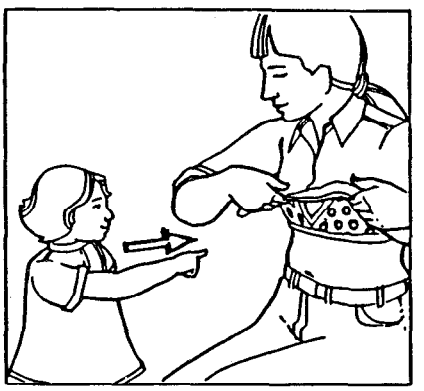
(2) total absence of the ME form, yet she seemed fully aware of herself and used YOU in contexts that specifically required the pronoun ME;

(3) contextual information, including mother's responses. For example, in one instance the child used YOU to indicate herself while signing to mother that she (the child) wanted to eat: "*EAT YOU WANT EAT". Because the actual form of the child's utterance carried the meaning that *mother* should eat, mother responded by telling the child that she (mother) was not hungry

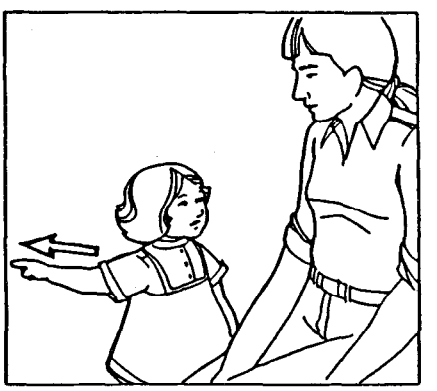
Figure 6. *Kate's formational differences in deictic pointing (age 22 months).*



YOU



Deictic Points to Objects



Deictic Points to Locations

and would eat later. The child first began to cry (apparently as a result of the misunderstanding), then dragged her food-bag from across the room to mother's feet and repeated the sign "EAT". Mother responded with clear surprise and signed the equivalent of "Oh, now I understand! You mean that **you** (Kate) want to eat! Do you want your bottle?". Kate signed "EAT" again, and mother then gave the child some peanuts as well as her bottle.

4.3.2. Results of Kate's pronoun elicitation tasks

The results of the pronoun elicitation tasks (administered to Kate at 23 months) were particularly revealing. Kate made production and comprehen-

sion errors on all three tasks. The elicitation tasks yielded a corpus of 106 utterances including 26 instances in which Kate produced the YOU pronoun to intend ME; there were no contexts in which she produced the YOU pronoun to intend the second person referent and none where she produced the ME pronoun. It was possible to assess Kate's correct and incorrect comprehension of pronouns in 18 contexts (11 for YOU, 7 for ME). Kate comprehended YOU when used by adults to refer to her (8 out of 11 trials). In the remaining 3 instances Kate appeared to interpret the adults' YOU pointing form as referring to them (the adults), rather than to her (Kate). (This error may have stemmed from the fact that this was precisely how she, Kate, used the YOU pronoun; that is, YOU = ME.) Although Kate did not produce ME, she appeared to correctly comprehend this sign when produced by the adult and understood this form to have multiple referents ($N = 7$). Table 3 summarizes the child's comprehension and production of personal pronouns across all tasks.

Kate's performance revealed errors in three other forms as well; her fingerspelled name sign, third person pronouns, and possessive pronouns. These are discussed in terms of each task.

(1) Picture identification task: Kate correctly identified the referents in 6 out of 7 pictures presented to her by producing proper nouns, and where appropriate, common nouns. However, she appeared unable to produce and comprehend her own name sign (which was formed by fingerspelling the

Table 3. *Summary of Kate's production and comprehension of personal pronouns across all tasks*

Child's production

Intended meaning	YOU	ME
YOU	0	0
ME	26	0

Child's comprehension

Adult's production	YOU	ME
YOU	8	3
ME	0	7

letter "K"). She failed to produce this form when presented with a picture of herself; instead, she used the sign GIRL.[9] Earlier videotapes revealed that the child's name sign "K" was rarely used by adults (YOU and PRETTY GIRL were used instead). Two instances of Kate's 26 YOU = ME errors occurred during this task. For example, while looking at a picture in which a person was eating ice cream, Kate spontaneously signed to mother that she (Kate) wanted to be given ice cream, but produced a YOU pronoun instead of ME ("*ICECREAM GIVE, ICECREAM YOU WANT").

Thus, Kate appeared to comprehend proper and common nouns as used by both mother and experimenter and produced them appropriately, but failed to comprehend her fingerspelled name sign, using instead the sign GIRL, which represented for her a general class of female referents (e.g., female dogs, dolls, other young girls). Note that Kate's use of GIRL is entirely consistent with young hearing children's use of, for example, *baby* in reference to themselves and other babies, including the use of *baby* for puppies and kittens (Petitto, in preparation).

(2) Action task: Of the 14 test items in this task, Kate correctly named all but 3. The task was successful in stimulating rich discourse among mother, child and experimenter. The analysis of this corpus revealed three types of errors: (a) consistent pronoun reversals, (b) third person referencing errors, and (c) possessive pronoun errors.

(a) Consistent pronoun reversals: 22 out of 26 Kate's YOU = ME pronoun reversal errors occurred with this task. Further, her use of YOU to intend herself was consistent; the referent of Kate's YOU was always herself and was never used to represent second person pronouns. For example, Kate requested permission to take her own hat out of the "action bag", and signed "*YOU WANT" instead of "ME WANT". A second example is particularly compelling. Kate described a photograph in which she was eating dinner; I was not in the photograph. Nevertheless, the child signed to me "*EAT EAT YOU EAT", then pointed to and contacted her **own** image in the photograph, in an attempt to convey that she was eating. The sequence also contained several spontaneous instances of her use of the sign GIRL in self reference. Interestingly, after signing the above utterance Kate named all three persons in the photo in the following way: "FATHER (points to father in the photo) EAT FATHER"; "(points to mother in the photo) MOTHER";

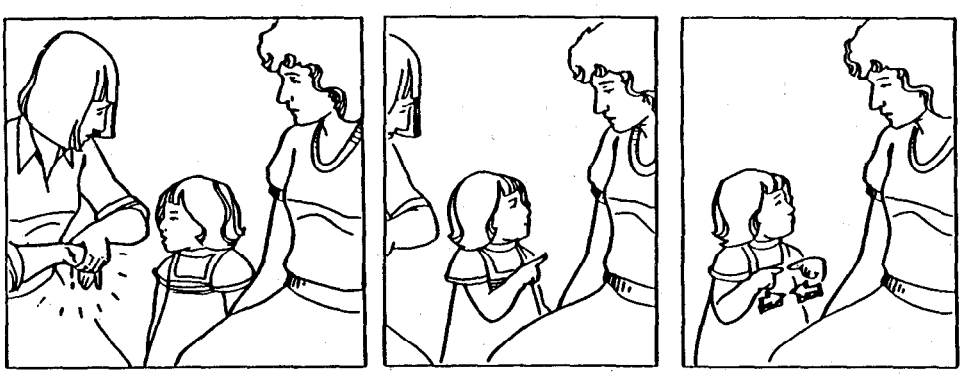
[9]It should be pointed out that she clearly understood that the child in the foreground of the picture was herself. She correctly described aspects of the picture in explicit detail (e.g., the fact that she had Edward Klima's hat on her head; that she was at Ed and Ursie's house—two people who were not in the actual photograph or present at the time of this testing session—whom she spontaneously identified in the course of her description; and she noted that her mother and father were in the background of the picture).

"(points to her own image in the photo) GIRL". In another example, Kate wanted a large wooden spoon that she had held earlier in the session; in doing so, she signed "*WANT YOU" instead of "WANT ME" (or "ME WANT").

(b) Third person pronoun referencing errors: In general, Kate did not use pointing to refer to other people present in the discourse context, but instead used proper nouns. On two occasions, she pointed to people while conversing with her mother, but it had the form of her general deictic pointing (rather than the YOU form). Here Kate's intentions seemed to be purely denotative and carried a meaning close to "Look over there!".

The session did contain, however, one unambiguous context in which a third person pronoun was required, but the child did not produce it. The example involved a situation in which Kate, mother, and myself were playing. I cut my hand and as Kate watched me bleeding, she turned to her mother and signed "*YOU HURT". A close examination of the videotape revealed the surprising fact that the child (age 1;11) was acting out **my** role, playing as if she had been cut rather than me. Having taken on this role, she produced a reversal error (Figure 7). This analysis is further supported by the fact that Kate had grossly distorted and painful facial expressions and clutched and pulled at her "bleeding" hand as if she was in pain. Kate's mother responded to her description of the event by attempting to correct Kate and sternly emphasized "NO, NO. NOT YOU HURT! [third person pronoun = Laura] HURT! NOT YOU, [third person pronoun = Laura]. YOU 'KATE', YOU YOU (contacting Kate's chest for emphasis)!" The point is that Kate could have merely used her knowledge of deictic indicating and pointed to me as she would point to a shoe or a door. Yet when the context obligatorily

Figure 7. *Kate's pronoun error in third person referencing (age 23 months).*



required her to use a third person pronoun, she appeared to avoid its use at all costs—even to the extent of excluding a third party's role from the description of the event altogether.[10]

(c) Possessive pronoun errors: Kate used the first person possessive pronoun MINE 5 times during this task, but her knowledge of this form was clearly unstable. On each occasion the form appeared to be a direct imitation of mother's MINE sign. In 3 instances the child's form was contextually appropriate. However, on two separate occasions Kate correctly imitated the form of the sign, but failed with respect to its meaning, thereby producing a possessive pronoun reversal error. For example, Laura, Kate, and mother were seated before the camera (Laura had mother's hat on). Mother instructed Kate to tell Laura that she (mother) wanted Laura to return her (mother's) hat by signing: TELL HER (= Laura) WANT MINE (= Mother), MY HAT ("Tell Laura that I want my hat"). Kate turned 180 degrees to Laura and signed: "*MINE (MINE = mother) HAT". She then took the hat from Laura, turned back to mother and gave her the hat.

It is interesting that the child was receptive to imitation of the MINE-MY form but not the YOU and ME pronoun forms. This may be because MINE-MY are formed with a flat "five" hand shape and not the indexical point. Again, Kate's behavior is noteworthy when one considers that she could have pointed deictically to mother (in a manner similar to the way she pointed to mother's blouse), thereby avoiding any ambiguity in this context concerning who wanted the hat; however, she did not use the pointing form to reference people at this time.

Moreover, Kate's errors were not simply a result of her inability to understand the third person role per se. Kate did produce third person possessive pronouns to refer to nonpresent referents (as in HER or HIS); however, like other children her age who are acquiring ASL, she did not specify the intended referent by first establishing the referent in the signing space in front

[10]In this example, Kate may have been attempting to use "role-shifting", one of the linguistic means for representing referents anaphorically in ASL. Specifically, role-shifting requires that the signer "take on the role" of the referent. The choice of using this particular system (as opposed to the other anaphoric referencing devices available in ASL) is governed by strict syntactic and discourse rules (e.g., Bahan & Petitto, 1980). Further, role-shifting is used mostly in narratives to refer to two or more non-present referents rather than in casual, colloquial discourse (e.g., Bahan & Petitto, 1980; Loew, 1983; Wilbur, 1979). The fact that Kate may have been attempting to use this system is interesting in itself because of her young age. Assuming, for the moment, that Kate was attempting to use role-shifting, the example is intriguing for another reason. It provides a powerful demonstration of how resilient her YOU = ME rule is. If Kate had "taken on my role" (as if she, Kate, had cut her hand) she should have signed "ME HURT", rather than "*YOU HURT". Because in her rule system, signing YOU means ME, from her perspective she had not erred. Kate also erred in using role-shifting because (1) the syntactic and discourse contexts were wholly inappropriate, and (2) the utterance lacked the full formational properties of the adult system.

of her body ($N = 4$); this point will be returned to in the discussion of the results for Carla.

(3) Hiding-box task: Kate comprehended proper nouns and pronouns on 7 out of 8 trials. The single error occurred when Kate failed to understand her own fingerspelled name sign, "K", and did not retrieve the grape under her own picture. After nearly 10 minutes of mother's attempts to instruct Kate that "K" was her name sign, Kate gazed down at her own picture, pointed to it, and signed GIRL, the sign that she used for female referents; Kate also produced this sign to a picture of herself in Task 1. Kate's behavior was exceptionally agitated during this trial, possibly due to the fact that she already had a form which she used to represent herself, namely the YOU form; her agitated state made it impossible to continue beyond this trial.

Kate comprehended ME to mean the signer and YOU to refer to herself. There were no instances during this task where Kate failed to understand a third person pronoun. However, because of the close physical similarity between third person pronouns and general deictic pointing, it is possible that this form comprised a single undifferentiated class of indicating gestures for the child at this time. Finally, 2 (out of 26) YOU = ME pronoun errors occurred in the course of this task.

Several additional questions were asked to determine the precise nature of Kate's YOU = ME pronoun error in production: First, can this error be accounted for by Kate's imitation of mother's YOU sign? The answer is clearly no, as there were only 3 instances where the child's YOU was immediately preceded by a mother's YOU. Second, was the YOU = ME error restricted to particular sign combinations in Kate's lexicon? This would indicate whether the error occurred because the child was using syncretic (unanalyzed) combinations, such as "Iwanna" is for some English-speaking children during an early period of pronoun acquisition. Fifteen errors occurred without the WANT verb, while 11 occurred with the WANT verb, but not in a fixed order (5 WANT YOU and 6 YOU WANT). Thus, the error was not due to routinized constructions. Finally, it was observed that Kate's YOU = ME error was impervious to explicit correction by the mother, and she did not imitate the mother's explicit modeling of the correct way to sign ME. During the period when Kate was producing the YOU pointing form to intend ME, the mother attempted to correct Kate's error by molding the child's hand into the correct ME configuration. Of course, such physical manipulation of the language articulators is impossible in spoken language. It might be predicted that the correction of grammatical errors in the acquisition of a signed language would be easier and would achieve more successful results than for spoken language. However, Kate's error persisted despite mother's physical manipulations. The importance of this finding is twofold:

(1) it provides evidence that the child cannot be forced to imitate linguistic forms that she is not yet able to analyze within her emerging grammatical system, and (2) it points to a powerful resistance to environmental influence on the acquisition of grammatical forms irrespective of the mode of language transmission.

In summary, the tasks revealed a surprising error: Kate used the second person pointing form YOU to indicate herself rather than the addressee. She did not produce ME, but appeared to understand it. She referred to herself (when not using YOU in self reference) with the sign GIRL and did not know her name sign "K". She did not use second and third person pronouns, but instead referred to people in these roles by using full proper nouns. Her few attempts at third person referencing yielded errors. Finally, her general deictic pointing gestures to objects and places were error-free.

4.3.3. Carla

As mentioned above, Carla's personal pronouns first appeared at 21 months. However, her knowledge of pronouns was initially very unstable. Specifically, she produced the following forms both correctly and incorrectly: YOU ($N = 5$), ME ($N = 6$), and third person pronouns ($N = 4$). She also produced the possessive forms MY ($N = 9$), MINE ($N = 2$), YOUR ($N = 4$) and a third person possessive pronoun ($N = 3$). Further, she attempted to articulate the letters of her fingerspelled name despite the fact that it required complex movements; these attempts resulted in jargon-like approximations to her name ($N = 4$) which continued through 25 months.

Three types of errors were observed: (a) inconsistent pronoun reversal errors, (b) third person referencing errors, and (c) possessive pronoun errors.

(a) Inconsistent pronoun reversals: Pronoun reversals (e.g., YOU instead of ME) occurred but were inconsistent. The unstable knowledge of the referents of pronouns, resulting in inconsistent performance and infrequent, unsystematic pronoun reversal errors, has been commonly observed among young hearing children (e.g., Charney, 1978, 1980; Chiat, 1981, 1982; Leopold, 1949; Macnamara, 1981).

The following example is illustrative. While playing with mother in the living room, Carla spontaneously signed MELON and pointed in the direction of the family's kitchen. Carla then got up from the floor, walked into the kitchen to the location of the refrigerator and then back to mother's side. Upon returning, Carla signed "*YOU WANT SOME MELON". Thus, Carla seemed to want to express to her mother that she (Carla) was hungry and wanted some melon, but signed YOU instead of ME. At this moment, Carla's 3;6 year-old deaf sister—appearing confused by the meaning of her younger sister's pronoun—interrupted Carla and asked her if she (Carla) really meant

to sign "YOU". Carla responded by signing "*MINE". It appears that in correcting herself Carla made an additional error; Carla used the wrong sign, as she should have used ME rather than MINE in this context.

Several minutes later, however, Carla used the YOU sign correctly. While teasing Carla about a "monster" on the ceiling (in reality, a bug), the researcher asked Carla if she wanted to touch it. Carla responded by correctly signing YOU to intend the other person. Specifically, Carla shook her head as in NO, signed YOU to the researcher, and then pointed to the bug (as in "no, you touch it").

Interestingly, the child showed a similar pattern of unsystematic reversals with first and second person possessive pronouns (e.g., MINE, YOUR); this reversal pattern has also been observed to extend to possessives in hearing children (see Charney, 1978, 1980; Chiat, 1981, 1982), and will be discussed further below.

(b) Third person pronoun referencing errors: When referring to non-present referents, Carla used third person pronouns in ways commonly observed in other deaf children acquiring anaphoric referencing devices in ASL (e.g., Lillo-Martin, 1986; Loew, 1983; Petitto, 1981): she produced third person pronouns without specifying the referent. This omission is similar to the use of unspecified pronouns which slightly older hearing children sometimes employ during storytelling. For example, a hearing child might say: "She went to the movies and saw her, and then she decided to go home", without specifying the referents.

To indicate non-present referents in adult ASL, a signer may either (a) establish a referent at an arbitrary spatial index along a horizontal plane in front of the body and inflect (or direct) subsequent signs to that spatial index, or (b) inflect signs towards a real-world spatial index which represents that particular referent (e.g., inflecting signs towards mother's favorite chair when in discourse about mother who is not present). Syntactic and discourse rules determine which linguistic device is used (e.g., Padden, 1983; Wilbur & Petitto, 1981, 1983); in certain restricted contexts, signers may refer anaphorically to non-present referents by taking on their role, termed "role-shifting". In all cases, however, a signer must specify the non-present referent **before** using pronouns. Failure to do so results in an "empty pronoun" (and an ungrammatical utterance). In the following example, Carla apparently wished to express to a research assistant that a particular hairclip belonged to someone (who was not present), but failed to specify the referent of her pronoun. Carla spontaneously introduced this topic by waving her hand to obtain the researcher's attention (as in "HEY", a common topic-initiating device in ASL; Wilbur & Petitto, 1981, 1983), and pointing to the hairclip on the floor. She then signed a third person possessive marker slightly to the right of her

body. In doing so, the child had adhered to the strict morphological constraints on spatial use in ASL (i.e., spatial indices to the right and left of a signer's body are reserved for third person referents, while center space is reserved for second person referents), and she articulated the third person possessive form correctly (i.e, a flat, open hand, with fingers extended and the palm facing outwards). However, the child's error was entirely in her failure to establish the identity of the spatial index prior to directing the possessive pronoun to that location. If Carla had first specified the pronoun's referent, her utterance would have meant "this hairclip is HERS" (or HIS, depending upon the context; recall that gender is not marked in ASL). When the researcher requested clarification, Carla re-indexed the hairclip and, this time, pointed to the left side of her body, towards the real-world location of her sister's bedroom (rather than to the space where she had originally placed the possessive marker). Interestingly, Carla had acquired parts of the morphological units required for anaphoric referencing in ASL, but not all of them. Like other hearing and deaf children acquiring language, she extracts out components of the adult linguistic system. Only later does she integrate the parts into a coherent, syntactically well-formed whole. Indeed, Carla's acquisition of anaphoric referencing was very like that observed in other deaf children (e.g., see Petitto & Bellugi, in press).

(c) Possessive pronoun errors: Two types of errors were observed in this child.

(i) Confusion over the appropriateness of possessive pronoun forms: Carla used the possessive pronouns MY and MINE in contexts where the personal pronoun ME was appropriate. The opposite pattern—ME used where MY or MINE were required—also occurred. Similarly, she sometimes used the personal pronoun YOU in contexts where the possessive YOUR was appropriate, and vice versa. Carla's confusion over when to use these forms was evidenced by false starts and hesitations in the course of their use. At other times, Carla appeared to realize that she had erred and would change her own utterance. At 21 months, for example, Carla saw a researcher place some cookies on the kitchen table (the researcher had brought them to the family). Wanting one, Carla (a) pointed towards the table and (b) signed MY in this context in which the pronoun ME would have been more appropriate. The researcher did not give Carla a cookie, and a moment later Carla (a) pointed toward the table, (b) signed MY, then hesitated, (c) pointed briefly towards the table again, and then (d) changed her MY sign to a ME sign and pointed once more. Upon receiving a cookie Carla signed ME appropriately three times while holding the cookie up to the researcher (and then eating it), but repeated her inappropriate use of MY rather than ME, to request another cookie several moments later.

These vacillations reflect confusion over when to use possessive vs. personal pronouns, rather than semantic errors over who or what the pronouns referred to. This interpretation is consistent with evidence from the literature on hearing children. A commonly reported pattern is one in which a child produces errors while learning the rules governing the occurrence of complementary pronoun pairs. For example, the child's use of one member of a pronoun pair is temporarily interrupted while mastering the rules for its complementary pronoun (e.g., I/ME, MY/MINE) (e.g., Charney, 1978; Leopold, 1949; Lise Menn, personal communication).

(ii) Inconsistent possessive pronoun reversal errors: Carla wanted to play with a doll that was in a glass case. Mother explained to her, however, that she could not have it because it was her sister Jane's doll, and that she (Carla) should continue to play with the doll she was holding because it belonged to her (Carla). Carla responded to mother by first pointing to the doll in her own arms and signing the equivalent of (a) "*this doll is Carla's, it is yours", and (b) "*that doll is someone's" (using an unspecified third person possessive pronoun). In (a), Carla had intended to indicate that the doll in her arms was her own, or MINE, but signed YOURS instead. Her error in (b) resulted because she failed to specify the referent of the third person possessive pronoun; specifically, she did not use the required spatial inflection for this form, which was obligatory in this context.

Later in the session Carla used the sign YOUR correctly. In another sequence Carla was indicating to the researcher that the purse on the floor was not hers (Carla's), but rather belonged to the researcher. She signed the equivalent of "this is not mine, it is yours, you, yours".

At 23 months Carla produced ME (N = 14) in self reference, YOU (N = 4) to refer to mother, and third person pronouns (N = 2). She produced the possessive pronoun forms MY (N = 3), MINE (N = 1) and YOUR (N = 6). In addition, Carla produced approximations to her fingerspelled name sign (N = 3). On four occasions, however, Carla used a first person personal or possessive pronoun to refer to mother, rather than to herself (ME = 1, MY = 2, MINE = 1); Carla used these forms appropriately on other occasions. It appeared that these errors may have resulted from the child's imitation of mother's input; in all four cases, mother's immediately preceding utterances also contained a first person pronoun. The importance of these errors remain, however, because they demonstrate that Carla does not yet have full control over the use of these pronoun forms. In this way, the child's performance at 23 months resembles her inconsistent pronoun reversal errors which were observed at 21 months.

4.3.4. Summary: error period

The children's inconsistent and unstable use of personal and possessive pronouns was due to their incomplete knowledge of the syntactic and semantic functions that these forms serve in ASL. They produced pronoun reversal errors, failed to specify the referents of third person pronouns, and made possessive pronoun errors. Kate showed systematic reversals of personal pronouns, while Carla did so inconsistently. The difference in the occurrence of reversal errors should not mask the basic similarity in the two deaf children's performance. Both acquired the use of pronouns over a period of time, during which they exhibited errors, a pattern similar to that observed for hearing children.

4.4. Correct use of personal pronouns: Age 25–27 months

At 27 months Kate possessed the full set of personal pronouns. She spontaneously and without error produced ME ($N = 3$) in self reference, YOU ($N = 5$) to refer to mother, and third person possessive markers ($N = 3$) to refer to non-present people. In addition, she produced the possessive forms MINE ($N = 3$) and YOUR ($N = 1$) spontaneously and correctly. Kate and her mother engaged in conversation about the child's friends who were not present. During this discussion, Kate referred to six of her friends individually by name and asked mother questions about each one of them. (Kate named one friend and subsequently referred to her by pointing to the chair that her friend typically sat in when she visited, an example of early anaphoric referencing.) Finally, Kate demonstrated clear evidence of knowing her name sign ("K"), and produced it on two occasions.

At 25 months Carla possessed the full set of personal pronouns. She produced ME ($N = 16$) in self reference, YOU ($N = 5$) to refer to mother and others, and third person pronoun pointing ($N = 3$). In addition, Carla produced the following signs: MY ($N = 6$), MINE ($N = 1$), YOUR ($N = 3$), and approximations to her fingerspelled name sign ($N = 4$). These forms were used spontaneously and without errors.

4.5. Summary of Kate and Carla's transition from the gestural to the linguistic use of the pointing form

The children's transition from the communicative use of the pointing form to denote self and others, to the linguistic use of the pointing form to represent personal pronouns was characterized by two distinct findings. Between 10–12 months the children had a rich repertoire of pointing gestures including pointing to objects, locations and people; from roughly 12 to 18 months all pointing to self and others disappeared. By 22 months the children used the

pointing form once again to reference people, but with errors. Thus, the deaf children's acquisition of the linguistic use of pointing was marked by a long period of avoidance of the use of the pointing form to denote person roles and a period marked by errors. The errors were corrected by age 27 months.

The deaf children's performance was strikingly similar to that reported for hearing children acquiring pronouns. The major milestones in the deaf children's acquisition occurred at times that correspond to those reported for hearing children: (a) the early occurrence of proper nouns (rather than pronouns) to refer to people, (b) the first occurrence of pronouns around 18–22 months, (c) a period when pronoun knowledge and use is unstable, and (d) correct use of pronouns by around 30 months.

5. Discussion

These results present two questions. First, given the deaf children's rich and continued use of deictic pointing, why does a selective function of the pointing form drop out? Second, given that the meaning of the pointing gesture is very transparent from its form, why do the children make pronoun errors?

5.1. Why does a selective function of the pointing form drop out?

One primary finding in this study is that a unique function of the pointing form dropped out over a period of time for both children. The deaf children initially used deictic points for a variety of communicative functions, including reference to self (Kate) and others (Kate and Carla). Then the children ceased to use the pointing form to indicate people, and instead used full proper nouns. What is puzzling is that at the same time that the children were not pointing to self and others, their general deictic pointing remained. When the children finally returned to referring to people through pointing, their performance was marked by errors.

Previous studies of language acquisition in hearing children have invoked the notion of the child's avoidance of certain phonological and grammatical constructions. Several researchers have noted that avoidance can be seen in the hearing child's early acquisition of phonology (e.g., Ferguson & Farwell, 1975; Kiparsky & Menn, 1977; Leopold, 1949; Schwartz & Leonard, 1982). Here the child will avoid the use of certain words containing sounds that she finds difficult to articulate. Further, Menn (personal communication) reports that the conscious avoidance of difficult phonological constructions has been observed in hearing children as early as 13 months. What is unique about the "avoidance" behavior observed in the deaf children in this study is that they

avoided in particular **function** of pointing, rather than the form itself. It is not that the children are unable to point; on the contrary, they point quite effortlessly beginning around 10 months, and they continue to use other types of pointing through the period when avoidance and errors occurred. Rather, a particular linguistic function of pointing drops out.

One possible explanation can be derived from research on the hearing child's acquisition of word meanings, morphology and syntax. Gleitman and Wanner (1982) refer to "The Three Bears" description of the way words are regarded by children in their earliest sentences. The child is said to take a strict view of the way words function as components of propositions, assuming that each word encodes either (1) exactly one of the arguments of a predicate, (2) the predicate itself, or (3) a logical connective (such as *and*, or *not*; p. 12). "To the extent a received word codes more than one of the countenanced functions, it is too big; less than one, it is too small; exactly one, and it is just right" (p. 12). In a similar vein, Slobin (1973, 1982, 1985) asserts that the child is biased to relating one meaning (and one concept) to one word-like, acoustically salient surface form. He found that in inflectional languages (which signal grammatical relations through morphology rather than word order), morphological units that have a single surface form with several underlying meanings take longer to learn than acoustically salient morphological units with a single underlying meaning. In the former case (fusional morphological units), the child is said to need time to sort out the multi-morphemic status of these forms and in doing so, may avoid the use of these forms until their components are fully mapped out.

This is particularly telling with respect to the pointing form in ASL, a synthetic (inflectional), rather than analytic (word-order) language. It would appear at first glance that the function of the pointing form is quite straightforward: One indexes something by pointing at it. On this basis alone, it is difficult to imagine why the children would ever avoid this form. However, as mentioned above, the grammatical function of the indexical point in ASL is much more complicated than this; pointing enters into the language in a number of ways. Some of these are quite arbitrary in the sense that usage is determined by the grammatical conventions of the language. Pointing in ASL represents a single surface form with complex underlying meanings and grammatical functions, and in this way can be viewed as a case of fusional morphology.

In light of these facts, one might expect the deaf child to avoid the use of the pointing form entirely, until its various meanings and functions have been understood. However, this does not occur; rather, a particular function is avoided. The obvious explanation for this selective avoidance is simply that pointing has such a pervasive function in the language that its use cannot be

avoided entirely. Furthermore, the children also appear able to distinguish between linguistic and extra-linguistic pointing, permitting them to continue using deictic pointing without disruption.

What must be explained, then, is why, among the various linguistic functions of pointing, the children specifically avoid first and second person pronominal pointing. The answer appears to reside in the particular grammatical and semantic properties of the class of pronouns. The use of pronouns is constrained by grammatical processes (e.g., strict syntactic, coreferencing rules). Further, the children have an alternate means for communicating the same information through use of full lexical nouns. Thus, confronted with the plurifunctionality of pointing in the language, and the conceptual complexity of pronominal referencing, the children avoid YOU and ME pointing in favor of simpler lexical items. In this sense, the children can be said to be avoiding indexical pointing in favor of forms which remove any ambiguity.

5.2. Why do the children make pronoun errors?

That Kate and Carla made errors while acquiring knowledge of pronouns is not remarkable in itself. The failure to specify a pronoun's referent, the inconsistent substitution of complementary pronoun forms, and pronoun reversals are commonly observed in hearing children acquiring pronouns. The most remarkable of the errors, however, were Kate's **systematic** YOU = ME pronoun reversals. Given the seemingly transparent relationship between the pointing form and its meaning, the interest of Kate's error is that it is completely unexpected. The basis of these errors will now be explored.

5.2.1. Egocentric hypothesis

The deaf child's error in producing YOU (and failing to produce ME) resembles pronoun reversal errors reported among some hearing children (e.g., Chiat, 1981, 1982). One explanation of the hearing child's errors appeals to cognitive factors, in particular the idea that children must acquire the ability to shift perspective. Piaget (1955) and others have suggested that young children are egocentric, failing to distinguish self from other. As a consequence, they are unable to take on the point of view of the listener in conversation. By this reasoning, the pronoun reversals of hearing children can be seen as resulting from a more general cognitive problem. Failure to understand that the referent of a pronoun depends on who is speaking results from the child's more general failure to understand her own role relative to others. The child's difficulties in learning the pronominal system of a language are seen as continuous with a general problem in learning to distinguish self from other. This problem is thought to be manifested both in language and in non-linguistic domains.

The strongest version of this hypothesis predicts that in production, the child should consistently produce symmetrical pronoun errors and in comprehension, the child should regard YOU as her name and understand ME as having a single referent (e.g., mother). However, in common with pronoun-reversing hearing children, Kate's reversals were not symmetrical and she understood ME to have multiple referents. Perhaps, however, a weaker version of this hypothesis can still be retained to explain the error that the child did produce. That is, perhaps the child produced the YOU = ME error because she failed to take on the adults' perspective for just this particular pronoun.

The case of deaf children acquiring sign languages provides the basis for a much stronger test of the perspective-shifting hypothesis than is possible in spoken language. In spoken language, a relatively small class of words, which include deictic, kinship and role terms, require perspective shifting, whereas in ASL, the specific nature of its transmission requires that **all** signs be acquired by first taking on the perspective of the signer. Consider the problem confronting the child attempting to learn new signs. The child cannot learn signs simply by copying exactly what she sees. For example, the child cannot learn to sign ME by exactly copying the ME gesture of another person; this would result in the child erroneously pointing to the other instead of herself. If mother formed the EAT sign and the child copied its exact form, she would direct the movement of the sign to the mother's mouth, rather than her own. Learning signs requires that the child be able to perform a spatial transformation, such that what she produces is the mirror image of what she sees, rather than its literal form. Failure to perform this transformation would result in perceptually-based errors. The important point is that the mirror-image transformation required in order to learn signs presupposes that the child is non-egocentric. The child must be able to assume the perspective of another in order to form signs correctly. Thus, an egocentric child should be unable to perform the mirror-image transformation.

The egocentric hypothesis is contradicted by two additional facts. First, if the problem derives from a failure to shift perspective as a consequence of egocentrism, the child should exhibit global and pervasive reversals, with errors occurring for a wide range of lexical items. Essentially, the child should sign backwards. In fact, this kind of pervasive reversal error does occur in the baby signs of very young children (ages approximately 10–12 months), but then disappears. The error seen in this study is selective, however, in that it is specific to a particular lexical item in a particular grammatical class. Thus, while the egocentrism hypothesis can account for these early, global errors, it does not explain the particular error that remains. The child continues to make a substantive error long after the early errors resulting from

a failure to shift perspective disappear.

It must be noted that the child is able to imitate novel signs at this time, especially nouns, effortlessly and without error, including signs with complex movements that require a shift in perspective. This casts severe doubt upon an explanation of the phenomenon that appears to a general cognitive deficit of this type.

Moreover, this hypothesis cannot explain the asymmetrical nature of the pronoun error. The child signs YOU to mean ME, but does not sign ME to mean YOU. Ignoring for a moment the meaning of the child's pointing, the perspective-shifting hypothesis suggests that when the mother formed YOU, the child should have been able to copy what she saw—namely, a point to her own chest—producing a point to her own chest. However, the child does not point to herself at this time. Thus, the child's asymmetrical error is wholly unexplained by a perspective-shifting hypothesis, and implicates other factors.

An alternative hypothesis is that Kate's YOU sign is a non-reciprocal, non-deictic, "frozen" lexical sign that stands for her, and her alone. In short, it is her name, rather than a pronoun. This analysis shares with Clark (1978) the notion that the child has formed the erroneous hypothesis that the YOU pronoun is her name. It differs from Clark's analysis, however, in its assumptions about the underlying cause of the error. Rather than producing the error because the child has failed to take on the perspective of the adult, I argue that to have made this error in the first place, the child had to shift, taking on the general perspective of other signers. Further, the incorrect meaning that the child has attached to the YOU form is a problem related to learning the structure of the linguistic system, rather than the by-product of a general cognitive deficit.

The derivation of Kate's error appears to be the following: the child's error occurs at a time when she has clearly begun to understand the symbolic relationship between a sign and its referent. It occurs during a period when her vocabulary is growing rapidly and her MLU is steadily increasing. At the same time, the frequency and distribution of her deictic points have begun to decline, replaced by full lexical nouns. It is at this time that the child observes other people using the YOU form to refer to her. Regardless of who is signing, the referent is the same (i.e., Kate). Thus, drawing upon her knowledge of sign-symbol correspondences, she hypothesizes that the YOU point is a symbol referring to herself, that is, a proper name. In effect, she is applying the abstract sign-symbol schema that works for other proper and common nouns to the YOU point. In sum, Kate has **over-symbolized** the indexical YOU point, treating it as a frozen lexical item with a stable referent, herself.

It is clear that in order to make the error, the child must ignore the indexical information that is physically realized in ASL pronouns (i.e., the fact that they are in fact points). The question to be addressed is why she would ever make such an error. At the time of the error, Kate has learned about two properties of object names: (a) that they denote concepts or categories of concepts rather than particular objects in the world (e.g., the sign SHOE does not index a particular object, but rather stands in an abstract relation to a class of items or kind); and (b) that they have stable referencing properties; the same individuals or objects are picked out regardless of who is signing (or speaking). As a consequence of these properties of object names, the signs that she is learning do not pick out individuals or objects in virtue of their forms. That is, the physical forms of the signs do not index their referents. Hence there is a good match between the physical forms of object names and their linguistic properties.

In this context, pronouns present a problem because they contrast with object names in terms of both linguistic function and physical form. Unlike object names, pronouns have shifting referencing properties; the referent of a pronoun depends on who is speaking. Moreover, pronouns, in contrast to object names, do index particular individuals relative to the speaker. In ASL, these properties of pronouns are reflected in their physical forms: pronouns in ASL index particular individuals by means of pointing; the referent of a pronoun depends on who is speaking both because of the shifting referencing properties of pronouns and because of the physical form of the sign. The use of pointing, in conjunction with the differentiated use of space, to perform pronominal referencing in ASL represents an elegant solution to the problem of realizing pronouns in a language that employs visual-gestural units. Like linguistic pronouns, the gestural point permits the expression of a potentially infinite class of person roles. The language exploits this physical property of gestures where it is congruent with the expression of linguistic functions; it does not recruit this property of gestures when, as in the case of object names, it would conflict with linguistic functions.

The child, having learned about the properties of object names, applies this knowledge to pronominal forms, with the result that she (a) treats the pointing form as though it has stable referencing properties, and (b) ignores the indexical information conveyed by its physical form. The error is genuinely linguistic because she ascribes the properties of object names to a gesture that happens to be literally indexical. The error is striking because she ignores seemingly transparent, perceptually-salient indexical information which she used in prelinguistic communication, and which she continues to use in deictic gestures. This information is ignored in favor of a symbolization

process that essentially **increases** the abstractness of the relationship between form and meaning.

Two facts would count as evidence against the hypothesis that Kate regarded YOU as her name: (1) if during the error period Kate produced the YOU form to refer to someone other than herself, (2) if Kate comprehended the YOU form as referring to another person when she was not the addressee but an onlooker in a conversation between two adults. Regarding the first point, it is clear that Kate only used YOU to refer to herself. In fact, the child's YOU = ME error was unusually consistent. Further, there appeared to be a formational difference between the child's YOU form and general deictic indicating. Recall that the formation of the child's YOU occurred with an index finger extended from a bent arm within the signing space, with eye gaze at the addressee, while general deictic indicating had an index finger extended from a fully extended arm, usually out of the signing space, with initial eye gaze directed to the locus of the indexical point rather than the addressee. This fact made it possible to monitor the child's referencing behavior to other people as well as herself (in a way that is not possible in spoken language). It is clear from the data that when referring to other conversational participants (not in second person role), Kate's tendency was to avoid the use of any kind of third person pointing. A powerful demonstration of this point was seen in the "bleeding hand" example presented earlier. In sum, the child's YOU pointing form was always used to refer to herself, and she avoided the use of third person indexing entirely, using proper nouns instead.

With regard to the second factor, was there any evidence that Kate understood the YOU form to refer to anyone else other than herself? And, if Kate had the hypothesis that YOU = her name, did she become confused when she observed other adults pointing to each other in second person referencing? Surely the child must have observed her parents conversing and using YOU. Did she think that they were using her name? How might she interpret this adult pointing form and still retain her hypothesis about the meaning of the YOU sign in her lexicon? The observational and pronoun elicitation task data suggested that Kate did not appear to be confused by this use of YOU, nor did she appear to make comprehension errors where they could be assessed. There is good reason why the adult use of YOU did not present Kate with a problem: Although the child saw mother (and father) pointing to other people either to mean the second person pronoun YOU or a third person (e.g., he or she), she never had to interpret these forms as being within the linguistic system at all. From her viewpoint, the adult pronoun forms were formationally very different from the YOU point that the adult directed specifically to her. The pointing form was not directed towards the child's body, there was little or no eye gaze with the child, and the contextual

information was inconsistent with interpreting the sign as referring to herself. Hence, from the child's point of view, the adult's YOU pronouns resembled the class of general deictic indicating gestures which were still outside her grammatical control. As such, the child need never have interpreted the utterances as pronouns, or her name.

Thus, the child's first hypothesis about the function of the pronoun pointing form appeared to be lexically-based; the child treated this symbol like other nouns. The comprehension errors, albeit few, suggest that the child then gradually begins to sort out the symbol's grammatical function.

The final puzzle concerns the asymmetrical nature of the child's production errors. The explanation for the asymmetry appears to be as follows: the child signs YOU to intend ME, which always has a single referent, namely the child. She does not sign ME, because she already means the other person. Furthermore, given that her YOU sign seems to function as a noun or name denoting herself, it might be expected that she would fail to use ME simply because it cannot be said the pronouns were part of her productive lexicon at this time.[11]

6. Conclusions

It should be clear, then, that the children's problem was a linguistic one, related to understanding the functions of pointing in the language. What is striking is that although the relationship between the form of the symbol, the point, and its meaning, either ME or YOU, appears to be quite a direct, explicit one, it was not obvious to the children who were analyzing these forms within the linguistic system of ASL. Even though the pointing gesture has a transparent meaning qua gesture, its meaning became non-obvious as it was incorporated into the linguistic system.

In mastering the use of personal pronouns, the children in this study moved from interpreting pronominal pointing gesturally to understanding it as part of a grammatical system. Use of pronominal pointing was not simply "built up" out of the prelinguistic pointing gestures. This is particularly surprising given that the language is constructed in such a way as to permit a simple transition between prelinguistic pointing gestures and the use of personal pronouns. However, the idea that gestures can function as linguistic symbols is so powerful that it overrides the transparent indexical information that pointing provides.

[11]I thank Dan Slobin for bringing this last point about Kate's absence of pronouns to my attention.

The deaf children's acquisition of personal pronouns resembled that of hearing children. Both deaf and hearing children acquire the use of personal pronouns over time, constructing and modifying different hypotheses about their meanings. Both make errors at similar points in time. Although it had been suggested by some that the transparent nature of the pointing gesture might make it possible for deaf children to acquire the use of these pronouns earlier than hearing children, this was clearly not the case. These similarities are strongly suggestive of a universal process of personal pronoun acquisition, one that holds despite radical differences in modality.

The deaf children's avoidance of the personal pronouns, together with the errors that occur as they are introduced, provide telling evidence concerning the reorganization of the child's knowledge structures in development, and discontinuities between linguistic and non-linguistic systems (Bowerman, 1982a, b; Karmiloff-Smith, 1979a, b, 1986a, b). The data suggest that the deaf child's knowledge undergoes a basic reorganization. The child shifts from conceptualizing person pointing as part of the class of deictic gestures to viewing them as elements within the linguistic, or grammatical, system of ASL. The children's initial hypotheses concerning their function within the grammar are incorrect, and must be revised. The evidence for this reorganization is particularly dramatic, in that the use of certain simple indexical pointing gestures was temporarily lost during this time. The disturbance in the processing of these seemingly transparent gestures provides compelling evidence for restructuring of the child's knowledge. Although the hearing child's acquisition of pronouns may also entail this type of reorganization, it can perhaps be more clearly demonstrated given the unique form of pronouns in ASL. The cognitive or neurological basis for this reorganization is unclear, and needs to be further investigated. However, the existence of the phenomenon cannot be doubted.

With respect to language acquisition models which propose a "direct mapping" and a continuity between the child's prelinguistic and linguistic representations, this study demonstrates that the deaf child's transition from gestural pointing to the linguistic use of YOU and ME pointing symbols is not smooth and effortless. The assumption that linguistic capacity is built up from (or mapped onto) pre-existing cognitive and communicative competence in a cumulative and continuous fashion is not supported by these data. Further, the data from this study compel us to consider that aspects of grammatical structure and its acquisition involve language-specific rather than general-cognitive knowledge which the child brings to the language acquisition process.

It cannot be said that there is no relationship between prelinguistic and linguistic knowledge, or that language acquisition is unrelated to cognitive

development. It can be said, however, that linguistic knowledge (concerning, for example, the relationship between form and meaning, and relations among forms) is not merely constructed out of the non-linguistic materials at hand. In this sense, then, the language acquisition process is discontinuous with other forms of knowledge.

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Résumé

Cet article évalue deux hypothèses qui jouent un rôle central dans des modèles récents de l'acquisition du langage: (1) la connaissance de la structure linguistique est "projetée" sur des formes préalables de connaissance non linguistique, et (2) l'acquisition d'une langue est un apprentissage continu dans lequel l'enfant passe d'une communication gestuelle précoce à la maîtrise de l'expression linguistique. Nous avons étudié l'acquisition des pronoms de première et deuxième personne MOI et TOI chez deux enfants sourds, nés de parents sourds, qui apprenaient l'American Sign Language (ASL) en tant que langue maternelle. En ASL, les pronoms personnels sont formés en montrant directement du doigt l'interlocuteur (YOU) ou soi-même (ME), et ne sont donc pas des symboles arbitraires. De ce fait, les pronoms personnels en ASL ressemblent à des gestes para-linguistiques qui accompagnent souvent la parole et sont utilisés pré-linguistiquement par les enfants sourds et entendants à partir d'environ 9 mois. Cela permet d'étudier le passage du geste pré-linguistique à l'expression linguistique dans un cas où geste et langage appartiennent à la même modalité.

Les résultats indiquent qu'il faut un certain temps aux enfants sourds pour acquérir les pronoms, et qu'ils commettent des erreurs du type de celles que commettent les enfants entendants, en dépit de la transparence des gestes. Au départ (les enfants étaient respectivement âgés de 10 et 12 mois), ils montraient du doigt des personnes, des objets et des endroits. Les deux enfants ont ensuite connu une longue période d'évitement, pendant laquelle l'une des fonctions du geste (montrer les autres et soi-même du doigt) disparut complètement. Pendant cette période, leur langage et leur développement cognitif étaient par ailleurs entièrement normaux, et ils continuèrent à montrer du doigt des objets, par exemple. Lorsqu'ils recommencèrent à montrer du doigt les autres et eux-mêmes, ils commettaient des erreurs courantes chez des enfants entendants; un des enfants commettait des erreurs systématiques d'inversion, pensant que le signe TOI le désignait lui-même, alors que l'autre commettait des erreurs d'inversion non systématiques. Les résultats des tâches expérimentales pour le premier enfant montrent qu'il produisait également ces erreurs en compréhension. L'usage des pronoms MOI et TOI ne fut complètement maîtrisé que vers l'âge de 25–27 mois, ce qui correspond à l'âge vers lequel les enfants entendants maîtrisent ces formes. Notre étude étaye donc l'idée qu'il existe une discontinuité chez l'enfant dans le passage de la communication pré-linguistique à la communication linguistique. Nous essayons de montrer que l'acquisition de la structure linguistique repose vraisemblablement sur des connaissances bien délimitées, propres au langage.