

Gesture, Speech, and Sign

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Notes

1. We are using the term 'sign' in the traditional semiotic sense—i.e., a display that is causally related to its significance or meaning. Another quite different sense of 'sign' (as in 'sign language') is reflected in the way the term is used in this book's title and elsewhere.
2. We are grateful to Stephen Krieger and Lisa Son for sharing this observation with us, and to Lauren Michelle Walsh, who coded the gestures.

CHAPTER 7

The development of gesture with and without speech in hearing and deaf children

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Introduction

Gesture—the spontaneous movements of the hands that accompany speech—offers a window into the mind of the speaker. Unlike speech, which assumes a linear and segmented form, gesture conveys information globally and imagistically, exploiting the analogue potential that the manual modality provides (McNeill 1992). Because gesture and speech draw on different representational resources, they can at times express different types of information. As a result, gesture can provide an alternative, perhaps easier, route for the expression of certain ideas—a route that young children just beginning the language learning process may be able to exploit.

1. The first goal of this chapter is to explore the forms and functions that gesture assumes in the early stages of language learning. We shall find that gesture plays a complementary role with respect to the speech it accompanies, and that it begins to form an integrated system with speech at early stages in language development.
2. The second goal is to explore gesture's fate when children are unable to learn a spoken language; as when, for example, a child is profoundly deaf. If a deaf child is born to deaf, signing parents, that child will learn sign language as naturally and effortlessly as hearing children learn spoken language (Newport and Meier 1985). But 90% of deaf children are born not to deaf parents, but to hearing parents. These children typically are not exposed to sign language unless their parents make a conscious effort to do so. Some parents choose instead to educate their deaf children orally, training them to make full use of their residual hearing in conjunction with visual and kinaesthetic cues to speech. Oral programmes do not offer instruction in sign language and, in many cases, actively discourage use of the manual modality for communication. Unfortunately, even with intensive oral training, the acquisition of spoken language is extremely difficult for most children with a profound hearing loss (Meadow 1968; Conrad 1979; Mayberry 1992). These children, in a sense, are left only with gesture.

The question then is—what happens to gesture when it is not part of an integrated system with speech but is itself forced to take over the communicative burdens typically assumed by speech (or sign)? Does it retain its global and imagistic form despite its new functions, or does it alter its form to become more linear and segmented, and thus more language-like?

I begin by reviewing the forms and functions that gesture serves in hearing children learning spoken language from their hearing parents. I then contrast gesture when it shares the communicative functions with speech in hearing children, with gesture when it must assume the full burden of communication in deaf children who are incapable of learning speech and are not exposed to a conventional sign language.

The development of gesture with speech in hearing children

Gesture is an early form of communication

At a time in their development when children are limited in what they can say, there is another avenue of expression open to them, one that can extend the range of ideas they are able to express. In addition to speaking, the child can also gesture (Bates 1976; Bates *et al.* 1979; Petitto 1988).

Children typically begin to gesture at around 10 months. They first use deictics, gestures whose referential meaning is given entirely by the context and not by their form. For example, a child may hold up an object to draw an adult's attention to it or, later in development, point at the object. In addition to deictic gestures, slightly older children also produce the conventional gestures common in their cultures, for example, nods and side-to-side headshakes. Finally, children produce iconic gestures, although the number tends to be quite small and variable across children (Acredolo and Goodwyn 1988). Unlike deictics, the form of an iconic gesture captures aspects of its intended referent and thus its meaning is less dependent on context. For example, a child might open and close her mouth to represent a fish, or flap her hands to represent a bird (Iverson *et al.* 1994). Children do not begin to produce metaphoric gestures until relatively late in development (McNeill 1992).

For many young children, gesture is the predominant form of communication at the start. Capirci *et al.* (1998) found that, in a group of 12 children learning Italian, six used gesture as often as, or even more often than, words at 16 months. At 20 months, this number dropped to two. Strikingly, even children acquiring sign language produce gestures in their earliest stages of language learning, typically exhibiting all three of the early types of gestures (deictic, conventional, and iconic). Capirci *et al.* (1998) also observed a hearing child learning both a spoken and a signed language. They attributed a sign (as opposed to a gesture) to the child when the forms the child produced resembled the forms used by adult signers, rather than the forms used by the monolingual child gesturers in the study. At 16 months, but not at 20, the child produced more gestures than either words or signs.

Interestingly, children very rarely combine their gestures with other gestures and, if they do so at all, the phase tends to be short-lived (Goldin-Meadow and Morford 1985). Children do, however, frequently combine their gestures with words and produce these word-plus-gesture combinations well before they combine words with words. Children's earliest gesture-speech combinations contain gestures that convey information redundant with the information conveyed in speech; for example, pointing at an object while naming it (de Laguna 1927; Guillaume 1927; Leopold 1949; Greenfield and Smith 1976). The onset of these gesture-speech combinations marks the beginning of gesture-speech integration in the young child's communications, an accomplishment to which we now turn.

Gesture becomes integrated with speech during the one-word period

The proportion of a child's communications that contains gesture remains constant throughout the single-word period. What changes over this time period is the relationship gesture holds to speech (Butcher and Goldin-Meadow 1998).

At the beginning of the one-word period, three properties characterize children's gestures:

- (1) Gesture is frequently produced alone, that is, without any vocalizations at all, either meaningless sounds or meaningful words.
- (2) On the rare occasions when gesture is produced with a vocalization, it is combined only with meaningless sounds and not with words; this omission is striking given that the child is able to produce meaningful words without gesture during this period.
- (3) The few gesture-plus-meaningless sound combinations that the child produces are not timed in an adult fashion; that is, the sound does not occur on the stroke or the peak of the gesture (cf. Kendon 1980; McNeill 1992).

During the one-word period, two notable changes take place in the relationship between gesture and speech (Butcher and Goldin-Meadow 1998). First, gesture-alone communications decrease and, in their place, the child begins to produce gesture-plus-meaningful-word combinations for the first time. Gesture and speech thus begin to have a coherent semantic relationship with one another. Second, gesture becomes synchronized with speech, not only with the meaningful words that comprise the novel combinations but also, importantly, with the old combinations that contain meaningless sounds. Thus, gesture and speech begin to have a synchronous temporal relationship with one another. These two properties—semantic coherence and temporal synchrony—characterize the integrated gesture-speech system found in adults (McNeill 1992) and appear to have their origins during the one-word period.

The relationship between gesture and speech predicts early language

The onset of gesture-speech integration sets the stage for a new type of gesture-speech combination—combinations in which gesture conveys information that is

different from the information conveyed in speech. For example, a child can gesture at an object while describing the action to be done on the object in speech (pointing to an apple and saying, 'give'), or gesture at an object while describing the owner of that object in speech (pointing at a toy and saying, 'mine') (Greenfield and Smith 1976; Masur 1982, 1983; Goldin-Meadow and Morford 1985; Zinober and Martlew 1985; Morford and Goldin-Meadow 1992). This type of gesture–speech combination allows a child to express two elements of a proposition (one in gesture and one in speech) at a time when the child is not yet able to express those elements within a single spoken utterance. Children begin to produce this type of combination in which gesture conveys different information from speech (e.g., pointing at a box and saying 'open') at the same time as, or later than—but, importantly, not before—they begin to produce combinations in which gesture and speech convey the same information (e.g., pointing at a box and saying 'box') (Goldin-Meadow and Butcher 1998). Combinations in which gesture and speech convey different information are first produced *after* gesture and speech begin to work together semantically and temporally. These combinations thus appear to be a product of an integrated gesture–speech system (rather than a product of two systems functioning independently of one another).

In turn, combinations in which gesture and speech convey different information predict the onset of two-word combinations. Goldin-Meadow and Butcher (1998) found in six children learning English as their first language that the correlation between the age of onset of this type of gesture–speech combination and the age of onset of two-word combinations was high ($r_s = 0.90$) and reliable ($p < 0.05$). The children who were first to produce combinations in which gesture and speech conveyed different information were also first to produce two-word combinations. In this regard, it is worth noting that the correlation between gesture–speech combinations and two-word speech is specific to combinations in which gesture and speech conveyed different information—the correlation between the age of onset of combinations in which gesture and speech conveyed the same information and the age of onset of two-word combinations was low and unreliable ($r_s = 0.46$, not statistically significant).

Thus, once gesture and speech become integrated, the child is able to use the two modalities to complement one another within a single communicative act. Moreover, the ability to use gesture and speech to convey different semantic elements of a proposition is a harbinger of the child's next step—producing two elements within a single spoken utterance (see also Capirci *et al.* 1998; Goodwyn and Acredolo 1998).

Gesture continues to play a role in communication over development

The findings described thus far suggest that gesture and speech become part of a unified system some time during the one-word period of language development. Over time, children become proficient users of their spoken language. At the same time, rather than dropping out of children's communicative repertoires, gesture

itself continues to develop and play an important role in communication. Older children frequently use hand gestures as they speak (Jancovic *et al.* 1975), gesturing, for example, when asked to narrate a story (McNeill 1992) or when asked to explain their reasoning on a series of problems (Church and Goldin-Meadow 1986).

As in the earliest stages of language learning, gesture can convey the same information as the speech it accompanies. Consider, for example, a six-year-old child asked whether the amount of water has changed when poured from a tall, thin glass into a short, wide dish. The child might say, 'It's different because the glass is tall and the dish is short,' while gesturing with his hands to indicate, first, the height of the water level in the glass and then the height in the dish. This child has referred to the same dimension, height, in both his speech and gesture.

However, children can also use their gestures to convey information that is not conveyed in speech. Consider a child responding to the same question who also says, 'It's different because the glass is tall and the dish is short.' But this child's gestures are different—she shapes her hands first to mirror the width of the glass and then the width of the dish. The child has, in effect, referred to the two dimensions relevant to eventually solving the problem correctly—height, in speech, and width, in gesture.

Responses in which gesture conveys information that is different from the information conveyed in the accompanying speech are called 'gesture–speech mismatches' (Church and Goldin-Meadow 1986). Mismatches are not unique to school-aged children, nor to water puzzle tasks. Indeed, by this definition, a young child's utterance 'give' produced along with a pointing gesture at a desired object constitutes a gesture–speech mismatch. Communications in which gesture conveys different information from speech have been found in a variety of tasks and over a large age range: 18 month old infants going through their vocabulary spurt (Gershkoff-Stowe and Smith 1991); preschoolers learning to count (Graham 1994) and reasoning about a board game (Evans and Rubin 1979); elementary school children reasoning about conservation problems (Church and Goldin-Meadow 1986) and mathematics problems (Perry *et al.* 1988); middle-schoolers reasoning about seasonal change (Crowder and Newman 1993); children and adults reasoning about moral dilemmas (Church *et al.* 1995); adolescents reasoning about tasks involving Piagetian bending rods (Stone *et al.* 1991); and adults reasoning about gears (Perry and Elder 1996) and problems involving constant change (Alibali *et al.* 1995). Moreover, communications in which gesture and speech convey different information can be quite frequent within an individual. At certain points in their acquisition of a task, children have been found to produce gesture–speech mismatches in over half of their explanations of that task (Church and Goldin-Meadow 1986; Perry *et al.* 1988).

As in the earliest stages of language development, gesture and speech adhere to the principles of gesture–speech integration described by McNeill (1992; see also Chapter 5, this volume) even when the two modalities convey different information. Consider again a child asked to explain why she thinks an amount of water

has changed after it has been poured. The child says the amount is different because 'the glass is tall' while indicating the width of the glass in her gestures. Although this child is indeed expressing two different pieces of information in gesture and speech, she is nevertheless describing the same object in the two modalities. Moreover, the timing of the gesture–speech mismatch also reflects an integrated system. The child produces the width gesture as she says 'tall', thus synchronously expressing her two perspectives on the glass.

Further evidence that gesture–speech mismatches reflect an integrated system comes from the fact that, as in the transition from one- to two-word speech, the relationship between gesture and speech is a harbinger of the child's next step. Children who produce many gesture–speech mismatches when explaining their solutions to a task appear to be in a transitional state with respect to that task. They are far more likely to profit from instruction and make progress in the task than children who produce few mismatches (Church and Goldin-Meadow 1986; Perry *et al.* 1988). If gesture and speech were independent of one another, their 'mismatch' would be a random event and, as a result, should have no cognitive consequence whatsoever. The fact that mismatch is a reliable index of a child's transitional status suggests that the two modalities are, in fact, *not* independent of one another (Goldin-Meadow *et al.* 1993).

Thus, gesture continues to accompany speech throughout childhood (and adulthood), forming a complementary system across the two modalities. At all ages, gesture provides another medium through which ideas can be conveyed, a medium that is analogue in nature. It is, in addition, a medium that is not codified and therefore not constrained by rules and standards of form, as is speech.

The development of gesture without speech in deaf children

I now explore what happens to gesture when it is the only form of symbolic communication available to a child. Deaf children whose hearing losses are so severe that they cannot acquire spoken language even with intensive oral training, and whose hearing parents have not exposed them to a model of a conventional sign language, cannot develop a conventional language. They do, however, have gesture at their disposal. What does the development of gesture look like in these deaf children?

Gesture takes on a language-like form at many levels

The gestures that such a deaf person uses to communicate, typically with the hearing members in the household, are called 'home sign'. Home sign has been described in places as far from one another as Belgium, Japan, Nicaragua, and the Rennell Islands (Morford 1996a). The most striking property of home sign is that it resembles conventional sign language (and spoken language) in terms of structure—categorical units organized according to rules (or at least probabilistic

tendencies) at several levels—rather than spontaneous gesture which is based on an analogue format. I review these levels below, beginning with the lexical level.

Lexicon

Home sign, like the spontaneous gestures that accompany speech, contains at least two types of gestures: pointing or deictic gestures, and iconic gestures based, for the most part, on pantomime (Tervoort 1961; Kuschel 1973; Kendon 1980; Goldin-Meadow and Mylander 1984). Pointing gestures refer to entities that are typically referred to by nouns in conventional languages (e.g., objects, people, places). Iconic gestures refer to predicates, either actions (e.g., a jabbing motion at the mouth used to refer to 'eat') or attributes (e.g., thumb and index finger forming a circle and held in the air used to refer to the 'round' shape of a penny). However, iconic gestures can also refer to entities (e.g., a jabbing motion at the mouth used to refer to an edible object, such as a grape, or the thumb–finger circle used to refer to the penny itself). While hearing children produce a small number of different types of iconic gestures, deaf home signers produce a large and varied set. Moreover, unlike the spontaneous gestures of hearing speakers whose forms vary with the changing context (McNeill 1992), iconic gestures used in home sign assume forms that are stable across uses and time (Goldin-Meadow *et al.* 1994).

Many home sign systems make a distinction between gestures used as nouns and those used as verbs (Macleod 1973; DeVilliers *et al.* 1993). For example, Goldin-Meadow *et al.* (1994) found that, at the earliest stages of development, one home signer used pointing gestures to fulfil noun-like functions and iconic gestures to fulfil verb-like functions. At the next stage, this child began to use some iconic gestures for noun-like functions but continued to distinguish between nouns and verbs by keeping the sets distinct—one set of iconic gestures was used in noun-like ways, and a completely different set was used in verb-like ways. Finally, the child began using a single iconic form in both noun-like and verb-like contexts, but he again distinguished between the two in two complementary ways:

- (1) Syntactically. When used as a noun, the gesture tended to precede pointing, but when used as a verb, the same gesture followed pointing.
- (2) Morphologically. When used as a noun, the gesture tended to be abbreviated in form and produced in neutral space. When used as a verb, the same gesture was produced in full form and was displaced towards objects in the room.

Thus, the child's strategy for distinguishing nouns from verbs changed over time, becoming more and more complex. There was, however, from the start, a distinction established between lexical items used to refer to objects, people and places, and those used to refer to actions and attributes.

Semantics

Young home signers combine their lexical items into gesture sentences conveying propositional information that is comparable to the information conveyed by hearing children in their early two-word combinations. Deictic pointing gestures

are combined with other pointing gestures (e.g., pointing at a grape and then at himself, to indicate that he had eaten the grape) and with iconic gestures (e.g., pointing at a tower and making the iconic gesture HIT, a request that mother hit the tower and topple it (iconic gestures are displayed in capital letters)).

Each of these sentences contains two elements of a single proposition. Although at this point in their development the children are limited to two gestures per sentence, they appear to know something about the larger argument structures underlying those two-element sentences. At various times, they produce sentences containing gestures for each of the appropriate arguments that a given predicate allows, for example 'baby drink', 'drink juice'; or 'mommy give', 'give juice', 'give me' (Feldman *et al.* 1978). Indeed, for children at the two-gesture stage, the rate at which a semantic element (like 'juice') is put into gestures depends on the argument structure underlying the sentence. A gesture for 'juice' is more likely to appear in a two-gesture sentence with a two-argument structure (*x* drinks *y*) than in a two-gesture sentence with a three-argument structure (*x* gives *y* to *z*), presumably because there is more 'competition' for one of the two slots in the surface form of a sentence conveying a three-argument proposition than in a sentence conveying a two-argument proposition. Patterns of this sort suggest that, at some level, the child knows how many arguments there ought to be in each frame (Goldin-Meadow 1985).

The children are also able to combine two iconic gestures within a single sentence. These combinations involve the concatenation of two propositions (Goldin-Meadow and Mylander 1984). For example, the child produces a BUILD-UP gesture followed by a HIT gesture to request the mother to build the tower (proposition 1) so that he can then hit it (proposition 2). The beginning and end of a gesture sentence are decided on motoric criteria. Thus, in this example, the child does not pause or relax his hands between BUILD-UP and HIT; the two gestures are consequently considered to constitute a single sentence. Devices that permit concatenation of two or more propositions within a single sentence reflect generativity, a property that characterizes all natural language systems.

Syntax and morphology

The gesture sentences that deaf home signers produce have syntactic structure in two senses. First, certain types of semantic elements (e.g., the object of an action) are likely to be gestured while others are likely to be omitted (e.g., the agent of an action). Thus, the sentences adhere to deletion regularities (Feldman *et al.* 1978). Second, the gestures that are produced appear in particular orders. In an analysis of the home sign system of a man living in England, Macleod (1973) found that the home signer typically placed agents, patients, sources, and goals before actions and states. Child (Goldin-Meadow and Feldman 1977; Goldin-Meadow and Mylander 1984) and adolescent (Emmorey *et al.* 1994; Morford 1996b) home signers demonstrate a similar pattern, with the exception that one child in the Goldin-Meadow studies produced transitive agents (but not intransitive ones) and recipients after their actions. These simple 'rules' predict which semantic elements

are likely to be gestured and where in the gesture sentence those elements are likely to be produced. In this sense, they constitute syntactic structures.

In addition to structure at the sentence level, young home signers' gestures also have structure at the word level, that is, morphological structure. Each gesture stem is composed of a handshape component (e.g., an 'O' handshape representing the roundness of a penny) and a motion component (e.g., a short arc motion representing a putting-down action). The meaning of the stem as a whole is determined by the meanings of each of these parts ('put-down-round'; Goldin-Meadow *et al.* 1995). As mentioned above, another example of morphological structure is found in the within-gesture variations that mark a gesture as either a noun or a verb. For example, the gesture stem PUT-DOWN-ROUND can either be used as a noun to mean 'penny', or as a verb to mean 'put-down (round)'. When used as a noun, the gesture is likely to be abbreviated and produced in neutral space; when used as a verb, it is likely to be produced in full form and oriented toward the penny itself (Goldin-Meadow *et al.* 1994).

Pragmatics

Young home signers do not invent structural complexity to serve a single function. Rather, they use their gestures for a large number of the functions typically served by language—to manipulate the world around them and to convey information about current, past, and future events. For example, to describe a visit to Santa Claus, one deaf child first pointed at himself, indicated Santa via a LAUGH gesture and a MOUSTACHE gesture, pointed at his own knee to indicate that he sat on Santa's lap, produced a FIRETRUCK gesture to indicate that he requested this toy from Santa, produced an EAT gesture to indicate that he ate a pretzel, and then finished off the sequence with a palm hand arcing away from his body (his way of marking past events) and a final point at himself (Morford and Goldin-Meadow 1997). In addition to the major function of communicating with others, young home signers sometimes use gesture when no one is paying attention, as though 'talking' to themselves (Goldin-Meadow 1993). Finally, the children also use gesture to refer to their own gestures, and to comment on (and indeed criticize) the gestures of others (Singleton *et al.* 1993).

The child's language-like forms are not found in the mother's gestures

Interestingly, the structure found at the lexical, semantic, syntactic, and morphological levels in young home signers' gesture systems *cannot* be traced back to the spontaneous gestures that their hearing parents produce when talking to them. Hearing mothers do use pointing and iconic gestures with their deaf children, not surprisingly since these are the types of gestures that typically accompany talk. However, the particular gestures that the mother uses overlap very little with her child's (Goldin-Meadow and Mylander 1984), suggesting that she has a different lexicon from her child. Moreover, the mother's iconic gestures vary in form far more than her child's—in this sense, the mother can hardly be said to have a lexicon

at all. In addition, the mother infrequently uses iconic gestures as nouns while, at later stages, the child does so half of the time (Goldin-Meadow *et al.* 1994).

Hearing mothers rarely combine their gestures into strings, preferring instead to produce their gestures one at a time—again, not surprisingly since this is the typical way gestures are produced when they accompany talk (McNeill 1992). As a result, in terms of semantic structure, the mothers rarely explicitly express in gesture two semantic elements within a single proposition. Moreover, they rarely produce complex gesture sentences containing two or more propositions (Goldin-Meadow and Mylander 1984).

When hearing mothers do produce gesture sentences, either they follow no consistent gesture order whatsoever or they follow a different order from their deaf children (Goldin-Meadow and Mylander 1983). The mothers thus have no syntactic structure to their gestures. In terms of morphological structure, the hearing mother's gestures do not conform to the handshape and motion morphemes found in her child's gestures (Goldin-Meadow *et al.* 1995), nor does she use morphological markings to distinguish between nouns and verbs (Goldin-Meadow *et al.* 1994).

Finally, the hearing mother does not use her gestures for all of the pragmatic functions that the child does. For example, she rarely uses her gestures to refer to the non-present, either displaced objects (Butcher *et al.* 1991) or events displaced in time and space (Morford and Goldin-Meadow 1997).

The children's gesture systems thus appear to be generated in large part by the children themselves. Even the lack of a model does not prevent the human child from communicating with self and other, in the here-and-now and about the non-present, using the segmented and combinatorial representational format that is the hallmark of human language.

The child's invented gesture system affects later language learning

Children who use home sign throughout childhood at some point typically enter a community where they are exposed to a conventional sign language. If home sign is represented as language in the minds of these individuals, then we might expect to see some effects of these home sign systems on the way in which the conventional sign language is acquired (Morford 1998).

To observe *lexical* transfer from home sign, Morford (1998) studied two profoundly deaf children who had developed home sign systems to communicate with their hearing families. She found that, after two years of exposure to American Sign Language (ASL), the children had replaced many of their pointing gestures with ASL nouns in a storytelling task. The ease of transfer from home sign points to ASL nouns suggests that these pointing gestures had indeed served a nominal function in the children's home sign systems. However, the children produced very few ASL verbs in the story, preferring their home sign verbs instead. Morford argues that home sign verbs and ASL verbs have different syntactic frames. ASL predicates mark person, number, and aspect morphologically, while home sign verbs encode

semantic elements of the predicates such as path and instrument information. Thus, transfer from home sign to ASL verbs is relatively difficult, requiring more work, and apparently more time, than transfer to ASL nouns.

To observe *morphological* transfer, Morford and her colleagues (Morford *et al.* 1995) gave one of the children in Goldin-Meadow's original sample a test of ASL morphology at age 23. This individual's first intense exposure to ASL was relatively late in life, coming after high school when he attended a college programme for deaf students which brought him for the first time into contact with many other deaf people. Like most deaf individuals who learn ASL after adolescence (Newport 1990), this late-learner made many errors on the morphological test. The interesting point, however, is that his errors on the ASL morphology test were not random and could be predicted, in part, from the home sign system he had developed as a young child. He was most successful in learning those ASL morphemes that were similar in meaning to his home sign morphemes, whether or not they were the same in form. Thus, form appeared to have little effect on his acquisition of ASL morphology—whether the ASL morphemes looked like the home sign morphemes did not affect how easily they were learned. Meaning, however, had considerable influence: ASL morphemes with the same meanings as his home sign morphemes were acquired much more easily than ASL morphemes with different meanings, demonstrating once again the impact home sign appears to have on later learning of ASL.

Finally, to observe *syntactic* transfer, Morford (1996b) assessed how two home signers marked the subject and object of a sentence when recounting a story in a wordless picture book. After two years of exposure to ASL, the children rarely used spatial inflections on verbs that required them. Importantly, spatial inflection was not a device found in their home sign systems. In contrast, both individuals did use gesture order to mark subjects and objects in their sentences, and gesture order was used for this purpose in their home sign systems. Presumably, the two were attentive to sign order in ASL because it had been an important cue to syntactic structure in home sign. Interestingly, when learning ASL, which is predominantly a subject–verb–object (SVO) language, they transferred only the generalized rule that sign order expresses relations among semantic elements, and not the specific object–subject–verb (OSV) order found in their home sign systems.

Taken together, these findings not only validate using linguistic categories and rules to describe home sign, but they also demonstrate that early home sign systems are relevant to the language learning that children do when exposed to a conventional system relatively late in life.

The deaf child's gestures look different from the hearing child's

Deaf children developing home sign systems mould gesture into a language-like form. Why don't the gestures that hearing children use also assume this language-like form? Occasionally, they do. For example, a hearing child who is delayed in

word-learning may rely on the manual modality for communication and produce a relatively large number of iconic gestures (Goodwyn and Acredolo 1998). However, the gestures used by hearing children never become elaborated into a system. Indeed, hearing children rarely combine their gestures into strings. Like hearing adults (McNeill 1992), hearing children tend to produce gestures one by one, each accompanying a separate clause.

Gesture and speech become integrated into a single system very early in development. As a result, once hearing children begin to learn a spoken system, they are no longer 'free' to have their gestures assume a linear and segmented form. The children's gestures are already part of a complementary system in which speech assumes the segmented and combinatorial aspects of communication, and gesture assumes the imagistic and analogue aspects. Gesture must play by the rules of that system and cannot assume the forms that are reserved for speech.

The constraints of an integrated gesture-speech system are so powerful that they even prevent the deaf children's hearing parents from producing gestures that are segmented and combinatorial in form. One might think that after years of interacting with their gesturing deaf children, the hearing mothers would alter the form of their own gestures, bringing them more in line with their children's. But they do not. Like the gestures of all speakers, the mothers' gestures must 'fit with the speech that they accompany. Their gestures therefore cannot assume a segmented and combinatorial form. We have previously suggested (Goldin-Meadow *et al.* 1996) that it is only when gesture must assume the full burden of communication that it can take on the segmented and combinatorial forms that are typically the province of speech. Indeed, it is very likely that if the hearing mothers were to stop talking to their children (an unacceptable option given that their goal is to teach their children how to speak), their gestures would begin to assume the language-like forms found in their children's gestures (see Dufour 1992 and Goldin-Meadow *et al.* 1996 for experimental support for this conjecture).

Conclusion

To summarize, what may be most impressive about gesture is its adaptability. Hearing children learning spoken language use gesture early in development. Their gestures are, almost from the start, integrated with the speech they accompany and, as a result, imagistic and analogue in form. Thus, gesture can assume a holistic and imagistic representational format, one that 'fills in' gaps left by the categorical and analytical speech code.

On the other hand, deaf children, unable to learn spoken language and not exposed to a model of conventional sign language, also use gesture early in development. They fashion it into a language-like system with discrete and categorical forms. Thus, gesture can also assume the segmented and combinatorial representational format that is characteristic of human language.

In brief, gesture's flexibility allows it to assume an analogue and mimetic form

when it accompanies speech, and a discrete form when it must fulfill the functions of language on its own. Ironically, it may be this very flexibility that has made language the province of speech. While gesture can assume either an analogue or a discrete form, speech is better suited to only one of these forms—the discrete. By default then the discrete and segmented aspect of language falls naturally to speech (Goldin-Meadow and McNeill, 1999).

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CHAPTER 8

Do signers gesture?

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Introduction

Before answering the title question 'Do signers gesture?' we must first answer the question 'What makes sign language different from gesture?' This analysis depends entirely upon one's definition of gesture. If gesture is defined sufficiently broadly, then the answer is 'nothing'. For example, Armstrong *et al.* (1995) define gesture as 'a *functional* unit, an equivalence class of coordinated movements that achieve some end (p.46; emphasis in the original).' Under this definition, speech itself, the gesticulation accompanying speech, pantomime, emblems, and sign language are all examples of gesture. However, the aim of this chapter is to explore whether we observe in signing a parallel to the gestures that hearing people use when they talk. Kendon (1980) refers to this phenomenon as *gesticulation* which is distinct from pantomime and emblems (conventionalized gestures such as the 'thumbs-up' sign). In this chapter, we will compare sign language primarily to the gestures (gesticulation) that accompany speech, rather than to pantomime, the early gestures of children, gesture 'systems' like home sign, or conventional emblematic gestures.

Some properties found in sign languages but absent in gestures accompanying speech

A review of significant differences between sign language and gesture provides an important backdrop for investigating whether and how gestures might accompany sign. Many authors have described the relation between sign language and gesture (e.g., Klima and Bellugi 1979; Kendon 1988; McNeill 1993), and the following lists some of the clearest distinctions, with specific examples from American Sign Language (ASL).

Sublexical (phonological) structure

Signs exhibit a systematic patterning of form (a phonology) not found in gesture. Signs participate in a system of minimal contrasts at the level of form, rather than