

The Resilience of Language: Mother-Child Interaction and Its Effect on the Gesture Systems of Chinese and American Deaf Children

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In all cultures, the language-learning child is exposed to a model of a particular language and, not surprisingly, acquires that language. Thus, linguistic input clearly has an effect on the child's acquisition of language. Nevertheless, it is possible that linguistic input does not affect all aspects of language development uniformly, and that variations in linguistic input will alter the course of development of some properties of language but not others. In our previous work, we have focused on isolating the properties of language whose development can withstand wide variations in learning conditions—properties of language that we have termed *resilient*.

In order to determine which properties of language can be developed by a child under one set of degraded input conditions, we have observed children who have not been exposed to conventional linguistic input. The children we study are deaf, with hearing losses so severe that they cannot naturally acquire oral language, and born to hearing parents who have not yet exposed them to a conventional manual language. In our previous studies of ten deaf children of hearing parents in America, we have shown that, despite their impoverished language-learning conditions, the deaf children develop gestural communication systems that are structured in many ways like the systems of young children learning language in typical linguistic environments (Goldin-Meadow & Mylander, 1990a). In particular, the gesture systems are structured at lexical (Feldman, Goldin-Meadow & Gleitman, 1978; Goldin-Meadow, Butcher, Mylander, & Dodge, in press), syntactic (Goldin-Meadow, 1982, 1987; Goldin-Meadow & Feldman, 1977; Goldin-

Meadow & Mylander, 1984), and morphological (Goldin-Meadow & Mylander, 1990b; Goldin-Meadow, Mylander, & Butcher, 1994; Singleton, Morford, & Goldin-Meadow, 1993) levels, and are comparable to conventional child language in the way they are used to communicate (Butcher, Mylander, & Goldin-Meadow, 1991).

These findings suggest that combinatorial structure at more than one level is so fundamental to human language that it can be developed by a child who does not have access to a conventional language model. Further, we have found that the deaf children's gesture systems were not patterned after the spontaneous gestures that their hearing parents used with them (Goldin-Meadow & Mylander, 1983, 1984, 1990b), suggesting that the children themselves may have played a large role in creating the combinatorial structure of their communication systems.

Nevertheless, it is possible that the structure in the children's gesture systems came not from the child, but from other nonlinguistic aspects of the child's environment. For example, Bruner (1974/1975) has suggested that the structure of joint activity between mother and child exerts a powerful influence on the structure of the child's communication. In order to determine the extent to which the structure in the deaf children's gestures is a product of the way in which mothers and children jointly interact in their culture (and in so doing, develop a more stringent test of the effects and non-effects of environmental factors on the deaf children's gesture systems), we have studied deaf children of hearing parents in a second culture, Chinese culture.

We have chosen Chinese culture as the second culture in which to explore the spontaneous communication systems of deaf children of hearing parents in large part because the patterns of parent-child interaction in Chinese culture appear to differ greatly from those in American culture. Asian culture, including Chinese culture, is said to be more group-oriented and to emphasize social harmony to a higher degree than American culture (Clancy, 1986; King & Bond, 1985; Kojima, 1986; Stigler, Smith, & Mao, 1985; White & LeVine, 1986; Wilson, 1970), and these values appear to affect the way in which parents interact with their children to socialize them into their society (Chen & Uttal, 1988; Lin & Fu, 1990; Wu, 1985). For example, Chinese mothers tend to view obedience, respectfulness, and humility as important characteristics to teach their young children, but American mothers stress creativity, individuality, and aggressiveness (Lee, 1987). These divergent values are conveyed (implicitly or explicitly) to Chinese and American children in the ways mothers interact with their children; in particular, in the teaching strategies mothers use with their children (Smith & Freedman, 1982) and in the spontaneous narratives mothers tell their children (Fung, 1987).

Given the salient differences between Chinese and American culture, if we find similarities between the spontaneous gesture systems developed by deaf children in Chinese culture and deaf children in American culture, an

increasingly powerful argument can be made for the noneffects of environmental factors (including cultural factors) on the development of these gesture systems. That is, we will have increasingly compelling evidence for the resilience of the linguistic properties found in the deaf children's gesture systems. Conversely, to the extent that the gesture systems of the Chinese deaf children are consistently different from the American deaf children's gesture systems, an equally compelling argument can be made for the effects of cultural variation on the spontaneous gesture systems of deaf children.

BACKGROUND ON DEAFNESS AND LANGUAGE LEARNING

Sign languages of the deaf are autonomous languages that are not based on the spoken languages of hearing cultures (Bellugi & Studdert-Kennedy, 1980; Klima & Bellugi, 1979; Lane & Grosjean, 1980). A sign language such as American Sign Language (ASL) is a primary linguistic system passed down from one generation of deaf people to the next and is a language in the full sense of the word. Like spoken languages, ASL is structured at the syntactic (Liddell, 1980; Padden, 1983), morphological (Klima & Bellugi, 1979; T. Supalla, 1982) and phonological (Liddell & Johnson, 1986; Padden & Perlmutter, 1987) levels.

Deaf children born to deaf parents, and exposed from birth to a conventional sign language such as ASL, have been found to acquire that language naturally; that is, these children progress through stages in acquiring sign language similar to those of hearing children acquiring a spoken language (Caselli, 1983; Hoffmeister, 1978; Hoffmeister & Wilbur, 1980; Kantor, 1982; Newport & Ashbrook, 1977; Newport & Meier, 1985). Thus, in an appropriate linguistic environment, in this case, a signing environment, deaf children are not handicapped with respect to language learning.

However, 90% of deaf children are not born to deaf parents who could provide early exposure to a conventional sign language. Rather, they are born to hearing parents who, quite naturally, tend to expose their children to speech (Hoffmeister & Wilbur, 1980). Unfortunately, it is extremely uncommon for deaf children with severe to profound hearing losses to acquire the spoken language of their hearing parents naturally, that is, without intensive and specialized instruction. Even with instruction, deaf children's acquisition of speech is markedly delayed when compared either to the acquisition of speech by hearing children of hearing parents, or to the acquisition of sign by deaf children of deaf parents. By age 5 or 6, and despite intensive early training programs, the average profoundly deaf child has only a very reduced oral linguistic capacity (Conrad, 1979; K. Meadow, 1968).

In addition, unless hearing parents send their deaf children to a school in which sign language is used, these deaf children are not likely to receive conventional sign language input. Under such inopportune circumstances, these deaf children might be expected to fail to communicate at all, or perhaps to communicate only in non-symbolic ways. This turns out not to be the case.

Previous studies of deaf children of hearing parents have shown that these children spontaneously use gestures (referred to as "homesigns") to communicate even if they are not exposed to a conventional sign language model (Fant, 1972; Lenneberg, 1964; Moores, 1974; Tervoort, 1961). Given a home environment in which family members communicate with each other through many different channels, one might expect that the deaf child would exploit the accessible modality (the manual modality) for the purposes of communication. However, given that no language model is present in the child's accessible modality, one might not expect that the child's communication would be structured in language-like ways. Our work has focused particularly on the structural aspects of the gestures produced by deaf children of hearing parents, and has attempted to determine whether any of the linguistic properties found in natural child languages can also be found in those gestures.

We have previously shown that the gesture systems produced by the ten deaf children in our American sample are productive at both the level of the word and the sentence. The "lexicon" of the gesture systems produced by the children contained three types of gestures:

1. Deictic gestures were typically pointing gestures that maintained a constant kinesic form in all contexts. These pointing gestures were used to single out objects, people, places, and the like.
2. Characterizing gestures were stylized pantomimes whose iconic forms varied with the intended meaning of each sign (e.g., a fist pounded in the air as someone was hammering).
3. Marker gestures were typically head or hand gestures (e.g., nod, head-shake, two-handed "flip") that are conventionalized within the American culture and that the children used as modulators (e.g., to negate, affirm, doubt).

The children combined these gestures into strings that functioned in a number of respects like the sentences of early child language, and were consequently labeled *gesture sentences*. Within these gestural sentences, relationships between gestures corresponded to certain properties of words within a sentence. For example, the child's gesture sentences expressed the

semantic relations typically found in early child language (in particular, action and attribute relations); in these sentences, characterizing gestures were assumed to represent the predicates and pointing gestures the arguments playing different thematic roles in the semantic relations (Goldin-Meadow & Mylander, 1984). For example, a child produced a pointing gesture at a bubble jar (representing the argument playing the patient role) followed by the characterizing gesture "twist" (representing the act predicate), to request that the experimenter twist open the bubble jar.

The purpose of the present study is to determine whether deaf children, raised in a culture distinctly different from the American culture, also use gesture to communicate and, if so, whether those gestures are structured as are the gestures of the American deaf child.

METHODS AND PROCEDURES

Chinese Sample

We have analyzed data from a single developmental point for four deaf children and their hearing mothers. The four children were studied at ages 2;9 (Jie-jie, girl), 4;1 (Bao-bao, boy), 4;4 (Qing-qing, girl), and 5;0 (Wen-wen, boy; the names of the children are pseudonyms). All four children were from Taiwanese middle-class families. At the time of videotaping, Jie-jie had no siblings, Bao-bao had one older, hearing brother, Qing-qing had one younger, hearing sister, and Wen-wen had one younger, hearing brother. The mother was the primary caretaker in each family. All four children were congenitally deaf, with no other reported cognitive or physical disabilities. The cause of deafness was unknown for three children. Qing-qing's deafness was believed to be caused by a drug taken by her mother during pregnancy. All four children had severe to profound hearing losses: Jie-jie had a 106-108 db loss in both ears; Bao-bao had a 70-90 db loss in both ears; Qing-qing had a 105-110 db loss in both ears; and Wen-wen had a 100 db loss in his right ear and a 110 db loss in his left ear.

At the time of videotaping, none of the four children had been exposed to Taiwanese Sign Language (TSL) or Chinese Sign Language. All four children attended oral schools in Taipei. Jie-jie attended preschool in the Taipei Qi Cong Municipal School, Bao-bao and Qing-qing attended the Taipei Zheng Yin Oral School for the Deaf, and Wen-wen attended the Ai Er Oral School for the Deaf part-time and a hearing school affiliated with Taipei Teachers University part-time. All three of the schools for the deaf that the children attended were committed to training the children to speak and did

not allow the use of TSL or Signed Mandarin (speaking while signing in the word order of Mandarin; Smith, 1987).¹

American Sample

Four American deaf children and their hearing parents were selected for comparative purposes from our original sample. The American children were matched to the Chinese as much as possible by gender and age: Mildred (2;9, girl), David (3;10, boy), Karen (4;2, girl), and Marvin (4;2, boy). All four children were from white, middle-class families. At the time of videotaping, Mildred had three older, hearing sisters, David had an older brother and sister, Karen had one younger sister, and Marvin had no siblings. The mother was the primary caretaker in each family. All four children were congenitally deaf, with no other reported cognitive or physical disabilities. The cause of deafness was unknown for all four children. Each child had a profound hearing loss: Mildred had a 90 db loss, David had a greater than 90 db loss, Karen had a 100 db loss, and Marvin had a 95 db loss. At the time of videotaping, Mildred, Karen and Marvin all attended the same oral preschool for the deaf in the Chicago area. David attended an oral preschool for the deaf in the Philadelphia area. None of the children had been exposed to ASL or Manually Coded English at the time of testing.

Data Collection and Coding

Each child was videotaped at home during natural play settings with a set of toys, books, and puzzles (described in Goldin-Meadow, 1979) designed to facilitate interaction. Each session lasted from 1 to 2 hours. The gestures that the American deaf children and their hearing mothers produced were coded according to a system described in Goldin-Meadow and Mylander (1984). The videotapes of the Chinese children were first transcribed for speech by a native Mandarin speaker, who translated into English all of the utterances produced by both mother and child. Next, a second native Mandarin speaker reviewed the tapes for nonverbal acts that appeared to be conventional Chinese gestures (i.e., emblems, e.g., index finger rubbed on the cheek to convey shame). All of the gestures that the Chinese children

¹One of the schools, the Taipei Zheng Yin Oral School for the Deaf, did use what can be called "sound gestures," gestures used to highlight for a deaf child the manner in which certain sounds are generated (a system somewhat comparable to the cued speech system used in certain schools for the deaf in America). For example, the first consonant for the Chinese word *niao* (bird) is a nasal sound. To make the nasalization salient, the index finger is pressed against the side of the nose, and this sound gesture is produced whenever the word *niao* is said. Both Bao-bao and Qing-qing were exposed to sound gestures; however, sound gestures accounted for 2% of the total gestures that each child produced. We have therefore eliminated sound gestures from our analyses.

and mothers produced were then coded according to the system described in Goldin-Meadow and Mylander (1984). Reliability was established between two trained coders, a native Mandarin speaker and an English speaker, who used the transcripts of the translated speech when coding the gestures. Overall, there was 90% agreement between the coders; reliability for individual coding categories ranged between 88% and 93%. It is important (and interesting) to note that the system developed to transcribe the gestures of the American deaf children was easily used without modification to transcribe the gestures of the Chinese deaf children. In addition to analyzing the gestures that the children and mothers produced during the play sessions, we also analyzed the way mother and child interacted during the session according to a system described in detail in Wang (1992). We begin by describing the results of these analyses.

MOTHER-CHILD INTERACTION PATTERNS IN TWO CULTURES

Based on previously published studies, we began this project with the assumption that mothers interact quite differently with their children in American and Chinese culture. In order to verify this assumption for our sample of mothers and children, we analyzed the way in which the four hearing mothers interacted with their deaf children in both samples. We found that there were indeed many differences in the way the American and Chinese mothers behaved with their deaf children. These differences may be unique to interactions with deaf children or they may be characteristic of interactions with all children in the two cultures. We consider this issue in the final section of this chapter.

We first examined which member of the dyad initiated episodes when mother and child interacted. An episode was considered to begin when mother and child centered their attention on a toy, picture, or event. As Fig. 19.1 reveals, we found that, in the American dyads, each of the four children initiated episodes more frequently than his or her mother. In contrast, in the Chinese dyads, three mothers were more likely than their children, and one was as likely as her child, to initiate episodes. Overall, the American mothers initiated interactions with their children 35% of the time, compared to 67% for the Chinese mothers. In addition, the American mothers seemed less eager to provide instruction to their deaf children than were the Chinese mothers. The American mothers tended to let their deaf children explore the toys and, only if the child failed to work the toy, would the mothers then offer direction (96% of the American mothers' instructions were deferred, compared to 9% for the Chinese mothers). In contrast, the Chinese mothers frequently provided direction to their deaf children even before the

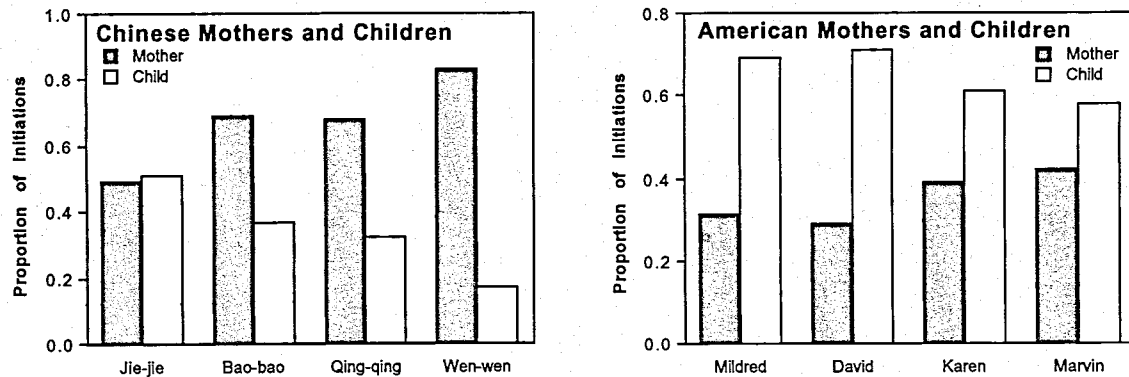


FIG. 19.1. The proportion of episodes initiated by mother vs. child in the Chinese and American groups.

child attempted to work on the toy (91% of the Chinese mother's instructions were immediate, compared to 4% for the American mothers).

The mothers in the two cultures also differed in the nature of the feedback they gave their deaf children. The American mothers focused on whether the task was performed correctly or not. For example, they would give their children feedback such as, *yes, it's right* or *no, turn it this way* (87% of the American mothers' evaluative comments were task-oriented in this way, compared to 48% for the Chinese mothers). In contrast, the Chinese mothers tended to evaluate the children themselves. For example, they would say *you are smart* if the child accomplished the task correctly, or *you are stupid* if the child failed the task (52% of the Chinese mothers' evaluative comments were child-oriented, compared to 13% for the American mothers).

Finally, we also examined the types of verbal behaviors that the mothers produced when interacting with their children, and again found differences between the two groups of mothers. As Fig. 19.2 reveals, the American mothers were less informative speakers with their children than the Chinese mothers were with theirs. When commenting on objects or pictures in a task, the American mothers tended to label the object and supply no other information. For example, *house; that's a house* (96% of the American mothers' comments on objects were labels, compared to 34% for the Chinese mothers). In contrast, the Chinese mothers labeled the object and then went on to describe it. For example, *house; the house is very high; there are houses over there* (66% of the Chinese mother's comments on objects were relatively elaborate descriptions, compared to 4% for the American mothers). We ask now whether the differences in the way the Chinese and American mothers spoke to their children were also reflected in the way they gestured to their children and, if so, whether those differences affected the way their children themselves gestured.²

THE GESTURES PRODUCED BY MOTHER AND CHILD IN BOTH CULTURES

Rate of Gesturing

We began by examining how frequently the Chinese and American mothers gestured—a measure of how much gestural input the children received. Consistent with the active way in which the Chinese mothers interacted with their deaf children, the Chinese mothers gestured quite often, producing

²Many of the maternal behaviors that we examined have been found to vary with socioeconomic status (Moore, 1985). It is therefore important to note that the Chinese and American families in our sample were both drawn from the same socioeconomic class; that is, the middle class (see the description of the Chinese and American samples).

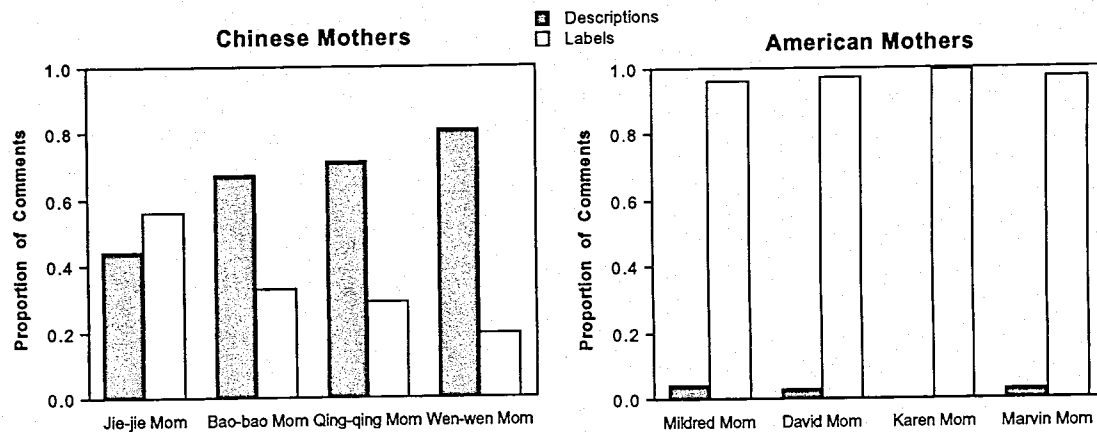


FIG. 19.2. The proportion of each mother's comments on objects that were labels of the object vs. more elaborate descriptions in the Chinese and American mothers' interactions with their children.

significantly more gestures per hour (374 gestures per hour) than the American mothers (85 gestures per hour). We then looked at the children's rate of gesturing and found that the asymmetry of the parents was mirrored, although to a lesser extent, in the children: The mean number of gestures per hour was 364 for the Chinese children and 193 for the American children. Thus, although the Chinese children gestured more frequently than the American children, they produced only two times as many gestures per hour as the American children (rather than four-fold disparity found in the mothers' rates). In other words, the difference in rate of gesturing was less for the children than for the mothers. In this sense, the American children gestured more often than might be expected on the basis of their mothers' rate (consistent with the possibility that there may be a minimal level of communication that a child will produce even if the child does not have a particularly active communication partner).

A common assumption in many studies of language acquisition is that the frequency with which a particular construction is used in a child's input will affect whether that construction is found in the child's output (that is, studies tend to correlate frequency in maternal input with child output, cf. Brown & Hanlon, 1970). However, in the typical language learning situation, a child hears many constructions so frequently that, if there were a minimal threshold input needed to acquire a construction, the threshold would likely be exceeded many times over (see Newport, Gleitman & Gleitman, 1977, for discussion). Thus, in typical language learning circumstances, it is difficult to explore the role of frequency of input in the child's acquisition of language. However, the degraded input conditions experienced by the deaf children we have studied facilitate the exploration of this issue.

Both the American and Chinese deaf children in our studies were lacking conventional language models and received only unconventional gestural input from their hearing parents. The fact that the Chinese mothers gestured so much more than the American mothers means that the Chinese deaf children received much more of this unconventional input than did the American deaf children. Thus, we can ask whether the frequency of input (albeit unconventional input) plays a role in determining whether a child will acquire a particular structural pattern. Consider a situation in which the American and Chinese mothers both produce a consistent pattern in their gestures, but the American mothers produce it far less frequently than the Chinese mothers. If the frequency with which a pattern is produced determines the likelihood of its output, the pattern will more likely be acquired by the Chinese deaf children than the American deaf children. If, on the other hand, repeated exposure to a pattern is not necessary for acquisition to proceed (i.e., if what is essential is that the pattern be consistently produced the few times it appears), the pattern will be acquired equally by both the Chinese and American deaf children.

Conventional Gestures (Emblems)

All of the mothers in both groups produced the three types of gestures that we have previously found in the deaf children's communications: deictic pointing gestures, characterizing gestures, and marker gestures. Characterizing gestures themselves can be divided into two types, pantomimic gestures in which the form of the gesture mimics its referent (e.g., moving an O-hand in a short arc toward the mouth to convey eating), and conventional gestures in which forms tend to be less transparently related to their referents. Conventional gestures or emblems (Ekman & Friesen, 1969) are gestures that are recognized within the hearing culture as particular symbols for a given meaning (e.g., thumbs-up means 'good' or 'okay' in the American culture).

Given the fact that emblems show a fair amount of cultural specificity (McNeill, 1992), we might expect to find differences in the conventional gestures used by the mothers in our two samples. Indeed, we found that the Chinese and American mothers used very different types of emblems or conventional gestures with their children (see Fig. 19.3). For the most part, the American mothers used conventional gestures to make requests (e.g., the 'give-me' gesture or the beckon used to request someone to come near), although they did occasionally use a conventional gesture to convey number (e.g., an index finger held vertically used to mean '1'), an emotion (e.g., eyebrows knitted and face scowling in an exaggerated fashion used to mean 'angry'), or a current state (e.g., a palm held on the cheek with the head tilted used to mean 'asleep'). In contrast, the Chinese mothers, used conventional request gestures no more frequently than they used their other conventional gestures. Moreover, they more often used different exemplars within a category of conventional gestures than did the American mothers (e.g., the Chinese mothers used a bent index finger to mean 'dead,' a current state, and an index finger brushed against the cheek to mean 'shame,' an emotion) and they used conventional gestures to evaluate, a use not found at all in this particular American sample (e.g., the Chinese mothers used an extended pinky to mean 'bad'). Thus, the deaf children in the two cultures were exposed to very different types of conventional gestures.

Moreover, given that conventional gestures have forms that are somewhat arbitrarily related to their referents, we might expect that the deaf children would not be able to invent such gestures, but would instead learn only the conventional gestures that they see. We found that this indeed was the case. In both cultures, the deaf children used essentially the same types of conventional gestures as their hearing mothers (Fig. 19.3). In fact, the proportion of a child's conventional gestures that could be found in that child's mother's gestures was very high in both cultures (.88 for the Chinese children and .73 for the American children). Parenthetically, it is important to note

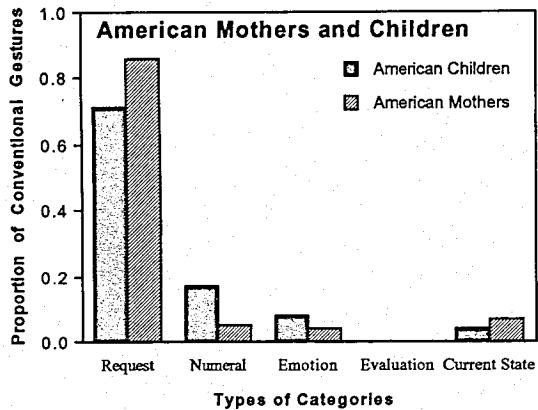
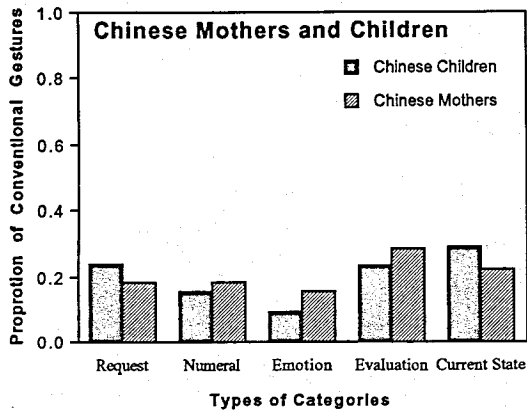


FIG. 19.3. Mean proportion of conventional gestures produced by the Chinese mothers and children and the American mothers and children during their play sessions.

that the children did produce gestures that did not appear to be learned from their mothers (the gestures we have called pantomimic gestures that are, by definition, iconic and that the deaf children were able to invent on their own). Indeed, the proportion of a child's pantomimic gestures that could be found in that child's mother's gestures was relatively low in each culture (.34 for the Chinese children and .25 for the American children), suggesting that the majority of these gestures were not modeled for the child by his or her mother.

Given the differences in Chinese and American cultures, it is not surprising that the emblems in the Chinese mothers' gestural repertoire differed from the emblems in the American mothers' repertoire. Interestingly, in a comparative study of the type of talk Chinese and American parents routinely use with their hearing children, Miller, Mintz, and Fung (1991) found that Chinese mothers were far more likely to evaluate their (hearing) children and to stress emotional states than were American mothers. These values appear to be so salient within the Chinese culture that emblematic gestures have been created to convey those values nonverbally. Our data suggest that the Chinese deaf children are exposed by their mothers to these values nonverbally, and the children incorporate them into their own nonverbal repertoires. Thus, despite their inability to hear the talk that their parents use, the Chinese deaf children are, at this level, being socialized into Chinese culture.

Distribution of Gesture Types

We also found the Chinese and American mothers differed in the relative frequency with which they produced gesture types in discourse. As Fig. 19.4 reveals, the Chinese mothers produced pointing gestures (i.e., gestures that are noun-like in that they indicate objects, people, places, etc.) more frequently than characterizing gestures (i.e., gestures that tend to be predicates), and characterizing gestures either more frequently than, or as often as, marker gestures (i.e., gestures used to get attention or to modulate, affirm, negate, doubt). The American mothers also produced pointing gestures very frequently, but they produced far more marker gestures than characterizing gestures. In other words, the American mothers used very few predicate-like gestures in their discourse, primarily producing gestures to indicate objects and to modulate.

Despite the fact that the Chinese and American mothers distributed their gesture types quite differently, their children were found to use their gestures in comparable ways. As Fig. 19.5 displays, the children produced pointing gestures either more frequently than, or as often as, characterizing gestures, and characterizing gestures more frequently than marker gestures. Thus, although the differences between the American and Chinese mothers' con-

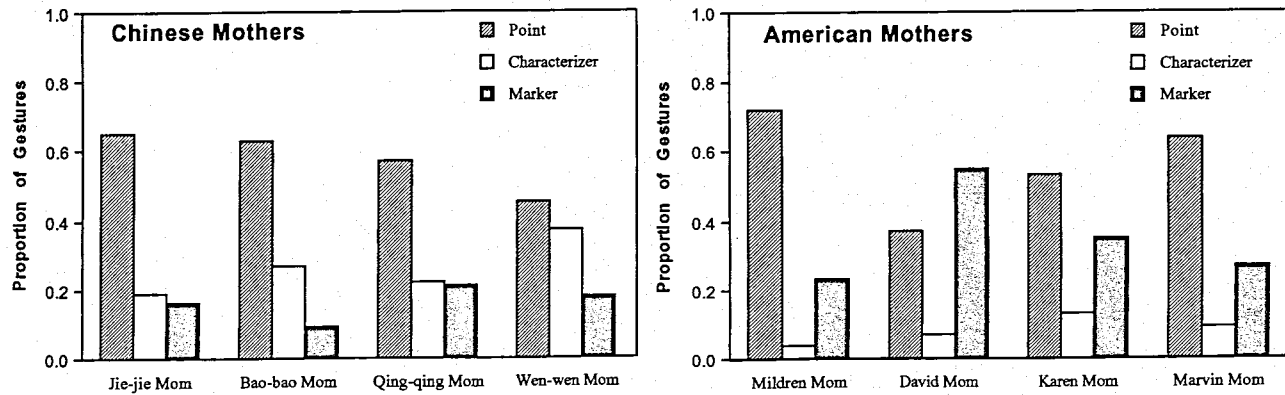


FIG. 19.4. The proportion of pointing, characterizing, and marker gestures produced by each Chinese and American mother when interacting with her deaf child.

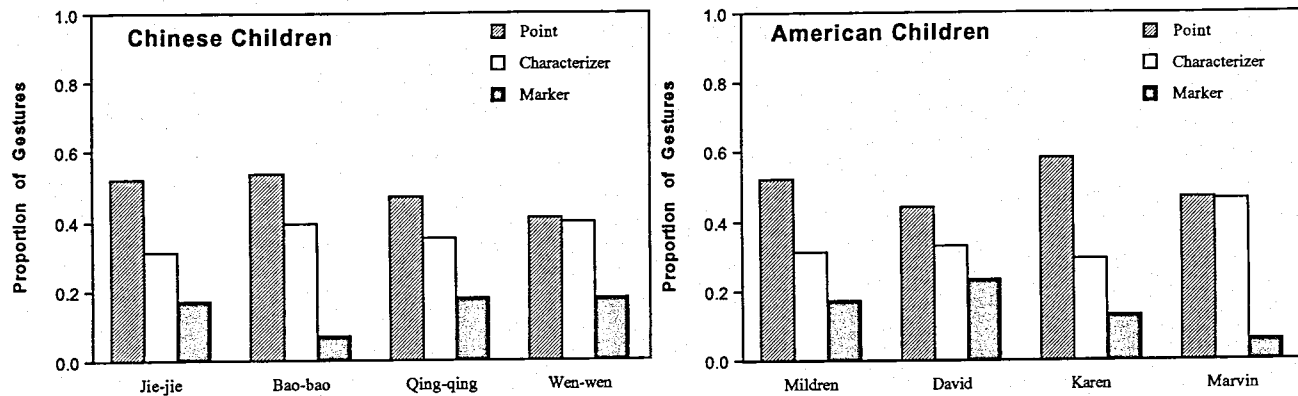


FIG. 19.5. The proportion of pointing, characterizing, and marker gestures produced by each Chinese and American deaf child.

ventional lexicons were mirrored in their children's lexicons, the differences between the American and Chinese mothers' distribution of gesture types in discourse were not mirrored in their children's gestures. Despite wide differences in the input they received, the children used their gestures in discourse in precisely the same ways. This pattern (that differences in the mothers' gestures are not reflected in the children's gestures) is one that we see again when we examine the frequency with which gestures are combined into strings.

Mean Length of Gestural Utterance

We examined the average length of the mothers' gesture strings (MLGU, the mean length of gestural utterances) and found that the Chinese and American mothers differed in their average length of strings. The averaged MLGU was 1.41 (range 1.02 to 1.90) for the Chinese mothers but only 1.10 (range 1.00 to 1.27) for the American mothers (note that 1.00 is the lowest possible mean; essentially, the American mothers produced only single gesture utterances). Despite the difference in the extent to which the mothers combined their gestures into strings, the deaf children showed no such difference. The averaged MLGU was 1.41 (range 1.26 to 1.62) for the Chinese children and 1.44 (range 1.16 to 1.80) for the American children.³ Thus, the children combined their gestures into strings whether or not their mothers did.

SIMILARITIES IN STRUCTURE DESPITE DIFFERENCES IN INPUT

In sum, in the limited sample we have analyzed to date, we have found that the Chinese and American hearing mothers interacted very differently with their deaf children. The Chinese mothers were more active in initiating interaction and more informative in producing elaborate spoken comments about objects than were the American mothers. In addition, the Chinese mothers were far more likely to produce gestures when interacting with their deaf children than were the American mothers. When we examined the types of gestures produced by the Chinese and American mothers, we found that there were very few similarities between them. In other words, the Chinese and American mothers provided their deaf children with very different gestural models. Despite the difference in the gestural models they received, the Chinese and American deaf children produced gestures that were comparable in many respects, differing primarily in their use of culturally-bound emblem-

³It is worth noting that the lowest MLGU in both the Chinese and the American children was found in the youngest child in each sample (1.26 for Jie-jie and 1.16 for Mildred, both of whom were 2;9).

atic gestures. On the basis of these preliminary findings, many of the structural properties that we have previously identified in the American deaf children's gesture systems appear to be resilient across cultural variation.

One question that immediately comes to mind is why the Chinese mothers' gestures were so different from the American mothers' gestures. In previous work (Goldin-Meadow, 1992), we have speculated that the gestures the American hearing mothers produce are structured differently from their deaf children's because their gestures serve different functions. The deaf children's gestures serve the function of a primary communication system (it being the child's sole means of effective communication), but the hearing mothers' gestures serve as an adjunct to speech, which itself fulfills the role of a primary communication system. However, the hearing mothers in the Chinese and American cultures both use gesture as an adjunct to speech. Why then are their gesture systems so different? One obvious possibility is that the gesture systems differ simply because the spoken languages to which gesture is an adjunct differ across the two cultures.

In order to explore this possibility, we need to examine how gesture is used by Mandarin and English speakers in general. Do Chinese mothers of hearing children gesture as much as, and in the same way as, the Chinese mothers of the deaf children in our sample? Do American mothers of hearing children gesture as little as, and in the same relatively unstructured way as, the American mothers of the deaf children in our sample? If so, cultural factors, including the structure of spoken Mandarin and English, may be suggested as good candidates for the source of the differences we find in the amount and type of gesturing in the deaf children's hearing mothers.

Indeed, there is some suggestion that the hearing mothers of the deaf children in both our American and Chinese samples are not atypical within their respective cultures. For example, Bekken, Goldin-Meadow, and Dymkowski (1990) compared the rate of gesturing and MLGU in a subset of the mothers of deaf children in our American sample to a group of American mothers interacting with their hearing children. Bekken et al. found that the gestures produced by the mothers of the deaf children were within the same distribution as the gestures produced by the mothers of the hearing children, although on the high end of that distribution. As an example from the Chinese data, Wang (1992) found that the Chinese mothers of the deaf children she studied used interaction strategies that were very comparable to those found in Chinese mothers of hearing children studied by Miller et al. (1991). In particular, the Chinese mothers related events that occurred during the play session back to events in the child's own personal experience, and made comments on emotions and internal states. These strategies were not found in any of the American mothers of the deaf children Wang studied.

Despite these suggestive observations, it is not at all certain that the mothers of the hearing children in the two cultures produce gestures that

parallel the gestures produced by the mothers of the deaf children. In fact, we might suspect that the Chinese mothers of deaf children may produce more gestures than the Chinese mothers of hearing children. They could do so in an effort to compensate for their children's handicap, a goal that may stem from the wider cultural belief in the importance of input and effort in fostering achievement.

It is generally recognized that modern Chinese parents place great emphasis on the achievement of their children (Ho, 1986). Americans are also interested in education, but they appear to differ from the Chinese in their beliefs about the factors necessary for academic achievement (Munro, 1977; Tobin, Wu, & Davidson, 1989). In America, it is generally believed that it is better for children to be bright than to be good students. In contrast, in Taiwan, hard work, rather than inherent ability, is more highly valued and believed to be essential for academic success (Stevenson et al., 1990). Consistent with these different beliefs, Chinese parents treat school and schoolwork differently from the way American parents do, allocating proportionately more space, money, and time to their children's schoolwork than American parents. Chinese parents spend a great deal of time helping their child with schoolwork; American parents spend less time, especially if the child is already doing well academically (Stevenson et al., 1990). In the Chinese family more than in the American family, hard work on the part of parent and child is believed to be essential to realize each child's academic potential (Chen & Uttal, 1988; Hess, Chih-Mei, & McDevitt, 1987).

Given the Chinese belief in the value of effort in academic achievement, we might expect that Chinese mothers would interact even more intensively with a deaf child than with a hearing child, making more effort to engage the child who has a handicap that must be overcome, perhaps focusing more attention on the gestural modality that is the child's only means of effective communication. Indeed, it might be the increased attention the mother pays to her own gestures (attention that speakers normally do not pay to their gestures) that alters those gestures, making them more language-like and more comparable to the deaf child's gestures (cf. McNeill, 1992). In contrast, given the American belief in the limitations that innate ability places on a child's possibilities for achievement, we might expect that American mothers would interact less intensively (or at least no differently) with a deaf child than with a hearing child, adjusting their input to their expectations of the child's future level. Data on hearing mothers interacting with their hearing children in each culture are needed to determine the source of the different types of input received by the deaf children in the two cultures.

We conclude by noting again that, whatever the source of the differences in input, the fact that the children experience such distinctly different environments yet develop gesture systems that are structured in similar ways

suggests that the children themselves may be predisposed to communicate in language-like ways. Moreover, the similarities in the two gesture systems developed in different parts of the globe suggest that these systems may reflect the units and structural arrangements that are natural to language in the manual modality, perhaps forming part of the basic framework for all conventional sign languages. We stress that these units and arrangements are not inevitable in the manual modality—the gestures of the hearing mothers (particularly the American hearing mothers) do not exhibit these properties. Indeed, we suggest that the hearing mothers are, in effect, not using their gestures as language, but are instead using their gestures as an accompaniment to language. It is when gesture is actually serving as a primary communication system that it must assume many (albeit obviously not all) of the properties that characterize linguistic systems—and it does so in large part whether or not a conventional language model is available to shape the process.

ACKNOWLEDGMENTS

This work was supported by Grant No. BNS 8810760 from the National Science Foundation and Grant No. RO1 DC00491 from NIH to S. Goldin-Meadow, and by a Pacific Cultural Foundation subsidy.

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