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Thought before Language: Do We Think Ergative?

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16.1 Introduction

Languages around the globe classify experience in different ways. Benjamin Whorf (1956) first popularized the notion that linguistic classifications might influence not only how people talk but also how they think. More specifically, Whorf suggested that the relentless use of a particular linguistic categorization might, at some point, also affect how speakers categorize the world even when they are not talking.

This provocative hypothesis is most often explored by comparing the nonlinguistic performance of speakers whose languages differ systematically in the way they categorize experience. In this chapter, however, I take a different approach: I observe people who have had no exposure to any conventional language whatsoever. The thoughts of these individuals cannot possibly have been shaped by language. As a result, whatever categories they express reveal thoughts that *do not* depend on language—thought before language. I begin by demonstrating that individuals who are not exposed to language are nevertheless able to communicate ideas with others. Moreover, I show that these communications are structured in linguistically regular patterns. I focus, in particular, on how patients and actors are treated in spontaneous communication that has not been shaped by a language model.

Before describing this work, I briefly review a study that is often taken to bear directly on the Whorfian hypothesis: a comparison of the categories expressed by speakers of languages that differ in the way they mark number. The example is instructive because it provides insight into the kind of role that language may play in shaping thought, the kinds of domains in which language may have its effect, and the kinds of experiments that are often taken as evidence of that effect.

16.2 Language Can Shift Where Boundaries Are Drawn along a Continuum: An Example from Number Marking

All languages mark number. As an example, English speakers indicate whether a noun refers to one or many by producing it in a singular or plural form (e.g., *cat* vs. *cats*, *broom* vs. *brooms*). However, while they are obligated to mark plurals for some entities (animates, implements), English speakers do not mark plurals for others (e.g., substances—English speakers say *mud*, not *muds*, whether they are talking about one puddle or many). In this sense, English speakers group animates and implements together, and distinguish them from substances, with respect to number marking. Lucy (1992) provides evidence that English speakers make the same groupings even when they are *not* talking. Lucy presented English speakers with a picture recall task and determined whether they paid attention to changes in the number of items in the picture. Lucy found that English speakers did notice when the number of animates and implements in the picture had changed (i.e., when the number of animates or implements varied from the original, they correctly said this was not the picture they had seen previously). In contrast, these same English speakers failed to notice a difference when the number of substances in the picture was changed (they erroneously accepted as correct pictures in which the number of mud puddles varied from the original).

Lucy then extended this paradigm to address the Whorfian hypothesis by presenting the same pictures to speakers of Yucatec Maya. Yucatec is a language that marks numbers of objects a bit differently from English (Lucy 1992, 58). At the extremes, like English, Yucatec marks plurals for animates and does not mark plurals for substances. However, the languages differ in the way they deal with the number of implements. In English, implements take plural marking and thus are treated like animates (e.g., *brooms*). In Yucatec, implements do not take plural marking and thus are treated like substances (i.e., the equivalent of saying *some broom*).

The Whorfian hypothesis would predict that after many years of speaking Yucatec, Mayans ought to perform differently from English speakers when recalling pictures of implements, even when not talking about them. And they did. As expected, speakers of both languages noticed when the number of animates in the picture changed, and they failed to notice when the number of substances changed (Lucy 1992). However, as Whorf might have predicted, Yucatec speakers did not notice changes in the number of implements, while English speakers did.

Note that the number-marking linguistic system is an ideal context in which to explore questions of language and thought. There is a continuum (ranging from animate objects to substances) along which these two languages—indeed, according to Lucy (1992), all languages—are organized. One end of the continuum is always treated as categorically different from the other end, thus establishing a basic framework within which differences among speakers can be detected (see Imai and Gentner 1997). Within this framework, languages differ with respect to where along the continuum they draw the categorical boundary. Implements can be thought of in terms of their form and thus categorized with animates, the English pattern. Alternatively, implements can be thought of in terms of their substance and thus categorized with substances, the Yucatec pattern. The crucial question revolves around whether speakers follow the patterns set by their language when categorizing exemplars from the middle of the continuum in a nonlinguistic context.

In this chapter, I examine another linguistic system, also organized around a continuum. The focus will again be on where boundaries are drawn when exemplars in the middle are categorized.

16.3 Language and Thought When There Is No Model for Language

Lucy's work suggests that language can influence thought, even languageless thought, at least after language has been well learned and become habitual. Here, I ask a slightly different question in a very different way. My work addresses what happens to thought when language is still a novel skill. Will language exert an influence on thought or, alternatively, will thought affect the way language itself is learned?

If thought drives the way language is learned, we might expect the initial stage of language learning to be comparable around the globe—perhaps revealing a basic child grammar of the sort that Slobin (1985) proposed. In fact, commonalities can be found at the very early stages of language learning. For example, children around the globe express the same basic semantic relations in their two-word utterances (Brown 1973). However, even at this early stage, we can see effects of the language model to which a child is exposed. As an example, children's earliest utterances reflect the word order patterns prevalent in their parents' talk (e.g., Bowerman 1973), and they display morphological devices if those devices are transparent in the adult language (e.g., as in Turkish; Aksu-Koç and Slobin 1985).

Thus, and perhaps not surprisingly, the language model to which a child is exposed has an immediate impact on at least some aspects of the language the child acquires (see also Berman and Slobin 1994; Choi and Bowerman 1991). Does this mean that children's thoughts are, from the start, molded by the languages they learn? Not necessarily. In fact, Lucy's own work indicates that before age 9, and long after they have acquired the Yucatec number-marking system in their language, Yucatec-speaking children display the *English* nonlinguistic number-marking pattern (focusing not on the substance of implements, but on their form) rather than the Yucatec pattern shown by adult speakers of their language (Lucy and Gaskins 2001, this volume). This finding suggests that if language does have an impact on thought, its effect may not be felt until the linguistic system has been routinely used for many years—until middle childhood.

What are the implications of these findings for language learning? Although children learn very early the particular forms of the language to which they are exposed, these forms may not influence thought until later in development. Why not? Perhaps children come to the language-learning situation with biases of their own. These biases may have to be overridden by a language model, but they clearly do not get in the way of language learning (and indeed may even facilitate the process). But how are we to discover these biases? We cannot take the early words and sentences children produce as an uncontaminated view of their biases simply because children's words are, from the very first, heavily influenced by the language to which they are exposed. The most straightforward approach is to look at what children do when they are not exposed to a model of a conventional language. Such situations, although rare, do arise.

Deaf children born to hearing parents are, at times, not exposed to a conventional sign language until adolescence. Moreover, if their hearing losses are so severe as to preclude the acquisition of spoken language, they are unable to profit from the conventional spoken language that surrounds them. Despite their lack of access to a usable conventional language model, these deaf children invent gesture systems to communicate with the hearing individuals in their worlds. The gestures have syntactic (Feldman, Goldin-Meadow, and Gleitman 1978; Goldin-Meadow and Feldman 1977; Goldin-Meadow and Mylander 1984, 1998), morphologic (Goldin-Meadow, Mylander, and Butcher 1995), and lexical (Goldin-Meadow et al. 1994) structure and thus have many of the rudimentary properties of natural language.

I explore in this chapter how deaf children creating their own gesture systems deal with one particular structural aspect of natural language that bears importantly on the issue of language and thought: typological variation in how actors and patients are marked in transitive and intransitive sentences. This system, like number marking, is organized around a continuum, with languages agreeing on how they treat the endpoints, but differing on where they mark the categories in the middle. All languages distinguish (syntactically, morphologically, or both) patients from actors in transitive relations. In English, for example, transitive actors precede the verb, patients follow (*John hit Sam*); in addition, transitive actors are replaced by pronouns in the nominative case, patients by pronouns in the accusative case (*He hit him*). What distinguishes languages along this dimension is how they treat exemplars from the middle category, the intransitive actor.

Some languages, English among them, are called "accusative" languages and mark intransitive actors like transitive actors. For example, both precede verbs (***John** ran home*, ***John** hit the cat*) and both take nominative case when replaced by pronouns (e.g., ***He** ran home*, ***He** hit the cat*). Moreover, patients are distinguished from both types of actors: patients follow verbs (*The cat hit **John***) and take accusative case when replaced by a pronoun (*The cat hit **him***). In this way, the initiator properties of the intransitive actor are highlighted (the fact that John initiates the running, as opposed to his being affected by the running). Other languages, called "ergative" languages, align intransitive actors with patients rather than with transitive actors (Dixon 1979; Silverstein 1976). If English were ergative, intransitive actors would follow verbs as patients do (*Ran **John***) and would be replaced by the same pronoun as patients (*Ran **him***). The ergative pattern highlights the affectee properties of the intransitive actor (the fact that John is affected by the running, as opposed to initiating the running).

In short, as with the number-marking devices examined by Lucy (1992), there are two categories that are distinguished from one another in all languages (transitive actor vs. patient) and a third category (intransitive actor) that is aligned with one category in one set of languages (transitive actor in accusative languages) and with the other category in the other set of languages (patient in ergative languages).

Children have no difficulty learning either accusative or ergative languages (Ochs 1982; Slobin 1985). Thus, on the basis of language learning in typical situations where children are exposed to accusative versus ergative language models, we might guess that children have no bias whatsoever as to how intransitive actors are to be treated. But, as already mentioned, it is difficult to identify children's predispositions from their early language. The most straightforward way to discover their biases is to examine children who have not yet been exposed to a language model: for example, deaf children creating their own gesture systems without linguistic input. I ask here whether, in their gesture systems, deaf children treat intransitive actors like transitive actors or like patients; that is, do these children (and, by inference, do all children) come to the language-learning situation with a bias for categorizing intransitive actors as either initiators or affectees? First, let us consider some necessary background on deafness and language learning.

16.4 Background on Deafness and Language Learning

Deaf children born to deaf parents and exposed from birth to a conventional sign language such as American Sign Language (ASL) 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 (Newport and Meier 1985). However, 90% of deaf children are not born to deaf parents who can 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 and 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 spoken language by hearing children of hearing parents or to the acquisition of sign language by deaf children of deaf parents. By age 5 or 6, and despite intensive early training programs, the average profoundly deaf child has only limited linguistic skills in speech (Conrad 1979; Mayberry 1992; Meadow 1968). Moreover, although some hearing parents of deaf children send their children to schools in which one of the manually coded systems of English is taught, other hearing parents send their deaf children to "oral" schools in which sign systems are neither taught nor encouraged. Thus, these deaf children are not likely to receive input in a conventional sign system, or to be able to use conventional oral input.

The children I have studied are severely (70–90 dB bilateral hearing loss) to profoundly (> 90 dB bilateral hearing loss) deaf, and their hearing parents chose to educate them using an oral method. At the time of our observations, the children ranged in age from 1;2 to 4;10 (years; months) and had made little progress in oral language, occasionally producing single words but never combining those words into sentences. In addition, at the time of our observations, the children had not been exposed to a conventional sign system of any sort (e.g., ASL or a manual code of English). As preschoolers in oral schools for the deaf, the children spent very little time with the older deaf children in the school who might have had some knowledge of a conventional sign system (i.e., the preschoolers attended school only a few hours a day and were not on the playground at the same time as the older children). In addition, the children's families knew no deaf adults socially and interacted only with other hearing families, typically those with hearing children.

We coded all of the gestures that the children produced during these spontaneous play sessions. In order for a manual movement to be considered a gesture, it must be produced with the intent to communicate. The difficulty lies in discriminating acts that communicate indirectly (e.g., pushing a plate away, which indicates that the eater has had enough)—acts we did not want to include in our study—from acts whose sole purpose is to communicate symbolically (e.g., a "stoplike" movement of the hands produced in order to suggest to the host that another helping is not necessary). Lacking a generally accepted behavioral index of deliberate or intentional communication, we decided that a communicative gesture must meet the following two criteria (Feldman, Goldin-Meadow, and Gleitman 1978; Goldin-Meadow and Mylander 1984). First, the movement must be directed to another individual. This criterion is satisfied if the child attempts to establish eye contact with the communication partner. Since manual communication cannot be received unless the partner is looking, checking for a partner's visual attention is a good sign that the child intended the movement to be seen. Second, the movement must not be a direct act on the other person or relevant object. As an example, if the child attempts to twist open a jar, that act is not considered a gesture for OPEN, even if the act does inform others that help is needed in opening the jar. If, however, the child makes a twisting motion in the air, with eyes first on the other person to establish contact, the movement is considered a communicative gesture. In sum, behaviors are included in our analyses only if they are produced with the intent to communicate. They thus reflect thoughts that have been recruited for this purpose.

16.5 Marking Actors and Patients in Transitive and Intransitive Gesture Sentences: An Ergative Pattern

The "lexicon" of the deaf children's gesture systems contained both pointing gestures and characterizing gestures. Pointing gestures were used to index or indicate objects, people, places, and the like, in the surroundings. Characterizing gestures were stylized pantomimes whose iconic forms varied with the intended meaning of each gesture (e.g., a C-hand rotated in the air to indicate that someone was twisting open a jar).

Gestures of this sort, particularly pointing gestures but also some characterizing gestures, are produced by hearing children (Acredolo and Goodwyn 1988; Butcher, Mylander, and Goldin-Meadow 1991). However, the deaf children's use of these gestures was unique in that their gestures fit into a structured system, while hearing children's gestures do not (Goldin-Meadow and Morford 1985; Morford and Goldin-Meadow 1992).

The deaf children combined their gestures into sentences. The boundaries of a gesture sentence were determined on motoric grounds. If the child produced one gesture and then, without pausing or relaxing the hand, produced a second gesture, those two gestures were considered part of the same sentence. If, however, the two gestures were separated by a pause or relaxation of the hand, each was considered a separate unit. I use the term *sentence* loosely and only to suggest that the deaf children's gesture strings share some structural properties with early sentences in child language. I focus on two properties here, beginning with data from the most prolific of the deaf children we have studied (David) to do so: (1) production probability, the likelihood that a particular semantic element will be gestured in a two-gesture sentence when it is permissible in that sentence; and (2) gesture order, the likelihood that the gesture for a particular semantic element will be produced in first or second position in a two-gesture sentence.

16.5.1 Production Probability

When we first observed David, he was in what might be called a "two-gesture" period, akin to a young hearing child's two-word period—a time when his utterances for the most part contained at best two gestures. If such a child wants to communicate an idea with three semantic elements, he will be forced to leave one of these elements out of the surface structure of his two-gesture sentences. For example, if describing a mouse eating cheese, David could not produce gestures for the eater (mouse), the eating action, and the eaten (cheese) in a two-gesture sentence. He might drop out elements randomly, producing gestures for each element a third of the time. However, this was not the strategy David adopted.

David was quite systematic in the elements he included and excluded from his two-gesture transitive sentences: he produced gestures for patients (the eaten-cheese) and omitted gestures for transitive actors (the eating-mouse). Thus, like all natural languages, David's gesture system made a distinction between actors and patients in transitive sentences, a distinction based on patterns of occurrence and nonoccurrence.

What about intransitive actors, such as a mouse running to its hole? Figure 16.1 (top) presents the probability of production for transitive actors, intransitive actors, and patients in David's two-gesture sentences that could, in theory, contain any two of these three elements (e.g., transitive sentences with an underlying structure of actor-act-patient, and intransitive sentences with an underlying structure of actor-act-goal). Note that David produced gestures for the intransitive actors (the running-mouse) as often as for patients (the eaten-cheese)—and far more often than for transitive actors (the eating-mouse). In this sense, then, David's gestures pattern like ergative languages: intransitive actors and patients are treated alike (produced), whereas transitive actors are treated differently (omitted).

16.5.2 Gesture Order

Where did David place his gestures in a two-gesture sentence, once he had produced them? Even at the two-word stage, children exposed to conventional languages tend to place words (or signs; see Newport and Ashbrook 1977) in privileged positions in their sentences, and the orders they follow tend to be the predominant orders used by adult speakers of the language. Thus, for example, an English-learning child would likely produce *Mouse eat*, *Eat cheese*, or *Mouse cheese* for the transitive renditions or *Mouse run* for the intransitive renditions—in each case, actors (both transitive and intransitive) occur in first position of a two-word sentence, and patients occur in second position.

David too followed particular order patterns, but in gesture. Interestingly, his gesture orders were distinct from the canonical word order of the English that was spoken around him. Figure 16.1 (bottom) presents the probability that transitive actors, intransitive actors, or patients would be the first gesture produced in a two-gesture sentence. Note first that David tended to produce gestures for patients in first position of his two-gesture sentences (*CHEESE*-EAT) and gestures for transitive actors in

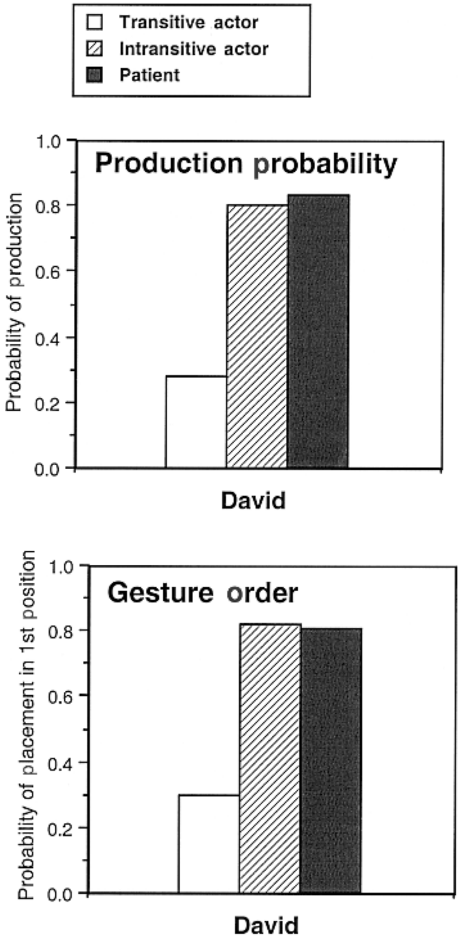

Figure 16.1
The likelihood that David will produce gestures for transitive actors, intransitive actors, and patients in two-gesture sentences that permit each of these elements (*top*); and that he will produce gestures for transitive actors, intransitive actors, and patients in the first position of a two-gesture sentence (*bottom*)

second position (EAT-*MOUSE*), thus distinguishing between actors and patients in transitive sentences not only in terms of production probability but also in terms of gesture order. Second, David tended to produce gestures for intransitive actors in first position (*MOUSE*-RUN)—precisely the same position in which patients occur (*CHEESE*-EAT) and distinct from the habitual position of transitive actors (EAT-*MOUSE*). Thus, David followed an ergative pattern (treating intransitive actors and patients alike) with respect to gesture order as well as production probability.

Was David unique? We might expect that deaf children left to their own devices might invent gesture systems with patterns found in all natural languages (e.g., they might all distinguish between transitive actors and patients), but their systems might vary in just the areas where languages vary (e.g., some children might align intransitive actors with patients as David did, thus reflecting an ergative pattern; others might align them with transitive actors, reflecting an accusative pattern). When we examine the 9 other deaf children in our American sample, 5 from the Philadelphia area and 4 from the Chicago area, we find that, as expected, all of the children did distinguish between transitive actors and patients in terms of production probability (see figure 16.2, which presents data from the 6 Philadelphia children, including David (top), and the 4 Chicago children (middle); Goldin-Meadow and Mylander 1984). Moreover, all 9 of the children also treated intransitive actors in precisely the same way that they treated patients, and different from the way they treated transitive actors. Thus, all 10 of the deaf children in our American sample displayed an ergative pattern with respect to production probability.

In terms of gesture order, like David, 8 of the 9 children tended to produce gestures for patients before acts (Donald 26 of 41, Dennis 10 of 11, Mildred 19 of 27, p's $< .05$; Karen 17 of 25, Tracy 7 of 8, p's $< .10$; Marvin 21 of 33, Kathy 8 of 12, Chris 6 of 10; and the exception, Abe 11 of 23). Although they produced fewer relevant sentences, many also showed a tendency to produce intransitive actors before acts as well (Abe 6 of 6, Tracy 7 of 7, Donald 7 of 10, Karen 5 of 6, Marvin 4 of 6, Kathy 2 of 3; Mildred and Chris were the exceptions, both 2 of 5; and Dennis produced no relevant combinations). Again, many of the children treated intransitive actors like patients. However, David was the only child who

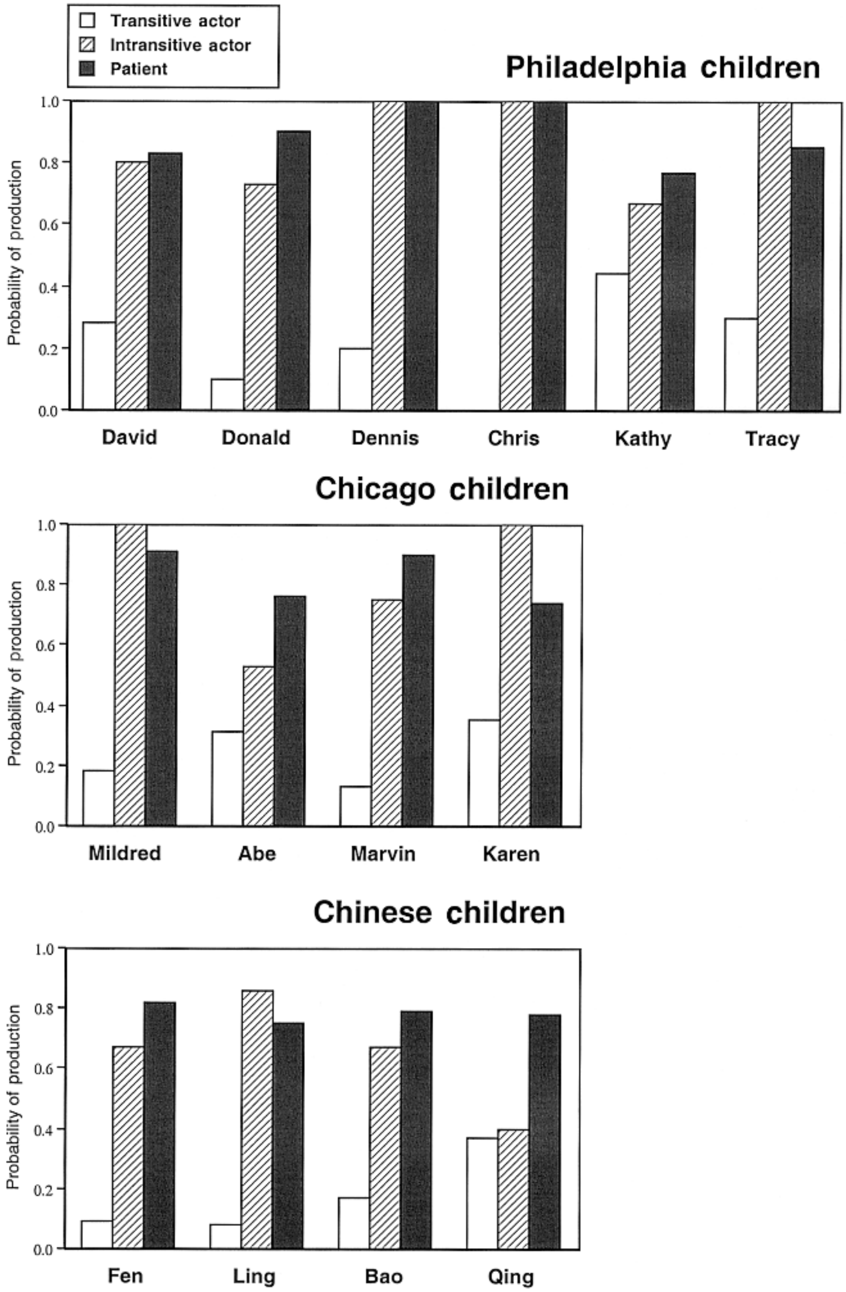

Figure 16.2
The likelihood that the American deaf children from Philadelphia (*top*) or Chicago (*middle*) and the Chinese deaf children from Taipei (*bottom*) will produce gestures for transitive actors, intransitive actors, and patients in two-gesture sentences that permit each of these elements

produced a sufficient number of transitive actors to determine a consistent order. As a result, it was impossible to determine whether transitive actors were distinguished from both patients and intransitive actors in terms of gesture order as well as production probability for the 9 other American children.

The ergative pattern in the deaf children's gestures could reflect a tendency to see objects as affected by actions rather than as initiators of action. In the sentence *You go to the corner*, the intransitive actor *you* has a double meaning. On the one hand, *you* refers to the goer, the actor, the initiator of the going action. On the other hand, *you* refers to the gone, the patient, the affectee of the going action. At the end of the action, *you* both "have gone" and "are gone," and the decision to emphasize one aspect of the actor's condition over the other is arbitrary. By treating intransitive actors like patients, the deaf children are highlighting the affectee properties of the intransitive actor over the initiator properties.

It is important to note that the deaf children really are marking thematic role, and not just producing gestures for the most salient or most informative element in the context. One very sensible (albeit wrong) possibility is that the deaf children produce gestures for intransitive actors and patients more often than for transitive actors because intransitive actors and patients tend to be new to the discourse more often than transitive actors (cf. DuBois 1987). In other words, the production probability patterns seen in figure 16.2 could be an outgrowth of a semantic element's status as "new" or "old" in the discourse. If the novelty of a semantic element is responsible for how often that element is gestured, we would expect production probability to be high for all "new" elements (regardless of role) and low for all "old" elements (again, regardless of role). We find no evidence for this hypothesis (Schulman, Mylander, and Goldin-Meadow 2001; see also Goldin-Meadow and Mylander 1984, 49). Rather, we find an ergative production probability pattern for "new" elements when analyzed on their own, as well as for "old" elements when analyzed on their own, as we would expect if thematic role, rather than novelty, determines how often an element is gestured.

16.6 Is the Ergative Pattern Unique to American Deaf Children? A Look at Chinese Deaf Children

All of the American deaf children whose gestures we have examined display, not only a distinction between transitive actors and patients, but also a tendency to treat intransitive actors like patients rather than transitive actors (i.e., an ergative pattern). Where does this ergative pattern come from? One possibility is that subtle differences in the way the children's hearing parents interact with them might influence the structure of their gestures. For example, Bruner (1974/75) has suggested that the structure of joint activity between a hearing mother and her hearing child exerts a powerful influence on the structure of the child's communication. To determine whether the ergative structure in the deaf children's gestures is a product of the way in which mothers and children jointly interact in their culture, we studied deaf children of hearing parents in a second culture, a Chinese culture.

We chose Chinese culture as a second culture in which to explore the spontaneous communication systems of deaf children because literature on socialization (Miller, Mintz, and Fung 1991; Young 1972), on task-oriented activities (Smith and Freedman 1982), and on academic achievement (Chen and Uttal 1988; Stevenson et al. 1990) suggests that patterns of mother-child interaction in Chinese culture differ greatly from those in American culture, particularly those in white, middle-class American culture. In addition, our own studies of the interaction between hearing mothers and their deaf children in Chinese and American families replicate these differences (Goldin-Meadow and Saltzman 2000; Wang 1992; Wang, Mylander, and Goldin-Meadow 1995).

We have examined 4 deaf children of hearing parents in Taipei, Taiwan, each observed twice between the ages of 3;8 and 4;11 (Goldin-Meadow and Mylander 1998). The children had hearing losses so severe that they could not acquire the spoken language of their parents even with intensive instruction. Moreover, their hearing parents had not yet exposed them to a conventional sign system (e.g., Mandarin Sign Language, Taiwanese Sign Language, Signed Mandarin). All 4 of the children were found to use gestures spontaneously to communicate with the hearing individuals in their worlds. Moreover, all 4 combined gestures into gesture strings characterized by production probability and gesture order regularities.

Figure 16.2 (bottom) displays the production probability patterns for the 4 Chinese deaf children. Note that all 4 children produced gestures for patients considerably more often than they produced gestures for transitive actors. Moreover, 3 of the 4 produced gestures for intransitive actors as often as for patients, and far more often than they produced gestures for transitive actors; that is, they displayed an ergative pattern identical to the American deaf children's pattern. One child, Qing, was an exception. Qing produced gestures for intransitive actors at the same low rate as she produced gestures for transitive actors, considerably less often than she produced gestures for patients. In this sense, Qing displayed an accusative pattern.

With respect to gesture order, all 4 of the Chinese children produced gestures for patients before gestures for acts (*CHEESE*-EAT): Ling 11 of 12, Bao 26 of 29, Fen 9 of 11, Qing 29 of 29 (p's $\leq .03$, binomial test on each child). Moreover, 3 of the 4 produced gestures for intransitive actors before gestures for acts (*MOUSE*-GO): Ling produced 14 of 15 relevant sentences conforming to this pattern, Qing 17 of 19, Bao 12 of 15 (p's $\leq .02$); Fen was an exception (1 of 4). Only Qing produced enough sentences containing transitive actors to explore order regularities for this semantic element. She produced gestures for transitive actors in first position of her two-gesture sentences (*MOUSE*-EAT, 8 of 8, $p \leq .004$), thus displaying neither an ergative nor an accusative pattern with respect to gesture order. She did, however, reliably produce gestures for patients before gestures for transitive actors when the two were produced in a single sentence (CHEESE-*MOUSE*, 6 of 7, $p \leq .06$), thus continuing to maintain a distinction between patients and transitive actors in gesture order as well as production probability.

Note that, in principle, it is possible for a child to produce gestures for intransitive actors at a rate completely different from gestures for either patients or transitive actors. Thus, the children need not have conformed to either an accusative or an ergative pattern with respect to production probability. Nevertheless, the patterns displayed in the gestures of 13 of the 14 children observed thus far, American and Chinese, followed one of the two predominant patterns found in natural languages. Indeed, 13 of the 14 children displayed an ergative pattern (i.e., intransitive actors are treated like patients and distinct from transitive actors), even though neither English nor Mandarin is an ergative language.

Why might this be? Of the two patterns, ergative structure is much less common in the world's languages than accusative structure. Why does almost every deaf child we have observed seem to find it so natural? One possibility is that the gesture production probability patterns reflect the way that *children* view the world before their thoughts have been molded by a language model. Children may have a bias to see scenes in terms of outcomes rather than initiating forces—a patient bias. Thus, when seeing intransitive actors—runners, for example—children may focus on their being affected by the running, rather than on their initiating the running. If so, we might expect the gesture patterns we have found thus far to be unique to children. We explore this possibility by examining the gestures that adults produce in two situations: the spontaneous gestures adults produce along with their talk, and the intentional gestures adults produce when asked to communicate without using their mouths.

16.7 Is the Ergative Pattern Unique to Children?

16.7.1 Spontaneous Gestures Adults Produce As They Talk

We examined the spontaneous gestures of a subset of the hearing mothers of the deaf children in our studies. We used precisely the same techniques for determining gesture sentences and the semantic elements contained within those sentences as we used for the deaf children—we viewed the mothers' videotapes with the sound off, as though they too were deaf. The production probability results are presented in figure 16.3 (top graph for the 6 American mothers who were on the tapes long enough for us to explore their gestures, data from Goldin-Meadow and Mylander 1984; bottom graph for the Chinese mothers, data from Goldin-Meadow and Mylander 1998).

The first point to note is that there was no uniformity across the mothers, either within one culture or across cultures. It is difficult to abstract a single pattern from these sets of gestures. However, as a group,

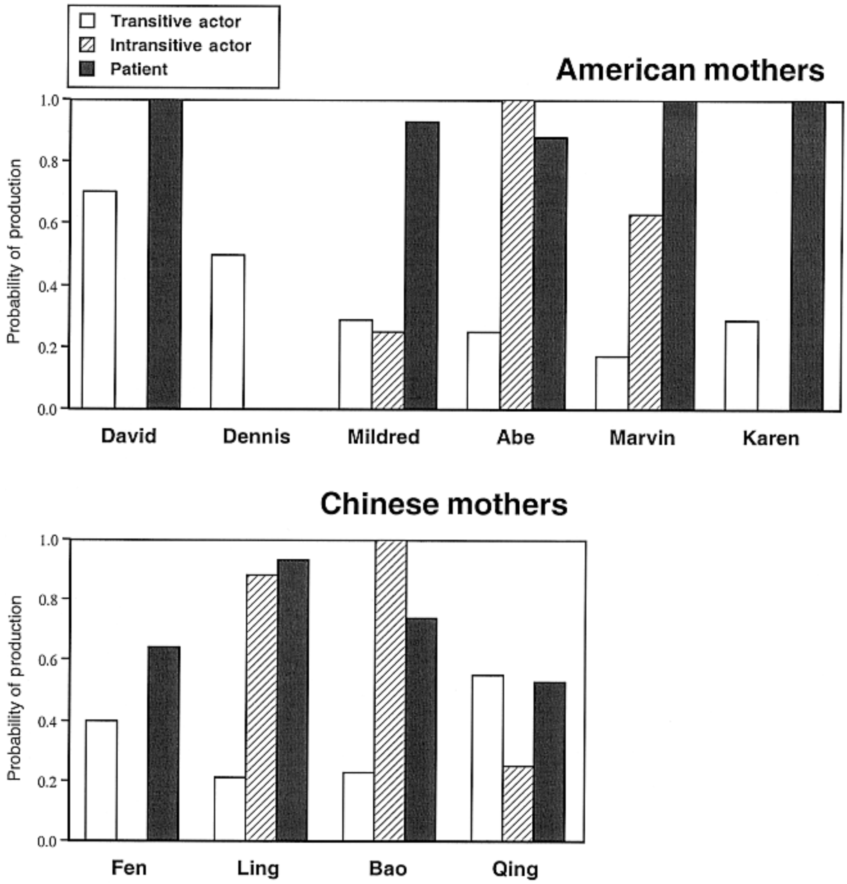

Figure 16.3
The likelihood that the hearing mothers of the American deaf children (*top*) or Chinese deaf children (*bottom*) will, in the spontaneous gestures that accompany their speech, produce gestures for transitive actors, intransitive actors, and patients in two-gesture sentences that permit each of these elements

the mothers did produce more gestures for patients than for transitive actors, thus distinguishing between the two, as did their children. But it is where *intransitive actors* are situated relative to transitive actors and patients that determines the typology of a language, and here mothers and children differed: the mothers showed no reliable patterning of gestures for intransitive actors, whereas their children produced gestures for intransitive actors at a rate significantly different from gestures for transitive actors but not different from gestures for patients, thus displaying an ergative pattern.

In terms of gesture order, Chinese mothers tended to order their gestures within sentences in the same way as their children, placing patients before acts (mothers Bao 16 of 21, Fen 14 of 16, Ling 11 of 11, p's $< .01$) and intransitive actors before acts (mothers Bao 5 of 5, Fen 7 of 7, Qing 6 of 6, p's $< .02$; Ling 9 of 12, $p < .07$), with the exception that Qing's mother showed no patient-act order (6 of 12) and no patient–transitive actor order (2 of 5) while her child did. American mothers produced very few gesture sentences at all. In the few they did produce, 5 mothers produced gestures for patients before acts (mothers Abe 5 of 6, Karen 4 of 5, Marvin 4 of 5, Dennis 1 of 1, Mildred 5 of 9; and the exception, mother David 1 of 4); but only 1 produced a gesture for an intransitive actor before a gesture for an act (mother Mildred 1 of 1), and 2 displayed the opposite order (mothers Marvin and Abe, 3 of 4; Goldin-Meadow and Mylander 1984).

Overall, the mothers' gestures did not show a consistent ergative pattern in the way that their deaf children's gestures did. Why not? The mothers' gestures were qualitatively different from their children's in that they were routinely accompanied by speech (all of the mothers were committed to oral education and thus spoke when communicating with their children). The mothers' gestures thus served a different function from the deaf children's gestures. While the deaf children's gestures were forced to fulfill all of the functions of communication, the hearing mothers' gestures shared that communicative function with speech. The lack of a stable pattern in the mothers' gestures is likely due to the fact that we analyzed their gestures *without* speech. However, the mothers' gestures were produced *with speech* and form an integrated system with that speech when analyzed in context (see Goldin-Meadow, McNeill, and Singleton 1996; McNeill 1992). Moreover, the mothers' gesture patterns are likely to be influenced by the speech they accompany (neither English nor Mandarin is an ergative language). If the adults found themselves in a situation in which they too had to rely solely on gesture to communicate, it is at least possible that a consistent, perhaps ergative, pattern would emerge. The next section explores this possibility.

16.7.2 Intentional Gestures Adults Produce without Talk

Two college students, both native English speakers who had no knowledge of sign language, participated in the study (Goldin-Meadow, Gershkoff-Stowe, and Yalabik 2000). We showed these adults videotaped vignettes from the battery designed by Supalla et al. (in press) to assess knowledge of ASL. The adults were asked to describe each event depicted on the videotape without using speech and using only their hands. Neither the gesturer nor the "listener" was permitted to talk. The two adults took turns gesturing and alternated playing the roles of gesturer and listener during the session (see Gershkoff-Stowe and Goldin-Meadow 1998 for further details on the basic experimental procedure). Because we were interested in whether there might be changes in the gestures over time, we arranged for the two adults to meet twice a week for several weeks.

We used the same system of analysis for the adults as we did for the deaf children and their hearing parents. For this analysis, we looked at gesture strings that could have contained three semantic elements but, in fact, contained only two (e.g., transitive sentences with an underlying structure of actor-act-patient, and intransitive sentences with an underlying structure of actor-act-goal). Figure 16.4 displays the probability that each of the adults produced a gesture for a transitive actor, an intransitive actor, or a patient in a two-gesture sentence. To determine whether the adults would display a consistent pattern immediately or needed time to evolve a pattern, we divided the data into three parts (the first three sessions, the second three, and the last three). Note that both gesturers produced gestures for intransitive actors as often as they produced gestures for patients, and far more often than they produced gestures for transitive actors—and did so from the very beginning of the

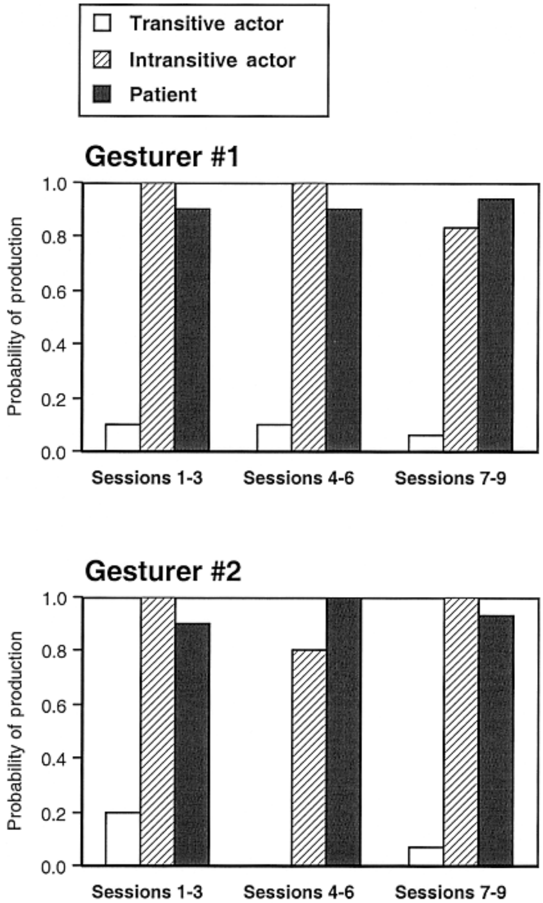

Figure 16.4
The likelihood that two adult English speakers, when asked to gesture without speaking, will produce gestures for transitive actors, intransitive actors, and patients in two-gesture sentences that permit each of these elements. The data are divided into three parts: the first three sessions in which the two gesturers participated, the second three, and the last three.

study. In other words, they immediately displayed the same ergative pattern seen in the deaf children's gestures.

In some of the vignettes, humans performed the action; in others, mechanical toys did the deed. To determine whether the animacy of the actor had any influence on production probability, we divided each adult's data into descriptions of scenes containing human actors versus toy actors and recalculated production probability scores. Figure 16.5 presents the data. The ergative pattern is apparent for both adults whether they described human or toy actors (although it is cleaner for the first gesturer when she described actions involving human actors).

In terms of gesture order, both adults tended to produce gestures for intransitive actors in first position of their two-gesture sentences (e.g., MOUSE RUNS; 94% of 51 sentences for one gesturer, 91% of 47 for the other). This result is hardly surprising, as the pattern parallels typical word order for intransitive actors in English. Neither adult produced many gestures for transitive actors (four for one, five for the other), which made it impossible to determine an order preference for this semantic element. More interestingly, both gesturers tended to produce gestures for patients in first position of their two-gesture sentences (CHEESE EAT; 84% of 81 sentences for one gesturer, 73% of 73 for the other). Not only is this pattern identical to the deaf children's gesture order for patients, but it is also different from the pattern typically found in English (i.e., *eat cheese* see also Hammond and Goldin-Meadow 2002). Thus, the patient-first pattern is particularly striking in English-speaking adults' gesturing.

The deaf children often (although not always; see Goldin-Meadow et al. 1994) used deictic pointing gestures to convey patients. The adults were not able to take advantage of this strategy simply because there were no objects in the room at which they could point. The adults were forced to invent an iconic gesture for their patients; for example, a smoking movement at the mouth to refer to an ashtray, which was then followed by a gesture representing the action that was done on that ashtray (e.g., a throwing action). Even though they used iconic rather than pointing gestures to refer to patients, the adults followed the same ordering patterns as the deaf children (see Yalabik 1999 for additional details on the adults' gesture productions).

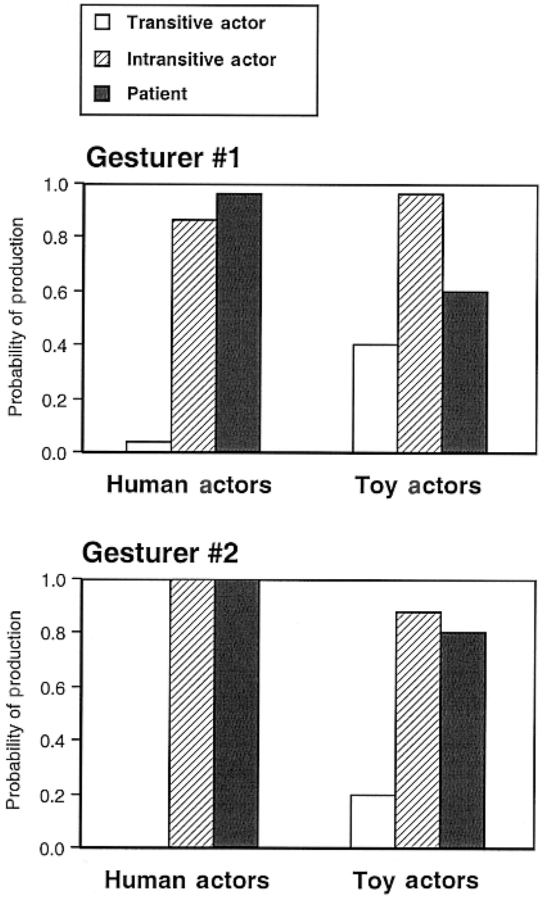

Figure 16.5
The likelihood that two adult English speakers, when asked to gesture without speaking, will produce gestures for transitive actors, intransitive actors, and patients in two-gesture sentences that permit each of these elements. The data are partitioned according to the scene described (scenes with human actors vs. toy actors).

16.8 The Ergative Pattern Is More Pervasive than Might First Appear

We have found the ergative pattern to be robust in communication situations. Deaf children of hearing parents who are inventing their own gesture systems tend to organize their gesture sentences around an ergative pattern. Equally striking, we found that when asked to describe a series of action vignettes using their hands rather than words, English-speaking adults invented an ergative structure identical to the one developed by the deaf children, rather than the accusative pattern found in their spoken language. These findings suggest that ergative structure is not unique to child language-creators. Rather than reflecting a childlike way of organizing information for communication, the ergative pattern may reflect a robust solution to the problem of communicating information from one mind to another, be it an adult or a child mind.

Even hearing children, who have a solution to the communication problem at their disposal in the form of a language model, often fall back on an ergative pattern. For example, children who are learning English and thus acquiring an accusative structure display an ergative pattern at the early stages of language learning, particularly when deciding which semantic elements to explicitly mention in words. Goldin-Meadow and Mylander (1984, 62–64) reanalyzed the data from 4 hearing children in the two-word period and showed that each child tended to produce words for intransitive actors and for patients at the same rate, and both at a higher rate than for transitive actors. Similarly, children learning Korean (Choi 1999; Clancy 1993), Inuktitut (Allen and Schroder, in press), and Samoan (Ochs 1982) go through a period during which their transitive verbs typically occur with a single argument, the patient, and intransitive verbs occur with the actor—an ergative pattern despite the fact that, although Inuktitut and Samoan are ergative, Korean is not. In fact, DuBois (1987) has suggested that ergativity underlies all languages, including accusative languages, at least at a discourse level.

Taken together, these observations suggest that the ergative pattern is robust in communication situations involving both adults and children. Does the patient focus found in ergative systems arise in noncommunicative situations as well? In our current work, we are exploring this question by asking adults to reconstruct an intransitive scene with pictures that represent objects playing different semantic roles in both communicative and noncommunicative situations (in the communicative situation, the adults, all English speakers, were asked to talk while selecting the pictures). Our initial results suggest that, even in noncommunicative situations, adults select pictures in a particular order (even though the task does not require them to do so). Moreover, while the order in which adults select the pictures resembles English word order in the communicative situation (moving object–action–stationary object), it resembles the order found in their own spontaneously created gestures in the noncommunicative situation (stationary object–moving object–action) (Gershkoff-Stowe and Goldin-Meadow, in press). Our future work will explore whether pictures for patients occupy a privileged position in reconstructions of transitive scenes, as our gesture findings suggest they might.

Recent findings from a very different type of study (Griffin and Bock 2000) suggest that focusing on the patient may, in fact, be a "natural" way of viewing an action. Griffin and Bock monitored eye movements under several conditions: adults described a simple event shown in a picture (with or without the opportunity to prepare their speech; speech conditions); adults viewed the picture with the goal of finding the person or thing being acted on in each event (patient condition); adults viewed the picture without any specific task requirements (inspection condition). From the perspective of our studies, the most interesting finding is that the adults' eye movements were skewed toward the patient early in the viewing, not only in the patient condition, but also in the inspection condition. In other words, when given no instructions, the adults' first inclination was to focus on the patient—the semantic element that typically occupies the initial position in the gesture sentences created by the deaf children and hearing adults in our studies. In contrast, when asked to describe the scene in speech, the adults skewed their eye movements to the agent, the semantic element that typically occupies the subject position of an English sentence.

Our data, taken with Griffin and Bock's (2000) findings, suggest that focusing on patients may be a default bias found in both processing and acquisition tasks. When asked only to view a scene, adults focus their attention on the patient. This attentional bias is abandoned when the adults are asked to talk about the scene in a conventional language whose syntactic structure does not match the bias. In a similar fashion, when not exposed to a usable conventional language model, children display a patient bias in their self-generated communication systems. This bias is abandoned when the children are exposed to a language model whose syntactic structures do not match the bias. Thus, the biases that we discover in our studies of the gesture systems generated by deaf children may have relevance beyond children and acquisition to human thought in general.

Whatever the outcome of future studies of noncommunicative situations, it is clear that the ergative pattern is resilient in communicative situations. Why then is it relatively infrequent in the syntax and morphology of the world's languages? If a patient focus is such a natural way of taking in a scene, why don't most of the world's languages design their structures to take advantage of what would appear to be an easily processed format?

We don't know, but we do have some guesses. Slobin (1977) has suggested that languages face several pressures simultaneously: pressures to be clear, processible, quick, easy, and expressive. Importantly, Slobin points out that these pressures do not necessarily all push language in the same direction. For example, the pressure to be semantically clear often conflicts with pressures to be processed quickly or to be rhetorically expressive. The need to be clear may pressure languages to adopt structures that reinforce the patient bias; however, at the same time, the need to be quick and expressive may pressure languages toward structures that do not have a patient focus. If the bias toward patients is as fundamental as Griffin and Bock's (2000) and the spontaneous gesture data suggest, it may be overridden only at a cost: there may greater cognitive costs involved in processing sentences that do not organize around the patient than sentences that do.

We have now come full circle. How robust the patient focus is in the face of a habitually used language that does not organize around patients is a Whorfian question. Can using a non-patient-focus language day after day, year after year, alter what appears to be a natural focus on the patient? If so, this would be a Whorfian effect: after enough habitual use, it is likely that there would be little or no cognitive cost to processing such a language (e.g., no cost to processing an accusative language such as English that overrides the patient focus). If, however, habitually using a language that overrides the patient focus does not alter this focus (a noneffect from the Whorfian point of view), there ought to be some sort of cognitive cost involved in processing a non-patient-focus language of this sort.

Whatever the answer, this set of questions is one that we are able to pose only after having explored the thoughts children communicate before they have been molded by a language model. Moreover, our findings underscore the robustness of ergative structure: children do not need a language model to focus consistently on the patient and adopt an ergative pattern in their language (or thought)—but they may well need one to adopt an accusative pattern.

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References

Acredolo, L. P., and Goodwyn, S. W. (1988). Symbolic gesturing in normal infants. *Child Development*, *59*, 450–466.

Aksu-Koç, A. A., and Slobin, D. I. (1985). The acquisition of Turkish. In D. I. Slobin (Ed.), *The crosslinguistic study of language acquisition: Vol. 1. The data* (pp. 839–878). Hillsdale, NJ: Erlbaum.

Allen, S. E. M., and Schroder, H. (in press). Preferred argument structure in early Inuktitut spontaneous speech data. In J. D. DuBois, L. Kumpf, and W. Ashby (Eds.), *Preferred argument structure: Grammar as architecture for function*. Amsterdam: John Benjamins.

Berman, R. A., and Slobin, D. I. (1994). *Relating events in narrative: A crosslinguistic developmental study*. Hillsdale, NJ: Erlbaum.

Bowerman, M. (1973). *Early syntactic development: A cross-linguistic study with special reference to Finnish*. Cambridge: Cambridge University Press.

Brown, R. (1973). *A first language*. Cambridge, MA: Harvard University Press.

Bruner, J. (1974/75). From communication to language: A psychological perspective. *Cognition*, *3*, 255–287.

Butcher, C., Mylander, C., and Goldin-Meadow, S. (1991). Displaced communication in a self-styled gesture system: Pointing at the non-present. *Cognitive Development*, *6*, 315–342.

Chen, C., and Uttal, D. H. (1988). Cultural values, parents' beliefs, and children's achievement in the United States and China. *Human Development*, *31*, 351–358.

Choi, S. (1999). Early development of verb structures and caregiver input in Korean: Two case studies. *The International Journal of Bilingualism*, *3*, 241–265.

Choi, S., and Bowerman, M. (1991). Learning to express motion events in English and Korean: The influence of language-specific lexicalization patterns. *Cognition*, *41*, 83–121.

Clancy, P. (1993). Preferred argument structure in Korean acquisition. *Proceedings of the Child Language Research Forum*, *25*, 307–314.

Conrad, R. (1979). *The deaf child*. London: Harper and Row.

Dixon, R. M. W. (1979). Ergativity. *Language*, *55*, 59–138.

DuBois, J. D. (1987). The discourse basis of ergativity. *Language*, *63*, 805–855.

Feldman, H., Goldin-Meadow, S., and Gleitman, L. (1978). Beyond Herodotus: The creation of language by linguistically deprived deaf children. In A. Lock (Ed.), *Action, symbol, and gesture: The emergence of language* (pp. 351–414). New York: Academic Press.

Gershkoff-Stowe, L., and Goldin-Meadow, S. (1998). The role of a communication partner in the creation of a gestural language system. *Proceedings of the Boston University Conference on Language Development*, 22, 246–256.

Gershkoff-Stowe, L., and Goldin-Meadow, S. (in press). Is there a natural order for expressing semantic relations? *Cognitive Psychology*.

Goldin-Meadow, S., Butcher, C., Mylander, C., and Dodge, M. (1994). Nouns and verbs in a self-stled gesture system: What's in a name? *Cognitive Psychology*, *27*, 259–319.

Goldin-Meadow, S., and Feldman, H. (1977). The development of language-like communication without a language model. *Science*, *197*, 401–403.

Goldin-Meadow, S., Gershkoff-Stowe, L., and Yalabik, E. (2000). The rsilience of ergative structure in language created by children and by adults. *Proceedings of the Boston University Conference on Language Development*, *24*, 343–353.

Goldin-Meadow, S., McNeill, D., and Singleton, J. (1996). Silence is liberating: Removing the handcuffs on grammatical expression in the manual modality. *Psychological Review*, *103*, 34–55.

Goldin-Meadow, S., and Morford, M. (1985). Gesture in early child language: Studies of deaf and hearing children. *Merrill-Palmer Quarterly*, *31*, 145–176.

Goldin-Meadow, S., and Mylander, C. (1984). Gestural communication in deaf children: The effects and non-effects of parental input on early language development. *Monographs of the Society for Research in Child Development*, *49*, 1–121.

Goldin-Meadow, S., and Mylander, C. (1998). Spontaneous gesture systems created by deaf children in two cultures. *Nature*, *391*, 279–281.

Goldin-Meadow, S., Mylander, C., and Butcher, C. (1995). The resilience of combinatorial structure at the word level: Morphology in self-styled gesture systems. *Cognition*, *56*, 195–262.

Goldin-Meadow, S., and Saltzman, J. (2000). The cultural bounds of maternal accommodation: How Chinese and American mothers communicate with deaf and hearing children. *Psychological Science*, *11*, 311–318.

Griffin, Z. M., and Bock, K. (2000). What the eyes say about speaking. *Psychological Science*, *11*, 274–279.

Hammond, A. J., and Goldin-Meadow, S. (2002). The robustness of non-English sequences in created gesture systems. *Proceedings of the Boston University Conference on Language Development*, *26*, 278–289.

Hoffmeister, R., and Wilbur, R. (1980). Developmental: The acquisition of sign language. In H. Lane and F. Grosjean (Eds.), *Recent perspectives on American Sign Language* (pp. 61–78). Hillsdale, NJ: Erlbaum.

Imai, M., and Gentner, D. (1997). A crosslinguistic study of early word meaning: Universal ontology and linguistic influence. *Cognition*, *62*, 169–200.

Lucy, J. A. (1992). *Grammatical categories and cognition: A case study of the linguistic relativity hypothesis*. New York: Cambridge University Press.

Lucy, J. A., and Gaskins, S. (2001). Grammatical categories and the development of classification preferences: A comparative approach. In M. Bowerman and S. C. Levinson (Eds.), *Language acquisition and conceptual development* (pp. 257–283). Cambridge: Cambridge University Press.

Mayberry, R. I. (1992). The cognitive development of deaf children: Recent insights. In S. Segalowitz and I. Rapin (Eds.), *Child neuropsychology: Vol. 7. Handbook of neuropsychology* (pp. 51–68). Amsterdam: Elsevier.

McNeill, D. (1992). *Hand and mind: What gestures reveal about thought*. Chicago: University of Chicago Press.

Meadow, K. (1968). Early manual communication in relation to the deaf child's intellectual, social, and communicative functioning. *American Annals of the Deaf*, *113*, 29–41.

Miller, P. J., Mintz, J., and Fung, H. (l991, October). *Creating children's selves: An American and Chinese comparison of mothers' stories about their toddlers*. Paper presented at the meeting of the Society for Psychological Anthropology.

Morford, M., and Goldin-Meadow, S. (1992). Comprehension and production of gesture in combination with speech in one-word speakers. *Journal of Child Language*, *9*, 559–580.

Newport, E. L., and Ashbrook, E. F. (1977). The emergence of semantic relations in American Sign Language. *Papers and Reports on Child Language Development*, *13*, 16–21.

Newport, E. L., and Meier, R. P. (1985). The acquisition of American Sign Language. In D. I. Slobin (Ed.), *The crosslinguistic study of language acquisition: Vol. 1. The data* (pp. 881–938). Hillsdale, NJ: Erlbaum.

Ochs, E. (1982). Ergativity and word order in Samoan child language. *Language*, *58*, 646–671.

Schulman, B. W., Mylander, C., and Goldin-Meadow, S. (2001). Ergative structure at sentence and discourse levels in a self-generated communication system. *Proceedings of the Boston University Conference on Language Development*, *25*, 815–824.

Silverstein, M. (1976). Hierarchy of features and ergativity. In R. M. W. Dixon (Ed.), *Grammatical categories in Australian languages* (pp. 112–171). Canberra: Australian Institute of Aboriginal Studies.

Slobin, D. I. (1977). Language change in childhood and history. In J. Macnamara (Ed.), *Language learning and thought* (pp. 185–214). New York: Academic Press.

Slobin, D. I. (1985). Introduction: Why study acquisition crosslinguistically? In D. I. Slobin (Ed.), *The crosslinguistic study of language acquisition: Vol. 1. The data* (pp. 3–24). Hillsdale, NJ: Erlbaum.

Smith, S., and Freedman, D. (1982). *Mother-toddler interaction and maternal perception of child development in two ethnic groups: Chinese-American and European-American*. Paper presented at the meeting of the Society for Research in Child Development, Detroit, MI.

Stevenson, H. W., Lee, S.-L., Chen, C., Stigler, J. W., Hsu, C.-C., and Kitamura, S. (1990). Contexts of achievement. *Monographs of the Society for Research in Child Development*, *55*, No. 221.

Supalla, T., Newport, E. L., Singleton, J. L., Supalla, S., Metlay, D., and Coulter, G. (in press). *Test battery for Amrican Sign Language morphology and syntax*. Burtonsville, MD: Linstok Press.

Wang, X-l. (1992). *Resilience and fragility in language acquisition: A comparative study of the gestural communication systems of Chinese and American deaf children*. Unpublished Doctoral dissertation, University of Chicago.

Wang, X-l., Mylander, C., and Goldin-Meadow, S. (1995). The resilience of language: Mother-child interaction and its effects on the gesture systems of Chinese and American deaf children. In K. Emmorey and J. Reilly (Eds.), *Language, gesture, and space* (pp. 411–433). Hillsdale, NJ: Erlbaum.

Whorf, B. L. (1956). *Language, thought and reality: Selected writings of Benjamin Lee Whorf* (J. B. Carroll, Ed.). Cambridge, MA: MIT Press.

Yalabik, E. (1999). *From deaf children to hearing adults: What is common (or different) in their self-created gestures?* Unpublished Master's thesis, University of Chicago.

Young, N. F. (1972). Socialization patterns among the Chinese of Hawaii. *Amerasia Journal*, *1*(4), 31–51.