Language Acquisition by Deaf Children

Children isolated from speech need not be deprived of language: They acquire linguistic skills in much the same way as children who hear

Richard P. Meier

Contemporary linguists have argued that the ability to learn language is more than an ordinary human skill; it is biologically based. Language is something we are born knowing how to know. Yet the hypothesis that there are biological underpinnings to human linguistic ability does not explain everything. There may indeed be an innate language capacity, a so-called universal grammar, but despite the proponents of Esperanto, there is no universal language. Depending on the accidents of birth, a child may end up a native speaker of any one of roughly 4,000 languages. Thus the predisposition to acquire language seems to be remarkably flexible as well as strong.

Given that our innate language capacity does not prescribe a particular language but instead sets the boundaries of the class of possible languages, what precisely is the relation between nature and nurture in language acquisition? What do nature (the innate ability) and nurture (the linguistic environment) each contribute when a child is acquiring a language?

This question is easy to ask but very difficult to answer. The obvious experiments would involve manipulating a child's linguistic input. For example, one might expose a child only to an artificial language that violates a hypothesized rule of universal grammar. Could the child acquire such a language? Or one might deprive a child of all linguistic input to see if he or she would develop a language in a linguistic vacuum. Of course, performing such experiments with a human subject is unthinkable.

Similar questions can be answered, however, by studying deaf children, whose linguistic experiences are very different from those of the hearing population. For example, it turns out that a child who has no access to a spoken language will readily acquire a sign language, and that a child deprived of both spoken and signed language sometimes invents his or her own gestural system of communication.

Studies of deaf children make it clear that human linguistic competence is in some sense deeper than the mode of expression. Language can assume either the vocal or the gestural mode as circumstances dictate. In other words, although we are biologically equipped to use language, we are not biologically limited to speech.

Evidence of Innateness

Several lines of evidence support the notion that a child has a biologically based capacity to learn language. At first what is most striking about the world's languages is their diversity, but closer study uncovers many universal elements. All known languages share certain organizational principles. For example, in all languages sentences have a hierarchical structure: words are grouped into phrases, and phrases are combined to form sentences. In no language are the words simply strung together like pearls on a necklace.

Moreover, as Noam Chomsky of the Massachusetts Institute of Technology has observed, it is easy to invent syntactic rules that seem reasonable but that occur in no known language. For example, in no language is an interrogative sentence formed by perfectly inverting the word order of the corresponding declarative sentence. Thus "The linguist from Austin was writing a paper," is never converted into a question having the form, "Paper a writing was Austin from linguist the?" One explanation for these language universals, and for many others that are more subtle, is that they are somehow part of our biological capacity.

A second line of evidence derives from close examination of the linguistic input children receive when they are learning a language. That input appears to be deficient in one key respect. Mature speakers know which sentences are grammatical in their dialect and which are not, but children are not taught the distinction in any straightforward way. As Roger Brown and Camille Hanlon of Harvard University were the first to show, a child typically is given many examples of grammatical sentences but very little information about grammatical errors.

Children obviously make grammatical errors, but it seems parents seldom correct them. When a child says, "Me want cookie," the parent seldom explains that only the Cookie Monster on "Sesame Street" says it that way. In any case, whether the child obtains the coveted cookie will probably have more to do with the time remaining until dinner than with the grammatical correctness of his or her request. Furthermore, there are many interesting classes of errors that children never make. It may be that children need little explicit instruction in grammar because they are biologically provided with a universal grammar, and that they never make some types of errors because those errors would violate principles of the universal grammar.

A third line of evidence comes from the study of pidgins and creoles, forms of language that arise when groups of people with no common language find themselves in prolonged contact. Such situations arose on the sugar-cane plantations of Hawaii in the 1890s, for

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Figure 1. A child gives fluent expression to her thoughts in American Sign Language (ASL), the primary language of the deaf community in the United States and Canada. The sign being made has the meaning NOT. Because the language-learning environment of deaf children differs fundamentally from that of hearing children, the linguistic experiences of deaf children can offer valuable insight into the process of language acquisition. (Photograph © 1989 by George Ancona; reproduced with permission from *Handtalk Zoo*, by George Ancona and Mary Beth, Macmillan Publishing Company.)

example. Pidgins are simplified, limited-purpose languages. Creole languages, in contrast, are complete and fully serviceable languages. Derek Bickerton of the University of Hawaii argues that the creole languages were the creation of the first generation of children born into the polyglot plantation societies. He considers their linguistic input to have been the local pidgin, which provided them with a sizable vocabulary, but with a limited and highly variable syntactic model. The creole they created and continued to speak as adults shows grammatical regularities not present in the pidgin or, for that matter, in any of the other languages spoken in Hawaii. This finding and the remarkable similarity of the syntaxes of the world's creole languages led Bickerton to conclude that the grammars of such languages are the product of what he calls the child's "language bioprogram."

Although each of these areas of research is fascinating, there are many questions they do not answer and that probably cannot be answered by studying hearing children exposed to spoken languages. Research on language acquisition by deaf children can further our understanding of the language capacity we all share.

Linguistic Environments

The linguistic environment of deaf children often differs in important ways from the typical linguistic environment of early childhood.

The most fundamental property of the typical language-learning environment is that it provides linguistic input that is accessible to the child. The deaf children of hearing parents, however, may not have significant exposure to any language in early childhood. Because of their sensory loss, these children perceive little of their parents' speech. Because in most cases the parents do not sign, the children are also not exposed to a conventional sign language. In the face of this linguistic deprivation, are these children mute?

A second property of the typical language-learning environment is that the input is auditory. Here the best counterexample is provided by the deaf children of deaf parents, who are exposed from birth to a sign language. For these children, linguistic input is visual rather than auditory. Studies of such children can therefore address the question: Does the acquisition of a visual-gestural language proceed in the same way as the acquisition of a spoken language?

A third property of the typical linguistic environment is that the child is exposed to language from birth. The deaf children of hearing parents, however, may not have significant exposure to any language, either signed or spoken, until they are of school age, or even until they are teens or young adults. This circumstance gives access to another question: If exposure to language is delayed, can the learner still achieve the competence of a native speaker or signer?

A fourth property is that linguistic input is arbitrary rather than iconic. Although there are exceptions, most spoken words do not sound like the things or actions or concepts they represent. Some sign languages, however, have many iconic signs—or at least the signs seem iconic to adults. Do the resemblances between the signs and their referents make it easier for the child to learn to sign?

Absence of Linguistic Stimuli

More than 90 percent of prelingually deaf children are born to hearing parents. Because of their sensory loss, these children are largely deprived of exposure to a spoken language. Acquiring speech is for them a long, frustrating and difficult endeavor, but many of them have had no alternative but to try. Until recently, the education of the deaf emphasized speech training to the exclusion of sign language. Hearing parents were discouraged from signing to their children and were told that the use of a sign language would impede their child's progress in learning English. Consequently, the deaf children of hearing parents, who were deprived of exposure to spoken language by biology, were deprived of exposure to sign language by society.

Although children in this situation had little exposure to language, they presumably wished to communicate with their parents and others. How did they accomplish this? The answer is that they invented their own gestural systems of communication. Susan Goldin-Meadow and her colleagues at the University of Chicago followed the development of 10 deaf children of hearing parents. The parents had decided to educate their children solely through speech and did not sign to them. When Goldin-Meadow first saw these children, at ages between 13 months and about four years, they had not yet shown significant progress in English.

At an early age, the children produced isolated gestures. These were either pointing gestures or gestures that in some way resembled the object or event to which the child was referring. For example, a gesture meaning "open jar" was a twisting movement of the hand; a gesture for "eat" took the form of a repeated bobbing movement of the fist at the child's mouth.

More impressively, however, the children soon began to combine gestures to form sentences. In such sentences, two or more gestures were concatenated without intervening pauses. The gestures were not produced at random; all of the children showed statistically reliable gesture-order tendencies. A typical ordering was *patient-act*, where *patient* indicates a gesture referring to an object that is acted upon and *act* indicates a verb-like gesture. (Goldin-Meadow avoids the standard terms for parts of speech to avoid imputing to the children a grammatical

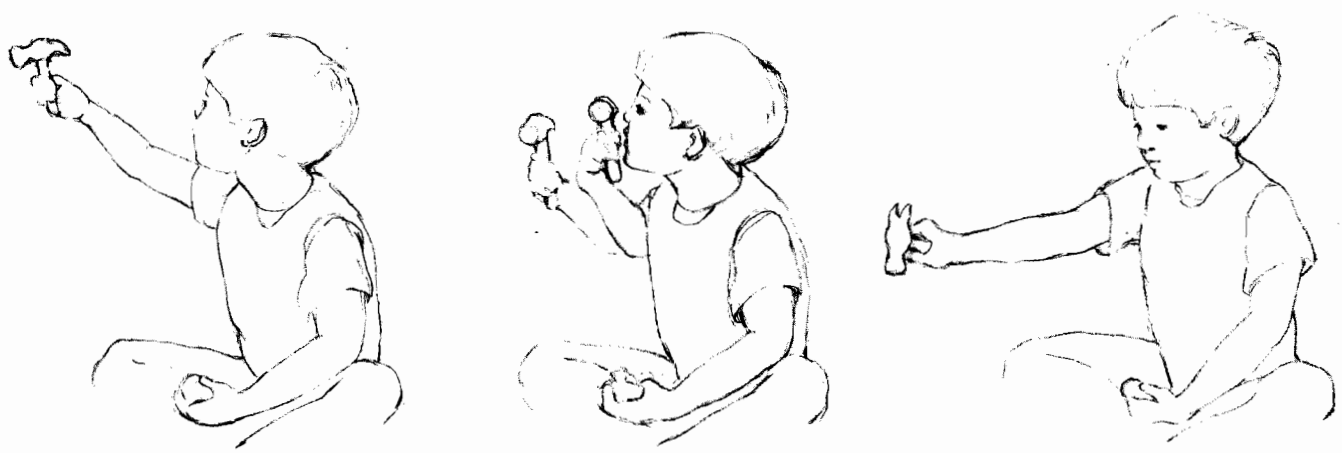

Figure 2. Novel system of gestures was invented by a deaf child, David, raised in the home of hearing parents. In the absence of either spoken language or signed language, David developed his own means of communication, which was documented in studies by Susan Goldin-Meadow and her colleagues at the University of Chicago. Here David produces a fluent, rapidly articulated sequence of three gestures: With a toy in his hand he points to a tray of food *(left drawing)*, makes a bobbing gesture in front of his mouth *(middle)* and finally points to Goldin-Meadow, who was sitting in front of him *(right)*. The meaning of this sentence-like sequence of gestures is "You eat that," but the order of the gestures is "That eat you." Goldin-Meadow observed that David consistently employed this ordering principle, which differs from the usual word order in both English and ASL. In particular, David regularly ordered verb-like gestures after gestures referring to an object that is acted upon. The drawings are based on a videotape made by Goldin-Meadow.

sophistication she has not yet demonstrated they have.)

The word ordering the children used could not have been borrowed, because it is characteristic neither of English nor of American Sign Language. For example, one child pointed to food, then made a gesture meaning "eat," then pointed to his addressee. This sentence could be transcribed word-for-word as "That eat you," but its meaning is "You eat that." Moreover, the children's word-order tendencies did not seem to have been shaped by any input from their parents. The parents' gesturing was quite limited, and the comparatively few multi-gesture sequences they did produce had no consistent ordering.

These invented gestural systems suggest that certain linguistic properties, including word order and some aspects of vocabulary, are quite resilient in the face of very limited linguistic input. One way to explain this resiliency is to assume that children are biologically prepared to acquire these properties.

The Native Signer

The linguistic environment of deaf children born into deaf families differs from the typical language-learning environment in one crucial respect: the children are exposed to a gestural language, not a spoken one. In the United States and much of Canada, the gestural language is American Sign Language (ASL). Does the acquisition of a sign language differ from that of a spoken language?

A sign language is not merely a transliterated version of a spoken language. ASL, for example, is a complete and well-formed language whose grammar is quite distinct from that of English. It developed naturally within the American deaf community, and it is not mutually intelligible with the sign languages used elsewhere, including those used in other English-speaking countries. (Oliver Sacks's recent book *Seeing Voices: A Journey into the World of the Deaf* offers a good overview of this subject.)

That ASL is a language in its own right and is organized around the same principles as other languages might lead one to expect that it would be acquired like any other. Yet the ubiquity of spoken languages suggests that the mode of linguistic expression is not a matter of total indifference. Although auxiliary sign languages are relatively common among Native Americans and Australian Aborigines, the primary language of every hearing community is a spoken language. Moreover, there is considerable evidence that *Homo sapiens* and speech have co-evolved. For example, evolutionary changes in the position of the larynx and in the structure of the vocal tract enable us to articulate a wider range of sounds than the great apes. These anatomical changes were not without costs—they put us at greater risk of choking—but the advantage they conferred apparently outweighed the costs. Taken together, considerations such as these suggest that children might be slower to acquire signed languages than spoken languages and that the process by which signed languages are acquired might be atypical.

In acquiring a spoken language children pass a series of milestones at relatively predictable ages. Hearing children generally produce their first words at 12 months. They acquire a rudimentary syntax between 18 and 24 months; at this stage they combine words to form simple two-word sentences. English inflectional morphology (such as word endings that mark tense and number) generally emerges between the ages of two and a half and three and a half years. The American

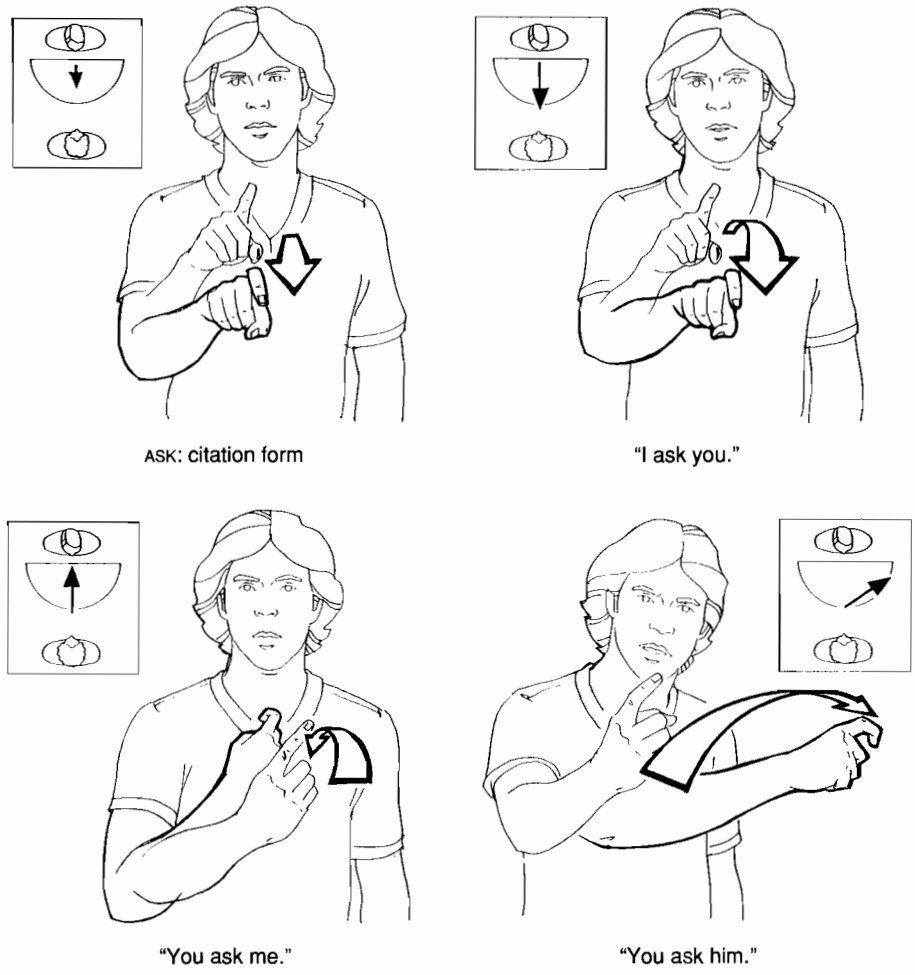

Figure 3. Sign for ASK in ASL has inflected forms much like those of a verb in a spoken language. Mastery of such morphological complexities is often one of the later milestones of language development. The citation form of ASK—the form that would be listed in a dictionary—is uninflected. The other three forms must agree with both the subject and the object of the sentence. When the sign means "I ask you," the direction of motion is from the signer toward his conversational partner. When the sign means "You ask me," the direction of motion is reversed. ASK can also agree with subjects or objects whose referents are not present, but which can be assigned to an empty location in the space in front of the signer. For example, the sign for "You ask him (or her)" begins close to the conversational partner and ends at an empty location. The drawings are by Frank A. Paul, who was fluent in ASL and worked as an interpreter for the deaf and as an illustrator for the Laboratory for Language and Cognitive Studies at the Salk Institute; Paul died in 1989.

linguist Eric H. Lenneberg pointed out that children tend to pass these milestones in the same sequence at roughly the same ages no matter what their linguistic environment (although there is evidence that the timing of the acquisition of morphology varies across languages). He argued that this regularity suggests language acquisition is fundamentally controlled by maturation.

Do signing children pass the same milestones at the same ages? From a review of the literature on the acquisition of ASL, Elissa Newport of the University of Rochester and I concluded that they do. Thus by 12 months, signing children, like speaking children, are at the one-word stage. They produce isolated signs drawn from the vocabulary of the adult language. Between 18 and 24 months, signing children enter the two-word stage. They begin to concatenate signs to form simple sentences. Although the considerable differences between ASL and English make further comparison difficult, it can be said that the children continue to pass comparable milestones at comparable ages. For example, the signer's mastery of ASL rules of verb agreement occurs at roughly the same age as the speaker's mastery of complex verb conjugations.

The two-word stage in the acquisition of English has one particularly interesting feature: Even at the outset, children make few errors in word order. Is this also true for the acquisition of ASL? Before I can answer this question, I must introduce a little of ASL's grammar. In adult ASL, as in English, the canonical word order is subject-verb-object (SVO). For example, in the simple declarative sentence "Mathilda kissed Bob," the postverbal position of "Bob" identifies it as the direct object of the verb "kissed." Consequently, we understand that Bob was the person who was kissed, not the one who did the kissing. Although ASL has the same canonical word order, it allows considerably more freedom in word order than English does. One reason is that ASL allows the identity of the subject and the object to be conveyed by the verb, by means of a rule of verb agreement. (My use of the term "object" masks a number of syntactic complexities.) Spoken languages with elaborate systems of verb agreement, such as Spanish and Italian, generally also permit considerable freedom in word order.

As English speakers, we have some acquaintance with verb agreement. If a present-tense verb has the suffix *-s*, we know that the subject of the sentence is in the third-person singular. Thus we say "I kick the football" but "She kicks the football." ASL exploits linguistic devices of this kind more fully. In particular, the verb may agree with both the subject and the object of the sentence. Figure 3 shows four forms of the ASL verb ASK. The citation form, or dictionary-entry form, of this verb is an outward excursion of the hand. When the signer is the subject and his or her addressee is the object, the excursion is longer, and it is directed toward the addressee. When the addressee is the subject and the signer is the object, the direction of motion is reversed. Finally, if the signer wants to refer to an absent person, a third, vacant, position can serve as a kind of pronoun. Verbs can then agree with that position.

Bearing in mind the grammatical differences between ASL and English, do deaf children display the same facility in the use of word order as hearing children? It appears that deaf children begin to use word order to indicate the syntactic relations of a verb and its noun arguments early in the two-word stage, even at age two. According to studies done by Robert J. Hoffmeister of Boston University and by Newport and Ashbrook, signing children reliably use SVO order in the two- and three-word stages of language development. Indeed, they may continue to do so even after they have acquired the ASL rule of verb agreement that allows freer ordering. In their reliance on word order, beginning signers resemble beginning English speakers.

In summary, the same sequence of milestones seems to characterize the acquisition of ASL and of spoken language. Nor is there any evidence that language acquisition is delayed in deaf children. Although human beings may have highly evolved mechanisms for the production and processing of speech, those mechanisms are apparently sufficiently flexible that the acquisition of signed languages is not disadvantaged. Helen J. Neville, Albert Schmidt and Marta Kutas, working at the Salk Institute, have uncovered neuropsychological evidence for such plasticity. Their studies of evoked potentials suggest that temporal-lobe regions implicated in auditory processing in the hearing can be reassigned to visual processing in subjects who have been deaf from birth.

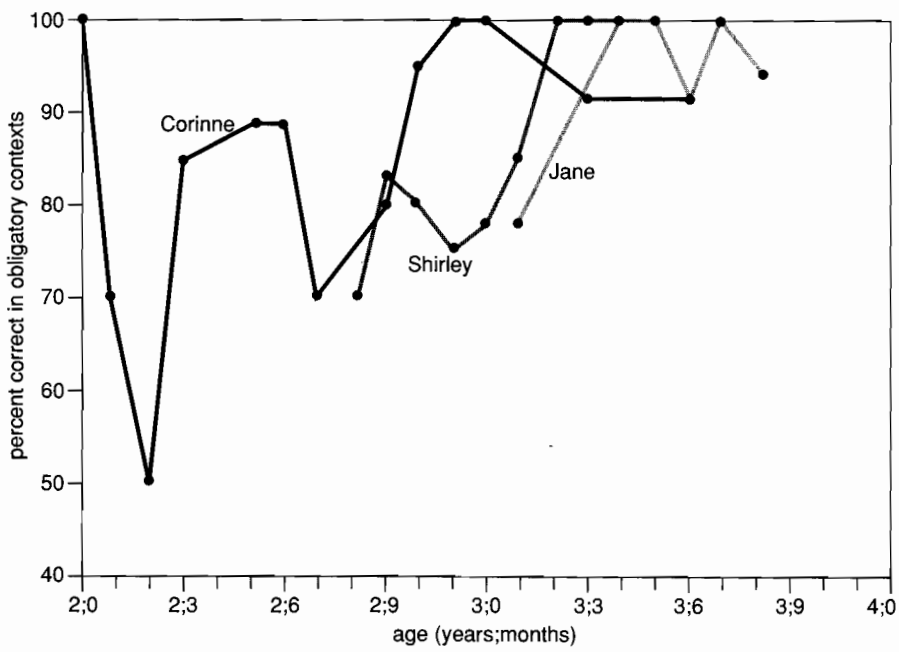

Figure 4. Milestones in language acquisition are the same for speaking and for signing children; furthermore, they pass these milestones in the same sequence and at roughly the same times. The progress of three deaf children toward mastery of ASL verb agreement was studied by the author. All three children achieved consistent command of verb agreement in the first half of their third year. Hearing children master English verb agreement at roughly the same age. One child, Corinne, provides an instance of a common learning pattern: near-perfect initial performance followed by deteriorating accuracy and a slower return to mastery. The child's initial performance is thought to be based on rote learning of a limited number of verbs inflected for agreement.

So far I have been concerned to show that the sign-language learner is not at a disadvantage. But there is even some evidence that signing children pass the very first milestones of language development *before* their speaking counterparts. The most persuasive evidence has to do with the age at which the child produces his or her first word and the age at which he or she has a small vocabulary. For example, John D. Bonvillian and his colleagues at the University of Virginia have reported that 13 signing children of deaf parents had amassed a 10-sign vocabulary by a mean age of 13.2 months. This is significantly earlier than the 18 English-speaking children studied by Katherine Nelson of the City University of New York, who did not reach the same milestone until a mean age of 15.1 months.

There are a number of plausible, although yet untested, explanations for the apparent precociousness of signing children. It may have a biological basis: the perceptual and motor systems subserving signed language may mature earlier than those required for speech. It is also possible, however, that the young child simply finds manual signs more perspicuous than spoken words, or even that parents (and linguists) are more likely to recognize a child's fumbling attempts at signs than his or her attempts at spoken words. The literature on neurological development provides some support for the first and strongest of these candidate explanations; it turns out that the post-thalamic visual pathways are fully myelinated at an earlier age than the comparable auditory pathways.

It may be that signing children provide a clearer window onto some parts of the language-acquisition process than speaking children do. In particular, the deaf children may begin to sign as soon as they have the linguistic and cognitive maturity to do so. Hearing children, on the other hand, may be delayed by slower development of perceptual or motor abilities needed for the modality of speech.

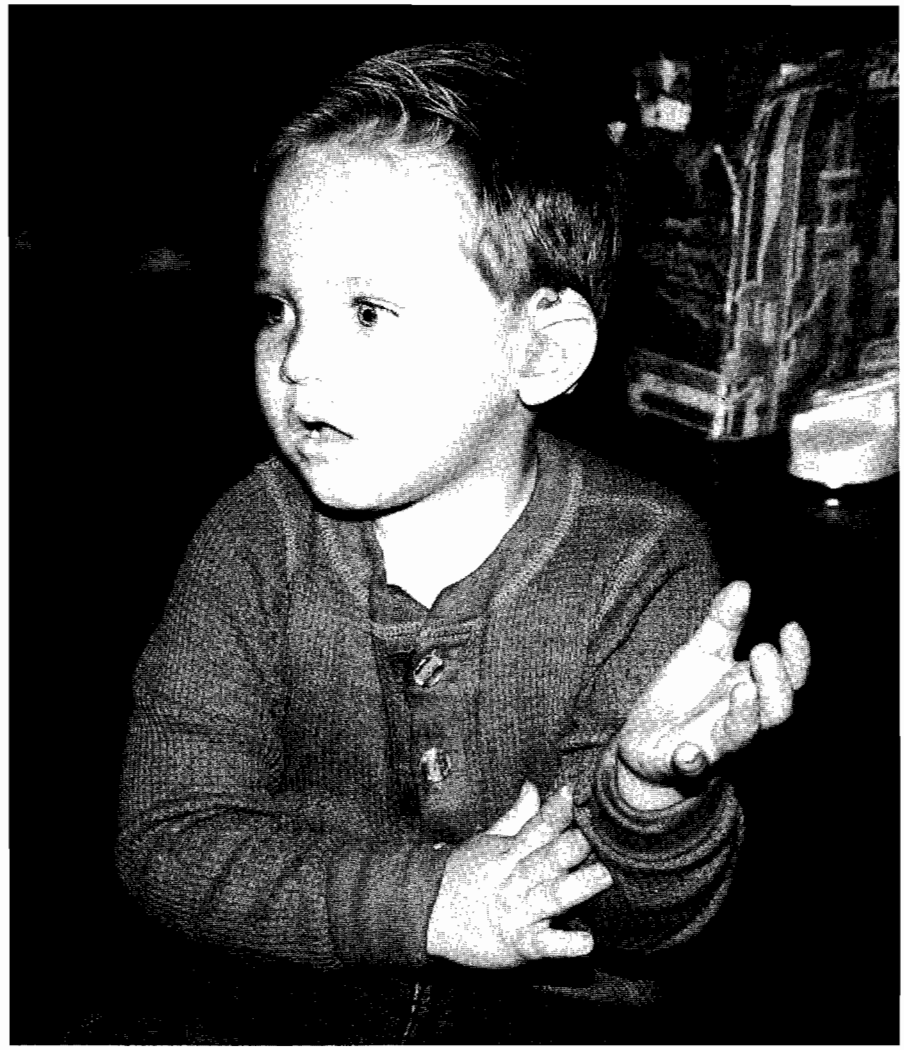

Figure 5. ASL sign for TREE is produced by a three-year-old child. The standard form of this sign is shown in the drawing at left. The child's sign differs slightly from the adult form but is still fully intelligible. Such discrepancies are typical of the signing of young children, just as speaking children at the same age have not achieved perfect pronunciation. Note that the child is signing with the left hand; ASL signs are not specifically left- or right-handed. (Photograph by Brian C. Price of the University of Texas at Austin; drawing by Frank A. Paul, from *A Basic Course in American Sign Language*, by Tom Humphries, Carol Padden and Terrence J. O'Rourke, T. J. Publishers, Inc., 1980.)

The Late Learner

In addition to arguing that the process of language acquisition is maturationally determined, Lenneberg hypothesized that children can gain a native speaker's competence only if they are exposed to linguistic stimuli during a critical period. He argued that this period, whose boundaries are presumably set by neurological development, extends roughly from the age of two (when children begin using two-word combinations) to 13 (the onset of puberty).

In developmental biology the classic example of a critical period is the imprinting of birds. Ducklings, for example, will follow the first moving object, duck or nonduck, to which they are exposed from 9 to 21 hours after hatching. Maturationally determined critical periods also characterize song learning in some birds, such as the white-crowned sparrow. Given the long philosophical tradition in which language is taken as the distinguishing mark of humanity, we might be reluctant to suppose it shares anything with imprinting in birds. But what does the evidence suggest?

Of course, it is more difficult to test Lenneberg's hypothesis than those concerning critical periods in animals. Lenneberg himself marshalled evi-

dence having to do with the acquisition of a second language, the probability of recovery from aphasia, and language acquisition by children with Down's syndrome. For example, the age at first exposure to a second language turns out to be a much better predictor of ultimate proficiency than the number of years of exposure.

The most direct test of Lenneberg's hypothesis is delayed exposure to a first language. In the hearing population, such delays occur rarely and even then they are difficult to interpret. There are interesting historical cases of abandoned children who could not speak when they were found, such as Victor, the wild child of Avignon, but accounts of these cases often reveal more about the history of ideas than about linguistic development.

A more recent case was discussed by Susan Curtiss of the University of California at Los Angeles. A girl whom Curtiss calls Genie was isolated in a back bedroom of her Los Angeles home by an abusive father. From the age of two until she was thirteen and a half Genie had virtually no exposure to language. At the time of her discovery, she neither spoke nor understood any English. Genie eventually succeeded in acquiring some hallmarks of fluency, such as a sizable vocabulary and command of word order and subordination, but she failed to acquire others, such as inflectional morphology and a command of auxiliary verbs and of the passive voice. Moreover, her speech was phonologically abnormal.

This outcome is certainly consistent with Lenneberg's hypothesis. What prevents us from reaching any firmer conclusions is that Genie's delayed exposure to language was part of a pattern of abuse. She was deprived not only of speech, but also of social, visual and auditory stimulation in general. Moreover, she was physically abused and malnourished.

A stronger test of Lenneberg's hypothesis is afforded by one segment of the deaf population: deaf children born into hearing families. In years past, these children often had little exposure to any language, either spoken or signed, during early childhood. Most of them eventually encountered ASL, but their age at first exposure varied enormously. For many, the first encounter came at age five or six, when they entered a residential school for the deaf. Even there they learned ASL not in the classroom but in the dormitories—from a few schoolmates who were fluent native signers. Other children, who attended strongly oralist day schools, did not encounter ASL until their early twenties.

Newport and Ted Supalla addressed the question of delayed exposure to language in a study of 30 adults who considered ASL to be their primary language. (Their English skills, in contrast, were quite limited.) The subjects all had 30 or more years of exposure to ASL, but the age at which they were initially exposed varied. All of them had attended the same residential school, but some were native signers who were exposed to ASL from birth, some were early learners who first encountered ASL when they enrolled in the residential school at ages between four and six, and others were late learners, whose first encounter occurred after age 12.

Figure 6. Iconic signs in ASL—signs that resemble the things they denote—seem conspicuous to English speakers who learn ASL as a second language in adulthood. Three such signs are shown in the upper row of drawings: HOUSE, CAT and ANGRY. It is tempting to suppose the young language learner uses the resemblance between the sign and its referent to guess at the meaning of the sign. There are several problems with this hypothesis, however. ASL is not consistently iconic. It has many arbitrary signs as well, such as those of the lower row: MOTHER, FATHER and CURIOUS. Moreover, the resemblances are much less apparent in a conversation then they are in drawings of signs, and native signers report being unaware of them. (Drawings by Frank A. Paul, from *A Basic Course in American Sign Language*.)

Newport and Supalla gave the subjects a battery of tests examining their ability to produce and comprehend various grammatical constructions in ASL. One result is particularly interesting in the light of the other evidence I have discussed. It turned out that a signer's knowledge of ASL word order was unrelated to his or her age of initial exposure; the performance of all three groups was almost error-free. This is consistent with the reliable use of gesture order by the children Goldin-Meadow studied, with the early mastery of basic word order by both beginning speakers and beginning signers, and with Genie's successful acquisition of basic word order.

Another set of tests yielded a very different pattern of results, however. These tests examined the production and comprehension of morphologically complex signs. In English, morphologically complex words are those that have more than one meaningful part. For example, *walked* consists of two morphemes: the verb stem *walk* and the past-tense inflection *-ed*. Similarly, in ASL the inflected form of the verb ASK meaning "You ask me" is made up of three morphemes: the verb stem ASK and the agreement markers for subject and object. Newport and Supalla found that the earlier a signer had been exposed to ASL, the better he or she scored on these tests. Native signers did better than early learners, who in turn did better than late learners.

Newport and Supalla's study provides strong support for the claim that a child can gain native competence in a language only if he or she is exposed to that language during a critical period. These data are particularly significant because signers are the only large population that undergoes delayed exposure to a primary language.

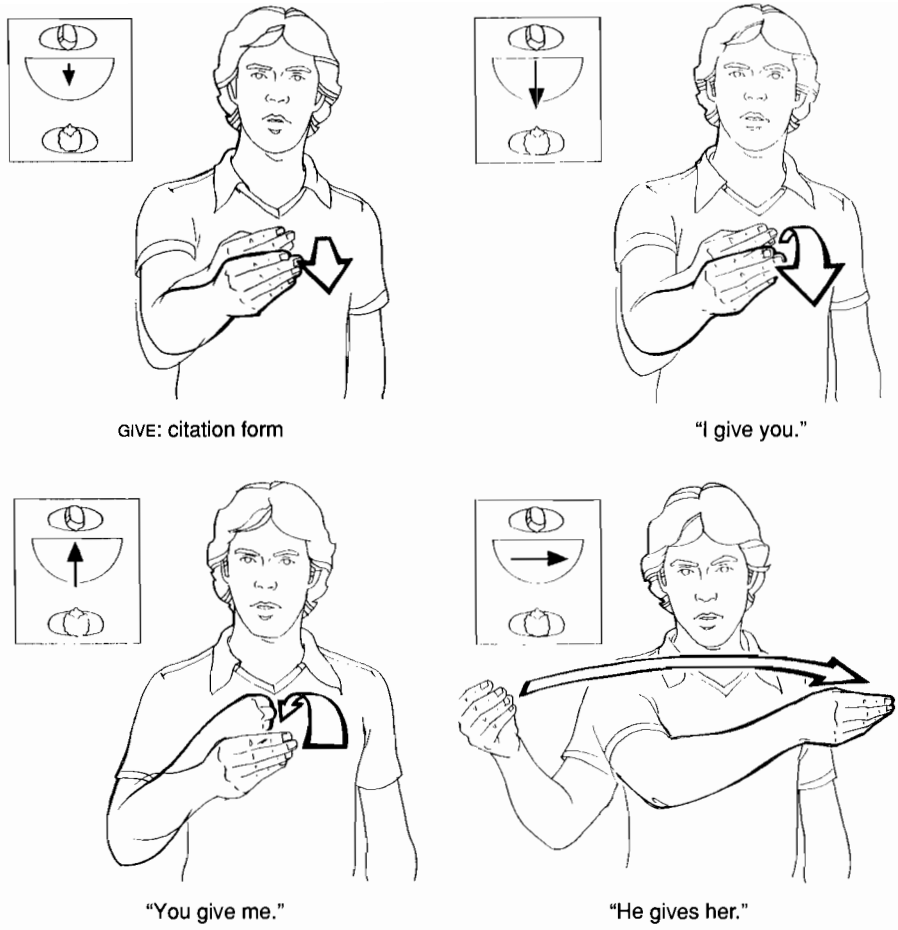

Figure 7. Inflections of the verb GIVE suggest a means of testing the importance of iconic content in ASL. The various forms exhibit different degrees and different forms of iconicity. The citation form and the form translated as "I give you" are iconic in the sense that the gesture is a mime of the action of giving. The forms "You give me" and "He (She) gives her (him)," in contrast, are not accurate mimes of the action they denote. All three inflected forms (but not the citation form) are iconic in a different way: they map the positions of the giver and the recipient in space. If either kind of iconicity aids language acquisition, children ought to learn the iconic forms more quickly and more accurately than the arbitrary forms. The author's studies show no such effect. (Drawings by Frank A. Paul, from *Journal of Memory and Language*, 1987, 26:362-376.)

Iconic Language

Only rarely is it possible to infer the meaning of an English word from its sound. The occasional onomatopoeic word, such as *bow-wow* or *meow*, is the exception rather than the rule. More typical is a word such as *give*: nothing about it in any way resembles the action of transferring an object from one person's possession to another's. In fact an arbitrary relation between the form of a word and the form of its referent is so usual that Ferdinand de Saussure, the Swiss linguist whose *Course in General Linguistics* laid the foundations of structuralism, insisted it is a fundamental property of all human language.

Saussure's conclusion rested entirely on the analysis of spoken languages. ASL, by contrast, has many iconic signs. Unlike the English *give*, or for that matter the Spanish *dar* or the French *donner*, the ASL sign GIVE is "motivated." As Figure 7 shows, GIVE closely resembles the act of handing a small object to another person. Many other ASL verbs with inflections that mark subject and object, such as TAKE and GET, also seem impressively pictorial.

At least they seem so to adults acquiring ASL as a second language. But are children acquiring ASL as a first language equally impressed by the iconic aspects of the language? Do the similarities between form and meaning make it easier for children to acquire an ASL vocabulary? Or are they "expecting" to encounter arbitrary mappings between form and meaning?

This is not a simple question to answer. For one thing, it is difficult to isolate the iconic elements in ASL. ASL has many iconic signs, but it also has many arbitrary ones. Such common signs as MOTHER, FATHER, WHITE, BLACK and AMERICA are essentially unmotivated. In addition, the formation of an ASL sign is never determined solely by resemblance to an object or act; it is also constrained by a complex system of grammatical rules. Finally, even when a sign has an iconic origin, a fluent signer may not experience its iconic content in normal discourse, any more than a native speaker of English is ordinarily aware of a word's etymolo-

gy—such as the sense of "tongue" in the word "linguistics."

Because iconicity is not a simple phenomenon, it is even conceivable that instead of assisting the language learner, it could place pitfalls in his or her way. For example, a child guided by iconicity might suppose that GIVE could only be used when the verb and the act were very similar. But the sign GIVE can be used to describe the transference of elephants and automobiles as well as of handheld items. Furthermore, the child who attended to iconicity would have to switch strategies when confronted by verbs such as PITY, ASK, HATE and INFORM. These verbs inflect in much the same way as GIVE, but they are not otherwise iconic in form.

I have examined the effect of iconic language in a study of the acquisition of verb agreement by deaf children of deaf parents. I proposed two models of iconic resemblance. One model assumed that children would be attuned to verbs that happen to be enactments, or mimes, of an action. The second model assumed that children would be attuned to verbs that map the spatial relations of the actors. Because these models pin down the somewhat vaporous notion of the iconic, they make precise predictions. For example, according to the model favoring enactments, the child would tend to learn the first two forms of GIVE shown in Figure 7 (the citation form and the form translated as "I give you") before the third and fourth forms ("You give me" and "He gives her"). The first two forms are simple mimes of the action of giving, whereas the last two forms do not have as straightforward a relation to the action referred to. According to the model emphasizing the spatial relations of actors, the child would learn the last three forms of GIVE before the citation form or before other forms of GIVE that happen not to agree with the agent who gives.

It turned out that the children followed neither model; indeed they seemed quite oblivious to the iconic elements of signs. Three aspects of the study are interesting: the children's progress toward error-free performance, the age at which they achieved error-free performance, and the type of errors they made. I was able to follow one child, Corinne, long enough to capture the acquisition process in detail (see Figure 4). Corinne's use of verb agreement seemed nearly perfect at the age of two, but then deteriorated precipitously. She did not again inflect verbs reliably until 10 months later. This pattern resembles the U-shaped trajectory followed by hearing children learning the rules for morphologically complex forms of words, such as the past tense. At first the children's performance is surprisingly good, apparently because they learn high-frequency words by rote. Later, as they begin to grapple with general rules rather than specific instances, their performance slips. Much the same seems to be true of Corinne. Her early success was largely confined to the use of one verb in a single inflected form. (Parents of two-year-olds will not be surprised to learn that the verb was SAY-NO and the form was second-person object agreement: "I say no to you.")

At what age did the children acquire verb agreement? According to the criterion I chose for the acquisition of a linguistic rule, the children I studied acquired verb agreement at the ages of three years, three years and three months and three years and six months. Under the same criterion, hearing children acquire English verb agreement at

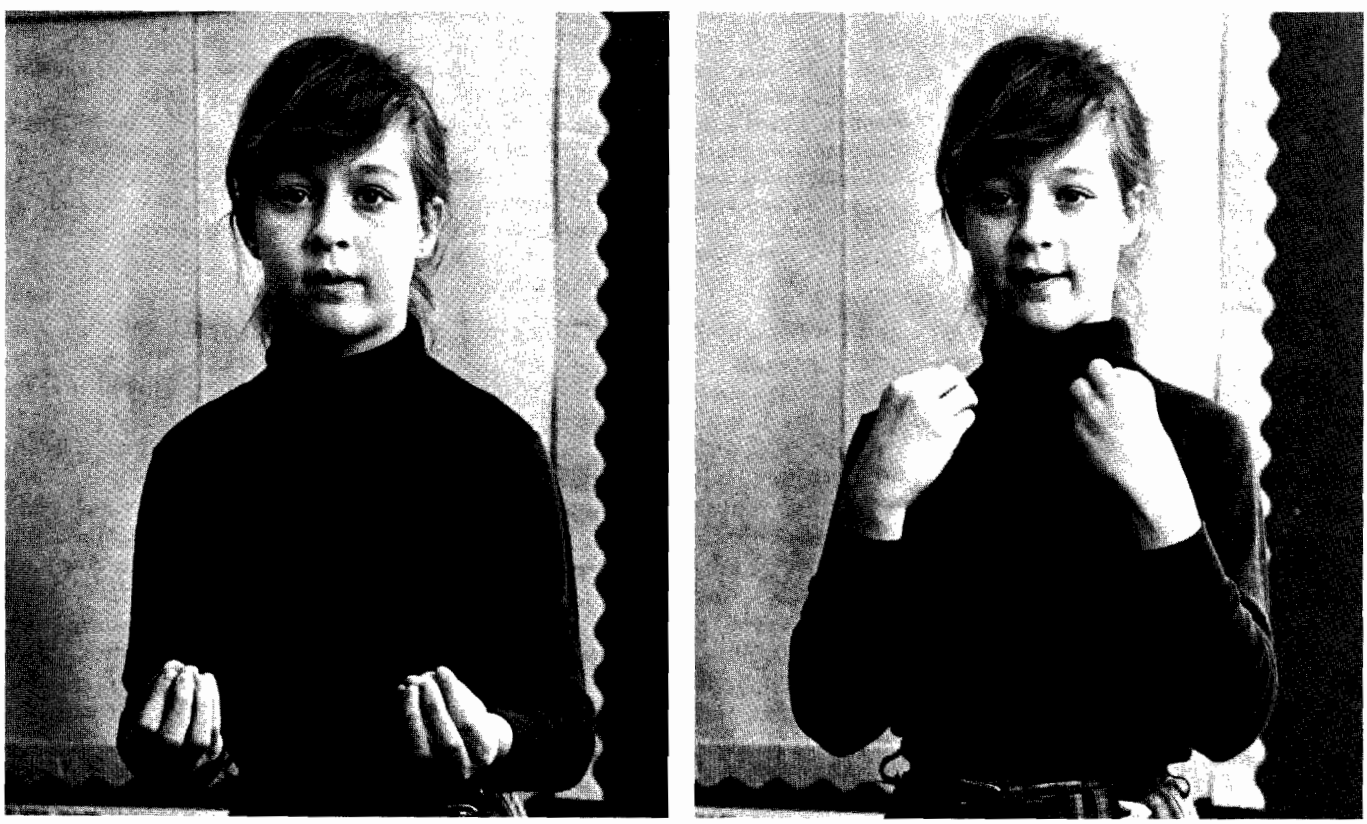

Figure 8. Signs meaning "I give you" and "You give me" are demonstrated by a student at the Merrick-Moore Elementary School in Durham, North Carolina. Note that the signs are articulated quite differently from the forms shown in Figure 7: The student employs both hands. (Photograph by John Rosenthal.)

	Acquisition of English: hearing children	Acquisition of ASL: deaf children of deaf parents	Minimal linguistic input: deaf children of hearing parents	Delayed exposure to a spoken language: Genie	Delayed exposure to a sign language: deaf, late learners of ASL
Vocabulary	First word at 12 months	First sign at 12 months (or somewhat earlier)	Gestural vocabulary developed	Successful acquisition of a large vocabulary	Large sign vocabulary
Word Order	Reliable English word order early in two-word period	Reliable ASL sign order early in two-sign period	Reliable gesture-ordering tendencies	Reliable English word order acquired	Age of first exposure has no effect on knowledge of sign order
Morphology	English morphology begins to emerge at roughly 30 months	ASL morphology begins to emerge at roughly 30 months	Some spontaneous morphological development (?)	Very poor control over English morphology	Age of exposure has significant effect on knowledge of ASL morphology

Figure 9. Comparison of populations of children with different linguistic experiences demonstrates that some aspects of language are extremely robust, whereas others are more fragile. A large vocabulary and consistent word order are acquired even under the most unpromising conditions. But command of morphologically complex words and signs is affected by the child's linguistic upbringing. Hearing and deaf children attain similar proficiency in similar language-learning environments; it appears not to matter whether the child's first language is a spoken or a signed one.

ages between two and a half and three and a half. Thus, the acquisition of ASL verb agreement does not seem to be advanced by the iconic properties of many ASL verb forms. Instead the rules for ASL verb agreement seem to be acquired at much the same time as the rules for English verb agreement.

The children in my study showed no tendency to use iconic verb forms—as defined by either of my models—earlier than arbitrary verb forms. And the errors the children made were inconsistent with the notion that they were attending to the iconic properties of the signs. They often erred by omitting verb agreement altogether, and quite frequently the erroneous verb forms were less iconic than the correct forms. As it happens, hearing children also tend to err by omission when they are learning inflectional morphology. For example, a child will say "two shoe" instead of "two shoes." In sign language as in spoken language, it seems grammatical complexity determines which errors children make. Typical errors often yield verb forms that are less iconic than the correct form, but that are grammatically simpler. In another study, I asked 10 native-signing children to imitate sentences containing agreeing verbs, and the errors they made also support the claim that it is grammatical complexity that matters.

My studies converge with those of other aspects of ASL. Whether the topic is early vocabulary acquisition, the acquisition of pronouns, or the acquisition of the complex morphology of ASL verbs of motion and location, it seems children are remarkably insensitive to the nonarbitrary properties of ASL signs. Although at first blush ASL sometimes strikes adults as pantomime, children respond as though it were a fully arbitrary language.

Conclusion

As we have seen, the linguistic properties of ASL and the demography of the signing community allow us to ask interesting questions about the relation between linguistic input and language development.

The gestural systems invented by the deaf children of hearing parents show that certain linguistic properties emerge even when the child is raised in a virtual language vacuum. This finding suggests that children may come to the task of language acquisition with expectations about how languages are organized, a notion consistent with the assertion that there is an innate, species-specific capacity to acquire language.

On the other hand, we have also seen that children's expectations about language are not so constraining that they find it harder to learn a sign language than to learn a spoken language. The acquisition process itself is relatively independent of modality; acquisition of a language—whether signed or spoken—follows a single maturational schedule.

Finally, we have seen that children are quite insensitive to certain properties of their linguistic input. Adult learners of ASL are charmed by the iconicity of some signs, but children appear to be oblivious to it. It may be that their expectations about language lead them to attend to some aspects of their linguistic input and not to others.

Deaf language learners provide a remarkable opportunity to investigate the child's ability to acquire, and even to create, language. But we must always remember that one reason they do so is that they have so often been denied input from a natural sign language such as ASL.

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Figure 10. Conversation in ASL is carried on by a student and his mother at the Merrick-Moore School. The subject under discussion is the outbreak of war in the Middle East. When deaf children are exposed to a language such as ASL at the appropriate age, their linguistic development appears to be remarkably similar to that of hearing children.

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