

An Invitation to Cognitive Science

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Language

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Chapter 1

The Invention of Language by Children: Environmental and Biological Influences on the Acquisition of Language

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Human children grow up in cultural settings of enormous diversity. This differentiation sometimes leads us to overlook those aspects of development that are highly similar, even universal to our species. For example, under widely varying environmental circumstances, while learning different languages within different cultures and under different conditions of child rearing, with different motivations and talents, all normal children acquire their native tongue to a high level of proficiency within a narrow developmental time frame. Evidence from the study of the language learning process suggests that this constancy of outcome, despite variation in environment, has its explanation in biology. Language is universal in the species just because the capacity to learn it is innately given. In Descartes's (1662/1911) words: "It is a very remarkable fact that there are none ... without even excepting idiots, that they cannot arrange different words together, forming of them a statement by which they make known their thoughts; while on the other hand, there is no other animal, however perfect and fortunately circumstanced it may be, which can do the same."

In other words, some part of the capacity to learn languages must be "innate." At the same time, it is equally clear that language is "learned." There are about five thousand different languages now in use on the earth, and the speakers of one cannot understand the speakers of the next. Moreover, specific exposure conditions strikingly influence how each of these is acquired: there is a massive correlation between being born in England and coming to speak English and being born in France and speaking French. This immediately shows that the language function is heavily affected by specific environmental stimulation.

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How can both of these claims (language is innate, and it is learned from the environment) be true? Like many developmental processes that have been studied in animals, *language acquisition in humans seems to involve a type of learning that is heavily constrained, or predisposed to follow certain limited courses, by our biology*. Clearly, no specific language is innate; the particular languages we come to speak must be learned. Yet, the commonalities among human languages are, upon careful study, far more striking than the differences among them. Every human language is organized in terms of a hierarchy of structures, composed of speech sounds that lawfully combine into morphemes and words, which in turn combine into phrases and sentences. Every human language has the wherewithal to express approximately the same meanings (that is, they are intertranslatable). Apparently, human children are in some sense prepared by nature to learn only languages that have just these formal and substantive properties, and to learn such languages relatively effortlessly during the natural course of maturation.

This chapter reviews two kinds of evidence for the claim that there is an important biological endowment in humans that supports and shapes language acquisition: (1) language learning proceeds uniformly within and across linguistic communities despite extensive variability of the input provided to individuals; (2) the child acquires many linguistic generalizations that experience could not have made available.

1.1 Uniformity of Learning

1.1.1 Milestones of Normal Development

Language learning follows the same course in all of the many languages that have been investigated. Isolated words appear at about one year of age. These are mainly nouns that describe simple objects and a few social words such as "bye-bye". Sometime during the second year of life, there is a sudden spurt of vocabulary growth accompanied by the appearance of rudimentary sentences. At first these are limited to two or three words; for example, "Throw ball," "Kiss teddy," and the like. These early sentences display considerable structure despite their brevity. Roughly speaking, there is a place for the noun and a place for the verb; moreover, the subject and object noun are positioned differently within the sentence. Thus, though the young learner never says long sentences like "Mommy should promptly throw that ball," the distinction between subject and object will show up in such foreshortened attempts as "Mommy throw" (the subject precedes the verb) versus "Throw ball" (the direct object follows the verb). As soon as children begin to combine words at all, they reserve structurally determined positions for subjects and direct objects.

This ability to hone in on such a crucial and fundamentally linguistic distinction forms a kind of skeletal base of language learning; this shows up early and in much the same way in two-year-olds all over the world.

Language use by the child in normal learning settings undergoes considerable elaboration between the ages of 2 and 5. Complex (multiclausal) sentences appear, and the function morphemes (prepositions, articles, bound morphemes like *-ed*, and so forth) make their appearance. By age 5 or before, youngsters sound essentially adult.

Lenneberg (1967) argued that these uniformities in the course of learning for children exposed to different languages are indicators that language learning has a significant biological basis. Like the regularities of physical and motor development (the appearance of teeth, or of walking), they suggest that language learning is controlled, at least in part, by some underlying maturational timetable. He provided some normative evidence that the achievement of basic milestones in language learning can be predicted from the child's age and seem, in fact, to be intercalated tightly with the aspects of physical development that are known to be maturationally dependent. For instance, youngsters utter first words just when they stand, two-word sentences just when they walk, and elaborate sentence structures just when they jump.

These findings alone, however, cannot prove the position that Lenneberg proposed, for they are consistent as well with other quite different conjectures about the processes that underlie language learning. Possibly, children move from talking childishly to speaking with great sophistication because of the maturation of their brains; but, on the other hand, they may go through these regular stages because such stages are the only logical way to learn, through time and exposure, all the detailed facts about the language that they are hearing from adults around them. (After all, foreign adults first arriving in a new linguistic community will also say things like "Throw ball" and later speak in longer and more complex sentences; but this is surely not because they are biologically changing from a primitive to a more advanced maturational state.)

A stronger way to test this view is somehow to disentangle the environmental exposure from the maturation of the learner. We will therefore next consider these two aspects separately, looking first at how language learning proceeds when the learning environment is changed, and second at how language learning proceeds when the maturational status of the learners themselves is changed. As we will show, while languages are in some sense certainly learned from the environment, alterations in the environment over a very large range do not change the fundamental character of acquisition. In contrast, changing the learner's maturational status has substantial effects on the nature and success of acquisition.

1.1.2 Altering the Learning Environment

There are several ways in which one might examine alterations in the linguistic environment to observe the consequences for acquisition. We will consider three: first, the modest natural variations in the degree to which mothers adjust the complexity of their speech to children; second, a much more radical change, in the presence versus absence of any conventional linguistic input; and third, a similarly radical change, in the presence versus absence of the visual nonlinguistic world during language learning. In each case, we will argue, young children proceed on a remarkably stable course of early acquisition.

Variation in Motherese

It is obvious that mothers talk differently to their young children than they do to other adults. This natural simplification is clearly an adaptation both to the fact that children are cognitively immature and to the fact that their understanding of the language is primitive. But it has sometimes been asserted that this simple kind of speech does more than serve the immediate communicative needs of caretakers and infants. Simplified speech (often fondly called *Motherese*; Newport, Gleitman, and Gleitman 1977) may play a causal role in the language-learning process itself. The idea would be that the caretaker first teaches the child some easy structures and contents, and then moves on to more advanced lessons—essentially, provides smallest sentences to littlest ears. For instance, perhaps the fact that the child learns nouns before verbs and declarative sentences before interrogative sentences is a straightforward consequence of caretakers' natural behavior toward infants.

This hypothesis, though plausible, turns out to be false. By and large, mothers speak in whole sentences even to youngest learners. Nouns, verbs, prepositions, and so forth occur in speech even to the youngest learners, and yet the children all select the nouns as the first items to utter. Worse, contrary to intuition, maternal speech is not characterized by simple declarative sentences of the kind that children utter first, such as "Mommy throw ball." In fact, these apparently simplest declarative formats occur in speech to youngest learners only about 25 percent of the time. Instead, the mother's speech is replete with questions ("Where is your nose?") and commands ("Get your foot out of the laundry!"), while the child's own first sentences are mostly declaratives.

Most interestingly, variations in maternal speech forms have been investigated to see if they are predictive of the child's learning; perhaps some mothers know just how to talk to help their children learn; other mothers may not be inclined to speak in ways that facilitate the learning process, in which case their children should progress more slowly in language knowl-

edge. One method for studying this (Newport et al. 1977) is to select a group of young children who are at the same stage of language knowledge (for example, 15-month-olds who speak only in single isolated words) and to collect samples of their caretakers' speech. If learning is a function of the caretaker's speech style, then variation among the mothers at this time should predict the further progress of these children. To study this, the children's speech was sampled again six months later. Analyzing the children's speech at these two times (ages 15 months, then 21 months), one can compute growth scores for each child on various linguistic dimensions (the length and structure of the sentences, the size of the vocabulary, and so forth). The question is whether properties of the mother's speech (in the first measurement, at age 15 months) predict the child's rate of growth on each measured dimension and explain the child's language status at the second measurement six months later.

The outcome of these studies was that, while the details of mothers' use of a few particular constructions of English predicted the children's rate of acquiring these same few constructions, the mothers' overall simplicity did not predict the rate at which their children progressed through the stages of acquisition. In this sense, then, the children's learning rate was largely unaffected by differences in their mothers' speech. Each child seemed to develop according to a maturational schedule that was essentially indifferent to maternal variation.

While such studies preclude certain strong versions of the view that language is learned just because it is taught, they also unfortunately leave almost all details unresolved. This is because the absence of measurable environmental effects may be attributable to threshold effects of various sorts. After all, though the mothers differed in their speech styles to some degree, presumably they all uttered speech that fell into some "normal range" for talking to children. This complaint is quite fair. To find out how the environment causes (or does not cause) a child to learn its native tongue, we would need to look at cases in which the environment is much more radically altered. The most straightforward technique would be to maroon some infants on a desert island, rearing them totally apart from adult language users. If they could and would invent a human language on their own hook, and if this invented language developed just as it developed in infants acquiring English or Urdu, this would constitute a stronger argument for a biological basis for language learning.

Classical cognoscenti will recall that, according to Herodotus (ca. 410 B.C./1942), this ultimate language-learning experiment has been performed. A certain Egyptian king, Psammetichus, placed two infants ("of the ordinary sort") in an isolated cabin. Herdsmen were assigned to feed them but were not to speak to them, on pain of death. Psammetichus's experimental intent was to resolve the question of which (Egyptian or

