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Humankind's Greatest Gift: On the Innateness of Language

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Although the environment has an effect on the quality of language development, the fact that language is limited to the human species, that neurological structures of the brain specialize in language functions, and that universal characteristics of language and language development occur independently of environmental factors suggests that human language has a definite biological component.

Language—perhaps the defining characteristic of man—has long been a favorite issue of the age-old "nature vs. nurture" debate. Current evidence points toward an innate hypothesis with some environmental constraints.

Language is a prime example of a "canalized" behavior, the "capacity to produce a particular definite end-result in spite of a certain variability both in the initial situation from which development starts and in the conditions met with during its course" (Locke 1993:221). The behavior develops along a genetically preadapted, internally regulated path which requires a supportive environment. Stable development is maintained as long as the supportive environment exists, and development will return to the normal growth path when an environmental deviation is corrected. Canalization incorporates the variation of evolution, while limiting the range of functional/structural variations at the same time. In the case of language development, the most obvious evidence lies in the universal patterns and rates of acquisition despite extreme variations in child-rearing environments.

Locke reviews earlier arguments for the innate capacity for language in humans:

1) Specialized neurological structures devoted to the production and perception of speech have been identified;

2) The basic design features of human languages are universal;

3) The acquisition of language unfolds in much the same way in all normal children; and

4) Language is species-specific—even most isolated human groups have language, yet extremely intelligent apes do not.

NEUROLOGICAL STRUCTURES

Although the mechanical apparatus of language includes the lips, mouth, tongue, diaphragm, and others, the brain —the center of comprehension and coordination for the language system—is obviously the most important element.

The development of the neurological structures of the brain specializing in language began three million years ago. During the Plio-Pleistocene, (the era of Australopithicene hominids), culture began to interact with biology to increase brain size. Social behaviors (especially those relating to memory and communication) became increasingly adaptive, creating selective pressures for a larger brain size, which required a longer period of growth/development, in turn strengthening the need for social bonds and, ultimately, for more complex social behaviors (Holloway 1981). From the time of Australopithecene hominids to modern man, brain size has increased three-fold, neuron density has increased, the amount of dendrite branching has increased, and cerebral asymmetry (lateralization) has commenced.

Lateralization refers to asymmetry of the functions performed by the two hemispheres of the brain; a particular function is localized to one hemisphere. When lateralization is present, if the hemisphere that a particular function is localized to is damaged, that function may no longer exist or may be damaged in some way; the other hemisphere has no way of making up for the loss. While most necessary for survival are symmetrically located on both hemispheres (creating a back-up system if needed), it is speculated that most of the "higher" mental functions are lateralized.

This is the case with language (language is defined as linguistic knowledge, separate from the motor skills of speech). Language functions are localized to several main areas on the left hemisphere of the brain (the most well-known being Broca's and Wernicke's Areas). Evidence for their existence comes from studies of individuals who have suffered brain damage due to a stroke, tumor, gunshot wound, or infection; damage to a certain area systematically produces certain symptoms. Broca's Area, in the frontal lobe of the left hemisphere, controls language production. Damage to this area, generally termed Broca's Aphasia, results in labored speech, disturbed word orders, syntactic deficits, apraxia (disorganized articulation), and/or dysarthia (systematic reduction of sound combinations). Wernicke's Area, located towards the back of the left hemisphere, controls language comprehension. Damage here (Wernicke's

aphasia) causes lexical errors (word substitutions), phonological errors, difficulty understanding speech, and/or difficulty keeping track of what oneself is saying (jargon aphasia). Other areas important to language have been identified. Damage to the area just above Broca's Area (Exner's Center) causes reading and writing problems (agraphia). Damage to the area behind Wernicke's Area (the Naming Area) causes anomia, an inability to use nouns (Fromkin and Rodman 1993). Facial processing (recognition and expression identification), as well as voice processing are also lateralized to the left hemisphere; to which damage causes prosopagnosia (face recognition disorder in which the victim may not be able to recognize even their own face) and/or phonagnosia (a disturbance in voice recognition) (Locke 1993).

Generally speaking, these specialized structures of the brain work together to segment sounds, attach meanings, and generalize rules of grammar, allowing humans to use and understand language.

UNIVERSAL DESIGN FEATURES OF LANGUAGE

Regardless of culture, environment, or time period, certain principals, language universals are present in all languages. Languages are all equally complex; none are more primitive or more advanced than any other. All languages change throughout time—when a language stops changing, it dies. All are arbitrary symbol systems, meaning there is no iconic relationship between the symbol and that for which it stands. They all contain rules, and they all have consonants and vowels, and categories/parts of speech. All languages are creative in the sense that any speaker has the ability to create and/or comprehend new, never-heard or spoken, sentences. All languages have a way of referring to time. All can negate; and all can make questions.

Due to the occurrence of such extraordinary parallels between the characteristics of language regardless of drastically varied environments, it has been theorized that there must be an innate universal grammar—an underlying set of principles that guide rule formation, etc. Unfortunately, this ideal guide to phonology, morphology, and syntax has yet to be realized. So far, however, universal grammar has proven to be a stronger theory than its opponents, monogenesis (the theory that all language originated from one language, then spread), and the functional/pragmatic theory (similarities among languages have developed out of the similarities among human experiences). Most importantly, universal grammar accounts for the regularities in language acquisition.

LANGUAGE ACQUISITION

Language acquisition provides perhaps the most riveting proof that language has an innate foundation. Regardless of child-rearing practice, immediate environment, culture, historical time period, or even the presence or absence of the ability to hear (as long as other faculties are not affected), children acquire language effortlessly, and in the same stages and developmental rates. This is even more astounding when one considers that "children do not learn a language by storing all the words and all the sentences in some giant mental dictionary, children learn to construct sentences, most of which they have never produced before," children "learn to understand sentences they have never heard before," (demonstrating that children construct the rules that permit them to use language creatively), and, finally, that "no one teaches them these rules; their parents are no more aware of the phonological, syntactic, and semantic rules than are the children" (Fromkin and Rodman 1993).

The process of language acquisition can be divided into prelinguistic and linguistic stages. The earliest cries of a newborn, which are entirely stimuli-dependent, are considered prelinguistic. However, during this time facial and vocal perception and discrimination ("the perceptual path to spoken communication" according to Locke, 1993) begin to develop. Even in the womb, a fetus will respond to voices by decreasing its heartrate. Neonates respond preferentially to sound stimuli that are familiar, or sound stimuli that change, by sucking faster (Locke, 1993).

At approximately six weeks of age, the child enters the "cooing stage." The first coos any child makes are nearly the same world-wide. All the phonetics possible to any language are present. However the coos themselves have a great range of meanings.

With the beginning of the "babbling stage" of language development, this starts to change; not all sounds are reinforced, so not all sounds continue being used. Locke (1993) calls this process "pruning"—the child begins to lose those sounds that are not present in its native language. At the same time "stabilizing" occurs—the sounds that are present in the native language, and thus those that are reinforced, are preserved and stabilized. Intonations also become distinguishable toward the end of this stage (when the child is approximately eight months to twelve months old).

Around one year of age, children learn that certain meanings are attached to certain sounds. Through the repetition of linking a sound to a meaning the child soon begins producing its first words. In virtually every language, a child's first word fits a front-back

phonological pattern, a closed consonant sound (i.e. *p, b, m*) followed by an open vowel sound (i.e. *a*); thus, the word for mother (a common first word) sounds oddly similar in several languages throughout the world. At this stage, the holophrastic stage, one word is equal to a whole sentence, encompassing several different meanings depending on context. For example, "book" may mean "I want that book," "That's my book," or "Mom is reading a book." At this time articulation is usually far from perfect; however, children can perceive many more phonological contrasts than they can produce themselves.

Within their second year, children begin making two-word utterances using syntactic and semantic relationships; most often the phrases consist of either a subject and an object (for example, "Daddy book" meaning "Daddy is reading a book"), a possessive and a noun ("Daddy book" meaning "Daddy's book"), or a subject and a locative ("Daddy couch" meaning "Daddy is on the couch"). However, functional words, inflections for number, person, and tense, as well as pronouns are not yet present (Fromkin and Rodman 1993).

After the two-word stage, acquisition seemingly explodes. Children begin stringing three, four, five, or more words together, at first eliminating "function" words (i.e. *to, the, is*, etc.), creating a speech similar to what one would find in a telegraph message. These word-strings are more sentence-like than the previous two-word strings in that they are hierarchical, and contain the constituent structures similar to those found in adult grammar (Fromkin and Rodman 1993). Children then begin to acquire the other, more detailed aspects of adult grammar—but always in the same order —first, the progressive *-ing* verb ending; next, the prepositions *in* and *on*; then the plural *-s*; the present tense copula (*am, is, are*); articles (*a, the*); the third person singular *-s*; the possessive *-s*; the past tense *-ed*; full progressives (auxiliary + *-ing* ending); the copula contraction; and finally, the progressive contraction. Children also acquire negatives in a set order: 1) negative + subject; 2) subject + negative; 3) the adult negative pattern (often involving contractions, etc.). While all the basics of language are in place by five to six years of age, full adult language is not thought to be achieved until the child reaches eight to nine years of age.

Throughout development, even the sequence of errors is regular and systematic. Once a child grasps a phonological, morphological, or grammatical rule they tend to over-generalize its use—thus, each stage of language development systematically corresponds to certain errors, which most often occur where the language is irregular. For instance, once a child has acquired the past tense ending *-ed*, they often say *bringed, hurted*, etc., until they learn the irregularities of such words.

These stages occur regardless of nearly all environmental conditions; furthermore, research on deaf children has shown that language acquisition is not hearing dependent. Deaf children go through the stages much the same as hearing children. The main differences occur in the babbling stage—while hearing children are pruning and stabilizing the sounds of their language, deaf children's babbling remains somewhat open and without intonation. However, if their parents/guardians consistently use sign language around them, a deaf child's first word (sign) may appear much earlier than a hearing child's first spoken word (Locke 1993). Although the deep structure, or meaning, is fully understood by deaf individuals, they often struggle with sentence surface structure. They tend to rely more heavily on their own experience of the world than on word order. Overall, "various studies attest that signed languages are learned as rapidly as spoken languages and carry information that is equally complex" (Locke 1993: 377).

The theories of imitation, and of reinforcement, although they are much less successful, have also tried to explain the regularity of language acquisition. According to the imitation theory, children acquire language by merely repeating what they hear; however, this cannot be so since children often are exposed to incorrect language, and since the children themselves say things they would not have heard (for example, an adult probably would not say, *"We goed to the movies").* According to the reinforcement theory, children acquire language through trial-and-error, by keeping those elements that are reinforced by others and eliminating those elements that are not. While this happens to a certain extent, it cannot account for the generalization of rules; and, as any parent knows, children often don't usually respond to correction anyway.

The theory of a universal grammar (as explained previously) along with the identification of specialized neurological structures explains the phenomenal regularity of language acquisition best. However, being "pre-wired" does not necessarily mean language acquisition will occur under any circumstances. In fact, it seems that not only consistent exposure to a language is required, but exposure during a certain developmental time-frame is necessary as well.

According to the "critical-age hypothesis," language will normally be acquired swiftly without effort before puberty, if the child is exposed to language on a regular

basis. Exposure does not necessarily have to be hearing a language; deaf children acquire language the same as hearing children if sign language is consistently used around them. However, if a child is, somehow, never able to experience language in any form before puberty, they will probably not be able to fully acquire language. With age, the human brain loses much of its elasticity, making it more and more difficult to learn new major components. After puberty, a child may be able to learn some words, etc., but they would require special teaching and special learning techniques. This hypothesis is obviously difficult to test, as no researcher could subject a child to prolonged isolation. But evidence lies in a few unspeakable instances, "experiments in nature," where children either wandered into the wilderness, were stolen by animals, or were actually isolated by their parents from all human contact, including language, until they were found by authorities or until they wandered back into human society.

Surprisingly, over 50 cases have been documented in the last few hundred years. In his book *Systema Natura* (1758), Carl Linneaus, the famous taxonomist, named the unfortunate subjects *Homo sapiens ferus* characterizing them as "tetrapus" (four-footed), "mutus" (mute), and "hirsutus" (hairy) (Singh & Zingg 1966).

One of the best-documented cases of a feral child comes from India. The case unfolded in the small village of Godamuri, in late 1920, when a traveling reverend, Rev. Singh, was begged to rid the nearby forest of ghosts. The "ghosts" turned out to be two young children living with a wolf family; the wolf-mother had evidently adopted the children and was raising them alongside her own cubs. The older girl, which he named Kamala, was approximately eight years old, while the younger, Amala, was probably one and one-half years old. Along with being naked and extremely dirty, both children looked "less-than-human"; their bodies had somewhat adapted to their lives in the wild—their jaws were higher and more raised than normal, completely parting when the children ate (probably an adaptation to chewing bones), their teeth were sharp and uneven, their eyes glared like a cat's at night, and they walked on all fours causing their legs and hands to be covered with scars and bloody sores. They also preferred the nighttime, sinking into dark corners during the day; and their senses of smell, hearing, and touch were extraordinarily strong, while they had no sense of temperature. The Reverend brought them back to his orphanage where he and his wife nursed them back to good health and attempted to raise them as normal children. At first they were extremely aloof and aggressive, seemingly detesting anything that had to do with human. In the beginning, the only sounds they made were shrieking howls during the night. Eventually, as they learned to associate their human caretakers with food, Amala began to whimper, "Bhoo Bhoo" to signal that she was thirsty and wanted a drink (Singh and Zingg 1966).

A year later, tragedy served as the turning point for Kamala's development. Amala became sick with nephritis, and died in September of 1921 (Singh & Zingg 1966). Once she finally understood what had happened, Kamala sunk into a deep detachment, and the Singhs feared the worst. But in time, the tragedy actually aided her attachment to Mrs. Singh—an element that, in retrospect, seemed necessary to begin her development.

Over the next eight years, along with strengthening her muscles and teaching her to stand, the Singhs began teaching her to talk. The teaching method included modeling with the other orphanage children, rewards, and Mrs. Singh constantly talking to her. By 1922, Kamala could only nod "yes," shake her head "no," and push or slap when she wanted something. She uttered her first word in 1923, three years after she reentered human society. She said, "Hoo" (a word the other children said when they were cold and wanted a blanket) to answer that she wanted more food, indicating that she had not yet formed the connection between words and meaning. Kamala learned her second word, with some semblance of meaning, soon after when she observed another orphanage child crying, "Na na na" when he was hurt; from this time forward, Kamala said "Na na na" whenever she didn't like something. Within the next few years her vocabulary increased dramatically, although her pronunciation was never perfect. Rev. Singh wrote that Kamala was making "quicker progress than an average child in learning things." (Singh & Zingg 1966: 105). However, she did not utter her first sentence until 1926—upon Mrs. Singh's return from a trip Kamala said, "Ma Elo" ("Mama come").

In 1928, Rev. Singh was invited to bring Kamala to the New York's Psychological Society to demonstrate her extraordinary progress; however, Kamala took ill that year and was not able to travel. Sadly, she died the following year, November 1929, from of the same disease which killed Amala eight years before. At the time she died, Kamala had learned over 50 words and was able to make over 130 small sentences consisting of a subject and a predicate.

The case of another "feral" child named Victor, was somewhat less promising yet similar. In the 1800s a young boy, approximately 11-12 years old, wandered out of the French countryside into a village, Aveyron, where he was discovered by a French scientist, Jean Itard.

Unlike Kamala, Victor had had no animal contact; he learned to survive by trial-and-error in the environment alone.

Itard worked with Victor for several years trying to teach him French, using techniques developed to teach deaf children to talk. Victor learned some French words and was able to respond to commands; however, he never learned how to combine words syntactically or semantically (Nova Productions 1994).

"Genie" is probably the most famous of the feral children cases. Genie was discovered in 1970 at the age of 13. Since her infancy, her parents, supposedly under the rule of an abusive father, had kept her isolated in a small room. She was never spoken to, and probably punished for any sounds she made. When the authorities finally found her, she was malnourished, non-social, and could not speak. She was admitted to a hospital, where her physical status improved quickly while she underwent tremendous research and therapy. Extensive efforts were made to teach Genie language—how to speak, comprehend, and even read. Slowly, she began to respond, at first only with rudimentary forms of body language and by reacting to familiar voices, then, by imitating sounds, and finally, with one-, two-, and eventually three- and four-word utterances. By the end of the research (when Genie's mother regained custody), three and one-half to four years after it began, Genie had a greater vocabulary than the average three and one-half year old, and her I.Q. tested higher than that of six to eight year olds; however, her learning began to drastically drop off towards the end of the study, she never fully developed negations, and, most importantly, she never grasped or used the rules of grammar (Nova Productions 1994).

The feral children studies support the critical age hypothesis in that the children were never able to fully acquire language—although it seemed that Kamala may eventually have grasped some sort of grammar, she was pre-pubescent, and, furthermore, she (as well as all the others) required special teaching techniques to learn. However, there are numerous possible confounds: no one knows whether these children were brain damaged at birth or before isolation—if so, their acquisition problems may be due to the brain damage and have nothing to do with missing the critical age for language acquisition; the research was not done systematically; and the research and/or teaching efforts often end abruptly—continued systematic efforts may have shown more improvement.

LANGUAGE AS SPECIES-SPECIFIC

Since only humans naturally possess the capability for language, and if language is innate (as the above evidence suggests), then non-human animals must not be naturally capable of language—language capabilities being the capacity for linguist knowledge, not necessarily speech. Thus, this premise forgoes talking birds, who may imitate human speech, but lack the meanings attached to the words.

Although nearly all species have some sort natural communication systems, allowing them to send and receive a variety of messages, these systems are not considered actual language (at least not the type of language humans possess), first and foremost because they are not creative, and thus not open systems. Whereas man has the ability to create and understand phrases/sentences that have never existed before, animals rely on a finite number of signals that cannot be modified or rearranged to imply new meanings. For instance, bees dance to relay the distance to a food source to the other bees of its hive; they can modify their dance to mean different distances, but the subject is always limited to distance from the hive (Fromkin and Rodman 1993). Secondly, non-human animal communication systems lack the ability for displacement—communicating about something that is not immediately present either spatially or temporally.

In order to test the theory that animals do or do not possess the capability for language, some have tried to teach animals language. Primates are often chosen because they are closest to humans physiologically and in brain structure. Early studies focused trying to teach the primates to actually speak, an impossible feat since primates lack the glottis and vocal cords necessary for speech. Eventually, researchers began focusing on gestural sign languages instead, with greater success. As the result of one such experiment, a chimpanzee named Washoe learned 120-140 signs of American Sign Language. Nim, another chimp learned over 125 signs and over 19,000 word combinations. Yet another chimp named Sarah was taught a language based on arbitrary shapes and colors, learning over 200 combinations of shapes and symbols. Other primates (i.e. Nim Chimpsky, Koko the gorilla, etc.) have come and gone with much of the same results—seemingly, a large amount of vocabulary, and sometimes some sense of semantic relations, is learned. However, whether the signs or symbols produced by the animal actually correspond to specific meanings is debatable. Reinforcement, inconsistent methods, non-relational approaches, and trainer signals (however unintended), all present themselves as likely confounds. For example, in Nim's

case, Nim learned to use several "wild card" signs (*me, Nim, more*) that would provide him with some sort of reinforcement for any situation (Muncer 1983). It is difficult to determine whether these failures were on the part of the primate or of the experimental design.

More recently, similar studies have been conducted using dolphins. Once trained, bottlenosed dolphins' comprehension of gestural sign languages is high even when distractions are present, when the meaning is altered by word order, when novel strings are created from known signs, and when the objects requested in a command are not presen (Herman, Morrel-Samuels and Pack 1990). Obviously, this research can only be directed at comprehension.

Such studies are considered failures—at least in full language acquisition/learning by a non-human animal—for several reasons. First, no clear sense of grammar or syntax is ever demonstrated by the animals. Second, the words and/or word strings produced never demonstrate displacement or recursion (a creative aspect of human language where similar phrases can occur within themselves an infinite number of times). Furthermore, the animals who are trained have never taught or tried to teach their offspring or other animals the "language" they have learned. Finally, and perhaps most importantly, the animals must be specifically *taught*; they cannot *acquire* language as human children do.

To explain the fact that non-human animals can learn vocabulary but not grammar, Premack (1986) suggests that language acquisition requires two components: learning (of words and schematic relationships) and hard-wiring (an innate construction of grammar). Thus, non-human animals can learn vocabulary simply because they are capable of learning, but they cannot learn grammar because it requires an innate component that only humans possess.

CONCLUSION

Language is perhaps the most important difference between *Homo sapiens* and the rest of the animal kingdom. The phenomenal linguistic evolutionary process, set in motion millennia ago, continues to shape and guide, if not ensure, the future of humankind. In the words of Noam Chomsky: "When we study human language, we are approaching what some might call the 'human essence,' the distinctive qualities of mind that are, so far as we know, unique to man" (Chomsky 1968).

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