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Maturational Constraints on Acquiring Native-like Competence in Second Languages

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Introduction

One of the principal research questions concerning the effect of age on second language acquisition has to do with the difficulty adults encounter in attaining native-like competence in any language other than their L1, or primary language. Typically, adults fall short of native-like abilities in an L2, or second language, in one or more domains, often markedly so.

Even those adults who are fortunate enough to achieve near-native competence in some areas of a second language are constrained in others, most notably in the area of phonology. Pinker (1994) holds that the key factor implicated in this lack of success is age. He notes that while some exceptionally-gifted adults may be able to master a good deal of the grammar of a foreign language, even these apparent “success stories” seem incapable of getting the sound system quite right. Pinker points to what has become known as the “Conrad Phenomenon”, named after Joseph Conrad, author of the classic novels *Heart of Darkness* and *Lord Jim*. Although Conrad was born in Ukraine and spoke Polish as his first language, he went on to become one of the greatest English writers of the 20th Century. Nevertheless, Pinker notes, his native accent made him virtually unintelligible when he spoke English, even among his close friends.

The way in which children and adults learn and access features of second languages, Pinker notes, is notably different and indicates that different internal processes may be at work.

Even the adults who succeed at grammar often depend on the conscious exercise of their considerable intellects, unlike children, to whom language acquisition just happens. Vladimir Nobokov, another brilliant writer in English, refused to

lecture or to be interviewed extemporaneously, insisting on writing out every word beforehand with the help of dictionaries and grammars. As he modestly explained, “I think like a genius, I write like a distinguished author, and I speak like a child.” (p. 291)

Answering the question as to whether adult native-like proficiency in a second language is possible, then, is just a first step. Perhaps more importantly, we need to ask what the factors are that constrain an adult’s abilities to achieve native-like competence. In other words, how can we account for the fact that children invariably succeed in second language acquisition while adults, generally speaking, do not?

This paper will examine some of the factors that may be implicated in the difficulty adults experience in attaining perfect competence in second or non-primary languages. In this regard, the Critical Period Hypothesis will be examined, followed by a discussion of the concept of universal grammar and its relevance to the critical period of second language acquisition. Following this, explanations that have been proposed to account for the critical period will be explored.

The Critical Period Hypothesis

The Critical Period Hypothesis (CPH), based on discoveries by Penfield and Roberts (1959) and refined by Lenneberg (1967) holds that there is a fixed period of time, from around the age of two until puberty, during which language learning can take place. After the termination of this critical period, the individual loses the capacity to acquire language. Lenneberg based this claim primarily on observations of aphasics, those people who have lost the ability to produce language due to traumatic brain injury, hemorrhagic stroke, or other causes. It was noted that in the case of aphasia that occurred prior to the age of 12, substantial, if not complete, recovery of language function was possible. After the age of 12, however, the ability to recover full language function was critically compromised. This observation led Lenneberg to conclude that the ability to produce language was associated with lateralization of language function in the left hemisphere of the brain, which he claimed takes place around puberty.

Additional evidence for a critical period of language acquisition came from a variety of sources. It was noted, for example, that children who were deprived of language input during their formative years, so-called “feral children”, were not able to develop complete language skills after assimilation into society. A well-known case cited throughout the

literature involves a girl, Genie, who was raised by psychotic parents in total isolation. Until she was discovered at the age of 13, Genie had received virtually no language input. Although remedial training showed that Genie was able to later make progress in some language domains, particularly vocabulary, she was never able to achieve mastery in others, most notably syntax and grammar.

Additionally, support for the notion of a critical period came from observation of deaf adults attempting to acquire American Sign Language (ASL). ASL is recognized as being every bit as complex and nuanced as any other natural language, and it was noted that those who attempted to learn it as adults typically fell short of complete mastery.

Although Lenneberg was concerned primarily with first language acquisition, the claims made by his hypothesis were extrapolated to second languages. The “strong version” of the CPH claims that second language acquisition that takes place before puberty will be similar in many respects to a child’s first language acquisition, but that second language acquisition after puberty will not. Additionally, full native-like competence in a second language cannot be achieved after puberty, particularly with respect to the target language’s phonological system. A number of empirical studies have lent support to this position and have demonstrated that native-like mastery of second languages becomes increasingly difficult, if not impossible, shortly after the first decade or so of an individual’s life.

Lenneberg’s hypothesis was later modified by Lamendella (1977), who proposed a *sensitive period* for second language acquisition, which, unlike the critical period, does not have sharply defined lower and upper bounds. This “weak version” of the CPH states that the loss of language acquisition ability takes place gradually and may be subject to a considerable degree of individual variation. Thus, according to this view, it may still be possible to acquire some or all aspects of a second language beyond puberty, although not to the extent of native-like mastery, and with the degree of proficiency negatively correlated with increasing age.

It is entirely possible, as well, that there is not one, but several, critical periods implicated in second language acquisition. Seliger’s (1978) Multiple Critical Periods Hypothesis states that different language domains may be determined by different critical periods, and that these different critical periods determine the degree of completeness with which various aspects of language may be acquired. Seliger hypothesizes, based on various studies of age-dependent aphasia, that

...there is a continuous long-term process of interhemispheric and intrahemispheric localization of function. The type of language dysfunction, either aphasic or as evidenced by universal second language inabilities, is taken to be indicative of both the state of localization and the amount of remaining plasticity [of the brain]. Since different aspects of language are affected at different stages in this process, it is hypothesized that there are multiple critical periods which correlate with localization and the gradual loss of plasticity. (p.18)

Thus, different aspects of second language competence may be affected at different points along an individual's development. Lamendella (1977) feels that the learning constraints are most stringent for the acquisition of target language phonology, a sentiment echoed by Scovel (1988), who finds overwhelming evidence for phonological interference around the age of puberty. Recent evidence, however, indicates that some aspects of language, particularly syntax, grammar, and morphology, may be acquirable with native-like accuracy through at least the mid-teens. Additionally, there is some indication, as was seen in the case of Genie and other feral children, that lexis can be continually acquired throughout life, and seems to be relatively unaffected by the termination of the critical period.

Access to Universal Grammar

Children are generally recognized as possessing an innate ability to learn language, an ability that Pinker (1994) asserts is an instinct. This ability was first proposed by Chomsky, who postulated two fundamental facts about language. One is that human beings have the ability to construct an infinite number of sentences using a finite set of words stored in the brain. The second fact is that children construct complex grammars rapidly and without formal instruction, often based on insufficient or "degenerate" input, yet still somehow develop the ability to give consistent interpretations to new sentence constructions they encounter. Chomsky (1975) felt that only the existence of an innate Universal Grammar (UG) could account for these two phenomena. He states:

Even knowing very little [of the substance of linguistic universals], we can be quite sure that the possible variety of language is sharply limited...The language each person acquires is a rich and complex construction hopelessly undetermined by the fragmentary evidence available [to the child]. Nevertheless, individuals in a speech community have developed essentially the same language. This fact can be

explained only on the assumption that these individuals employ highly restrictive principles that guide the construction of grammar. (p. 11)

The notion of a critical period is predicated on the existence of UG. The CPH contends that as individuals get older, they can no longer acquire language with the same ease and efficiency as they did as children. This decline in language ability can be seen to be a direct result of steadily decreasing access to the innate processing of UG.

Although a few researchers such as Flynn and Manuel (1991) contend that the evidence does not support the conclusion of a qualitative difference between the processes of adult and child L2 acquisition, this argument seems difficult to sustain considering the overwhelming body of research in support of some type of maturational constraints on second language acquisition.

Clahsen and Muysken (1986), in a study of the differences between children and adults in the acquisition of German word order, conclude that “children possess learning capacities specific to language...whereas adults use acquisition strategies which may be derived from principles of information processing and general problem-solving strategies” (p. 110-111). Their main finding was that children acquire language using a Language Acquisition Device (LAD), defined by Nativist theorists such as Chomsky as an innate or instinctive capacity to acquire language, whereas adults do not, and that this difference accounts for children’s intuitive ability to grasp grammar and syntax, and conversely, the adult reliance on cognitive abilities to sort out language.

The truth of the matter may lie somewhere in between the two extremes mentioned above, with adult access to UG being incomplete or indirect. Schacter (1996) contends in her Incompleteness Hypothesis that in adult L2 acquisition, the only source of knowledge available is a knowledge of L1, which, “together with the information derived from input, constitutes the database from which the learner constructs the grammar of the L2” (p. 172). Similarly, Bley-Vroman (1987), in an analysis of ten fundamental differences between adult and child second language acquisition, believes that adults do not have direct access to UG, but instead must rely on the construction of a “UG surrogate” which accounts for the less than perfect success adults are able to achieve in attaining a second language.

Factors Constraining Adult L2 Acquisition

Various explanations as to how the critical period operates in language acquisition have been proposed. Principal among these are theories stemming from cognitive psychology and human neurophysiology, both of which describe internal processes that account for adult second language acquisition. Other factors such as talent, environment, personality, social context, and affective concerns are seen as contributing factors that determine to a large degree the quality and quantity of input that the individual receives, and to what extent this input is made available for assimilation into the learner's interlanguage.

Cognitive Psychology

Cognitive explanations have been posited that attribute the older learner's inability to achieve full native-like competence in second languages to the individual's maturing intellectual development. According to this view, a maturing cognitive system in the human mind, which enables the adult to form hypotheses and relate abstract principles to one another, somehow interferes with the innate ability to acquire languages.

Felix (1985) proposes that the reason children are able to achieve native speaker competence in any language to which they are exposed while adults, as a rule, do not, has to do with a conflict between two largely independent processing systems in the mature adult brain. These systems process linguistic data in very different ways, and thus can be said to "compete" with one another in the analysis of that data.

Felix claims in his Competition Model that children acquire language through the use of an innate processing system, consistent with Chomsky's UG, which he refers to as a Language-Specific Cognitive system (LSC). The LSC allows the child to process linguistic information intuitively without the need for conscious analysis.

At around the time of puberty, an alternate cognitive system develops that enables adolescents to begin to form hypotheses about the input to which they are exposed. This Problem-solving Cognitive system (PSC), comes about with the advent of Piaget's *formal operations* stage of human intellectual growth, and entails the use of abstract processing abilities not available to children. According to Piaget (1981):

Formal thought reaches its fruition during adolescence. The adolescent, unlike the child, is an individual who thinks beyond the present and forms theories about everything, delighting especially in consideration of that which is not. The child, on the other hand, concerns himself only with action in progress and does not form

theories, even though an observer notes the periodical recurrence of analogous reactions and may discern a spontaneous systematization in his ideas. This reflective thought, which is characteristic of the adolescent, exists from the ages of 11-12 years from the time, that is, when the subject becomes capable of reasoning in a hypothetico-deductive manner, i.e., on the basis of simple assumptions which have no necessary relation to reality or to the subject's beliefs, and from the time when he relies on the necessary validity of an inference (*vi formae*), as opposed to agreement of the conclusions with experience. (p. 148)

Thus, while the child processes language intuitively using the LSC, the adult has two separate systems, the LSC and the PSC, operating simultaneously. While one might imagine that this could be an advantage for the older learner, it is not. The PSC system, which is activated automatically and cannot be suppressed, results in a transfer of cognitive processing abilities onto a domain for which it is not equipped, i.e., the formal complexity of natural language. Inadequate to the task of language acquisition, it leads adults to form erroneous conclusions about the input they are receiving, and thus leads to errors such as overgeneralization and the superimposition of L1 grammar and syntax onto the L2.

Thus, the competition between an innate processing system and a processing system that arises due to the individual's intellectual growth, according to Felix, explains why adults are generally inferior to children in the success they achieve in second language acquisition. Rather than simply acquiring language as children do, adults have no choice but to use their intellectual skills in the analysis of linguistic data of natural languages, which are not suited to handle their inherent complexities.

Neuropsychological Change

It has also been proposed that maturational constraints on the adult ability to acquire second languages may arise as a result of neurophysiological processes. This position holds that changes in the neurological makeup of the maturing human brain preclude the native-like acquisition of language beyond a certain age.

Lenneberg (1967) believed that the termination of the critical period was related to a loss of adaptability and inability for reorganization in the brain. In particular, he implicated cerebral lateralization of language function in the left hemisphere as constraining the adult ability to acquire language. It has since been discovered that cerebral lateralization may take place much earlier than Lenneberg believed. Seliger (1978) asserts that "in

opposition to the traditional view that lateralization and the critical period are coinceptive and conterminous, many recent studies indicate that lateralization may be independent of the critical period” (p. 14). Lateralization, he states, may actually occur prior to the onset of language.

Thus, lateralization may not be a factor at all in the constraint of adult L2 ability, and it entirely possible that the termination of the critical period, at least in some aspects of language, may begin to occur well before the individual reaches puberty. Pinker (1994) believes that “the acquisition of a normal language is guaranteed for children up to age six, is steadily compromised from then until shortly after puberty, and is rare thereafter” (p. 148). Plausible causes for this loss of language ability, he states, include a number of maturational changes in the brain, such as decline in both the metabolic rate and number of neurons in children, followed by a “bottoming out” of the number of synapses and metabolic rate at around the time of adolescence.

Long (1990) also believes that the termination of the critical period may occur much earlier than Lenneberg originally proposed. He holds that the ultimate level of attainment in first or second languages is constrained not by a catastrophic one-time loss, but rather because of cumulative decline in learning capacity beginning as early as age six. In his radical version of Lenneberg’s Maturation State Hypothesis, Long sees a gradual loss of neural plasticity associated with increasing myelination, a process by which neurons in the brain become encased in lipid and protein sheaths, as one probable cause for this deterioration in language ability.

Given the fact that the human brain is a highly complex organ, indeed, the most complex biological adaption in the history of evolution on Earth, it is likely that a variety of neurological factors may operate in constraining language ability. Lamendella (1977) sets forth a series of steps of *genetically regulated maturational parameters*, based on the work of Berrill and Karp (1976) and Jacobson (1970), that may exert varying degrees of influence on both the onset and termination of the critical period, including:

1. MYOTIC DISION: division of germinal cells; occurs one year postnatally when the infant possesses a full complement of neurons.
2. MIGRATION: germinal cells travel long distances along predetermined routes to organize into nuclei, ganglia, and cortical laminae.
3. GROWTH AND DIFFERENTIATION: immature neurons grow larger and develop into many specialized subtypes with different anatomical and physiological

characteristics.

4. SYNAPTIC CONNECTIVITY: axonal and dendritic cell processes grow out from the cell body in particular directions to make contact with specified portions of other cells.
5. ELECTROPHYSIOLOGICAL MATURATION: neurons gradually acquire the electrophysiological properties of mature neurons of that type.
6. SYSTEMS ORGANIZATION: organization of types and groups of neurons into neurofunctional systems with either a dual bilateral or unilateral (lateralized) representation in the nervous system.
7. MYELINIZATION: acquisition by neurons of myelin sheaths that both increases the speed of transmission of action potentials and insulates one axon from another.
8. METASYSTEM ORGANIZATION: incorporation of neural systems into a cross-level hierarchical organization of different systems as the means of organizing metasystemic functional hierarchies. (Adapted from Lamendella, p. 174)

Rather than attributing a single neurological contributing factor to the termination of the critical period, then, it seems more in line with the evidence that a variety of internal changes in the makeup and chemistry of the brain are at work. As the human brain matures, it gains certain advantages, such as the ability to hypothesize and perform analytical operations, but loses other abilities, specifically the ability to intuitively process and assimilate linguistic input. This trade-off of skills and abilities is linked to progressive neurological refinements in the brain.

The Evolutionary Origins of the Critical Period

Up to this point, this paper has described the characteristics of the critical period of language acquisition and has provided accounts of what causes the critical period to come to a close. Essentially, then, the focus has been on *how* this phenomenon operates. In order to sustain the CPH, however, a plausible explanation of *why* the critical period operates must be posited. Otherwise, we are left with an interesting enigma and little else. In other words, why, after having bestowed on humankind the ability to acquire language, should nature limit the operation of this marvelous biological adaptation to the first decade or so of life?

A compelling explanation comes from Skehan (1998), who proposes an answer arising from evolutionary necessity – constraining variability. The critical period, he believes, evolved as a means to curtail the enormous power of the LAD, which permits human beings to acquire language and construct an infinite array of linguistic permutations based on limited and divergent input. For early hunter-gatherer societies, this ability entailed the very real risk of resultant “linguistic fragmentation” and “a lack of mutual intelligibility”. For these primitive societies, a compromised ability to communicate with one another could have threatened their very survival. Skehan explains :

The existence of a critical period means that the essential core of language will remain relatively unmodified. Such a situation will, inevitably, place constraints on the capacity of language to change, but it will bring the very substantial reward that members of such a speech community will be ‘guaranteed’ successful communication with one another throughout their lifetime, ensuring that the process of language change will be relatively slow, spanning many generations before mutual comprehension is lost. (p, 232)

Thus, from the standpoint of evolutionary biology, Skehan finds positive reasons for the critical period to terminate when it does, as this has the effect of constraining excessive linguistic variability among members of a speech community. For early humans, the loss of language acquisition ability associated with increasing age ensured that members of the group would be able to communicate with each other, which increased the likelihood of the survival of the group, and by extension, that of the human species.

Conclusion

It has been commonly observed that children are able to “pick up”, i.e., rapidly acquire, competence in second languages. Anecdotal stories abound of young children who, accompanying parents on work assignments overseas, seem to have little difficulty learning to speak the new language to which they are exposed, and to do so in a relatively short period of time, while their parents struggle to get along in the new language environment. Research backs up this common observation and concludes that this is a result of innate learning processes that children possess but which they gradually lose as they grow up. These processes argue in favor of the theory of a critical period in language acquisition owing to the so-called language acquisition device and access to universal grammar.

As human beings mature, they lose this innate ability due to either cognitive changes in the adult brain (i.e., a competing language processing system that causes adults to form hypotheses about input to which they are exposed rather than intuitively grasping such input without the need for conscious analysis), or to neurophysiological changes in the adult brain (i.e., lateralization and loss of neural plasticity). The reason for these changes limiting the adult's ability to acquire second languages may well have its origins in evolutionary biology stemming from a need for members of speech communities to be mutually intelligible as a matter of survival.

It seems clear, then, that when it comes to learning a second language, the sooner the individual begins learning the better. While there is evidence to show that adults can acquire vocabulary throughout their lives, other language domains become increasingly difficult to master the older they become, particularly phonology and grammar, and that adults who attempt to learn a second language must rely on imperfect processing systems to analyze and interpret language input as opposed to children who are able to process such input innately.

The implications of this for English language education in Japan are to address the relatively low proficiency level of Japanese nationals by introducing English education earlier in elementary schools. In a recent survey in 2022 of 112 non-English speaking countries and regions, Japan ranked 80th, behind all Asian countries surveyed ("Japan's English Proficiency Falls", December 8, 2022). In recognition of this problem, the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) has introduced educational reforms designed to increase English-language proficiency.

There are several main changes in the new guidelines. First, in elementary school, the current requirements for students in the fifth and sixth grades to take part in English-language activities are brought forward to the third and fourth grades. Fifth- and sixth-grade students will take English as a full-fledged subject. ("Chronic Reforms", July 3, 2018)

Introducing English language education to students while they are still within the boundaries of the critical period for language acquisition only makes sense in our increasingly globalized world. For Japanese nationals, learning a second language early in life will help to give them a competitive edge and, as was the case with early humans and their need to be mutually intelligible, may even be a matter of survival, in this case, economic survival.

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