

Perspectives on a Critical Period for Language Acquisition: Implications for language research and practice

Jayeon Lim
(The University of Seoul)

1. Introduction

We all tend to accept the view that it is better to learn languages as early as possible. In fact, the idea that languages must be learned during childhood to achieve native-speaker fluency has been widely supported by educators for over a century (Colombo, 1982). Both researchers and educators argue for this “younger is better” approach build their claims on the notion of critical or sensitive period hypothesis. This paper begins with a brief history of the critical period concept. In this overview of the critical period, we will see that the terms ‘critical period’, ‘sensitive period’, or ‘windows of opportunity’ are used in a number of different fields, with slightly different meanings (Bauer, 2001). Although a critical or sensitive period may be used by different people with sometimes conflicting meanings, this paper will address that there is a common idea that unites these varied definitions. The common idea is that having a certain kind of experience at one point in development has a profoundly different impact on future behavior than having that same experience at any other point in development.

Given the above idea, I will then investigate the following unanswered

【Keywords】 language, language acquisition, critical period hypothesis, sensitive period hypothesis

questions in critical or sensitive period research: First, what exactly is a critical period, and what are the evidence for it in language acquisition? Second, what is the criteria in defining a critical period? In this article, the issues are addressed by reviewing the available evidence on a critical period for human language acquisition, and then by asking whether this evidence meets the expected criteria for the critical periods in both human and nonhuman learning. Through this, we will be able to evaluate other critical period claims and their possible implications for language acquisition.

2. What is a critical period?

The critical period hypothesis states that there is a limited developmental period during which it is possible to acquire a language, whether it is first language or second language, to normal, native-like levels (Birdsong, 1999). Once this window of opportunity has passed, however, the ability to learn language declines. Lenneberg (1967) states that maturational processes constrain abilities for normal language acquisition. Reduction of neural plasticity after puberty due to the completion of cerebral lateralization. prevents complete attainment of a first or second language. Based on the clinical evidence that children with left hemispherectomy did not exhibit major language disorders, as opposed to adults, Lenneberg claimed that the transfer of language function from the left hemisphere to the right hemisphere is possible in prepubertals.

Given the above claims, a critical or sensitive period for learning can be found when there is a relationship between the age at which a crucial experience is presented to the learner and the amount of learning that results (Newport, Bevelier, & Neville, 2001). In most organisms with critical or sensitive period,

the critical time for learning usually occurs during some early years in life. The important characteristic is that there is a peak period of plasticity, occurring at some maturationally defined time in development, followed by reduced plasticity later in life. However, this may not be the necessary case for some domains and systems. For example, plasticity has been shown to characterize and sensory and motor maps even in adult mammalian brains (Kaas, 1991, cited in Weber-Fox & Neville, 1996). Yet, many such changes that arise from experience occur typically during specific critical or sensitive periods. A general principle that emerges from a variety of studies is that the effect of experience in many cases diminishes with maturation.

Until Lenneberg (1967) published his seminal work, the concept of critical period had not received much attention. Until then, it was assumed that if language acquisition were driven largely by biological mechanism, there would be a critical period for its development. Lenneberg noted that language development has parallels in other domains, such as motor development, that are assumed to be driven largely by biological maturation. He pointed out that just as walking and grasping follow a relatively predictable maturational timetable, the same occurs for many aspect of language development.

2.1. Evidence for a critical period in language acquisition:

behavioral and neural

2.1.1. Behavioral evidence from first language acquisition

Evidence of a critical period in development, in its best form, should originate from carefully controlled studies. In reality, however, the actual evidence available on a critical period in language acquisition cannot come

from any controlled studies due to ethical reasons. One would not imagine denying a person of an experience on language at an early period in life. Yet, history has allowed us to look into some of the rare cases of children who have been deprived of normal social and linguistic interaction during their first years of life.

These feral or abused children, isolated from exposure to their first language until after puberty (Curtiss, 1977) show severe deficits in their normal language development even when they are exposed to language later in life. Although the possibility that these children had mental retardation to begin with has been raised so as to refute a critical period, the fact that more extreme deficits occurred in phonology, morphology and syntax makes us believe that a critical period was responsible for their diminished language development.

Less extreme cases of a critical period for first language acquisition involve deaf populations. Newport (1990) studied deaf signers of American Sign Languages (ASL) who were first exposed to ASL at different ages. There were three groups in the study: native learners, early learners, and late learners whose respective age of first exposure to ASL were infancy, ages 4-6, and after puberty. Newport administered various tests of signing ability to subjects. At the time of the experiment, all subjects had at least 30 years of daily use of ASL. The results showed that only those who began learning ASL before 6 had demonstrated native-like fluency. Specifically, although all signers mastered basic word order, only native signers mastered morphology. The group who began learning between the ages of 4 and 6 showed subtle nonnative characteristics in their ASL. These early signers used morphology better than late signers, but not as well as native signers. Those in the postcritical period group demonstrated significant deficits that are typically the mark of non-native speakers. These late signers exhibited inconsistent use of morphology and used whole-word signs with no morphological structure.

2.1.2. Behavioral evidence from second language acquisition

A number of researches support the existence of a critical period for second language acquisition. First, many studies in language acquisition have supported for a close relationship between the age of exposure to a language and the ultimate proficiency level achieved by a language learner (see, for example, Newport, 1990; Johnson & Newport, 1989; Patkowski, 1980; Pallier, Bosch, & Sebastian-Galles, 1997, among many others). For instance, those who achieve a native-like proficiency, especially in phonology and syntax, in a certain language are mostly the ones who were first exposed to the language during their infancy. As age of exposure increases, average proficiency in language declines, beginning as early as ages 4 to 6 and continuing until proficiency plateaus for adult learners (Johnson & Newport, 1989, 1991; Newport, 1990).

Among the above-mentioned studies, Johnson and Newport (1989) study is worth mentioning. These researchers studies native speakers of Chinese and Korean with an untimed, grammatical judgement task present auditorally (with a written response) using a variety of English grammatical structures. Age of second language acquisition (with a written response) using a variety of English grammatical structures. Age of second language acquisition correlated with grammatical judgement scores between the ages of 3 and 15 ($r = -.87$) but not between the ages of 17 and 39 ($r = -.16$). These findings were interpreted to mean that the ability to acquire any language, first or second, disappears with increasing maturation. Two subsequent studies failed to replicate this non-linear function between age of second language acquisition and grammatical outcome, however.

First, Flege et al. (1999) tested Korean learners of English with procedures similar to those used by Johnson and Newport (1989). Pre-puberty ages of acquisition correlated with grammatical outcome (3-12 years, $r = .52$) but,

importantly, post-puberty ages also correlated with grammatical outcome (13-21 years, $r = .27$). In another study, Birdsong and Molis (2001) used the same methods and English stimuli as Johnson and Newport (1989) but with native Spanish speakers. Age of second acquisition did not correlate with grammatical outcome between the ages of 3 and 15. This was primarily due to ceiling effects; many second language learners performed within the range of the native English speakers. Moreover, age of second language acquisition correlated with grammatical outcome at ages well beyond childhood, specifically between the ages of 17 and 44 ($r = -.69$), corroborating the findings of Flege et al. (1999). These studies have been claimed to run counter to the existence of a critical period in second language learning.

One final important point is that age of exposure does not affect all aspects of language acquisition at the same rate. For example, late learners acquire the basic word order of a language relatively well, but more complex aspects of grammar show strong effects of late acquisition (Johnson & Newport, 1989; Newport, 1990). Very recent studies have reported that late learners may not have problem in acquiring lexical stress but display difficulty in acquiring the phonetic information that are important in being judged as native-speakers (Sanders, Yamada & Neville, 1999). Clearly, further studies are needed to characterize the exact nature of the areas which show strong effects of age of learning.

2.1.3. Neural evidence from language acquisition

In addition to the behavioral evidence mentioned above, recent studies have produced neural evidence. For example, PET (positron emission tomography), fMRI (functional magnetic resonance imaging) and ERP (event-related potential) studies all indicate strong left hemisphere activation for the native

speakers and early bilinguals. However, with second language learners whose age of exposure are relatively late (after 7 years), the regions and patterns of activation partially or completely nonoverlap with those for the native language. Neural organization for late-learned languages displays less lateralization and a high individual variability (Weber-Fox & Neville, 1996; Dehaene et al., 1997).

Neural evidence points to the possibility of different specificity depending on the aspects of language, supporting Johnson and Newport (1989) and Newport (1990). For example, age of exposure had a stronger effects when it comes to processing grammar in the brain than on processing semantics (Weber-Fox & Neville, 1996). Chinese-English bilinguals, who began learning English as late as 16 years did not display the organization of the brain system when it comes to lexical/semantic processing: when responding to the appropriateness of open class content words in English sentences, all groups of learners display similar distribution of evoked potential components over the posterior regions of left and right hemispheres. In a stark contrast, when these bilinguals were tested on the grammaticality of English syntactic constructions or the placement of closed class function words in sentences, only early learners showed the characteristic anterior left hemisphere ERP components; learners with delays as little as 4 years showed significantly more activation in both hemispheres (Weber-Fox & Neville, 1996). Similar results found among American Sign Language speakers (Neville et al., 1997) support the previous studies.

In sum, we could say these results, behavioral and neural, provide fairly strong evidence for a critical or sensitive period in the acquisition of phonology and semantics. Nonetheless, the question of whether there is a critical period for language acquisition still remains controversial. Therefore, in the next section, I will address some of the theoretical questions concerning what a critical or sensitive period for language acquisition may constitute.

2.2. Evidence of a nonlinguistic critical period

The concept of a critical period is widely known in nature and certainly not something restricted to humans (see Eubank & Gregg, 1996 for a review). In fact, one well known example comes from the study on the development of the visual system (Hubel & Wiesel, 1970). In their seminal experimental study, kittens were deprived of normal visual experience (by eye closure). The researchers in the study systematically varied both the age and the duration of the deprivation. They found that as little as three days of deprivation beginning at age 23 days cut the normal vision development from 98% to 50%. They concluded that “These experiments show that the sensitive period has a duration of at least several weeks, during which a few days of closure causes a marked cortical changes” (Hubel & Wiesel, 1970, p.425). This experiment, which ensured that the experimental subjects received the same experimental manipulation at different ages and for different durations, clearly shows that there is a sensitive period to single-eye closure in the development of the cat’s visual system. What they call the period of susceptibility or the critical vulnerable period begins shortly after birth and lasts until age 2 months. Within this period there is a time of heightened sensitivity to the experimental manipulation lasting through the fourth and fifth weeks of life. Hubel and Wiesel call this period of heightened sensitivity the sensitive period.

Another well known example comes from studies on barn owls. Knudsen (1988), in his study found that auditory localization in the barn owl displays full adjustment of a monaural ear plug if the plug is inserted early; with later and later ages of plug insertion (during adolescence), there is a gradually reduced degree of error correction achieved; and adult barn owls show only a limited ability to correct for plugs. At the same time, the amount of correction shown at

various ages is greater for removing an earplug than for inserting earplug, suggesting that plasticity during the intermediate stages of development is also differentially responsive to experiences for which the system is best tuned (for the barn owl, apparently the 'normal' settings, where both ears are open or balanced in the auditory input they receive) versus experiences for which the system is not. Similar gradual declines in learning, involving intermediate degrees of plasticity and differential sensitivity to strong or weak stimuli, are also found in imprinting (Hess, 1973) and in certain aspects of avian songs learning (Eales, 1987).

As shown above, the hypothesis that the age of immersion in a language learning as well as other learning has differential effects on the outcome of the learning is a valid one. Within the systems, be it linguistic or nonlinguistic, the nature of sensory input significantly affects the development of specific neurophysiological and behavioral processes. Moreover, different functions within a system display distinct vulnerabilities to altered timing of input during development. For example, within the visual system, the timing of abnormal visual experience differentially affects the development of different domains in the visual system (e.g., stereopsis, monocular spatial resolution, and spectral sensitivity). The same is true for language development. Studies on feral children and deaf adults found specialized systems that mediate different aspects of language may be distinct in their susceptibilities to alterations in the timing of language learning. That is, particular aspects of language have been found to be more profoundly impacted by delays, for example, grammatical functions of language. Other aspects such as vocabulary are relatively unaffected by delays in language immersion.

3. Some theoretical questions concerning a critical period in language acquisition.

Given the discussion on what a critical period means and what constitutes a valid evidence for a critical period, several major questions concerning a critical period in language acquisition need to be discussed. First, does a critical period imply that no late learners can achieve native-like proficiency? How can we interpret findings that a few late learners who have displayed native or near-native proficiency? Some SLA researchers have claimed that the concept of a critical period would not be valid if we find any learners, however small in number that may be, who have shown native-like achievement after puberty. (Birdsong, 1999; White & Genesee, 1996). However, there are a number of explanations for the individuals who have achieved native-like proficiency post-critical period.

To begin with, examination of individual differences in language development reveals more variability, suggesting that even if there is a critical period for language learning, they may be influenced by individual differences to a nonsignificant degree. Thus the individual differences in biological and environmental factors necessarily are responsible for making the effects of a critical period on individuals look ambiguous (Bortfeld & Whitehurts, 2000).

The phenomenon of expressive language delay is one important example such individual variability in the time course of language development. As reviewed by Whitehurts and Fischel (1994), children who will eventually achieve similar linguistic outcomes during the elementary school years may include those who will have hundreds of words in their vocabularies at 2 years of age and who are combining those words into multiword sentences, and those who will have virtually no expressive vocabulary at 2 years of age. Likewise,

there are children who will have acquired mature expressive control over the phonology of their language by age 4, and others whose expressive phonology will be incomprehensible to others at this age, yet most of the children with articulation delays will catch up to their peers by elementary school. From an educational or policy perspective, it is particularly important not to confuse children at the slower end of the normal curve of language development with children who have missed some vaguely defined critical period for development.

Second, is it possible to distinguish a critical period from an interference effect? Late learners of a second language have used their native language significantly longer than early learners, and therefore do show a high proficiency in that language. However, this does not necessarily imply that difficulty in acquiring a second language is due to interference rather than to a critical period.

Previous SLA studies have attested two accounts in the interpretations of age effects: maturational and exercise hypothesis (Long, 1993). For example, maturational hypothesis asserts that there might be maturational changes in the plasticity of the system, so that learning is reduced or no longer possible after the critical period. The exercise hypothesis states that there might also be effects of early experience which change the capacity of later experiences to affect the system further.

Unlike in second language acquisition, where these two accounts have been considered as competing with each other, claims in developmental psychology attest that early experience always interacts with maturation, and both accounts are interpreted as critical or sensitive period effects. For example, according to Bateson (1979), birds isolated in their cages during the critical period are not deprived of their early experience, but will learn from whatever they are exposed to. That is, regardless of the types of the early experiences, early

learning will occur which will have priority over later learning.

One implication from this view is that separating maturational change and interactions between early and later learning are extremely difficult, if not impossible. In fact, maturational and interference effects may actually be different descriptions of the same process (Newport, Bavelier, & Neville, 2001). Some SLA researchers who argue that age effects arise from interference of the first language on the second (Flege, 1999; McCandliss et al., 1998, among many other versions of this claim). Such claims by Flege and others cannot explain the late acquisition of a first language: Why should the late acquisition of a first language be limited if there has been no prior learning of another language? If one hypothesizes that early linguistic input narrows the language systems to what has been experienced, both late first or second language acquisition should suffer, and maturational and interference accounts become inseparable.

Thirdly, if language learners exhibit differences in language development according to their social environments, does it constitute evidence against a critical or sensitive period? Bortfeld and Whitehurst (2000) argue against such view. If is possible, for instance, that high frequency parent-child language interactions have their strongest effects during the preschool period, and that similarly rich verbal interactions at later points in a child's development might not make up for relative deprivation of these interactions during early childhood. In other words, any studies demonstrating differences in language development according to differences in experience within a common developmental framework, are entirely consistent with the possibility that the time frame is a sensitive period for such development.

Fourth, some researchers such as Bialystok and Hakuta (1999) claimed that a critical period must involve an abrupt decline and a total loss of plasticity at the end. Supports for such position comes from some animal studies such as ducks imprinting, where a critical period lasts only for a very limited time with an

abrupt ending. Hence, it is an all-or-nothing matter for ducks to imprint their attachment figure. However, as we have seen in the previous section on evidence from nonlinguistic organisms imply that critical periods in some animals do not necessarily point to an abrupt ending followed by a complete loss of plasticity.

Finally, if there are differing ages at which learning declines for different aspects of language (such as phonology versus syntax, or different aspects of syntax), does this mean that there is no true critical period, or that there are multiple critical periods as Seliger claimed as early as 1978? In the language acquisition studies, a number of investigators have found different ages of decline in plasticity for syntax versus phonology or for other aspects of language (Flege, Yeni-Komshian & Liu, 1999). The results indeed suggested that multiple critical periods for different aspects of language (Flege, Yeni-Komshian & Liu, 1999; Scovel, 1988; Long, 1990). According to Newport, Bavelier & Neville (2001), we can find even more distinctive contrasts between the formal (phonological or grammatical) aspects of language versus those that deal with meaning (semantic or lexical), where the former show strong changes in acquisition over age, while the latter appear to show little or no effect of age of learning (Weber-Fox & Neville, 1996; Johnson & Newport, 1989).

At present, it is not clear whether differing critical period effects always indicate the existence of distinct subsystems within a language system, having differing critical periods (or no critical period), or differing effects are merely because one structure is more difficult than another. The contrast in developmental plasticity between formal (phonological and grammatical) versus semantic aspects of language appears to be widespread and consistent with other types of evidence suggesting separately developing subsystems (Newport, 1981; Newport, Gleitman & Gleitman, 1984). But it is less clear whether there are different critical periods for phonology and syntax (Newport,

Bavelier & Neville, 2001). Does phonology appear to show an earlier decline in plasticity, as compared with syntax, because it truly has a different critical period? Or does it show these differences because the aspects of phonology we have tested are more difficult than those we have tested for syntax? Future research will need to consider how to distinguish a contrast across subsystems, displaying different developmental timetables and types of plasticity, from effects of stimulus strength and complexity.

Given the above claims, research in the area of a critical period is only in its infancy, especially in brain development (Neville & Bruer, 2001). There is certain to be variability in how early experience may affect brain organization. This variability may occur both within and between systems. In addition, within systems in which there are critical periods, these periods can differ for specific subsystems.

4. Implications for research and practice

It is true that studies on a critical period has produced more questions than answers so far. However, given the findings stated above, several future directions for research and practice are clear. First, different windows open at different times. Thus, in the field of education, teachers and parents need to know general developmental milestones so that we know when it is and is not appropriate to focus on specific skills. Although we know a great deal about development already, research is needed to clarify when windows of opportunity generally open for certain specific skills, and this information needs to be made available to parents and teachers in a much more accessible format.

Second, researchers have to make it clear that both parents and teachers remember each learner follows a unique developmental course. Thus, knowing

general developmental milestones does not ensure that we know when to begin to provide certain kinds of experiences for an individual child. Effective parents and teachers are aware of each child's level of development and provide experiences that are challenging enough to promote development but not so challenging that they result in constant failure or frustration. Research is needed on how best to identify individual opportunities for learning, and tools are needed that parents and teachers can use with individual children.

Third, there is no point in trying to teach something if the window is not yet open. For example, a 12-month-old child is not ready to learn letters of the alphabet. Thus, providing these experiences earlier would make little sense and, in fact, could easily be harmful. McCall and Plemons (2000) even claim that more stimulation than the minimum necessary to maintain and promote basic functions is not always beneficial and can be harmful, especially when such stimulation is forced on children and it becomes aversive. Indeed, nature has built the human infant to shut out excessive stimulation by closing the eyes, turning the head away, arching the back, and crying *inexcessively*. We need research that helps us understand the potential negative consequences of too much stimulation of the wrong type, and this information needs to be made more accessible for families and teachers.

5. Conclusion

The ultimate purpose for having discussions on a critical period is to improve our understanding of the mechanisms regulating early development. By understanding what we know and do not know about early development from both a brain and behavior perspective, informed and rational interventions designed to alter development can be tested.

Works Cited

- Bailey, D. B., Bruer, J. T., Symons, F. J., & Lichtman, J. W. (Eds.) *Critical thinking about critical periods*. Baltimore, MD: Paul H. Brookes Publishing Co., 2001.
- Bateson, P. How do sensitive periods arise and what are they for? *Animal Behavior*, 47-48. (1979)
- Bialystok, E. & Hakuta, K. Confounded Age: Linguistic and cognitive factors in age differences for second language acquisition. Chapter 7 in D. Birdsong (Ed.), *Second language acquisition and the critical period hypothesis*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.
- Birdsong, D. (Ed.) *Second language acquisition and the critical period hypothesis*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.
- Bortfeld, H. & Whitehurst, J. T. Sensitive period in first language acquisition. Chapter 9 in Bailey, D. B., Bruer, J. T. Symons, F. J., & Lichtman, J. W. (Eds.) *Critical thinking about critical periods*. Baltimore, MD: Paul H. Brookes Publishing Co., 2000.
- Bruer, J. T. A critical and sensitive period primer. Chapter 1 in Bailey, D. B., Bruer, J. T. Symons, F. J., & Lichtman, J. W. (Eds.) *Critical thinking about critical periods*. Baltimore, MD: Paul H. Brookes Publishing Co., 2001.
- Colombo, J. The critical period concept: Research, methodology, and theoretical issues. *Psychological Bulletin*, 9, 260-275 (1982).
- Dehaene, S., Dupoux, E., Mehler, J., Cohen, L., Perani, D., van de Moortele, P. F., Leherici, S., & Le Bihan, D. Anatomical variability in the cortical representation of first and second languages. *Neuroreport*, 17, 3809-3815 (1997).
- Eales, L. A. Do zebra finch males that have been raised by another species still tend to select a conspecific song tutor? *Animal Behavior*, 35, 1347-1355 (1987).
- Eubank, L. & Gregg, K. Critical periods and (second) language acquisition: divide et impera. Chapter 4. In D. Birdsong (Ed.), *Second language acquisition and the critical period hypothesis*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.
- Flege, J. E. Age of learning and second-language speech. In D. Birdsong (Ed.), *Second language acquisition and the critical period hypothesis*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.
- Flege, J. E., Yeni-Komshian, G. H., & Liu, S. Age constraints on second language acquisition.

- Journal of Memory and Language*, 41, 78-104 (1999).
- Hess, E. Imprinting. NY: D. Van Nostrand. Hewlett, B. S. (ed.) *Father-child relations: Cultural and biosocial contexts*. NY: Aldine, 1973.
- Hubel, D. H. & Wiesel, T. N. The period of susceptibility to the physiological effects of unilateral eye closure in kittens. *Journal of Physiology*, 206, 419-436 (1970).
- Johnson, J. S. & Newport, E. L. Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology*, 21, 60-99 (1991).
- Johnson, J. S. & Newport, E. K. Critical period effects on universal properties of language: The status of subadjacency in the acquisition of a second language. *Cognition*, 39, 215-258 (1989).
- Kaas, J. H. Plasticity of sensory and motor maps in adult mammals. *Annual Review of Neuroscience*, 14, 137-167 (1991).
- Knudsen, E. I. Capacity for plasticity in the adult owl auditory system expanded by juvenile experience. *Science*, 279, 1531-1533 (1998).
- Lenneberg, E. *Biological foundations of language*. New York: John Wiley & Sons, 1967.
- Long, M. H. Second language acquisition as a function of age: research findings and methodological issues. In Hyltenstam, K. and Viberg, A. (Eds.), *Progression and regression in language*. New York: Cambridge University Press, 1993.
- Long, M. Maturational constraints on language development. *Studies in Second Language Acquisition*, 12, 251-285 (1990).
- McCall, R. B. & Plemons, B. W. In Bailey, D. B., Bruer, J. T. Symons, F. J., & Lichtman, J. W. (Eds.) *Critical thinking about critical periods*. Baltimore, MD: Paul H. Brookes Publishing Co., 2001.
- McCandliss, B., Fiez, J., Conway, M., Protopapas, A., & McClelland, J. Eliciting adult plasticity: Both adaptive and non-adaptive training improves Japanese adults' identification of English /t/ and /l/. *Society for Neuroscience Abstracts*, 24, 754.10 (1998).
- Neville, H. & Bruer, J. T. Language processing: How experience affects brain organization. In Bailey, D. B., Bruer, J. T. Symons, F. J., & Lichtman, J. W. (Eds.) *Critical thinking about critical periods*. Baltimore, MD: Paul H. Brookes Publishing Co., 2001.
- Newport, E. L. Maturational constraints on language learning. *Cognitive Science*, 14, 11-28 (1990).

- Newport, E. L. Constraints on structure: Evidence from American Sign Language and language learning. In W. A. Collins (Ed.), *Minnesota Symposium on Child Psychology*. Hillsdale, NJ: Lawrence Erlbaum Associates, 1981.
- Newport, E. L., Bavelier, D., & Neville, H. J. Critical thinking about critical periods: Perspectives on a critical period for language acquisition. In E. Dupoux (Ed.), *Language, Brain and Cognitive Development: Essays in Honor of Jaques Mehler*. Cambridge, MA: MIT Press, 2001.
- Newport, E. L., Gleitman, H., & Gleitman, L. R. Mother, I'd rather do it myself: Some effects and non-effects of maternal speech style. In C. E. Snow & C. A. Ferguson (Eds.), *Talking to Children: Language Input and Acquisition*. Cambridge: Cambridge University Press, 1984.
- Neville, H. J., Coffey, S. A., Lawson, D. S., Fischer, A., Emmorey, K., & Bellugi, U. Neural systems mediating American Sign Language: Effects of sensory experience and age of acquisition. *Brain Language Development*, 57, 285-308 (1997).
- Pallier, C., Bosch, L., & Sebastian-Galles, N. A limit on behavioral plasticity in speech perception. *Cognition*, 64, B9-B17 (1997).
- Patkowski, M. The sensitive period for the acquisition of syntax in a second language. *Language Learning*, 30, 449-472 (1980).
- Sanders, L., Yamada, Y., & Neville, H. Speech segmentation by native and non-native speakers: An ERP study. *Society for Neuroscience*, 25, 358-383 (1999).
- Scovel, T. *A time to speak*. New York: Newbury House, 1988.
- Weber-Fox, C. & Neville, H. J. Fundamental neural subsystems are differentially affected by delays in second language immersion: ERP and behavioral evidence in bilinguals. Chapter 2. In D. Birdsong (Ed.), *Second language acquisition and the critical period hypothesis*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.
- Weber-Fox, C. & Neville, H. J. Maturation constraints on functional specializations for language processing: ERP and behavioral evidence in bilingual speakers. *Journal of Cognitive Neuroscience*, 8, 231-256 (1996).
- White, L. & Genesee, F. How native is near-native? The issue of ultimate attainment in adult second language acquisition. *Second Language Research*, 12, 238-265 (1996).
- Whitehurst, G. J., & Fischel, J. Early developmental language delay: What, if anything should the clinician do about it? *Journal of Child Psychology and Psychiatry*, 35, 613-648, (1994).

[Abstract]

**Perspectives on a Critical Period for Language Acquisition:
Implications for language research and practice**

Jayeon Lim
(The University of Seoul)

In recent years there has been much discussion about whether there is a critical, or sensitive period for language acquisition. Research on a critical period provides an excellent example around which we can organize a discussion of the behavioral and neural evidence. In this paper, the early history of critical periods and evidence for the existence of critical periods in various domains of human cognition and learning are reviewed. Followed by this overview, evidence for a critical period in both linguistic and nonlinguistic area are presented. The paper then provides some unresolved questions regarding a critical period in language acquisition and states what the outcome of this issues mean for an understanding of language acquisition. Finally the paper concludes with some educational implications of a critical period for practice.

접 수 일 : 2005년 4월 21일
심사기간 : 2005년 4월 29일~5월 20일
재 심 사 : 2005년 5월 30일
게재결정 : 2005년 6월 4일(편집위원회)