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Critical Thinking About Critical Periods

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A Critical Period for Second Language Acquisition?

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The critical period hypothesis for second language (L2) learning has found resonance in a variety of policy positions regarding when an L2 should be introduced in the curriculum. For immigrant students, in a 1998 court declaration urging that such students be exposed to English as early as possible, an advocate wrote, "The optimal time to learn a second language is between age three and five or as soon thereafter as possible, and certainly before the onset of puberty" (Porter, 1998, p. 1). Porter is a leading advocate for English-only approaches to the education of language minority students and an opponent of bilingual education programs because they delay intensive instruction in English. She has found the critical period hypothesis to be in support of her position.

Advocates for the early introduction of foreign language in the elementary schools, dating back to the Foreign Languages in the Elementary Schools (FLES) programs of the 1960s, also have found an important ally in the critical period hypothesis. For example, the New Jersey State Department of Education's World Languages Curriculum Framework cited critical period research to make the following point: "With each year of growth, children are less able to filter out fine distinctions among the sounds of other languages. After early childhood, the language acquisition mechanism becomes highly structured creating an interference effect that may account for the difficulty in learning languages at a later time" (1999, p. 7).

Such statements draw on the critical period hypothesis for L2 acquisition, the origins of which are attributed to Penfield and Roberts (1959) and more prominently perhaps to Eric Lenneberg (1967), who amassed evi-

dence in support of the view that first language (L1) acquisition is a biologically constrained process, with a specific timetable ending at puberty. In a single paragraph, Lenneberg speculated about the implications for L2 acquisition, noting that after puberty, second languages are acquired consciously and with great effort, and often not successfully (see Chapter 9). The purpose of this chapter is to make assumptions underlying this hypothesis and to highlight what is known and not known about its empirical status.

FIRST LANGUAGE (L1) ACQUISITION

A brief foray of the standard version of the critical period hypothesis for L1 acquisition is in order. The clearest account can be found in Pinker (1994). This view is based on Chomsky's account of linguistic competence—an abstract set of rules and representations that is highly specific to language (i.e., organized differently from other mental capacities, e.g., visual cognition) and an innate component of the human mind. The standard argument is that it is logically impossible for a child to acquire linguistic competence of this complexity through the types of exposure to language that children receive in their home environment. The argument states that a specialized biological program must exist for language acquisition, similar to the programmed course of development of physical systems such as vision, digestion, and respiration. As long as children are exposed to a threshold amount of linguistic exposure during the critical period, they will all uniformly acquire linguistic competence, much as children develop similar physical organs despite considerable variation in nutrition. And, if they are deprived of this exposure during the critical period, no amount of exposure after it can compensate for it.

Direct evidence in support of the critical period for L1 acquisition is thin and based on theoretical arguments and analogy to other well-explored developmental processes, such as visual development in the cat (Hubel, 1988). Most children are exposed to language early in life and acquire it successfully. Indeed, the first argument in favor of a critical period is its uniformity in spite of considerable environmental variation in the ways that parents talk to children. For ethical reasons, experiments in which infants are deprived of exposure to language during the putative critical period are not conducted. Other evidence in support of the hypothesis comes from unusual, tragic cases of language deprivation resulting from child abuse, and from studies of deaf children who are born to hearing parents, but who are exposed to American Sign Language (ASL) at a later age. Nevertheless, the hypothesis is commonly accepted. As Pinker stated, "Acquisition of a normal language is guaranteed for children up to the age of six, is steadily com-

promised from then until shortly after puberty, and is rare thereafter" (1994, p. 293).

ELEMENTS OF THE CRITICAL PERIOD HYPOTHESIS FOR SECOND LANGUAGE (L2) ACQUISITION

In theorizing about a putative critical period for L2 acquisition, a key framing question is whether L2 acquisition recapitulates the L1 acquisition process (a hypothesis known in literature as the L2=L1 hypothesis), or alternatively, whether L2 acquisition is a cumulative process that builds on the competence already developed in L1. If the L1=L2 hypothesis is correct, then the evidence for or against a critical period for L1 acquisition is relevant to L2 acquisition. However, if the cumulative model is correct, the evidence from L1 acquisition is irrelevant to answering the question about L2 acquisition.

The research evidence on the nature of L2 acquisition is clear on two points, but they are contradictory. First, with respect to rate of acquisition, there is evidence that linguistic similarity between the L1 and L2 matters (Odlin, 1989). A native speaker of Spanish will acquire English more rapidly than would a native speaker of Chinese, all other things being equal, because of the linguistic similarity between Spanish and English. This evidence would imply that the cumulative model is correct. Second, with respect to error patterns and the overall qualitative course of L2 acquisition, there is a similarity across speakers of different languages learning a given L2, indicating that more than a simple transfer from L1 to L2 is occurring (Bialystok & Hakuta, 1994). Indeed there is some sort of reenactment of the L1 acquisition process at work. As for Lenneberg, the originator of the critical period hypothesis for L2, it appears that he favored the cumulative model when he wrote that "we may assume that the cerebral organization for language learning as such has taken place during childhood, and because natural languages tend to resemble one another in many fundamental aspects, the matrix of language skills is present" (1967, p. 176). In any event, the jury is still out as to whether L2 is a recapitulation of L1 acquisition or an add-on process. What would be the key elements of a critical period in L2 acquisition?

1. *Clearly specified beginning and end points for the period:* Lenneberg suggested puberty, and others have followed suit. Johnson and Newport (1989) considered age 15 to be the end of the critical period. As noted previously, Pinker considered it to begin at age 6 and end at puberty. For present purposes, assume that the critical period hypothesis is set by puberty and ends at age 15. In any event, any claim to a critical period for L2 acquisition should be specific about an end point.

2. *Well-defined decline in L2 acquisition at the end of the period:* The ability to learn things declines with age, such as learning to ride a bicycle, yet it would not be stated that there is a critical period for cycling. *A general decline in learning is not strong evidence for a critical period for L2 acquisition.* The appeal of a critical period hypothesis lies in its specificity, that is, its ability to target specific learning mechanisms that get turned off at a given age (Birdsong, 1999). Thus, one important piece of evidence would be if a rapid decline could be found around the end of the critical period, rather than a general monotonic and continuous decline with age that continues throughout the life span.
3. *Evidence of qualitative differences in learning between acquisition within and outside the critical period:* A critical period is assumed to be caused by the shutting down of a specific language learning mechanism. Therefore, any learning that happens outside of the critical period must be the result of alternative learning mechanisms. If that were the case, then there should be clear qualitative differences in the patterns of acquisition between child and adult L2 learners. For example, if certain grammatical errors could be found among adult learners that are never found in child learners, or if child learners were able to learn specific aspects of the language that adults could not learn, then this would be strong evidence for a critical period.
4. *Robustness to environmental variation inside the critical period:* Another attraction of the critical period hypothesis is that there is a threshold level of exposure with uniformed outcomes, even with considerable environmental variation. The environment might play a larger role beyond that period and the outcomes would become more variable.

JOHNSON AND NEWPORT'S STUDY

A study by Johnson and Newport (1989) reported results consistent with the critical period hypothesis. The study's results are cited as authoritative evidence for a critical period in L2 acquisition. In their study of native speakers of Chinese and Korean who came to the United States at ages ranging from 3 to 39 years old, they asked individuals to identify grammatical and ungrammatical sentences that were presented auditorily. They reported that prior to age 15 there was a negative correlation with age, but after age 15 there was no correlation with age (satisfying conditions 1 and 2). In addition, the adult learners showed great variability in learning outcomes, whereas the child learners did not (condition 4).

A reanalysis of the data by Bialystok and Hakuta (1994), however, revealed some problems with the original interpretation. Bialystok and Hakuta argued that the data showed a discontinuity not at puberty but rather

at age 20, and that there was statistically significant evidence for a continued decline in L2 acquisition well into adulthood. It is likely that the peculiarities of the sample (students and faculty from the University of Illinois at Urbana-Champaign) could have further complicated their results. A picture of the reanalysis is shown in Figure 10.1. The data show a continuous decline with age of arrival, which is not consistent with condition 2. Furthermore, the data patterns suggest two distinct groups of subjects, those before and after age 20, both of which show declining performance with age. The study should not be considered definitive in light of its sampling limitations.

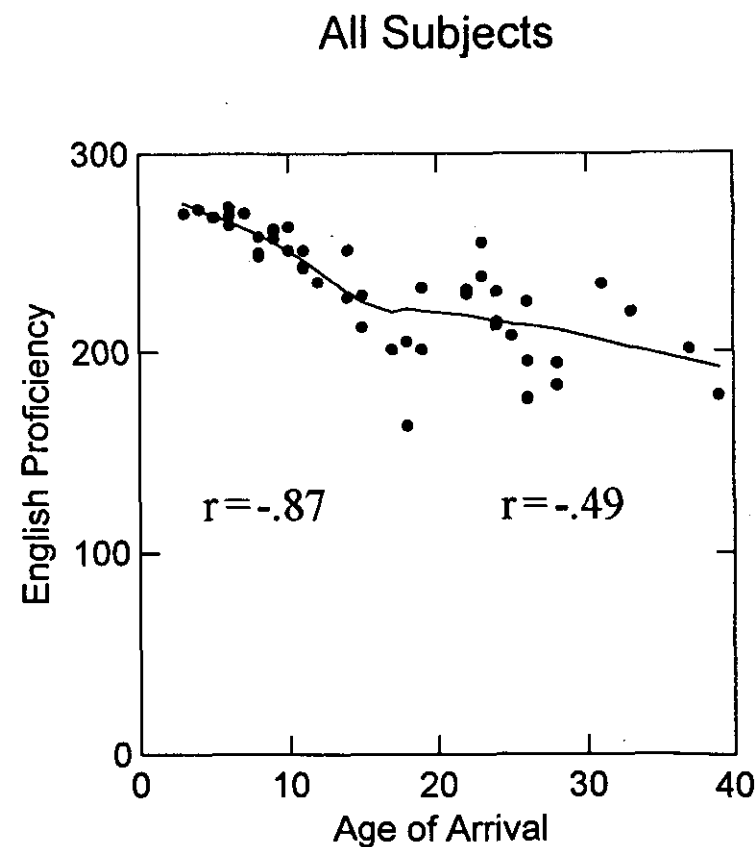
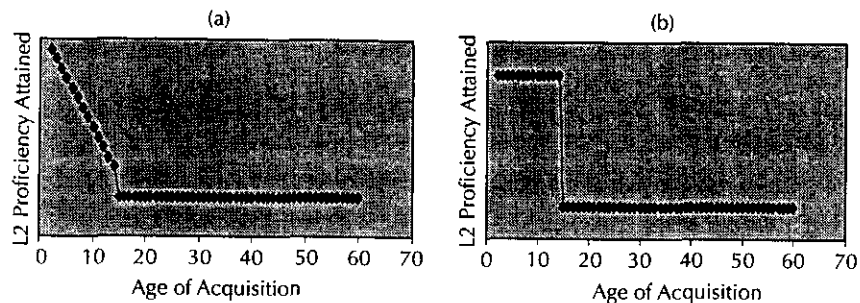


Figure 10.1. Reanalysis of Johnson and Newport (1989) study showing discontinuity at age 20, and continued decline in adult subjects. (From Bialystok, E., & Hakuta, K. [1994]. *In other words: The science and psychology of second-language acquisition*. New York: Basic Books; reprinted by permission.)



Figures 10.2a and 10.2b. Some theoretical predictions of the critical period hypothesis showing disruption at predicted end of the critical period.

CONDITIONS 1 AND 2: END POINT FOR THE CRITICAL PERIOD AND DISCONTINUITY AT THAT POINT

Theoretically, the critical period hypothesis generates a prediction that should look like Figure 10.2a or 10.2b, with a disruption occurring at the predicted age point. The difference may be in slope breaking at the age point, as in Figure 10.2a, or the slopes may be the same on either ends of the age point, but there could be a sharp drop-off at the age point, as in Figure 10.2b. A test of conditions 1 and 2 can be found in a study reported by Bialystok and Hakuta (1999) using the United States census data from 1990. The study looked at a large sample of immigrants whose native languages were Chinese and Spanish and who had immigrated to the United States at ages ranging from birth to 70 years old. The census bureau asked for a self-report of their English ability, which was converted to a four-point scale. The scale was validated by the census bureau against actual measures of English proficiency in a separate study. The data from this study showed continuous decline with age and no evidence of a discontinuity or sharp break at puberty as would be expected by conditions 1 and 2. The data are shown in Figure 10.3—it is essentially a straight line and there is no evidence for conditions 1 or 2.

CONDITION 3: QUALITATIVE DIFFERENCES BETWEEN CHILD AND ADULT LEARNERS

It is important for a critical period hypothesis to demonstrate that a specific learning mechanism is present during the period but not outside of the period, and one way to do so would be to show different patterns of acquisition in adults and children. Studies that compare the errors and performance patterns of child and adult L2 learners are informative in testing for the viability of condition 3.

One area of research is in the extent of native language influence L2 learning. The relevant question is whether children differ from adults in the extent to which native language influence can be found. The theoretical basis for this can be found in the late 1950s and 1960s when the predominant view of L2 acquisition was that of language transfer, based on the principles of behaviorist psychology (Hakuta & Cancino, 1977). In this view, the points of contrast between the native language and the target language determined the course of learning—positive transfer happened where the two languages were similar and negative transfer where they were different. For example, native speakers of Japanese have difficulty with the English determiner system (e.g., *a, the, some*) because there is no equivalent system in their native language. Native speakers of Spanish, however, do not have as much difficulty because a similar system exists in their native language. The question, then, is whether adult learners show more evidence of transfer errors than children because, according to the critical period hypothesis, children directly gain access to the target language whereas adults must go through their native language. This does not appear to be the case. Children who are learning a second language show evidence of transfer errors similar to adults and overall patterns of errors are not distinguishable between children and adults (Bialystok & Hakuta, 1994).

Another opportunity to look for differences between children and adults is in the pattern of development in the L2. In one study, Bailey, Madden, and Krashen (1974) compared the performance of adult and child

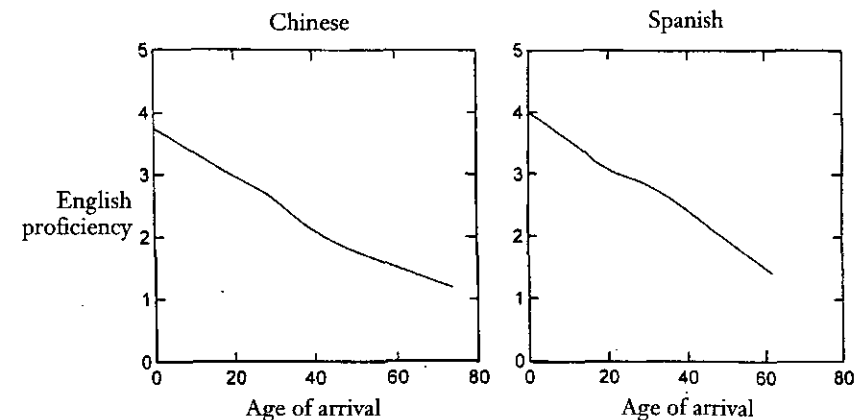


Figure 10.3. Self-reported English proficiency for U.S. immigrants as a function of age of arrival: Data from the 1990 U.S. census. (From Bialystok, E., & Hakuta, K. [1999]. *Contextual factors in age differences in second language acquisition*. In D. Birdsong [Ed.], *Second language acquisition and the critical period hypothesis* [pp. 161–181]. Mahwah, NJ: Lawrence Erlbaum Associates; reprinted by permission.)

learners of English as L2 on a test of English morphological structures. Specifically, they compared their ability to correctly use the present progressive *-ing*, forms of the verb *to be*, the plural *-s*, determiners (*a, the*), the past tense, the third person indicative (he runs every day), and the possessive *'s*. The results found a remarkable similarity in the rank ordered performance between children and adults, as can be seen in Figure 10.4. The native language background of students did not seem to affect the results. Overall, this study provides support for the fact that child and adult learners progress along similar paths of development.

A specific way to test the critical period hypothesis is by asking whether adult learners can demonstrate knowledge in the abstract aspects of language that are presumably accessible only through language-specific learning mechanisms (what linguists have come to call *universal grammar*). White and Genesee (1996) conducted such a test to see whether adult L2 learners of English had access to the following pattern of intuitions that all native speakers of English have:

1. Who do you want to see?
2. Who do you want to feed the dog?
3. Who do you wanna see?
4. *Who do you wanna feed the dog?

Number 4 (marked by *) is ungrammatical. Why, despite surface similarities, is 3 considered okay, but 4 is not okay? If grammatical intuitions were formed on the basis of analogy, 4 should be okay. The logical argument made by linguists is that the underlying structure for the sentences can be hypothesized as,

5. You want to see *who*?
6. You want *who* to feed the dog?

According to the theoretical model of universal grammar, these underlying forms of *who* are moved to the front of the sentence, leaving behind a trace *t* in the original location:

7. Who_i do you want to see *t_i*?
8. Who_i do you want *t_i* to feed the dog?

The rule that reduces *want to* to *wanna* for 8 is blocked by the trace between *want* and *to*. According to this analysis, this knowledge is needed in order to find 3 to be okay but 4 not to be okay. The abstractness of this rule makes it hard to learn without preexisting knowledge. The critical period hypothesis says that the learning mechanism that allows for this knowledge to be acquired is no longer present in adults.

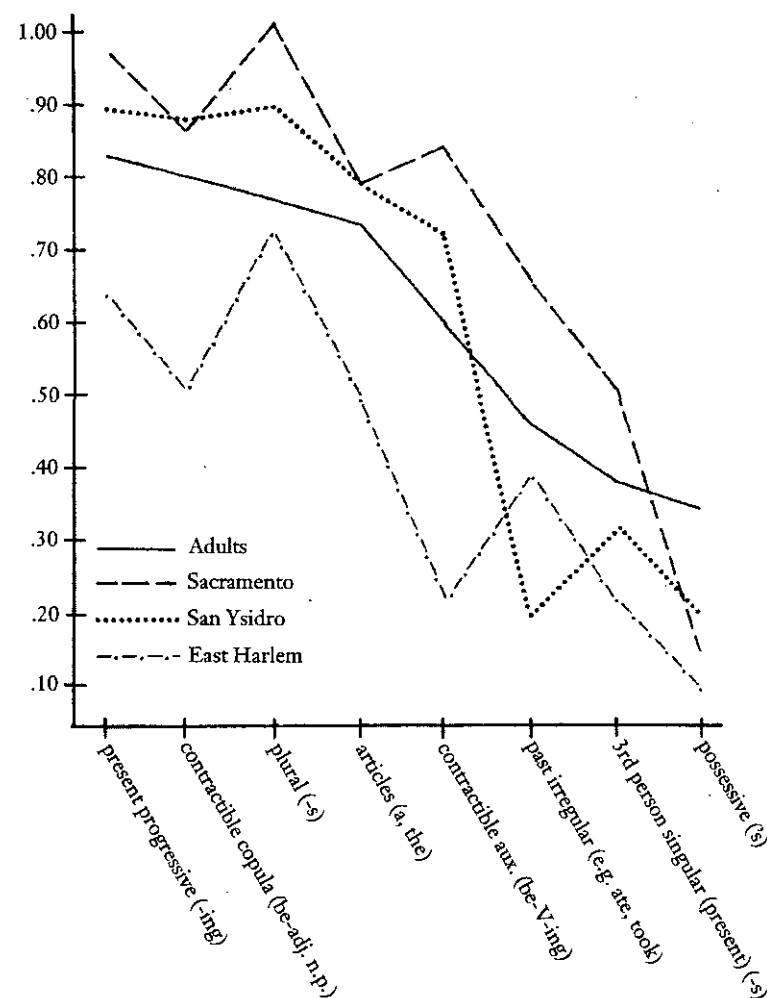


Figure 10.4. Comparison of performance on selected English grammatical structures in adult and child learners. (From Bailey, N., Madden, C., & Krashen, S. [1974]. Is there a "natural sequence" in adult second language learning? *Language Learning*, 24, 235-243; reprinted by permission.)

Using sentences like these, White and Genesee asked adults who had learned English at different ages to discriminate between grammatical and ungrammatical sentences based on abstract concepts. Although more adult learners had difficulty in distinguishing between these sentences than child learners, about one third of the adults who had acquired these rules showed equivalently high performance to child learners and native speakers of English. Thus, adults are capable of learning highly abstract rules that

theory would say are accessible only with specialized language acquisition mechanisms.

There are no demonstrated differences between the process of L2 acquisition in children and adults, with respect to condition 3. As Bialystok and Hakuta concluded, "The adult learning a second language behaves just like a child learning a second language: he walks like a duck and talks like a duck, the only major difference being that, on average, he does not waddle as far" (1994, p. 86).

CONDITION 4: THE EFFECTS OF ENVIRONMENTAL VARIATION

The critical period assumes a minimal role for environment in learning, such that once the learner is exposed to a necessary and sufficient amount of stimulation, the learning is complete. An important variant in the envi-

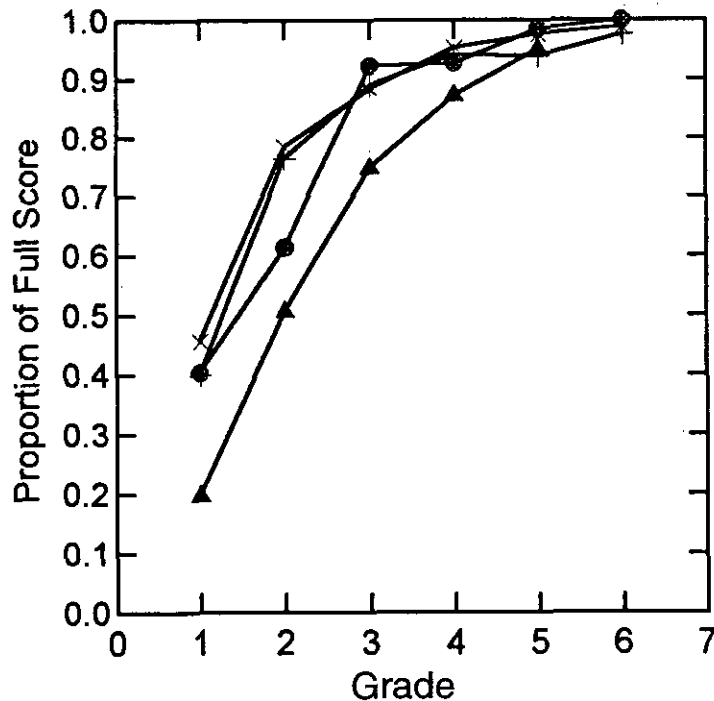


Figure 10.5. English oral proficiency development in immigrant students from a northern California school district, separated by poverty level in schools. This is a cross-sectional sample, but all subjects included in this analysis were enrolled in this school district since kindergarten. (Key: Poverty level: ▲ 70, + 50, x 25, ● 10.)

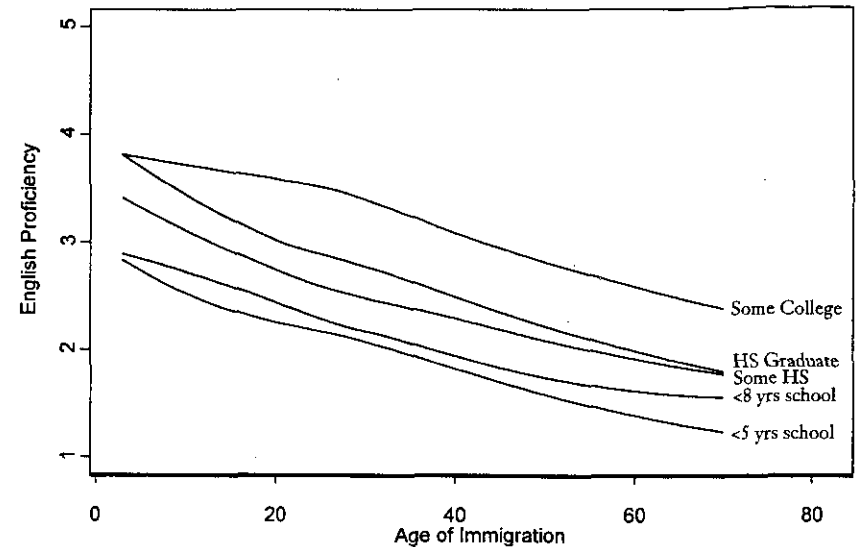


Figure 10.6. Self-reported English proficiency for native Chinese immigrants as a function of age of arrival, separated by educational attainment: Data from the 1990 U.S. census

ronment is socioeconomic status of the learner. Figure 10.5 shows oral proficiency data for immigrant students from a school district in northern California, varying by the socioeconomic environment of the school. This school district does not provide bilingual education and students are exposed only to English during the school day. The data show students who are from lower socioeconomic schools attain English proficiency a year slower than those students in higher socioeconomic schools.

Strong socioeconomic effects can be found in the census data as well. Figure 10.6 shows the same data as Figure 10.2, but they are separated by years of education attained as a proxy for socioeconomic status. There are effects for years of education—a regression analysis revealed that education accounts for the same amount of variance as the effects of age of immigration. In addition, the education effects are uniform across the life span and there is no indication, as might be suggested by the critical period hypothesis, that it works differently in child and adult learners.

CONCLUSION

The evidence for a critical period for L2 acquisition is scanty, especially when analyzed in terms of its key assumptions. There is no empirically definable end point, there are no qualitative differences between child and

adult learners, and there are large environmental effects on the outcomes. None of the conditions are met by the present research.

This is not to say that there are not any age effects for L2 acquisition. All studies show that there is a monotonic decline in ultimate attainment in L2 with age. Failure to find supporting evidence for a critical period means that the view of a biologically constrained and specialized language acquisition device that is turned off at puberty is not correct. The gradual decline over age in the ultimate attainment of an L2 means that there are multiple factors at work—physiological, cognitive, and social. Researchers who wish to pursue the critical period hypothesis would need to become more specific in their predictions, such as identifying the linguistic processes that are putatively shut down at the end of the critical period. Yet, it is incumbent on those who wish to stress the cognitive and social factors in L2 acquisition to be equally specific in their predictions. Given the harsh implications of a critical period for policy and practice (i.e., not only that exposure is needed early, but also that exposure later in life is less valuable), the standards of evidence in this area must be held high and educators and policy makers who pay attention to this research should demand no less.

Beyond urging for the highest standards in research that bear on this theoretical question, policy makers and practitioners should also seek additional information related to age and L2 instruction, such as

1. What capabilities are there for staffing different program options at different grade levels?
2. Are students in different grade levels differentially responsive to technology-supported language learning environments?
3. In what ways does the relationship between language and content change as students progress through school?
4. What specific resources and needs exist in the community for L2s that can help motivate students at different ages?

Informed answers to such questions can help guide local communities and states in making decisions about optimal times for L2 instruction.

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