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Three Misconceptions About Age and L2 Learning

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Age has often been considered a major, if not the primary, factor determining success in learning a second or foreign language. Children are generally considered capable of acquiring a new language rapidly and with little effort, whereas adults are believed to be doomed to failure. Although older learners are indeed less likely than young children to master an L2, a close examination of studies relating age to language acquisition reveals that age differences reflect differences in the situation of learning rather than in capacity to learn. They do not demonstrate any constraint on the possibility that adults can become highly proficient, even natively-like, speakers of L2s. Researchers, in other words, have often committed the same blunders as members of the general public: misinterpretation of the facts relating to speed of acquisition, misattribution of age differences in language abilities to neurobiological factors, and, most notably, a misemphasis on poor adult learners and an underemphasis on adults who master L2s to natively-like levels. By clarifying these misconceptions, we hope this article will lead to a better understanding of L2 learning and, in turn, better approaches to L2 teaching.

The term *critical period* for language acquisition refers to a period of time when learning a language is relatively easy and typically meets with a high degree of success. Once this period is over, at or before the onset of puberty, the average learner is less likely to achieve natively-like ability in the target language. It is generally accepted among psycholinguists that a critical period for L1 acquisition exists, but controversy arises when the critical period claim is extended to L2 learning. The existence of a critical period for second language acquisition (SLA) would have serious implications for foreign language teachers working with older students, not the least of which would be a need for a complete overhaul of expectations and methods of evaluation. If older students are biologically incapable of mastering another language to a

very high level, then they should not be graded in comparison to native speakers. As expectations are lowered, so too should teaching methodologies be modified to promote limited proficiency, allow for a greater number of errors, and avoid even broaching the unreachable goal of native fluency. Furthermore, if a critical period for L2 learning does exist, then schools should obviously introduce foreign languages earlier, and all states should introduce policies to accelerate the exposure to English of immigrant children, as California has done. Clearly, knowing the facts about the critical period for SLA is relevant to policy and to practice in education.

The purpose of this article is to analyze some common misconceptions about L2 learning by examining the relevant literature; it does not present a comprehensive review of critical period research.¹ We conclude from this analysis that older learners have the potential to learn L2s to a very high level and that introducing foreign languages to very young learners cannot be justified on grounds of biological readiness to learn languages. Rather than focusing on the low probability that adults will acquire fluency in L2s, we argue, it is more productive to examine the factors that typically lead to nativelike proficiency in L2s for any learner. Such an approach can also inform sensible decisions about the allocation of resources for foreign language or L2 teaching.

The idea of a critical period was first introduced by Penfield and Roberts (1959), who argued that language acquisition is most efficient before age 9, when “the human brain becomes . . . stiff and rigid” (p. 236). Later Lenneberg (1967) claimed that during this period of heightened plasticity, the human brain becomes lateralized. He argued that puberty represents a biological change associated with the firm localization of language-processing abilities in the left hemisphere. He also claimed that postpubertal language acquisition was far more difficult and far less successful than acquisition occurring during the prepubertal period of rapid neurological development. Krashen (1973), among others, challenged Lenneberg’s characterization by showing that brain lateralization may be completed by the age of 5. Lamendella (1977) argued that Lenneberg’s conclusion regarding the critical period was overstated and introduced the term *sensitive period* to emphasize that language acquisition might be more efficient during early childhood but was not impossible at later ages. Today, many researchers in the field use the two terms interchangeably, as we do throughout this article.²

¹ Attempts at a more or less comprehensive overview of the literature include, for example, McLaughlin (1984, 1985), Larsen-Freeman and Long (1991), Harley and Wang (1997), and Birdsong (1999).

² When citing other people’s work, however, we preserve the term chosen by the original authors.

Case studies of several individuals who began to acquire an L1 late in life, and who were generally not very successful, are available. Most concern *wolf children*, children reared in isolation without any linguistic input (e.g., Genie in Curtiss, 1977) or congenitally deaf children whose hearing was improved with the help of hearing aids only after puberty (e.g., Chelsea in Curtiss, 1989). Such cases, though rare, demonstrate the effortfulness and poor outcomes associated with language learning in later childhood or adolescence as compared with its normal course in early childhood. Furthermore, most people can think of dozens of acquaintances who have attempted to learn an L2 after childhood, found it a challenging and frustrating task, and achieved only rather low proficiency. These two phenomena seem on first view to be quite similar and to converge to support the credibility of a critical period for language learning. It is thus not surprising that the notion of a critical period for L2 learning is widely taken for granted. We argue, though, that the cases of children deprived of an L1 and those of L2 learners who encounter obstacles to high-level achievement are entirely different and that the critical period that limits the learning of the first group is irrelevant to explaining the shortcomings of the second.

Neither researchers nor others can ignore the overwhelming evidence that adult L2 learners, on average, achieve lower levels of proficiency than younger L2 learners do. However, this evidence is not sufficient to conclude that a critical period for SLA exists; a careful reexamination of the arguments offered in support of the critical period hypothesis suggests that each of them is subject to one of three fallacies: misinterpretation, misattribution, and misemphasis. The person in the street will offer as support for the existence of the critical period the observation that children “pick languages up so quickly.” This claim, not accepted by researchers who have actually carried out age comparisons, represents a straightforward misinterpretation of the facts. Other researchers, especially those in the field of neurobiology, report differences in the brain organization of early and late L2 learners and then misattribute presumed language proficiency differences to these brain organizations, often without any direct measures of proficiency. Finally, another set of studies documents that some adults have poor L2 outcomes and then imply that no adults are capable of achieving nativelike proficiency, ignoring the existence of proficient adult learners. We argue that this body of work suffers from the fallacy of misemphasis. In this article we review studies on the critical period in SLA to analyze these misconceptions and to present an alternative view.

MISINTERPRETATION

Many people have misinterpreted the ultimate attainment of children in an L2 as proof that they learn quickly and easily. It is not uncommon for a teacher to hear adults lament how easy a new language would be “if only I had studied it when I was young.” A recent article in the news magazine *The Economist* typifies this misconception; the author claims in passing that bilingual children in English-only classes “can absorb the language within months” (“Ron Unz,” 1998, p. 32). Research shows, however, the exact opposite (see Table 1 for a brief review of relevant studies). Significant work in the 1970s (e.g., Snow & Hoefnagel-Höhle, 1977, 1978; and summarized in McLaughlin, 1984, 1985) focusing on learners in an L2 environment showed that older learners are generally faster and more efficient in the initial stages of L2 learning. These results are continually confirmed.³ Rivera (1998) found that, at early stages of phonological acquisition, adolescents performed better than children. Evaluations of French immersion programs in Canada show that English speakers receiving late immersion (L2 introduced in Grade 7 or 8) have performed as well as or better than children in early immersion programs (L2 introduced in kindergarten or Grade 1) (Genesee, 1987). Genesee argued that older students are more efficient L2 learners than younger students, and he speculated that more intensive L2 programs introduced at the secondary level may “offset any possible advantages associated with amount of exposure” (p. 61) to the L2. Finally, foreign language educators also widely recognize that the progress of young foreign language learners is considerably slower than that of language learners at the secondary level. Even researchers who argue that younger learners tend eventually to achieve greater proficiency have admitted that older learners initially acquire a new language more rapidly (Krashen, Long, & Scarcella, 1979). These findings call into question the alleged advantages of younger learners in foreign language programs and demonstrate that older students can learn more than younger ones in the same period of time.

Another type of misinterpretation is epitomized by a widely cited study by Johnson and Newport (1989) that has been accepted as the best evidence in support of the critical period in L2 learning (Long, 1990). The study is based on the speculation that, once children master general problem solving, their ability to acquire new languages diminishes.

³ It is interesting to note that, in studies comparing the L1 acquisition rates of children with specific language impairment (SLI) and of their language-matched, normally developing counterparts (who are younger in chronological age), the older children with SLI showed higher rates of language acquisition despite their impairment (Nelson, Camarata, Welsh, Butkovsky, & Camarata, 1996).

TABLE 1
Summary of Studies Discussed Under “Misinterpretation”

Study	Age of subjects	Major findings	Authors' interpretation of results as support for critical period hypothesis	Comments
Johnson & Newport (1989)	Early arrival (before age 15); late arrival (after age 17)	Age on arrival correlated strongly and negatively with performance on L2 grammaticality judgment test.	Yes	Study used different scales to present results and did not emphasize adults who performed as well as the youngest subjects; early arrivals were too old.
Rivera (1998)	10, 12, 17–18	Adolescents did better than children in early stages of L2 phonological acquisition.	No	Subjects were learning L2 in formal instruction.
Snow & Hoefnagel-Höhle (1977) (laboratory)	5–31	Oldest subjects performed the best, and youngest performed the worst on a pronunciation task.	No	Short-term study showed that older learners were faster at L2 learning than children.
Snow & Hoefnagel-Höhle (1977) (naturalistic)	3–60	Young children had no immediate advantages in learning L2 pronunciation.	No	Study claims that adults are better than children on vocabulary, morphology, and syntax, but no data are given.
Snow & Hoefnagel-Höhle (1978)	8–10, 12–15, adults	Adolescents were the fastest and achieved the highest proficiency in pronunciation, morphology, and syntax, followed by adults; youngest children performed worst.	No	Age differences were addressed only cross-sectionally.

Johnson and Newport studied native speakers of Chinese and Korean who had first been exposed to English either before puberty (which they somewhat oddly place at 15 years) or after puberty (17 years or older). The subjects, who completed a grammaticality judgment test that assessed knowledge of various English grammatical rules, showed a decline with age in correctness of the judgments.

However, upon reexamination of Johnson and Newport's (1989) data, Bialystok and Hakuta (1994) found age-related effects for only some of the structures examined. Furthermore, when there were such effects, they concerned structures that are very different in English and in Chinese/Korean (e.g., determiners, plurals, and subcategorization of verbs). Bialystok and Hakuta recalculated the correlation between age on arrival and scores on the grammaticality judgment test and showed deterioration in subjects' proficiency only after age 20, much later than biological changes associated with puberty. Other studies have also shown that age effects in L2 learning continue well after a critical period is terminated by physiological changes in the brain or by puberty (Birdsong, 1992; Oyama, 1976).

MISATTRIBUTION

The field of SLA lacks a uniformly accepted theory of how L2s are acquired. As a result, some researchers have turned their attention toward neuroscience in the hope of finding new and more conclusive evidence based on which they could create more coherent theories of SLA (Danesi, 1994). Given the glamour of brain science and the seemingly concrete nature of neurophysiological studies, the conclusions have often been readily accepted by the public. However, neuroscientists have often committed an error of misattribution, assuming that differences in the location of two languages within the brain or in speed of processing account for differences in proficiency levels and explain the poorer performance of older learners (see Table 2).

For example, a recent, widely reported study (Kim, Relkin, Lee, & Hirsh, 1997) looked at the localization of languages learned at different ages, though it did not report data on the L2 proficiency of the bilingual subjects. The authors used functional magnetic resonance imaging, a procedure for scanning brain activity during specific tasks, with early and late bilingual subjects; the early bilinguals had first been exposed to the L2 during infancy, whereas the late bilinguals had had their first exposure during adulthood. Both age groups were given a sentence-generation task, which they performed silently while their brain activity was recorded. The results indicated that the late bilinguals had two distinct but adjacent centers of activation in Broca's area (the language

TABLE 2
Summary of Studies Discussed Under "Misattribution"

Study	Age of subjects	Major findings	Authors' interpretation of results as support for critical period hypothesis	Comments
Furtado & Webster (1991)	Adults who were bilingual before age 6 (early bilinguals); other bilingual adults (late bilinguals)	Early and late bilinguals showed similar lateralized interference patterns that were language specific, regardless of L2.	No	Effects of language were more important than those of age.
Kim et al. (1997)	Adults with first exposure to L2 in infancy; adults with first exposure in adulthood	Two separate areas were found in brain for production of L1 and L2.	Yes (unclear)	Early learners were too young; this implied that younger learners have better L2 pronunciation due to brain differences.
Weber-Fox & Neville (1992)	Adults	Native speakers and early L2 learners showed different brain patterns for processing function and content words, which were absent in older learners.	Yes	Brain processing was assumed to be responsible for different language performance.
Weber-Fox & Neville (1996)	Adults exposed to L2 at age 1-3, 4-6, 7-10, 11-13, or > 16	When subjects detected semantic anomalies in L2, brain responses altered only for subjects who were first exposed to L2 after age 11.	Yes	Connection between different brain responses and L2 learning outcome is unclear.
Wuillemin & Richardson (1994)	18-36	Left-hemisphere advantage was found for processing words in languages learned before age 9; right-hemisphere advantages were found for languages learned after puberty; proficiency declined with age.	Yes	Study did not reveal relationship between L2 proficiency and brain lateralization.

area of the brain responsible for speech production) corresponding to their L1 and L2, whereas in the brains of the early bilinguals there was no separation of the areas of activation associated with the two languages.⁴ The authors related their findings to work (e.g., Kuhl, 1994; Werker & Tees, 1984) showing that infants limit the phoneme distinctions they hear to those that are present in their environmental languages by about 1 year of age. In other words, they claimed, phonemes from two languages become permanently represented in the organization of Broca's area in the early bilinguals. They further argued that

it is possible that representations of languages in Broca's area that are developed by exposure early in life are not subsequently modified. This could necessitate the utilization of adjacent cortical areas for the L2 learned as an adult. (Kim et al., 1997, p. 173)

Although Kim et al.'s (1997) results are intriguing, they are in fact irrelevant to the possibility that adults can achieve nativelike proficiency in an L2. Nor do they incontrovertibly demonstrate age effects on brain organization. Perhaps adults who have in fact learned to make phonemic distinctions in the target language (which is entirely possible, with good training and sufficient exposure) show brain activation patterns equivalent to those of the early bilinguals, and the findings Kim et al. reported simply reflect the fact that the late bilinguals studied were less proficient in the target language than the early bilinguals (which, on average, is very likely). Snow (in press) argues in commenting on Kim et al.'s findings that "the real question about age differences in brain localization is whether it implies anything about behavior or about critical periods." At a bare minimum, Kim et al. should have looked at differences in late bilinguals' L2 proficiency as related to the differentiation of L1 and L2 brain activation patterns.

Other neurobiological studies have purported to provide evidence in support of the critical period hypothesis by showing that older learners process L2 information differently from younger learners. Weber-Fox and Neville (1992, 1996, 1999) have performed a series of experiments utilizing various brain-imaging techniques and different stimuli, and their results have consistently shown differences between younger and older learners in activation patterns and location of language processing. Weber-Fox and Neville demonstrated that when learners responded to semantic anomalies, their brain responses also varied as a function of age

⁴ On the other hand, in the late and early bilingual subjects, similar or identical cortical regions served both L1 and L2 within Wernicke's area (where speech perception occurs). That is, there was no separation of activity based on the age of language acquisition. This implies that even if there are differences, they concern only certain tasks (such as speech production) and not every aspect of using an L2.

at L2 learning, and the effect was most prominent in the older age group. When subjects were presented with sentences containing grammatical anomalies, the brain response typical of younger L2 learners was considerably altered in subjects who had first been exposed to L2 after the age of 11. Furthermore, the type of grammatical anomaly was related to the parameters of the age change, with the response to some grammatical anomalies suggesting that age 4 constituted the end of a sensitive period and the response to others suggesting age 11.

Like the results reported by Kim et al. (1997), those reported by Weber-Fox and Neville (1992, 1996, 1999) fail to relate differences in brain activation patterns to differences in target language proficiency and thus are essentially irrelevant to any claim concerning a critical period. All of these studies are subject to two possible misattributions. First, there is no strong evidence that the localization of the processing of any of the experimental tasks in a particular part of the brain was associated with better processing; it is entirely possible that adult and child learners localize their learning differently without showing different levels of learning, or alternately show similar localization but different learning outcomes. The different patterns of language processing in adult brains reported by Weber-Fox and Neville (1996) might simply mean that adults are better able to attend to grammatical anomalies than are children, who may not even be aware that the sentences are ungrammatical. Confirming this view, Wulfeind and Richardson (1994) have shown that the different localization of L1 and L2 cannot account for poorer knowledge of one of the languages. Wulfeind and Richardson examined the relation between degree of lateralization of the two languages in bilinguals' brains and their L2 proficiency. Their subjects learned English at various ages, from early childhood through the end of adolescence. The results showed that the younger learners displayed a significant left hemisphere advantage for processing words in the L1 and L2, whereas in older learners there was an increase of right hemisphere involvement in the processing of second or subsequent languages. However, there was no relationship between proficiency in the L2 and right hemisphere involvement. Another study (Furtado & Webster, 1991) compared subjects who were first exposed to their L2 before age 6 with those exposed to it after that age. When asked to read and translate a list of words from their L1 into their L2 while they were tapping with their fingers, both groups showed similarly lateralized, language-specific interference patterns. Once again, it seems that any difference in proficiency in an L1 or L2 cannot be attributed to the different localization of the two languages in a bilingual brain.

Alternately, it is entirely possible that the presumption that any type of processing has an optimal localization in the brain is correct, but that the adult learners assessed in these studies were poorly selected and do not

represent highly proficient adult bilinguals. It seems obvious that low-proficiency speakers of an L2 will process it differently, and likely with different brain localization parameters, than high-proficiency speakers will. The critical study yet to be undertaken would compare the brain activation patterns of child and adult learners who have achieved equivalent levels of proficiency in the target language.

Although localization has been the most frequently researched brain correlate of age of acquisition, another line of research in the field of neurobiology has focused on the process of myelination as a factor in limiting plasticity and thus perhaps determining the critical period. *Myelination* refers to the covering of neural axons with myelin, a process that occurs after birth and that allows for more efficient transport of neural impulses (Jacobs, 1988). As myelination slows, it “results in reduced neural plasticity and, consequently, in difficulty in learning” (Pulvermuller & Schumann, 1994, p. 719). Researchers in neuroscience have admitted that the exact connection between learning and the state of the neural network is unknown. Still, the loss of plasticity in the brain is cited as an important factor in explaining the existence of the critical period for language acquisition (Jacobs, 1988). Indeed, it is commonly believed that children outperform adults due to greater brain “flexibility.”

Pulvermuller and Schumann (1994) agree that even if plasticity were related to learning, it could only account for the better performance of younger learners when they are viewed as a group and would not explain the great variation in ultimate achievement in the L2 among older learners. However, as the authors are unable to determine exactly how plasticity might influence learning, they conclude by suggesting that motivation plays a determining role in the success of SLA, noting that all younger learners, but only some adults, will be highly motivated to learn an L2. As we shall see, motivation is not an insignificant factor in language learning, though its relation to brain plasticity is tenuous to say the least.

MISEMPHASIS

Perhaps the most common error that has led to the widespread belief in a critical period in L2 learning is that of placing an enormous emphasis on unsuccessful adult L2 learners and ignoring the older learners who achieve nativelike L2 proficiency. Numerous studies and abundant anecdotal evidence have shown that many adults do have significant problems in learning another language. Yet researchers and nonspecialists alike have mistakenly assumed that this somehow implies that all adults are incapable of mastering an L2. First, adults are not a homogeneous group of linguistically incompetent creatures. In fact,

many studies, both for and against the idea of a critical period, have shown that whereas younger learners tend to perform fairly similarly to one another, older learners show great variation in their proficiency (Asher & Garcia, 1969; Birdsong, 1992; Bongaerts, van Summeren, Planken, & Schils, 1997; Coppieters, 1987; Johnson & Newport, 1989; Oyama, 1976, 1978; Riney & Flege, 1998; Seliger, Krashen, & Ladefoged, 1982; Shim, 1993, Singleton, 1995; White & Genesee, 1996). Unfortunately, only very few of the studies (Birdsong, 1992; Coppieters, 1987; Seliger et al., 1982; Shim, 1993) have reported details on the individual performances of their older subjects. Most researchers have provided only average scores for each age group and have paid little or no attention to the adults who performed at the native or near-native level. A recent study by Johnson, Shenkman, Newport, and Medin (1996), for example, reported age differences but made no mention of the degree of variation among the older learners tested. Another, by Shim (1993), also concluded that older learners are less proficient than younger learners, yet the study actually contained a few examples of adolescent and adult learners who outperformed some of the early learners both in speed of language processing and in the number of correct responses in the L2 (see Table 3).

In a more in-depth study, Birdsong (1992) made a significant contribution when he showed that, although the average performance of a group of near-native speakers of French was below that of native speakers, the near-native-speaker group did include adults who performed well above some of the native subjects. Birdsong also questioned another long-standing belief, that adults' L2 skills eventually fossilize, plateauing at some point prior to reaching native proficiency (see Selinker, 1972). Clearly some adults, albeit not the majority, are capable of mastering an L2. In his discussion, Birdsong pointed out that it is important to study these most advanced L2 learners in order to understand the factors that contribute to an adult's success in an L2.

Problems in Testing

Successful adult L2 learners may go undetected due to problematic testing conditions. For example, many adults have been evaluated as having "poor" or nonnative accents. Rarely, however, have researchers clearly established either the exact margins of what is considered a standard accent in the target language or the degree of variability among native speakers. Most of the studies designed to examine the foreign accent of L2 learners have used judges who are adult native speakers of the language in question. Yet these studies have often ignored the fact that native speakers have accents that themselves vary from the standard.

TABLE 3
Summary of Studies Discussed Under "Misemphasis"

Study	Age of subjects	Major findings	Authors' interpretation of results as support for critical period hypothesis	Comments
Asher & Garcia (1969)	7-19	Young subjects and those who resided longer in L2 country had the best pronunciation.	Yes	Study involved small amount of oral data, no spontaneous speech.
Bialystok & Miller (in press)	Adults who were either early (<15 on arrival) or late (>15 on arrival) L2 learners	No difference was found between early and late L2 learners (Chinese); younger learners performed better than older (Spanish).	No	Age influenced proficiency level achieved through all ages rather than defining a critical period.
Birdsong (1992)	35-40 (average)	Some L2 learners performed as well as natives; age on arrival in L2 country affected some grammar tasks.	No	Study tested few tasks but highlighted possible adult L2 proficiency.
Bongaerts et al. (1997)	Adults	Some learners pronounced better than natives; need to establish "standard accent."	No	Authors specifically studied good L2 learners.
Bongaerts et al. (1997)	19-52	Some learners pronounced as well as natives.	No	Few details on good L2 learners are given; perhaps motivation or type of L2 exposure played a role.
Champagne-Muzar et al. (1993)	Adults	Special phonetic training improved pronunciation.	No	First 6 hours of training involved only listening.

Coppieters (1987)	Adults	Natives and near-natives showed differences in grammar performance.	No	Performance of near-natives varied greatly.
Ehrman & Oxford (1995)	39 (average)	Many factors were shown to influence L2 proficiency more than age did.	No	Important variables were cognitive aptitude, beliefs about self, reading skills, and education.
Flege et al. (1997)	2.6–9.6 on arrival	All bilinguals had at least slight accent in L2; judges of L2 accent did not always agree.	No	Study implies effect of L1 use on L2 but did not study L1 use or proficiency.
Flege et al. (in press)	Adults 1–23 on arrival	With increased age on arrival, foreign accents grew stronger and grammaticality judgment decreased.	Some	Effect of age on arrival disappeared when variables confounding with age were controlled for.
Gardner, Tremblay, & Masgoret (1997)	University age	L2 achievement correlated most strongly with factors such as anxiety about language learning and self-confidence.	No	Authors did not study age.
Ioap et al. (1994)	21–23	Adults achieved native proficiency in grammar and pronunciation.	No	Study was small ($n = 2$).
Jia & Aaronson (1998)	1–38 on arrival; length of residence at least 5 years	Younger arrivals switched to L2; late arrivals maintained L1.	No	L1 proficiency plays a role in L2 learning.
Johnson (1992)	Adults	Written version of Johnson & Newport (1989) found weaker correlation found between age and proficiency.	Yes	Study did not focus on adults' greater improvement between tests.
Johnson et al. (1996)	Adults	Older learners improved on retest, confirming Johnson & Newport (1989).	Yes	L2 oral proficiency was worse than native but improved between tests; sample was small ($n = 10$).

TABLE 3, Continued
 Summary of Studies Discussed Under "Misemphasis"

Study	Age of subjects	Major findings	Authors' interpretation of results as support for critical period hypothesis	Comments
MacIntyre & Charos (1996)	Adults	Factors such as willingness to communicate and attitudes toward target culture for L2 achievement are important.	No	Authors did not study age.
Neufeld (1979)	Adults	Native L2 pronunciation was achieved after special training.	No	Training involved 12-hour silent period (listening, no speaking).
Oyama (1976)	Adults	Younger learners had better pronunciation regardless of length of exposure.	Yes	Authors studied only phonology.
Oyama (1978)	14-37	Younger learners had better L2 comprehension.	Yes	No research was done into environment of young learners.
Riney & Flege (1998)	Adults	L2 exposure affects L2 pronunciation; some adults do as well as natives.	No	Study highlights learning environment.
Seliger et al. (1982)	<9 to >16	Older subjects believe they have stronger L2 accents, regardless of length of exposure.	Yes	In self-reported study, those with strong L2 accents were said to have more L1-speaking friends.
Shim (1993)	Adults who were early (3-8), adolescent (9-17), or late (20-30) L2 learners	Proposed a critical period before age 3; language-processing speed and error rate decreased with increase of age of onset of L2.	Yes	Study reported only mean scores for different ages and did not emphasize observed individual differences.

Singleton (1995)	Adults	Performance on vocabulary acquisition tasks showed no major difference relating to age.	No	Older learners showed greater variation in proficiency.
White & Genesee (1996)	16-66; average 29	Access to universal grammar did not decline with age.	No	Most young learners become proficient in L2, as do almost one third of older learners; authors did not study effect of L1.
Yeni-Komshian et al. (1999)	Adults who were 1-23 on arrival	Most subjects were more proficient in either their L1 or their L2; young learners (1-5) achieved near-native L2 pronunciation; older learners (12-23) achieved native L2 pronunciation.	Some	Language use affects both L1 and L2; deviation from native pronunciation resulted from interactions between L1 and L2.

As a result, different judges have been shown to rate the same L2 speaker quite differently (Bongaerts et al., 1997). Thus, a nonnative speaker could be perceived as native in some parts of the host country and as foreign in others. In addition, native speakers' perception of a foreigner's accent may be influenced by the amount of background information they are given about the L2 learner; judgments are themselves influenced by the generally held belief that adults cannot and children can achieve nativelike pronunciation.

Studies of pronunciation that elicited spontaneous speech from their subjects have tended to report better performance by older learners than studies that used only reading-aloud and imitation tasks (Asher & Garcia, 1969; Bongaerts et al., 1997; Seliger et al., 1982). These results could be explained by the fact that the learners' pronunciation of spontaneous speech in the L2 may have been flawless due to their familiarity with the words and phrases they chose to use. However, given that adults usually have literacy skills that are greatly advanced over their knowledge of the target language from direct exposure, they are often unfamiliar with the pronunciation of words they are asked to read. This can be a particular problem for languages such as English (and French), in which the relationship between spelling and pronunciation can be rather complex.

Still another example of the problems in testing is found in Johnson's (1992) follow-up to Johnson and Newport's (1989) study, previously mentioned. Johnson presented the same test to her subjects, but in written form, whereas in the original study subjects had judged the grammaticality of sentences heard orally. Results on the written task showed fewer and less severe age-related effects on proficiency in the L2. Similarly, in a follow-up study, Bialystok and Miller (in press) found a significant effect of the modality of test presentation, replicating the older learners' better performance on the written test. They even found that native-speaking control subjects responded faster to written stimuli, although the instances of errors in the oral and written conditions were equal, thus confirming Bialystok and Hakuta's (1994) suggestion that such differences often reflect a general decline with age in auditory processing and attention, not in linguistic capabilities (Bialystok & Hakuta, 1999).

The Role of Environment

Even with proper testing, many older learners reveal considerable difficulties in SLA. However, one must avoid extrapolating to the conclusion that adults have problems because they are adults. The truth is that myriad factors are involved in successful L2 learning, many of

which may be correlated with age but have nothing to do with changes in the brain. Notable among these is the environment in which the language is learned. A study by Champagne-Muzar, Schneiderman, & Bourdages (1993) showed that the amount of phonological training before testing had a significant positive effect on the pronunciation of a group of university students who were at the beginning level of French as an L2. This finding, in fact, confirms the results of a series of earlier studies by Neufeld (1979). He demonstrated that adult L2 learners could attain nativelike pronunciation in the target language after experiencing a *silent period* during which they were asked to listen to L2 speech without speaking it (conditions replicating the learning situation of young children).

A recent study by Riney and Flege (1998) shows that living in an environment where the target language is the standard has a positive effect on older L2 learners' global pronunciation. The authors observed a group of Japanese university students who were initially tested at the beginning of their first year in college and then were retested 42 months later. The pronunciation of the group of students who spent most of the time between the two tests in English-speaking countries improved significantly more than that of the students who remained in Japan. Similarly, learners who live in a foreign country but interact primarily with speakers of their native language tend to have stronger accents than those who use their L1 less often (Flege, Frieda, & Nozawa, 1997).

Lately, researchers have extended their attention to age effects on both the L1 and the L2 of bilinguals. The critical period hypothesis would predict that learning any language prior to the termination of that period would result in proficiency undistinguishable from that of monolinguals. Yeni-Komshian, Flege, and Liu (1999) studied the level of perceived pronunciation proficiency in the L1 and L2 of Korean-English bilinguals. Although their results showed a general decrease in L2 pronunciation with age, none of their age groups, including the youngest learners, who had arrived in the United States before age 5, had L2 pronunciation ratings indistinguishable from those of monolingual English speakers. Moreover, their results indicated that even the youngest learners (those who arrived before age 11) were rated as having pronunciation proficiency significantly different from that of monolinguals in both Korean and English. Yeni-Komshian et al. concluded that learners who live in an L2 environment do not automatically achieve nativelike pronunciation in the L1; only those who depart from their L1 environment after age 8 consistently retain a nativelike pronunciation in their L1. This suggests that prepubescent children may attain high levels of proficiency in their L2 only at the expense of their L1 and that older learners tend to retain nativelike proficiency in the L1 at the expense of their L2.

Older immigrants are more likely to structure heavily L1 environments for themselves, thus retarding their own L2 exposure and acquisition. Jia and Aaronson (1998), studying Chinese immigrants to the United States, showed that the richness of the English language environment correlated negatively with the richness of the Chinese language environment available to the learners. Obviously, the older arrivals had access to relatively richer Chinese environments (because they could choose their own friends and seek out films, TV, and literacy experiences in Chinese more effectively), and the younger arrivals all reported preferring to talk and read in English by the end of 1 year in the United States. Jia and Aaronson also reported a stronger correlation between age on arrival and maintenance of exposure to Chinese than between age on arrival and proficiency in English, suggesting that even some older learners with relatively impoverished English learning environments acquired reasonable proficiency in English. Jia and Aaronson's study raises an issue often ignored in studies of age differences in SLA—that older learners are more likely to maintain their L1 at a high level, whereas younger learners are more likely to switch to dominance or even monolingualism in the L2.

Flege (1999) has recently explained that the general decline in L2 pronunciation with age does not result from a loss of ability to pronounce but is “a function of how well one pronounces the L1, and how often one speaks the L1” (p. 125). In another study, Flege, Yeni-Komshian, and Liu (in press) also found a significant effect for age on arrival on their subjects' performance on phonological and morpho-syntactic tests. However, the authors claim that changes in how the L1 and L2 phonological systems interact as the L1 system develops better explain the older learners' poorer performance on the phonological test. They explain the age effects on the morphosyntactic measures as a result of variation in the education and language use of their subjects, factors they found to be highly correlated with age on arrival.

The Role of Motivation

Ioup, Boustagui, Tigi, and Moselle (1994) examined the acquisition process of two native speakers of English who had achieved nativelylike proficiency in Arabic. Both women had first been exposed to Arabic in their early 20s, both were married to native speakers of Arabic and lived in Egypt, and both had a strong desire to master the new language. These women were judged to have achieved native or near-native proficiency in their L2 based on the quality of their speech production, their ability to recognize accents in the L2, and their knowledge of syntactic rules for which they had not received explicit feedback. Their

success in L2 learning was attributed to their high degree of motivation to learn the language, their exposure to a naturalistic environment, and their conscious attention to grammatical form.

A good deal of research in motivation and learning strategies sheds light on adult SLA, but this research has rarely been connected to work on the critical period. Ehrman and Oxford (1995) identified a number of factors, including age, that may affect the success of adults in achieving proficiency in speaking and reading an L2. They found, however, that variables such as cognitive aptitude and beliefs about oneself were more strongly correlated with success of L2 learning than was age. Another study by MacIntyre and Charos (1996) revealed the importance of factors such as self-efficacy and willingness to communicate. Gardner, who has done extensive research on motivation, published findings with Tremblay and Masgoret in 1997 highlighting the importance of over 30 motivational variables, a number of which (notably language anxiety, motivation, and self-confidence) are strongly correlated with L2 proficiency.⁵

CONCLUSION

The misconception that adults cannot master foreign languages is as widespread as it is erroneous. We argue in this article that this misunderstanding rests on three fallacies associated with the uncritical acceptance of a notion of a critical period for SLA. The first fallacy is misinterpretation of observations of child and adult learners, which might suggest that children are fast and efficient at picking up L2s. Hard data make it clear that children learn new languages slowly and effortfully—in fact, with less speed and more effort than adolescents or adults. The second fallacy is misattribution of conclusions about language proficiency to facts about the brain; connections between brain functioning and language behavior will no doubt in time be confirmed, but their exact nature cannot even be guessed from the data currently available on brain functions in early versus late bilinguals. Finally, the common fallacy of reasoning from frequent failure to the impossibility of success has dogged L2 research. Most adult learners of an L2 do, in fact, end up with lower-than-nativelike levels of proficiency. But most adult learners fail to engage in the task with sufficient motivation, commitment of time or energy, and support from the environments in which they find themselves to expect high levels of success. Thus, researchers and laypersons alike have been misled by a misemphasis on the average attainment of

⁵ For a summary of motivational research, see Oxford (1996).

the adult learner. This misemphasis has distracted researchers from focusing on the truly informative cases: successful adults who invest sufficient time and attention in SLA and who benefit from high motivation and from supportive, informative L2 environments. We hope this review of thinking about the critical period for L2 learning will dispel the persistent myths that children learn more quickly than adults and that adults are incapable of achieving nativelike L2 proficiency.

IMPLICATIONS

Age does influence language learning, but primarily because it is associated with social, psychological, educational, and other factors that can affect L2 proficiency, not because of any critical period that limits the possibility of language learning by adults. We see the work reviewed in this article as relevant to three crucial areas of language policy and teaching practice.

Foreign Language Teaching in the Early Grades

This work should be of some interest to schools and school districts contemplating the introduction of foreign language teaching in the early grades to satisfy desires to benefit from the hypothesized critical period. We certainly would not argue against the value of excellent foreign language instruction for learners of any age, but administrators and parents should not proceed on the assumption that only early foreign language teaching will be effective, and they need furthermore to be realistic about what can be expected from younger learners (McLaughlin, 1992). Typically, the early elementary foreign language course will be able to cover only half as much material in a year as the middle school course, which in turn will progress much more slowly than the secondary or university course. Research has shown that in formal settings early L2 instruction does not prove advantageous unless followed by well-designed foreign language instruction building on previous learning (Singleton, 1997). Children who study a foreign language for only a year or two in elementary school show no long-term effects; they need several years of continued instruction to achieve even modest proficiency.

Investment in elementary foreign language instruction may well be worth it, but only if the teachers are themselves native or nativelike speakers and well trained in the needs of younger learners; if the early learning opportunities are built upon with consistent, well-planned,

ongoing instruction in the higher grades; and if the learners are given some opportunities for authentic communicative experiences in the target language. Decisions to introduce foreign language instruction in the elementary grades should be weighed against the costs to other components of the school curriculum; as far as we know, there are no good studies showing that foreign language instruction is worth more than additional time invested in math, science, music, art, or even basic L1 literacy instruction. In fact, Collier (1992) interpreted studies of bilingual children in the early grades as indicating that L1 instruction is more important than L2 instruction for ultimate literacy and academic achievement in the L2. Furthermore, it has become obvious that many immersion programs violate the principles we would like to see instantiated in an optimal L2 learning environment—access to rich input from many native speakers, for example. Older immersion learners have had as much success as younger learners in shorter time periods (Swain & Lapkin, 1989), and late-immersion students have achieved results similar to those of early-immersion students on literacy-based tests (Turnbull, Lapkin, Hart, & Swain, 1998). However, neither early- nor late-immersion students have typically emerged with nativelike skills in the L2, an observation that further supports our and Singleton's (1997) regard for the importance of continued L2 education.

Bilingual Education

The argument presented here would also suggest that the widely declaimed "failure" of bilingual education has nothing to do with the postponement of English instruction for children attending bilingual classes. First, much evidence would suggest that access to and acquisition of English for immigrants to the United States begins quite early, with or without bilingual instruction. Second, the robust evidence that children in late-exit bilingual programs do better than those in early-exit programs (Ramírez, Yuen, Ramey, & Pasta, 1991), as well as the evidence that children who arrive as immigrants in U.S. schools in later grades show better academic performance than those who start in kindergarten (Collier, 1987), directly contradicts the predictions of the critical period hypothesis. Third, children who start learning English after the early elementary years, even as late as during high school, can become nativelike speakers if their instructional environments are well structured and motivating (Singleton, 1995).

L2 Teaching

Finally, the work we have reviewed spells good news for ESL and other foreign language teachers of older students, for even though teachers can do little to “improve” a student’s age, they can do much to influence a student’s learning strategies, motivation, and learning environment. Thus, such teachers are justified in holding high expectations for their students and can give their motivated students research-based information about how to improve their own chances for learning to a high level.

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