

The Critical Period Hypothesis: Support, Challenge, and Reconceptualization

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ABSTRACT

Given the general failure experienced by adults when attempting to learn a second or foreign language, many have hypothesized that a critical period exists for the domain of language learning. Supporters of the Critical Period Hypothesis (CPH) contend that language learning, which takes place outside of this critical period (roughly defined as ending sometime around puberty), will inevitably be marked by non-nativelike features. In opposition to this position, several researches have postulated that, although rare, nativelike proficiency in a second language is in fact possible for adult learners. Still others, in light of the robust debate and research both supporting and challenging the CPH, have reconceptualized their views regarding a possible critical period for language learning, claiming that in combination with age of exposure, sociological, psychological, and physiological factors must also be considered when determining the factors that facilitate and debilitate language acquisition. In this paper, a review of literature describing the support, challenges, and reconceptualizations of the CPH is provided.

INTRODUCTION

The presence of highly developed cognitive abilities allows adults to outperform children in most areas of learning. Yet in the realm of language learning, children seem to have a notable advantage. Virtually all children are able to master their native language, and most children who are surrounded by a second language at an early age can acquire this language with nativelike competence. Among adult language learners, however, incomplete mastery of the target language appears to be the norm. The presence of this phenomenon has raised the question as to whether or not some type of critical, or sensitive, period exists for language learning. In other words, both casual observers and scholars have posited that children have a particular advantage in acquiring language—be it a first or second language—before they reach a certain age (usually believed to be sometime around puberty). After this critical period has ended, whatever mechanisms have accounted for this advantage disappear, and as a result, those seeking to acquire a language with native-like proficiency are markedly less successful than their younger counterparts.

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Considering the realm of first language acquisition only, Lenneberg (1967) sought to determine the age at which it becomes too late for an individual to acquire language. Using different types of evidence including data from recovered aphasics, the development of language in the mentally disabled, and the effects of sudden deafness on people of different ages, he surmised that due to structural reorganizations that occur within the brain during puberty, any language skills which were not learned before this restructuring occurs would remain permanently underdeveloped. Consequently, the ages between the onset of language development during infancy and the restructuring of brain functions during puberty represented a window inside which a first language could be acquired. Language learned outside this *critical period*, Lenneberg hypothesized, would develop neither normally nor sufficiently.

Given the nature of Lenneberg's (1967) Critical Period Hypothesis (CPH), however, affirmative or negative empirical proof for a critical period governing first language acquisition is intrinsically difficult to come by. As virtually all human beings are exposed to adequate stimuli during their early childhood, which enables the development of first language proficiency, subjects who have missed the critical period for first language acquisition are few and far between. Subjects like Genie (Curtiss, 1977), whose lack of linguistic stimuli was only one ramification of the severe abuse to which she was subjected, may provide clues and insight into the ramifications of the critical period. However, such cases are isolated in nature and unique in circumstance, and the conclusions which can be drawn from them are limited in scope.

Consequently, researchers have turned to second language acquisition as a medium through which to test the effects of maturation on language learning. At first glance, the evidence supporting a critical period for second language acquisition seems to be convincing. As Bley-Vroman's (1988) Fundamental Difference Hypothesis argues, adult language learning of an L2 as opposed to an L1 is characterized by widespread failure. Countless learners have been frustrated by an inability to successfully acquire a second language after they have reached young adulthood, causing many to believe that an adult language learner is consigned to incomplete mastery. However, exceptions to this norm—adult learners who have seemingly eluded the constraints of the purported critical period so as to achieve native or near-nativelike competence in a second language—have led some to favor a *weak* version of the CPH (Krashen, 1975). As opposed to *strong* conceptualizations of a critical period, which view exposure to appropriate stimuli during a critical window as absolutely essential for normal development, a weak version of the CPH suggests that a late learner can compensate for a lack of linguistic exposure during childhood with intensive exposure at a later stage in life. From a weak CPH perspective, Krashen (1975) states that although language development “would proceed quite differently and involve different mechanisms after puberty” (p. 212), significant second language development is possible. Thus, in rare cases, it would seem plausible that an adult, given concentrated exposure, might possibly attain nativelike proficiency in a second language.

As a result of the complexity and ambiguity of the CPH, researchers have made continual attempts to determine if and how the CPH is applicable to second language learning. While studies have provided evidence which seemingly confirms the existence of a critical period in the domain of second language acquisition, other studies have highlighted weaknesses in the CPH, leading some scholars to redefine and reconceptualize the role of the critical period. In this paper, I will discuss this division of opinion vis-à-vis the CPH in three stages: first, I will provide a review of the literature which supports the notion that a critical period exists for second language acquisition; next, I will review studies that put forward a variety of data which

challenge the validity of the CPH; and finally, I will discuss various studies which have provided a basis for reconceptualization of the CPH so as to address some of its perceived weaknesses.

SUPPORT FOR THE CRITICAL PERIOD HYPOTHESIS

Hoping to extend Lenneberg's (1967) hypothesis to second language acquisition, early studies regarding the CPH aimed at establishing a link between the age of an individual's first exposure to a second language and his or her ultimate attainment in that language. Researchers reasoned that if learners exposed to a second language after puberty were deficient in their ultimate attainment—while learners acquiring the language before the onset of puberty performed in a nativelike fashion—the effects of the critical period must be responsible for this gap. To test this notion, early studies by Oyama (1978, as cited in Johnson & Newport, 1989) and Patkowski (1980) focused on the ultimate attainment of certain grammatical structures by immigrants who arrived in the United States at a variety of ages. Both studies, finding that the age of a subject's arrival was the only variable which strongly predicted his or her ultimate attainment in English, seemed to uphold the notion that learning a second language after the close of the critical period results in its incomplete mastery.

Johnson and Newport (1989) sought to further probe the relationship between the effects of maturation and the ability of an individual to acquire a second language. Specifically, they first aimed at either verifying or disproving the existence of age-related effects on second language acquisition of grammar by establishing a correlation between age of first exposure to a language and level of morphosyntactic accuracy in that language. Forty-six native Chinese and Korean speakers who had arrived in the United States between the ages of 3 to 39 and had learned English as a second language were asked to determine the grammaticality of a variety of English sentences in order to determine their respective knowledge of English morphosyntax. Subjects were divided into 4 groups depending on their age of arrival (age 3-7, age 8-10, age 11-15, and age 17-39, respectively), and their overall performance on this grammaticality judgment test was then examined for correlations between age of arrival and test score.

Johnson and Newport's (1989) study arrived at an important conclusion regarding the effects of maturation on language acquisition. Similar to the findings of the earlier studies by Oyama (1978) and Patkowski (1980), Johnson and Newport's data showed a demonstrable correlation between subjects' age of arrival in the United States and their performance on the test. While the ultimate attainment of subjects exposed to English between the ages of 3 and 7 was consistent with the performance of native speakers, those who arrived between the ages of 8 and 10 scored highly overall, but universally lower than their younger counterparts. Again, with the 11 to 15 years of age-at-arrival group, there was a perceptible drop in scores compared to the younger groups, yet the 11 to 15 year-old group scored on average higher than their adult counterparts. Simply stated, "success in learning a language is almost entirely predicted by the age at which it begins" (p. 81). Furthermore, Johnson and Newport argue that although there is widespread individual variation in the competence of adult learners of a second language, a late age of first exposure to a second language precludes native or native-like performance in that language. None of the adult learners scored within the range of the native speakers or the 3 to 7 years of age-at-arrival group (and only one scored within the range of the 8 to 10 years of age-at-arrival group), allowing Johnson and Newport to surmise that after the closing of the critical period, attaining a native level of proficiency in a second language is a virtual impossibility.

One other finding that the Johnson and Newport (1989) study points to is that the importance of maturational effects in language learning can be illustrated through a comparison of pre-pubertal learners' test performance with that of post-pubertal learners. Johnson and Newport claim that because the human brain is presumably maturing throughout the critical period between infancy and puberty (and thus gradually losing its sensitivity to language acquisition), one would expect a negative correlation between age of exposure and test performance among those exposed to a second language before puberty. Conversely, they contend, because the brain of an adult has completed the process of maturation, there should be a leveling off of test performance among adult arrivals, and no correlation between age of exposure and test performance should be identifiable. As mentioned earlier, Johnson and Newport's data reveal a steady decline in performance among pre-pubertal learners, with the 3 to 7 age-at-arrival group scoring the highest, the 8 to 10 age-at-arrival group scoring lower, and the 11 to 15 age-at-arrival group scoring lowest among pre-pubertal subjects. Within the adult group, however, no comparable stratification was evident. As Johnson and Newport had hypothesized, the age of first exposure of the adult arrivals, instead of foretelling ultimate attainment as it did with those who arrived as children, contained no relationship with test performance. Given the existence of a negative correlation between age of exposure and ultimate attainment among pre-pubertal learners and the absence of a similar pattern among post-pubertal learners, Johnson and Newport were able to further support the belief that effects of maturation during the critical period are indeed largely responsible for determining one's ultimate attainment.

Johnson and Newport's study, along with Oyama's (1978) and Patkowski's (1980) studies, have provided influential evidence supporting the notion that a critical period influences the acquisition of morphosyntactic structures in a second language. Others have ventured beyond the realm of morphosyntax to examine another area of second language acquisition which, at least superficially, seems to be particularly susceptible to the effects of maturation: second language pronunciation. Perhaps the most readily observable trait of language, native speakers are often able to detect even the slightest hint of phonological foreignness in speech (Flege, 1984; Neufield, 1980), making the attainment of nativelike pronunciation a daunting task for language learners. Long (1990) and Patkowski (1994) both contend that the achievement of a nativelike accent in a second language is an impossibility if an individual is not exposed to the language during childhood, or, at the very latest, as an adolescent. Scovel (1988) goes so far as to claim that a critical period exists *only* in the realm of pronunciation. He contends that unlike other areas of language acquisition, "phonological production is the only aspect of language performance that has a neuromuscular basis" (p. 101). Learning new words and using new syntactic structures, he maintains, are fundamentally different tasks from the production of nativelike sounds, as the former do not involve a "physical reality" (p. 101)—they do not necessitate the refined neurobiological activity that is required when producing second language phonemes. Consequently, Scovel surmises that language learners who do not acquire the neuromuscular structures of the L2 that are different from their L1 before the close of the critical period (which he places around the age of 12) will forever be noticeably foreign in their second language phonological production. He theorizes that only highly exceptional second language learners—perhaps one individual out of one thousand—will be able to surmount the neurobiological barriers which materialize when the critical period for pronunciation closes.

In order to examine the effects of maturation on pronunciation, multiple studies have been conducted, again often using immigrants with various ages of arrival as subjects (e.g.,

Flege, Munro, & Mackay, 1995; Oyama, 1976; Thompson, 1991; Yeni-Komshian, Flege, & Liu, 1997). In one of these studies, Thompson (1991) examined data collected from 39 Russian-born subjects who had immigrated to the United States between the ages of 4 and 42. The subjects were each given three types of speaking tasks: (1) reading a list of 20 sentences which were intentionally “seeded” with English sounds that are known to be difficult for native Russian speakers; (2) reading a 160-word passage which had not been seeded; and (3) speaking spontaneously for one minute about their activities on the day of the experiment. The speech samples were then examined both by a group of native English speakers who had little or no knowledge about or exposure to foreign languages and linguistics, and by a group who was familiar with linguistics and had had frequent exposure to the Russian language. The judges were asked to rate the samples on a scale from 1 (no foreign accent) to 5 (heavy foreign accent).

Thompson’s results pointed to a strong link between a subject’s age of first exposure to English and the nativeness of his or her accent. While none of the subjects were universally judged to speak English wholly without a foreign accent,² subjects with an early age of arrival scored consistently and considerably better than subjects with a late age of arrival. In fact, although Thompson’s study examined several other variables to determine their influence on mastery of nativelike pronunciation (e.g., sex, education in English, use of English at home and with friends, pro-American orientation, among several others), she concluded that because of the extremely strong correlation between age of arrival and a subject’s ultimate attainment in pronunciation, relatively little could be drawn from an analysis of the other independent variables. Thus, Thompson’s conclusion that “the age at which [the immigrants] arrived in the U.S. was the best indicator of the accuracy of their pronunciation in English” (p. 195) points strongly to the notion that maturation is overwhelmingly the most important factor in ultimate attainment in pronunciation, and that a critical period proscribes late acquisition of a nativelike accent in a second language.

CHALLENGES TO THE CPH

Despite the strong evidence produced in the studies by Johnson and Newport (1989) and Thompson (1991) supporting the existence of a critical period for second language acquisition, important questions remain regarding the CPH. As Long (1990) states, “the easiest way to falsify [claims supporting the existence of a critical period in second language acquisition] would be to produce learners who have demonstrably attained nativelike proficiency despite having begun exposure well after the closure of the hypothesized sensitive periods” (p. 274). To this end, and in opposition to Johnson and Newport’s (1989) claim that nativelike competence is unattainable after the close of the critical period, scholars have pointed to the existence of speakers of a second language who, despite having little or no pre-pubescent exposure to a language, seem to have attained native or near-nativelike performance. Several studies (e.g., Bialystok, 1997; Birdsong, 1992; Birdsong & Molis, 2001; White & Genesee, 1996) have used this logic to challenge the acceptance of the CPH. White and Genesee (1996), seeking to determine whether

² While Thompson regards the presence of a non-nativelike accent among those exposed to English before the age of 10 as evidence to support a possible refutation of the CPH, Patkowski (1994) points out that although learning during the critical period provides a learner with the potential to achieve nativelike proficiency, it does not guarantee that he or she will ultimately perform in a nativelike manner. Because learners under 10 received several (if not universal) “accent-less” ratings, and because young learners repeatedly outscored their older counterparts, Thompson’s data is consistent with the CPH. Consequently, in this review, her results have been interpreted as support for the CPH, rather than a challenge against it.

highly proficient adult acquirers of a second language were indeed at a nativelike level, tested 89 speakers of English as a second language, using a grammaticality judgment task, a question formation task, and an interview task in which they were evaluated on their performance in terms of pronunciation, morphosyntax, fluency, choice of vocabulary, and overall nativeness. These judgments were then used to determine what relationship, if any, existed between the age of a subject's first exposure to English and his or her ultimate attainment in the language.

The results of White and Genesee's (1996) study provided them with ample evidence to controvert the CPH. Not only did several subjects demonstrate an ability to achieve near-native levels of competence despite their age of first exposure taking place after the purported critical period, but White and Genesee also found that "the performance of [these] near-native subjects on the grammaticality judgment task, both in terms of their accuracy and their speed, was indistinguishable from that of the native speakers, as was their performance on the written production task" (p. 258). White and Genesee do not deny the commonly held belief that a negative correlation exists between age of acquisition and ultimate attainment in a second language; those who learn a language at a young age, they admit, are more likely to achieve near-native competence than those who begin learning in adulthood. They do, however, challenge the notion that a critical period exists in the domain of second language acquisition which bars nativelike proficiency when language is learned after its closing. White and Genesee argue that the existence of adult learners of a language whose competence is indistinguishable from that of native speakers proves that adults have access to the language learning mechanisms to which children have access, and disproves the notion that after the closing of a critical period, nativelike performance in a second language is unattainable.

Building upon White and Genesee's (1996) critique, Birdsong and Molis (2001) offer an expanded challenge to the CPH not only by demonstrating the existence of nativelike achievement among adult learners, but also by raising doubts as to the universality of Johnson and Newport's (1989) results. Using materials and methodologies that were virtually identical to those used in the Johnson and Newport study, Birdsong and Molis substituted Spanish speakers for speakers of Chinese and Korean as their subjects, and sought to replicate Johnson and Newport's study. What they found, however, contrasted sharply with the outcome of Johnson and Newport's original study, and provided counterevidence to the CPH. One significant difference highlighted by Birdsong and Molis' study was a marked gap between the number of their Spanish-speaking subjects that performed at a nativelike level and the number of Chinese and Korean speaking subjects from Johnson and Newport's study who performed similarly well. While only one of Johnson and Newport's 23 late arrival subjects scored over 92% accuracy on the grammar judgment test, 13 of Birdsong and Molis' 32 late arrivals achieved a 92% or higher accuracy score on the same test. Birdsong and Molis suggest that these data challenge the validity of the CPH on two fronts: first, they meet Long's (1990) aforementioned criterion for rejecting the notion of the critical period by demonstrating nativelike ability in a learner whose first exposure to a language came after the close of the presumed critical period; second, and perhaps more importantly, these data call into question the generalizability of Johnson and Newport's results. If ultimate attainment is truly limited predominantly by maturation as the CPH suggests, these limitations should be present regardless of the subject's native language or the second language being acquired. In their own words, one would expect that "critical period-type effects and near-zero incidence of nativelike attainment should be observed no matter what the paring of L1 and L2" (p. 235). Because Birdsong and Molis found many nativelike subjects among their native Spanish speakers while Johnson and Newport's study found almost none

among their Chinese and Korean speakers, the authors suggest that Johnson and Newport's data are not generalizable to multiple L1-L2 pairings, and thus they cannot be taken as strong support for the existence of a critical period.

In addition to the existence of significantly higher numbers of nativelike late arrivals, the results of Birdsong and Molis' (2001) study differ from those of Johnson and Newport's (1989) study in another area which presents a further challenge to the CPH—the relationship between pre-pubertal arrivals and post-pubertal arrivals, and their subsequent ultimate attainment. Recall Johnson and Newport's claim that second language attainment should correlate negatively with age only until the closing of the critical period. In other words, for late arriving pre-pubertal learners, as the brain is maturing and the sensitivity for language learning is waning, their ultimate attainment should similarly decrease. For post-pubertal learners, on the other hand, Johnson and Newport maintain that there should be a plateauing of ultimate attainment due to the fact that the adult brain has presumably finished the maturation process and reached a more static state. However, Birdsong and Molis found no leveling off of scores among adult arrivals. Pre-pubertal learners did experience decreases in attainment with increasing age, a pattern similar to that demonstrated in Johnson and Newport. But instead of seeing a leveling off of ultimate attainment for adult arrivals, competence continued to decrease as a function of age of arrival throughout the post-pubertal group. Because Birdsong and Molis found that age of arrival correlated negatively with ultimate attainment among *all* subjects, not just those who arrived before the close of the critical period, they were able to hypothesize that mechanisms other than maturation were responsible for limiting or facilitating a learner's ultimate attainment.

While White and Genesee's (1996) and Birdsong and Molis' (2001) studies both demonstrate the ability of adult second language learners to achieve nativelike proficiency in terms of grammatical ability, Bongaerts, van Summeren, Planken, and Schils (1997) extended the challenge to the CPH beyond the realm of morphosyntax by examining the ability of advanced learners to replicate nativelike pronunciation. Well-known cases of adult learners who have seemingly mastered the vocabulary, morphology, and syntax of a second language but yet retain a noticeable, if not heavy foreign accent (what Scovel, 1988, termed the Joseph Conrad phenomenon) seem to suggest that pronunciation is an area of language that is strongly correlated with some sort of critical period. To test the validity of this notion, Bongaerts et al. performed a study testing the ability of native speakers of Dutch to acquire a variety of British English known as Received Pronunciation (i.e., a variety of English that is "unaccented... because it lacks a regional association within England," Wardaugh, 2006, p. 46). The subjects, none of whom had had any consistent exposure to English before the age of 18, were all considered to be highly proficient speakers of English. Speech samples were elicited both from these subjects as well as from native speakers of British English, and their samples were subsequently judged by two groups of judges ("experienced judges" who had been either English as a Foreign Language teachers or phoneticians, and "inexperienced judges" who had not received any training in linguistics or language instruction) on a scale of 1 (definitely nonnative) to 5 (definitely native).

In clear contrast to Scovel's (1988) claim that only highly exceptional second language learners are able to overcome the neurobiological obstacles that arise with the closing of the critical period, Bongaerts et al. (1997) found that a significant number of their subjects were rated comparably with the native speaker groups by both groups of judges. More than half of the participants in the non-native English speaker group (6 out of 11) had mean scores which fell within the native speaker range, and several of the non-native speakers received overall scores

equal to or higher than their native English speaking counterparts. As the subjects of the experiment were all carefully screened and selected on the basis of their high level of English ability, Bonagaerts et al. freely concede that despite the relatively high number of their subjects who passed as native speakers of British English, acquisition of nativelike pronunciation by adult learners of a second language is by no means a common phenomenon. Yet the fact that several of the native Dutch speaking participants produced Received Pronunciation that was indistinguishable from native speakers provides strong counter evidence to Scovel's contention that perhaps only 1 out of 1000 adult learners are able to achieve nativelike mastery of foreign language pronunciation. While Bonagaerts et al. are only able to speculate about what factors might enable an adult second language learner to overcome the disadvantages of a late start, they suggest that the acquisition of a nativelike accent after the closing of the purported critical period is by no means an impossibility.

RECONCEPTUALIZATION OF THE CPH

For White and Genesee (1996), Birdsong and Molis (2001), and Bongaerts et al. (1997), it is clear that the existence of nativelike second language learners is central to their respective arguments against the CPH. While they have taken examples of nativelike attainment by adult learners as a repudiation of the CPH, others have sought to explain the existence of these 'outliers' by reconceptualizing rather than discounting the notion of a critical period. DeKeyser (2000) concludes that the presence of these high-performing adult second language learners does not represent evidence contrary to the CPH; rather, it simply highlights the need to reexamine its parameters. He argues that human beings have both language-specific mechanisms of implicit learning (which are available only in childhood during the critical period and are relatively equal among individuals) as well as general mechanisms of explicit learning (which develop with age, and vary greatly according to the individual). Thus, if an individual is able to overcome the loss of implicit learning mechanisms and successfully acquire a language as an adult, a general mechanism of learning, he argues, must be compensating for this loss of implicit ability. DeKeyser hypothesizes that the relatively small number of successful adult language learners are not accessing these implicit mechanisms, as White and Genesee (1996) would contend. Rather, one of the general mechanisms of explicit learning—verbal ability—is compensating for the disadvantages brought about by the closing of the critical period. Therefore, only learners with high verbal ability, he surmises, will be able to acquire a second language with native-like proficiency as an adult.

To test this hypothesis, DeKeyser (2000) replicated the work of Johnson and Newport (1989), using 57 Hungarian learners of English in the United States. In addition to testing each subject's morphosyntactic performance, DeKeyser also included a test measuring the verbal ability of each subject. Just as with Johnson and Newport's study, DeKeyser's study shows a strong negative correlation between a subject's age of first exposure to English and his or her performance on grammaticality judgments. Additionally, an examination of those who scored highly on the grammaticality test reveals a strong correlation between native-like proficiency in adult learners and high verbal aptitude. DeKeyser writes, "no adult acquirers would score within the range of child acquirers unless they had high verbal aptitude" (p. 514). By establishing this link between outstanding performance and high verbal ability, DeKeyser is able to argue that adult language learners can compensate for a loss of implicit language learning mechanisms through the use of explicit general learning mechanisms. He states, "[i]f the scope of [the CPH]

is limited to implicit learning mechanisms, then it appears that there may be no exceptions to the age effects that the hypothesis seeks to explain” (pp. 499-500). The exceptionally high performers, he argues, were able to overcome the loss of implicit language learning mechanisms brought about by the closing of the critical period by utilizing an uncommonly high verbal aptitude.

In much the same vein as DeKeyser (2000), Moyer (1999) also reconceptualizes traditional views of the CPH and age effects on language acquisition. Yet rather than narrowing the purview of the CPH as DeKeyser proposed, Moyer challenges conventional thinking by suggesting that using age effects as an explanation for ultimate attainment in a second language is overly simplistic and insufficient. Instead she contends that age and maturation are inextricably linked to several sociopsychological variables which, in combination with age effects, serve to either constrain or facilitate an individual’s ability to reach nativelike proficiency. For Moyer, nonbiological factors such as learner motivation, cultural empathy, desire to sound like a native speaker, and type or amount of input are crucial factors often left unexamined by researchers, causing them to fall back solely on CPH-related factors such as learners’ age of acquisition or length of residence as a default explanation for variance in learner outcomes. Thus, in Moyer’s view, the effects of age should not be disregarded in seeking to explain a learner’s competency in a second language, but rather, they should be considered in combination with the nonbiological differences that arise as a learner matures.

Using 24 native English-speaking graduate students in German who had received no exposure to German prior to the close of the critical period, Moyer (1999) tested her hypothesis by administering a series of pronunciation tasks, ranging from highly structured (reading of word lists) to relatively naturalistic (free speech on a pre-selected topic). The students’ speech was recorded, and the nativeness of their respective pronunciation was then rated by four native speakers of German on a six-point scale (1 being “definitely native,” and 6 being “definitely non-native”). As none of the subjects consistently scored within the native speaker range on the pronunciation tasks, Moyer concedes that her findings do not refute the fundamental link between age of exposure and ultimate attainment as postulated by the CPH. However, despite the inability of the subjects to overcome the biological restrictions of their advanced age at first exposure, the results did evince strong links between certain variables and ultimate attainment, suggesting that age effects are not solely responsible for learner proficiency. For example, in measuring professional motivation and its effect on proficiency, Moyer found that those subjects whose professional goals included professional writing, translation, or speaking in German scored significantly closer to nativelike production than their counterparts. Additionally, the type of instruction received by the subjects also correlated closely with ultimate attainment. Those who received instruction in both suprasegmental and segmental aspects of German pronunciation were scored consistently closer to nativelike by the raters than those who received only a single type of instruction. While age of exposure was an important element in determining the subjects’ final state, it was by no means the only noteworthy factor. By demonstrating a clear link between both professional motivation and manner of instruction in relation to a learner’s ultimate attainment, Moyer contends that conventional notions of the CPH are inadequate, as they reflect an over-reliance on the effects of age in explaining inter-learner variance. She maintains that, in order to obtain a clearer picture of how second languages are acquired, it is necessary for researchers to consider both CPH and sociopsychological factors in order to obtain a clearer picture of SLA.

Flege (1999), like Moyer (1999), also contends that the scope of the CPH must be reconsidered so as to provide a more accurate conceptualization of the relationship between age and language acquisition. Long a critic of the CPH for its inability to disentangle the effects of maturation from the myriad other factors which might possibly affect language learning (see Flege, 1987 for a discussion), Flege (1999) draws upon previous studies by Flege, Munro, and MacKay (1995) and Yeni-Komshian, Flege, and Liu (1997) to conclude that traditional notions of a critical period for language learning are dated. In analyzing both studies, Flege (1999) concedes that, corresponding to conventional views of the CPH, individuals with an early age of first exposure almost universally outperform those whose first exposure to a second language comes after puberty. However, data from Flege et al. (1995) and Yeni-Komshian et al. (1997) suggest that even among those individuals exposed to a second language as very young children, the likelihood that they would speak with an entirely nativelike accent—an outcome which Flege claims is predicted by the CPH—was quite low. Instead, even individuals with an early age of exposure were characterized by varying degrees of foreignness in their pronunciation. As a result of these mixed data, Flege, instead of directly affirming or disputing the notion that a critical period governs the acquisition of pronunciation in a second language, attempts to offer an alternate, more comprehensive view of the factors affecting second language pronunciation. As part of what he terms the Speech Learning Model (SLM), Flege contends that a learner's first language and second language influence each other, inhibiting proficiency in the pronunciation of both languages. Put simply, the greater the continued use of a first language, the more pronunciation proficiency in a second language will be restricted. In this sense, the SLM goes beyond the CPH by proposing that a bilingual's pronunciation competency will not be governed solely by the age at which he or she began learning his or her second language, but additionally by the relative use or disuse of the first language. The SLM also serves to explain the lack of nativelike accents among some childhood learners. According to Flege, if the native language is maintained and used, even sparingly, it will have an effect on second language phonology and partially influence pronunciation. So while Flege does not deny the importance of age or the advantages of an early start in language learning, he challenges the validity of the CPH by placing first language use alongside age of first exposure as one of the key components which determines ultimate attainment in the pronunciation of a second language.

Flege (1999) draws support for this hypothesis from a study by Flege, Freida, and Nozawa (1997). Using two groups of native Italian speakers who had immigrated to Canada at the average age of 5, Flege et al. (1997) sought to discover the extent to which robust use of a native language attenuates ultimate attainment in pronunciation in a second language. The two groups, which were separated by self-reported use of Italian into high-use and low-use groups, were asked to read a variety of English sentences that were subsequently judged by native speakers as either "definitely English," "probably English," "probably Italian," or "definitely Italian." What Flege et al. found were data patterns that supported the notion that age of exposure was not the sole factor in determining the relative nativeness of a second language learner's accent. First of all, like Flege et al. (1995) and Yeni-Komshian et al. (1997), not all of the subjects were judged to have spoken without a foreign accent regardless of their average age of arrival. Furthermore, as the SLM hypothesizes, significant differences were apparent between the early learners who used Italian frequently and those who used it infrequently, as the frequent users of Italian were judged as having significantly stronger foreign accents than their low frequency counterparts. For Flege et al. (1997), the data clearly demonstrate that the subjects' respective maintenance of their native Italian was in turn influencing their English pronunciation

ability. While Flege et al. do not discount the notion that maturation has an effect on language acquisition, for them it is not the only predictor of ultimate attainment in a second language. They write, “while the results do not disprove the existence of a critical period, they indicate that the passing of a critical period is not sufficient in itself to explain all the aspects of non-nativeness in the speech of individuals who have learned English as [a second language]” (p. 184). By establishing a role for first language use and its influence on second language pronunciation, Flege et al. challenge conventional notions that age of exposure alone determines L2 ultimate attainment, and contend that the CPH’s parameters are too narrow.

In contrast to Flege’s (1999) and Fledge et al.’s (1997) call for a reconceptualization of the CPH, Eubank and Gregg’s (1999) reconceptualization of the CPH does not involve a reevaluation of the factors which influence ultimate attainment in a second language. Instead, Eubank and Gregg argue that the means and methods which are used to measure ultimate attainment—not the CPH itself—must be reevaluated. Much like DeKeyser (2000), Eubank and Gregg theorize that the existence of adult second language learners whose proficiency seems to be indistinguishable from that of native speakers does not controvert the CPH; rather, it simply highlights a need to reexamine the traditional CPH and reconceptualize its underpinnings. The crux of Eubank and Gregg’s reconceptualization lies in the type of evidence that is generally presented as “proof” of the nativelike proficiency of late language learners. Citing White and Genesee (1996), Eubank and Gregg (1999) concede that certain adult learners of a second language may in fact be indistinguishable from native speakers. However, they contend that this is only half of the story. For them, the problem with White and Genesee (1996), as well as other studies which point to nativelike late learners as counterevidence to the CPH, is that these studies base their conclusions solely on behavioral evidence such as grammaticality judgment tests and native speaker ratings. The underlying physiological functioning of the brain is not taken into consideration, and thus it is impossible to determine if a highly proficient non-native speaker has truly attained nativelike competence, or if he or she is simply overcoming the absence of native speaker cognitive structures through the use of advanced metalinguistic knowledge, native language positive transfer, or some other coping mechanism. Eubank and Gregg point to studies involving other species (cf., Colombo, 1982) which suggest that while behavioral stimuli provided to a subject following the close of a critical period can seemingly bring the subject back within the normal range of functionality for a particular task, such stimuli will have no effect on the underlying neural mechanisms which govern that task. They contend that theoretically it is well within the range of possibility for an adult exposed to a second language after the close of a critical period to exhibit nativelike competence, yet be physiologically and neurologically distinct from a native speaker. Consequently, according to Eubank and Gregg, the demonstration of nativelike proficiency in an adult learner of a second language does not constitute evidence against the existence of a critical period for language learning unless it is accompanied by nativelike neurological functions.

To ballast their argument, Eubank and Gregg (1999) point to a series of studies by Weber-Fox and Neville (1996, 1999) that measured subjects’ neurological activity in addition to testing language proficiency. In the original study, Weber-Fox and Neville selected 61 Chinese/English bilinguals whose age of first exposure to English ranged from very early childhood (1-3 years of age) to adulthood (after 16 years of age). The subjects, who had all been immersed in an English-speaking environment for at least 5 years, were given standardized tests of grammar as a means of measuring their proficiency in English. In addition to these behavioral measurements, subjects also had their Event-Related Brain Potential (ERP) monitored when

viewing sentences violating various semantic expectations or syntactic rules so as to measure the underlying brain activity that governed their language use.

Weber-Fox and Neville's (1996, 1999) findings, Eubank and Gregg (1999) claim, lend support to the notion that the nativelike proficiency of highly successful late learners of a second language, while on the surface indistinguishable in some cases, is based on neurological activity different from that of native speakers. At first glance, Weber-Fox and Neville's data seem to simply represent further affirmative evidence for the existence of a critical period for language acquisition. In terms of behavioral competence, the subjects' syntactic proficiency was clearly negatively impacted by delays in exposure to the second language, as subjects with an age of exposure over 7 generally showed a considerable decline in syntactic accuracy judgments. Similarly, the ERP results exhibited decreased left-hemispherical specialization and increased use of the brain's right hemisphere among late-learners, suggesting differences in brain activity based on age of immersion. While these findings seemingly only provide further support for the position that morphosyntactic competence is profoundly influenced by the effects of maturation, Eubank and Gregg (1999) point out that when examined more closely, they prove to be far more instructive. For example, although grammaticality judgment tests showed relatively uniform scoring in specificity constraint rules in all subjects with an age of exposure under 16, ERP readings showed decreased left-hemispherical specialization and increased right-hemispherical activity starting with the 11 to 13 years of age-at-exposure group. In other words, the subjects' performance in terms of behavioral testing was nativelike up to the age of 16, but the underlying neurophysiological activity of those tested showed evidence of non-nativelike activity starting around the age of 11. Eubank and Gregg (1999) contend that these mild discrepancies between behavioral and neurophysiological data support the notion that while an adult learner may in fact be able to attain a competence that is indistinguishable from that of a native speaker, his or her brain is almost certainly not functioning in the same manner as that of a native speaker. Instead they claim that he or she is likely using some other mechanism to overcome the disadvantages of the closing of the critical period for language learning.

DISCUSSION

Despite the vast amount of research investigating the CPH, no clear consensus has been reached on the role that age and maturation play in the acquisition of a second language. Perhaps one of the central reasons why researchers have failed to reach an agreement on the issue is due to the difficulty in pinpointing some essential notions about the CPH and language attainment. In order to prove or disprove the existence of a critical period for second language acquisition, one might presuppose that fundamental empirical and theoretical concepts have been well defined. In terms of the debate over the CPH, however, this has not been the case. One essential issue—the notion of what can be considered nativelike performance in a language—has not been resolved. Moreover, the very definition of the critical period—its onset, its offset, and its relevance to various areas of linguistic performance—is one that is in a continual state of flux. A brief examination of the ambiguities surrounding these terms and concepts may help to illuminate the source of continuing debate over the CPH.

Long (1990) advanced the notion that by producing one late-learning nativelike speaker of a second language, one would essentially falsify the fundamental tenets of the CPH. While several studies have purportedly satisfied this criterion, many researchers remain skeptical about the validity of these claims, being generally unconvinced that these high-performing participants

are indeed functioning in a nativelike fashion. In considering several recent studies which present counterevidence to the CPH, Long (2005) attempts to demonstrate how the findings of each study are tempered by various limitations or design flaws. One area that Long places significant focus on is the methodology by which various studies determined a participant had attained nativelike ability in a second language. For example, he contends that studies such as Birdsong (1992) and White and Genesee (1996), in which subjects were deemed to have performed in a nativelike fashion, were unreflective of true nativelike abilities. Because the studies were either unsped or limited in the linguistic functions they examined, Long contends that the nativelike performance of the participants cannot be taken as a falsification of the CPH.

On the other side of the argument, critics of the CPH have also taken issue with the manner in which nativelike performance has been defined. Traditionally, the production of non-nativelike utterances by a second language learner has been taken as proof of a learner's inability to become proficient in a second language. Birdsong (2005), however, casts doubt on the accuracy of this assumption. He claims that while researchers are undecided on what exactly comprises a nativelike ability to speak a language, in general, the standards that one must reach to be considered nativelike have been set too high, falsely preserving the validity of the CPH. To uphold the CPH, he states that "individuals who have demonstrated nativelikeness in several areas of experimental performance could be subjected to even further poking and prodding, until a betraying shibboleth is found" (p. 322). Instead, he maintains that "[t]he falsification process should not require data from every imaginable nook and cranny of linguistic behavior" (p. 322). In other words, one should accept a speaker as nativelike if he or she is able to perform in a nativelike manner on a reasonable battery of linguistic tests. By calling into question the norms by which language learners are judged, Birdsong mirrors Long's (2005) concerns regarding nativelike ability, but from the opposing point of view. While Long attempts to demonstrate that some studies' conceptualization of nativelike proficiency is incomplete, Birdsong claims that falsification of the CPH has been made unduly difficult due to arbitrarily high standards. Despite this ideological opposition, both Long and Birdsong taken together highlight the ambiguity which is attached to research and discussion on the critical period for second language learning. The extreme complexity of defining concepts such as nativelike proficiency makes confirming or disproving the CPH exceedingly difficult, and helps to partially account for the difficulty in coming to a consensus on the issue.

Similar to the complexity in defining nativelike proficiency is the difficulty with which researchers have sought to define the critical period itself. As Singleton (2005) points out, the literature regarding the CPH is rife with incongruent interpretations and competing explanations of what the critical period actually is and when it begins and ends. In an extreme example of these conflicting views, some researchers (e.g., Hyltenstam and Abrahamsson, 2003; Molfese, 1977) have suggested that the critical period draws to a close around a child's first birthday, almost one year before Lenneberg (1967) postulated the critical period begins (i.e., at age two). Furthermore, as has been illustrated in this review, multiple areas of linguistic development (e.g., morphology, syntax, phonology) do not seem to be uniformly subject to the influence of maturation. Consequently, the concept of multiple critical periods has been suggested by several researchers, adding further complexity to arguments regarding the CPH. Finally, although the terms critical period and sensitive period are often used interchangeably in the literature, the inherent difference evinced by these two terms points to a fundamental disparity in the manner in which the CPH is conceptualized. Reflecting the distinction between strong and weak versions of the CPH (Krashen, 1975), use of the term critical period seems to suggest that an individual not

exposed to stimuli during a given period of time will forever be deficient in some realm, while sensitive period seems to imply that although an individual may be best suited to respond to certain stimuli during this period, a lack of exposure during the sensitive period may not necessarily exclude an individual from normal functioning in a given domain. Thus, with this discordance concerning the very definition of the critical period—when it begins and ends, which aspects of language are affected by it, and how absolute its effects are—it is relatively unsurprising that attempts to confirm or deny the CPH have yielded inconclusive and at times contradictory results.

CONCLUSION

The idea that childhood immersion in a second language environment leads to widespread success in achieving nativelike proficiency in that language is hardly controversial. Likewise, there is general agreement that exposure to a second language in adulthood is marked by widespread failure to attain nativelike competence. Yet despite this consensus, the function of age and maturation in second language acquisition remains a subject of much debate. Perhaps it is not surprising that given the difficulty in defining the terms and concepts associated with the CPH, important questions remain unanswered regarding the role of age in ultimate attainment of a second language. While some contend that biological factors wholly proscribe learners from achieving nativelike proficiency after the onset of adulthood, others have produced empirical evidence which seems to disprove this hypothesis. Consequently, recent studies have taken a new approach to the CPH by either narrowing its focus, expanding its parameters, or suggesting that it be considered in conjunction with other important factors. So while the importance of age effects on language learning cannot be denied, the causes and the pervasiveness of these effects are areas that continue to be debated, contended, and researched.

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