

# *Age and Accent in a Second Language: A Reply to James Emil Flege*

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*This article responds to the arguments raised against the Critical Period Hypothesis (CPH) by James Emil Flege in 'A Critical Period for Learning to Pronounce Foreign Languages?' published in Applied Linguistics (8/2). An examination of the relevant literature leads to the conclusion that there is sufficient evidence to support the notion of an age-based limitation on eventual proficiency that can be attained by learners in a second language. It is argued that Flege did not represent the CPH entirely accurately, and that convincing counter-evidence to the CPH has not been presented. It is further argued that there is enough evidence to show that child second language acquirers are indeed superior in terms of ultimate ability, so that rejection of the CPH is unjustified at this time.*

## 1. INTRODUCTION

With the recent publication of two survey articles concerning the acquisition of second language phonology (Flege 1987; Major 1987), the notion of a critical period for the acquisition of a second language is again undergoing scrutiny. Flege focuses entirely on the issue of a critical period (CP) for the acquisition of second language (L2) phonology, while Major devotes more attention to examining factors other than age which affect L2 accent (with less than 2 pages given to the age factor); nevertheless, both authors strongly reject the Critical Period Hypothesis (CPH). The purpose of this article, then, is to argue that the current research evidence is in fact quite consistent with the CPH and that convincing counter-evidence has not yet been presented. The paper will largely be devoted to replying to Flege; essentially, it will be asserted that Flege does not represent the CPH entirely accurately, and that many studies which he contends provide evidence against it do not in fact bear directly upon the issue. On the other hand, it will also be argued that those studies which bear directly upon the CPH do provide evidence which is consistent with it. Indeed, it will be suggested that Krashen *et al.*'s (1982) generalization that child second language acquirers are usually superior in terms of ultimate proficiency, even though adults and older children may often display initially faster L2 acquisition rates, remains unchallenged by current findings. It is recognized that even though such findings may be highly consistent with the CPH, they cannot be taken as definitive proof of the existence of a CP, because statistical correlation simply does not prove causality. However, it is also proposed that in the light of such findings, absolute rejection of the CPH is not justified.

Since it is the purpose of this paper to argue against the rejection of the notion

of an age-based constraint on the acquisition of full native fluency in a second tongue, the term 'critical period' is taken here only to refer to this particular notion and is used as an approximate synonym with 'sensitive period'. A terminological discussion concerning distinctions between these terms would be diversionary in the context and will be avoided. In addition, excellent discussions are available elsewhere (for example, Oyama 1979; Colombo 1982).

#### ON THE NOTION OF A CPH

Flege does concede that 'the results of many acoustic and perceptual experiments have provided empirical support for the popular belief that the earlier an individual begins to learn a foreign language ... the better will be his or her pronunciation' (p. 162), and cites several supporting studies which will be examined later in this paper; but he then claims that the CPH is built upon two major predictions, neither of which is sustained by the research evidence. However, it can be shown that these two predictions are not in fact central to the notion of the CPH.

The first prediction, according to Flege, is that speech acquisition, to be entirely effective, must take place before the hemispheric specialization of language occurs. Lenneberg's (1967) original formulation did link the CP to the completion of cerebral lateralization of language at puberty but, as Flege points out, some degree of hemispheric specialization is now known to be present at birth (for example, Whitaker *et al.* 1981) and there has been controversy concerning the age at which cerebral lateralization is complete. Yet, this does not by any means invalidate the notion of a biologically based CP. Indeed, the presence of linguistically specialized zones in the newborn brain would seem quite consistent with the concept of a biological basis to language. Furthermore, there remains much evidence for the existence of a high degree of neurological plasticity in the language zones of a child's brain which tapers off during early adolescence (for example, see Hecaen 1976, for a review of the relevant literature in aphasiology), even though complete recovery from aphasia may not occur even in young children, as Flege points out. Thus, the contention that the CP-lateralization link is fundamental to the notion of a CPH is misleading; it is in fact the concept of plasticity which is fundamental.

Similarly, the fact that other researchers have advanced other neurologically-based hypotheses to explain age differences in L2 pronunciation which have not been widely accepted by speech-perception researchers (for example, see Flege's discussion of Walsh and Diller 1981 on p. 163) merely shows that the CP, if there is one, has not yet been given an adequate neurobiological explanation; it does not provide fundamental evidence of the incorrect nature of the CPH.

The second prediction made by the CPH, according to Flege, is that speech learning after the CP both proceeds more slowly and is ultimately less successful than before the CP. The author subsequently refers to studies which have shown faster initial L2 learning rates for adults (for example, Snow and Hoefnagel-

Höhle 1977) to reject this prediction. However, the issue of initial learning rates is a separate one, and one which does not bear directly upon the validity of the CPH. Indeed, proponents of the CPH generally only hold that ultimate L2 proficiency, and not speed of acquisition, is subject to an optimal period.

For example, Oyama puts it as follows:

There is some developmental period, stretching roughly from 18 months to puberty, during which it is possible to master the phonology of at least one . . . nonnative language, and after which complete acquisition is impossible or extremely unlikely. (Oyama 1982: 21)

Patkowski (1982) similarly describes the age limitation as one which prevents adults from ultimately 'passing for native' in a second language, but not children. It is crucial to further add that the CPH concerns naturalistic 'language acquisition', as opposed to formal 'language learning' (as defined by Krashen 1981) and that native proficiency in L2 is not seen as the necessary product of pre-CP acquisition, but rather as a possible outcome under optimal sociolinguistic and other conditions. Lenneberg (1967: 176) himself admitted that 'our ability to learn foreign languages tends to confuse the picture', but also held that what was affected by the CP was the ability to eventually 'overcome the accent and interfering influences of the mother tongue' (1973: 95). Thus, the evidence which bears directly upon the CPH is evidence concerning the eventual proficiency of child and adult learners in 'naturalistic L2 acquisition situations' under sociolinguistic conditions which do not adversely impact upon the language acquisition process as, for example, appears to happen with large numbers of minority language children in the United States (United States Commission on Civil Rights 1975). However, before turning to such evidence, more of Flege's arguments against the CPH need to be examined.

#### FURTHER ARGUMENTS AGAINST THE CPH

Flege contends that another good reason to question the CPH is that the CP concept was originally developed to describe animal and not human behavior; he then presents four characteristics of the behavior which results from imprinting in chickens, ducks, and geese (as a good example of a critical period in ethological research), and finds that only one (that such behavior appears under well-defined developmental conditions) applies to human language behavior (p. 165). However, it could be argued that the other three characteristics (the behavior cannot be revised or forgotten, it involves recognition of species characteristics, it may be learned long before it is manifested) do in fact apply to human speech learning: (1) in a general sense, speech cannot be forgotten once it is learned; that is, while particular languages can be forgotten or revised, nobody, short of severely traumatized patients, 'forgets' how to talk; (2) unless one wishes to argue for a strict behavioristic model of language acquisition, it has to be considered that human speech learning does involve the recognition of some type of species characteristics; (3) it seems well-established in psycholinguistic and second language acquisition studies that comprehension

frequently precedes production, i.e. that linguistic rules can be learned before they are manifested.

More importantly, and following Flege's own line of reasoning, it can be pointed out that since the concept of imprinting is one which was initially developed to describe the behavior of certain types of fowl, it is difficult to see why human speech behavior should exhibit exactly the same characteristics, even if a CP is involved. Indeed, as Immelmann and Suomi (1981: 407) state:

There is only one criterion, except for an enhanced degree of stability, that seems to hold true for a general characterization of imprinting: the existence of sensitive phases. In all the phenomena that have been called imprinting or been compared to it, some developmental and learning processes are favored in one way or the other during certain, usually early, periods of the individual's lifetime. In the nature of such phases, however, large differences exist.

The authors then discuss how sensitive phases are not generally sharply defined in terms of onset and termination, how they differ from species to species, individual to individual, and functional system to functional system. Clearly, the fact that human language may not meet four rigid characteristics of the behavior resulting from imprinting in ducks, geese, and chickens is not convincing counter-evidence to the CPH.

Along a different line of argumentation, Flege also quotes studies which have shown superior performance by adults over children in perceiving and producing L2 sounds, such as the aforementioned Snow and Hoefnagel-Hohle study, which essentially shows that adults and older adolescents can initially learn faster. However, Flege disregards that, with respect to eventual attainment, the same authors noted in another report (1978: 1122) that 'the adults, despite their initial rapid acquisition, fell increasingly behind because their subsequent improvement was very slow. The teenagers had almost achieved native performance very rapidly'. Another study which is quoted is Winitz (1981), who found that native English adults were better able to discriminate Chinese tones than eight-year-olds. However, this research involved comparing English monolingual college-age students and third-grade students on a task involving the recognition (same or different) of tones presented in contexts ranging from isolation to short Chinese sentences. Since little L2 acquisition, let alone 'naturalistic' L2 acquisition appears to have been involved in the experiment, it is difficult to see how the findings bear upon the CPH in any direct manner.

A more convincing study which is referred to is Mack (1984), who investigated the question of whether the linguistic performance of fluent early bilinguals is indistinguishable from that of monolinguals. The subjects had acquired both English and French before the age of 8, and all but two of them indicated that they were either dominant in English or balanced in their abilities in both languages. The purpose of the research was to determine whether the bilinguals would prove indistinguishable from the English monolinguals in their performance on various psycholinguistic tests. The results showed no

significant differences in the production and perception of voice-onset time (VOT) for the /d/ and /t/ vowels; however, significant differences were found in how the two groups labelled the /i/ to /ɪ/ vowel continuum, and in their reaction time and accuracy in grammaticality judgments, as well as in word acceptability judgments.

In the light of Flege's and Eefting's (1986) recent findings that adult native speakers of both Spanish and English show category boundaries for stop consonants at longer VOT values than children of the same native language background (an age effect consistent with earlier findings by Williams for monolingual English adults (1979a) and children (1979b)), it is not entirely clear that the differences found by Mack in the labelling of the /i/ to /ɪ/ continuum are solely indicative of a 'non-nativeness' factor, since native speakers themselves seem to differ in certain aspects of their phonological production and perception. Mack, in discussing her results, does conclude that 'the bilinguals responded significantly differently from the monolinguals to tests tapping the phonetic, syntactic, and semantic components' (p. 173) but suggests that 'a bilingual's linguistic system (in one or both of the languages) may be different from a monolingual's system because the bilingual has acquired two languages' (p. 172) and that therefore, the results of her study do not undermine the CPH.

Even if one both accepts Mack's explanation and bears in mind the caveat regarding variability in native phonological performance, it nevertheless cannot be denied that the Mack findings do present somewhat of a challenge to the CPH. However, the sample size involved in these experiments was quite restricted (10 monolinguals and 10 bilinguals) and it is not clear to what extent all 10 bilinguals were fluent enough to 'pass for native', given that only 3 out of the 10 rated themselves perfectly in English on a self-evaluation questionnaire. Furthermore, the average scores for the group on a ten-point scale (as rated by a single 'trained linguist') ranged from 8.4 for fluency in reading to 10 for accent in speaking; thus, the 8.4 rating also suggests that the bilinguals may have been less than fully native-like in English, though this is not entirely clear since the monolingual group was not subjected to the same rating procedure and there is no basis for comparison. Given these limitations, the results should not be interpreted as disconfirmation of the CPH (and Mack herself certainly does not interpret them as such) but rather as preliminary findings warranting further research.

Flege also argues that the CPH leads to the expectation of a marked discontinuity in the ability to pronounce L2 by individuals of differing ages, and he points out that the Oyama (1982) study uncovered a linear relationship between age and accent with no such abrupt difference. However, her research design did not lend itself well to uncovering such a discontinuity because the age at onset of L2 acquisition for her sample only ranged from 6 to 20 years. This range can be judged insufficient for the purpose of uncovering any marked discontinuity, if one considers that the critical turning point may be somewhere in the teens (with considerable room for individual variation).

However, Patkowski (1980) did uncover such a discontinuity for a sample of 67 second-language learners (with age at L2 onset ranging from 5 to 50 years). Though the study primarily concerned itself with the eventual syntactic proficiency of child and adult acquirers of English as a second language, subjects were also rated for accent (on a five-point scale with intermediate + values); the correlation obtained between accent and age at L2 was very close to that obtained by Oyama ( $R = -0.76$ , compared to 0.84 and 0.71 on two separate measures of accent for Oyama 1973,  $p < 0.01$  in all cases). The contrasting positive and negative  $R$  values simply reflect the fact that a low score in the Patkowski study indicated a higher degree of accent whereas it indicated a lower degree of accent in the Oyama study.

At the time, no further computations were carried out with the accent measure in the Patkowski study; however, the findings concerning the eventual L2 syntactic proficiency of the subjects revealed strikingly different population distribution curves for pre- and post-CP learners, and scatterplots showing separate pre- and post-CP regression lines for age at L2 with syntactic proficiency also made the discontinuity plain. In order to verify whether similar findings would be obtained with the accent measure, as might well be expected since the two measures correlated highly ( $R = 0.80$ ,  $p < 0.000$ ), the Patkowski (1980) accent data were re-examined, and the results are presented below.

As Figure 1 shows, the distribution of scores on the accent variable for those who began L2 acquisition after the age of 15 ( $n = 34$ ) can be recognized as belonging to the 'normal' bell-shape variety (distributed around a mean of about 2+), despite a 'glitch' in the frequencies at the 3+ and 4 rating levels. On the other hand, the distribution for L2 acquirers who began between the ages of 5 and 15 ( $n = 33$ ) is strikingly not of the bell-shape variety, but markedly skewed, with 29 of 33 cases scoring at the 4+ or 5 level. These results are essentially

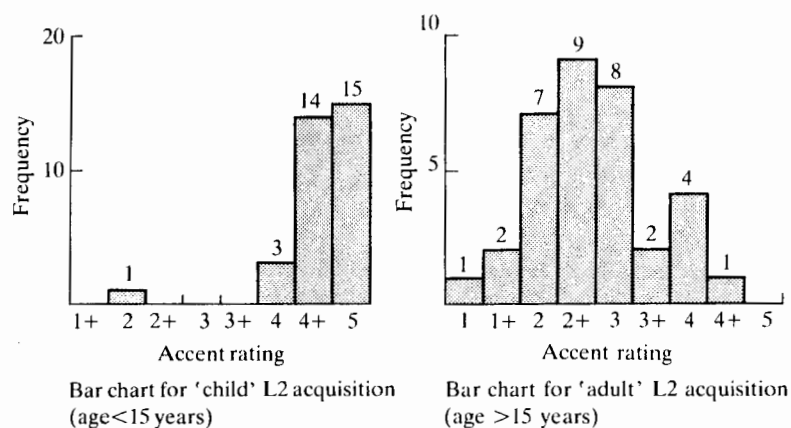
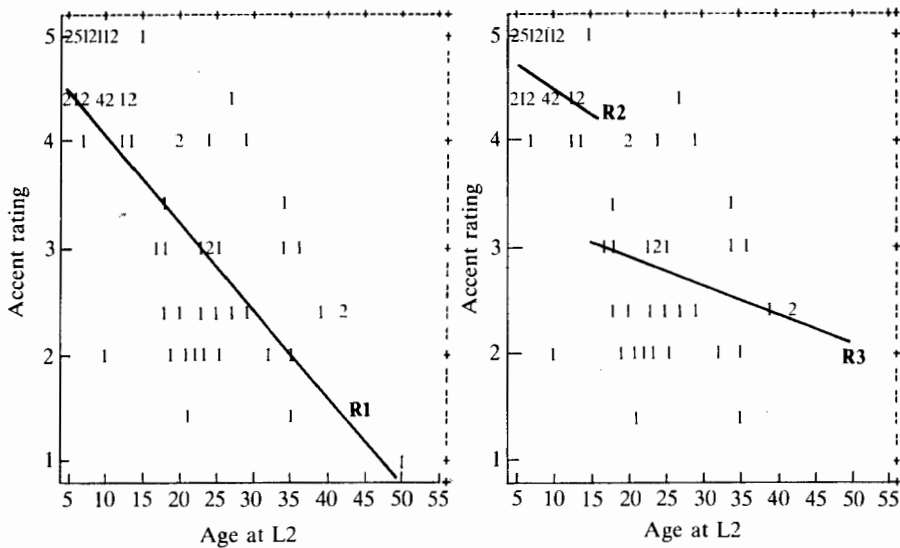


Figure 1: Bar charts showing population frequencies for pre-CP ( $n = 33$ ) and post-CP ( $n = 34$ ) learners on accent rating (5 = 'negative' accent). (Based on data from Patkowski 1980.)

similar to those for the pre- and post-CP groups with the syntactic measure in Patkowski (1980). Thus, the adult group showed a clearly 'normal' distribution, centered about a mean of 3+ ('syntactic proficiency' also being measured on a scale of 0 to 5). Only one adult learner out of 34 cases obtained a 5 rating. In marked contrast, the curve for the younger group was very strongly skewed to the right and showed almost no scatter, with 32 of 33 cases in the 4+ and 5 rating levels. Thus, the distributions of both the accent and syntactic measures reveal a discontinuity and suggest that pre- and post-CP subjects are drawn from different populations.

Turning to scatterplots showing the relationship between age at L2 and eventual proficiency, it can be seen from Figure 2 below that the regression line



Scatterplot showing regression line for Accent and Age at L2 for both 'child' and 'adult' learners (R1)

Statistics:  
 Correlation (R1) = -0.764  
 Significance = 0.000  
 Slope = -0.081

Scatterplot showing separate regression lines for 'child' (R2) and 'adult' (R3) learners

Statistics:  
 Correlation (R2) = -0.245  
 Significance = 0.169  
 Slope = 0.052

Correlation (R3) = -0.288  
 Significance = 0.098  
 Slope = 0.028

Figure 2: Scatterplots showing regression lines for accent rating with age at which L2 acquisition began: (a) for entire sample (n = 67); (b) for pre-CP learners (age < 15, n = 33); (c) for post-CP learners (age > 15, n = 34). (Based on data from Patkowski 1980.)

for the entire sample (R1) does show a clear negative relationship of age at onset of L2 with eventual L2 accent, but that no discontinuity is revealed; this is not surprising, because linear regression analysis by definition produces *straight* lines 'of best fit' to the points in a scattergram. However, when separate age-L2 proficiency regression curves are plotted for the pre-CP and post-CP groups, the regression line for the adult group (R3) can be seen to be markedly lower than that for the younger group (R2); the discontinuity seen in Figure 1 above is thus also made evident on the scatterplot. The correlations between Accent Rating and Age at L2 associated with the separate regression lines R2 and R3 fail to reach significance for two reasons: (1) because of the reduction in the size and scatter of the sub-samples (a straightforward statistical consideration) and (2) because of the reduced slopes for the R2 and R3 lines (an indication that major age differences can only be uncovered when comparisons are made across child-adult groups rather than within those groups—a finding consistent with the notion of a critical turning point). A similar analysis involving the syntactic measure in Patkowski (1980) revealed similar results, with the regression line for the post-CP group also markedly lower than that for the pre-CP group. Thus, it would seem that important discontinuities between child and adult L2 learners can in fact be uncovered; at the same time, it must be recognized that the results discussed above would clearly benefit from replication with samples of increased size and scatter.

#### SOME ARGUMENTS FOR THE CPH

As mentioned in the introduction, Krashen *et al.* (1982) reviewed about 25 studies concerning age, rate, and eventual attainment in L2, and concluded that the literature was consistent with the notion that even though adults and older children may initially acquire L2 faster than children (both in 'naturalistic exposure' and 'formal learning' situations), child L2 acquirers (in 'naturalistic exposure') are usually superior in terms of eventual attainment. Since ultimate proficiency is the real test of the CPH (and not rates of acquisition, whether initial or otherwise), a brief review of the handful of studies devoted to this issue is now in order.

Asher and Garcia (1969) gave sentence pronunciation tasks to 71 Cuban immigrants who had arrived in the US between the ages of 1 and 19 years. Most of the subjects had resided in the country (in the San Francisco Bay Area) for at least five years. While only descriptive statistics and bar charts were presented, a clear 'younger is better' factor appeared, though not one of the subjects attained a fully native English pronunciation. Since information concerning the sociolinguistic circumstances of the sample is lacking, one can only speculate that such factors may have been involved in the latter finding which, in any case, does not disturb the basic conclusion of the study—that there seems to exist a marked age effect. Seliger *et al.* (1975) asked over 300 immigrants both to the US and to Israel for L2 self-reports; 85 percent of those who had begun L2 acquisition before the age of 10 reported no accent, and 92 percent of those over 16 reported an accent. Exposure, which ranged up to 20 years or more had no effect.



Tahta *et al.* (1981a) tested 109 subjects of various language backgrounds who had resided in the UK from 2 to 55 years. The results showed a strong relationship between age at arrival and degree of accent ( $R = 0.657$ ) and the authors speculated that age of acquisition is an overwhelming factor especially up to age 7 and after age 12. Other factors (especially extent of L2 use at home) were thought to operate more strongly at ages 7 to 12. Length of stay in Great Britain had no effect. Oyama (1982) had 60 Italian immigrants, who had resided in the USA from 5 to 18 years and who were drawn from upper educational groups, read paragraphs and tell anecdotes, and uncovered a very strong effect for age on accent ( $R = 0.83$  with the effects of years in US removed, on the paragraph task). Patkowski (1982) replicated this finding with 67 immigrants of upper-middle socio-economic status and of various nationalities who had resided in the USA from 5 to 50 years ( $R = -0.72$  on the syntactic measure with the effects of exposure and formal instruction removed). In both the Oyama and Patkowski studies, neither exposure nor other attitudinal or practice factors showed any substantial effect.

Regrettably, the statement by Krashen *et al.* (1982: 162) that 'there have been surprisingly few studies investigating child-adult differences in eventual attainment in second language acquisition' still holds true today. Indeed, to this writer's knowledge, only one such study, Johnson and Newport (1989), has appeared.

Johnson and Newport studied 46 native Koreans and Chinese who had arrived in the United States between the ages of 3 and 39 (with half coming before the age of 15, and half coming after the age of 17) and who had resided there for periods ranging from 3 to 26 years. All subjects had at least five years of exposure to English. The respondents had to judge the grammaticality of 276 spoken English sentences (roughly half of which were grammatical). Six- and seven-year-old natives had 'virtually perfect' performance on this task, which suggested to the authors that the task tested not 'metalinguistic skills' but 'variation in the knowledge on the language'. In addition, the type and amount of L2 exposure, as well as motivational and attitudinal factors were gauged by means of half-hour interviews.

The results showed a correlation of  $-0.77$  for the entire group between age at arrival and performance on the task, a strong upholding of the earlier findings reviewed above. The results further demonstrated that before the age of 15, but particularly before the age of 10, there was considerably less individual variation in ultimate L2 proficiency than after age 17. This is consistent with the previously discussed Patkowski findings which also showed a greater variation in the ultimate proficiency of adult learners.

As in previous studies, Johnson and Newport found no significant effect for years of exposure to English (beyond 5) and for amount of classroom instruction. They did, however, uncover an effect for an 'identification with American culture' attitudinal measure of  $R = 0.63$ . However, when the effect of age was partialled out, this correlation was reduced to 0.39, whereas when the opposite procedure was performed (when 'identification' was partialled out), the correla-

tion for age only fell from  $-0.77$  to  $-0.65$ . Clearly, age at L2 had a considerably stronger effect on the ability of respondents to perform on the grammaticality task than did the attitudinal variable. Indeed, Johnson and Newport conclude that 'children are indeed better than adults in their ultimate attainment in a second language'. Thus, the finding that child L2 learners are usually superior in terms of ultimate proficiency remains unchallenged by current findings.

In addition to research on the eventual proficiency of child and adult L2 acquirers, studies which concern the ability of adults to perceive or produce native-like L2 sounds are also clearly relevant to the CPH. Again, few studies have really focused on this crucial question, but those which have have fallen short of demonstrating full native-like abilities in such cases. Such research includes Sorenson (1967) and Salisbury (1962), reviewed in Hill (1970), which examined adult language acquisition in South American Indian and New Guinea societies where there is strong social pressure for adults to learn new languages. Sorenson and Salisbury suggest that these adults are highly successful, but Hill points out that not enough information is given to answer the question whether their acquisition is as successful as that of their children.

Another example is Neufeld (1980) who sought to demonstrate that adult L2 acquirers can 'pass for native'. Seven highly proficient non-natives and three native controls recorded a corpus in French which was then judged by French-speaking judges who consistently misidentified five of the non-natives as being native. The study does, however, suffer from certain limitations. First, the participants were allowed to record the passage as many times as they liked; second, the passage was of very short duration (seventy-eight words); third, the experiment was carried out in Ottawa, a predominantly English-speaking city where there may have been greater laxity by the judges in assessing accents than might have been exhibited by judges in a Continental French-speaking country. Nevertheless, this study urgently calls for replication. If similar results were obtained under conditions which remedied the stated limitations, then the CPH would indeed be subject to serious challenge.

Another example in this vein concerns MacKain *et al.* (1981) who investigated the categorical perception of the English /r/ and /l/ phonological contrast. They found that a group of 5 'experienced' adult Japanese speakers of English had largely overcome the limitation in their perception of the /r/ /l/ distinction, and performed like the 10 American controls on an identification task, but did not do as well on two discrimination tasks. Thus, the authors concluded that some Japanese speakers learning English as adults are capable of categorically perceiving /r/ and /l/ in a manner similar to (but not the same as) native English speakers. In fact, both Neufeld (above) and Flege do propose that phonological competence considerably outstrips performance for adult L2 speakers, and the MacKain study seems to reinforce such a claim. However, until it can be shown that phonological competence in adult L2 speakers is fully equivalent to that of natives, the relevance of such claims to the CPH is not immediately obvious.

Finally, a recent study provides intriguing evidence concerning the limits on the ability of adults to acquire full native-like competence in the syntactic and semantic aspects of a second language. Thus, Coppieters (1987) tested 21 highly proficient speakers of French as a second language who had acquired French as adults, and compared their responses on a wide range of grammatical and semantic tasks to those of 20 native speakers. The non-natives were selected on the basis that 'it was no longer clearly possible to distinguish them from native speakers by mistakes which they made, or by the restricted nature of their choice of words and constructions' (p. 549). Six of the subjects were also described as showing 'no clearly detectable traces of a foreign accent' (p. 551). Yet, results revealed marked differences in the linguistic judgments of the two groups; the 21 adult learners of French, many of whom could 'routinely pass for native speakers' (p. 568), were thus clearly distinguishable from native speakers on a variety of syntactic and semantic tasks. However, until it can be shown that native-like speakers of French who acquired L2 as children perform similarly to the native controls in the Coppieters study, any conclusions based upon these findings with respect to a hypothesized age-related decline in second language syntactic and semantic abilities must necessarily be tentative.

In contrast to research on eventual L2 proficiency, a number of studies concerned with age (often with the range of age at onset of L2 failing to encompass both adult and child subjects), initial learning rates, and form of L2 exposure have appeared in recent years. These seem to follow the patterns discussed by Krashen *et al.* for earlier studies (for example, Olson and Samuels 1973; Ervin-Tripp 1974; Burstall 1975; Ramirez and Politzer 1978; Ekstrand 1982a and b) which show some superiority for older over younger learners, usually under conditions of shorter exposure periods to L2 or in 'non-naturalistic' language learning situations where subjects with more developed cognitive abilities (i.e. older subjects) could well be expected to perform more effectively.

Thus, Thogmartin (1982) reported on two experiments to test the hypothesis that younger children would find it easier than older children to acquire new speech sounds under intensive training. Both tests involved a 'formal learning' situation; in the first experiment, subjects learned artificial words, and in the second one, students were tested after a ten-week course in Mandarin Chinese. Not surprisingly, the results did not support the 'younger is better' hypothesis. Similarly, Loewenthal and Bull (1984) found that younger children could not imitate Armenian sounds as well as older children; none of the children apparently had ever had any exposure to Armenian outside of the testing situation.

Fokes *et al.* (1985) compared two groups of Arabic children (2 to 5 year-olds and 7 to 11 year-olds) learning English as a second language. The purpose of the study was to investigate the acquisition of the voicing contrast for stop consonants. The results showed that neither age nor experience with English (less experienced group = 2 to 12 months exposure to English, more experienced group = 18 to 54 months) could predict phonetic proficiency; however,

the age and experience of the groups involved are clearly inadequate to properly test the question of age and eventual L2 achievement.

Schmid (1986) compared the acquisition of tone accents in Swedish for L1 children and L2 adults over a seven-month period. The data indicated that children and adults show completely opposite patterns of tone accent acquisition in the beginning stages; furthermore, there seemed to be clear L1 interference in the adults' acquisition of Swedish as L2. The author suggests that factors other than neurolinguistic ones may account for these differences; yet, it should be pointed out that these differences are also clearly consistent with the notion of a neurologically based age limitation.

Morris and Gerstman (1986) investigated the performance of 182 school children on semantic and syntactic (but not phonological) tasks after exposure to one twenty-minute Hawaiian lesson. Older children (junior high and high school students) did better than a fourth-grade group; furthermore, a core of L1-related proficiencies and academic factors consistently predicted the performance of the subjects on the tests. Again, it would seem clear that this experiment did not adequately test the age and eventual attainment issue, but did uncover results consistent with the Krashen *et al.* generalizations.

Finally, Collier (1988) reported on the length of time required for over 1,500 limited English proficient (LEP) students to reach grade level norms in academic and language achievement as assessed by standardized tests. The sample consisted of school students attending a large public school system in the United States who had a strong educational background in their first language and whose parents came from middle or upper-class backgrounds in their home countries. Students spent part of their day with specialized ESL teachers and the rest of the day in the mainstream classroom. The results indicated that LEP students who arrived at ages 8 to 11 were the fastest achievers, requiring 2 to 5 years to reach grade-level norms. LEP students who arrived at ages 5 to 7 came in second, and those who had come at ages 12 to 15 experienced the most difficulty, requiring 6 to 8 years to reach grade-level norms.

As the author points out, the study concerned the acquisition of 'cognitive academic (second) language proficiency' or CALP (see Cummins 1979) rather than the acquisition of 'basic interpersonal communicative skills' or BICS. One hypothesis under investigation was that older students would be able to transfer academic skills and concepts acquired in their first language to the L2 and the process of CALP acquisition would be more rapid than for younger children. However, as mentioned, the older students had the greatest difficulty; though the author refuses to attribute the dramatic drops in the adolescents' scores to the CPH, instead suggesting that they are the result of the schools' greater demands on students at the secondary level, it can be equally argued that these findings are quite consistent with CPH; older students who are still below the critical threshold but are more cognitively developed than their younger counterparts can acquire CALP in an L2 more efficiently, while adolescents who have passed that threshold have far greater difficulty despite their even higher cognitive abilities.

In concluding this section on studies concerning age, rate, and form of exposure, it should be noted that some such studies have also uncovered 'younger is better' effects. Fathmam (1975), for example, studied 200 children aged 6 to 15 using a picture-based sentence-completion task to elicit specific linguistic items as well as taped samples of speech and found that, while older children performed better on morphological and syntactic items, younger ones did better on phonological tasks. Cochrane and Sachs (1979) subjected 16 seven-year-olds and 16 adults to the same amount and same type of exposure to new linguistic material (Spanish words). The subjects were then rated for imitation ability and stress rule learning. Findings showed that the children's imitation excelled that of the adults, and that children showed less interference from English stress patterns.

Cochrane (1980) examined the ability of 54 native Japanese children and 24 Japanese adults to produce and discriminate the English /r/ and /l/ sounds in various listening and speaking tasks. The children had first been exposed to English at ages 1 to 12 and the adults at ages 18 to 43. The study did not appear to concern ultimate proficiency, as indicated by the fact that the average 'exposure' scores (number of hours of daily English usage  $\times$  number of days since arrival in the USA) were 244.63 for adults and 193.22 for children. Nevertheless, children outperformed adults on the pronunciation of /r/ and /l/, though sociolinguistic factors did emerge as a potential confounding variable. On the other hand, a second experiment showed that adults profited significantly from 5 hours of intensive articulation training, while the children did not.

Tahta *et al.* (1981b) studied the effect of age on the ability to replicate foreign pronunciation at first exposure in an experimental situation (with a sample of 231 five to fifteen-year-old school students) and found a steady decline in that ability with age. The findings also indicated a slight resurgence in the ability to replicate foreign intonation among the eleven to fifteen-year-olds; nevertheless, the five to eight-year-old group was markedly superior in that ability too. As Tahta *et al.* put it, it is difficult to explain these messy up-and-down-and-up-again findings concerning the role of age in short-term or non-naturalistic L2 studies. For the purposes of this paper, however, it is enough to again point out that such findings do not concern ultimate L2 ability and are not directly relevant to the CPH, and also that these findings stand in contrast to the strong and steady age effect uncovered by studies which do focus on eventual achievement.

#### CONCLUSION

The handful of studies which examine the effect of age at the start of L2 acquisition on the eventual proficiency attained in L2 under conditions of 'naturalistic exposure' and in 'advantaged' sociolinguistic circumstances all show a strong effect for age, and virtually no effect for other practice or motivational variables. The numerous studies which show adults or older children outperforming younger children invariably involve issues of learning rates, often in artificial L2 situations, and these studies do not in fact bear

directly upon the CPH. Many of the studies which claim to examine the CPH do not have adequate ranges of age at onset of L2, and thus uncover age effects within either child or adult groups, but not across them. Those studies which seek to show adult L2 acquirers functioning at fully native levels, in some cases fail to demonstrate fully native-like functioning and in others suffer from damaging research design limitations, as do those seeking to show that bilinguals who acquired their L2 at an early age still do not function at fully native-like levels.

At the same time, even if Flege's main objections to the CPH are rejected, it must nevertheless be agreed that 'the age of L2 learners is inevitably confounded with other conditions that co-vary with chronological age' (p. 167), especially sociolinguistic and attitudinal ones (for example, Cochrane 1980). Thus, Flege's discussion on the role of developmental factors, L2 input, motivational and affective factors, and social factors is most useful and illuminating. There can be no doubt that the latter factors play an essential role in determining the course of L2 acquisition both for individuals and for social groups. Major also provides a valuable review of the role of first language interference, developmental factors, style, and other factors in L2 phonology. But neither author offers a truly convincing rationale for entirely discarding the notion of a biologically based age limitation on the ability to acquire second languages with native fluency, nor do they offer convincing competing hypotheses.

For example, it is not clear how Flege's recent proposal that 'differences between adults and children, if observed, would not be seen as arising from a difference in basic ability, so much as from a difference in the *extent to which* (italicized in the original) that basic ability is tapped during the course of naturalistic L2 acquisition' (1987: 174) or his earlier proposal that '[adults and children] may retain the same kind of phonetic learning ability evident in early childhood and yet still speak with an accent because phonological translation provides a two language source of phonetic input' (1981: 443) would account better than the CPH for the strong evidence for an important age factor in eventual L2 proficiency, or for the marked difference in the population distribution curves discussed earlier. Similarly, Major's reason for rejecting the CPH (because it is possible for many adults 'to achieve native-like utterances in syntax and morphology' (p. 187)) is not supported by the evidence. On the other hand, the notion that a powerful biological factor (Chomsky's 'language acquisition device') is at work with younger learners but not adults would seem quite consistent with the bulk of the evidence. For, if the difference between child and adult L2 learners is just one of degree of ability (or even of degree of ability to tap that ability), then surely many adults could in fact overcome the social, cultural, and psychological factors which are often claimed to be the sole cause of their established lesser capacity for eventual L2 proficiency, and both adults and children could be expected to exhibit similar population distribution characteristics, even if the population curves were centered about different means. On the other hand, if the differences between child and adult L2 learners

is of a fundamental, qualitative nature, then findings such as those discussed herein should well be expected.

In conclusion, while the CPH remains to be demonstrated beyond any measure of doubt, the mass of relevant evidence is demonstrably consistent with the hypothesis, and until convincing counter-evidence is produced, it would seem premature to discard the notion of a biologically based age limitation on the ability to acquire non-native languages. Indeed, given the evidence, it seems improbable that progress in the field of L2 acquisition studies can be impeded by the idea of a CPH, as suggested by Flege. On the contrary, progress seems more unlikely if the CPH is rejected and ignored in the framing of L2 acquisition research paradigms. At the very least, it would seem that a number of studies, including many mentioned here, deserve replication and further investigation before fully rejecting the CPH.

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