

The Critical Period Hypothesis Concerning L2 Revisited: A Critical Review of Two Seminal Articles

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ABSTRACT

This paper re-examines the Critical Period Hypothesis (CPH) which proposes that human biology, in the form of brain development, dictates the success of language learning. Specifically if children start learning a language before puberty, it is claimed that, due to the way language is represented in the brain in that period, they learn it more naturally and their ultimate success will be greater than if they start learning after that. This notion has created considerable argument in the field of second language acquisition research (SLA) since the 1960s. In what follows, a critical review is undertaken of the traditional arguments for and against the CPH in the literature in this field, culminating in an in depth analysis of the arguments in two key articles: *A critical period for learning to pronounce foreign languages?* by J. Flege, and *Age and accent in a second language: A reply to James Emil Flege* by M. Patkowski.

The conclusion is that, as much today as when these articles were written, two issues hinder researchers arriving at a clear confirmation or disconfirmation of the truth of the CPH: problems of definition of the critical period and what exact aspects of language learning it is supposed to affect, and problems of confounding variables that cannot be controlled in empirical studies attempting to test it. Although the CPH itself has limited implications for many practical issues in teaching English as a foreign language, nevertheless it is argued that the exploration of the controversy yields many useful suggestions for teachers, six of which are elaborated.

Key Words: Accent, Age, Critical Period Hypothesis, Second language acquisition.

INTRODUCTION

Second language acquisition (SLA) contrasts sharply with first language acquisition (FLA) (Meisel, 2013). One reasonable explanation for the facts of FLA and SLA is given by the Critical Period Hypothesis (CPH) which essentially states that there is a limited developmental period during language acquisition. If someone starts learning a language, whether first or second, before the end of the critical period (CP), the nature of their language acquisition is different in kind from that if they start after the end of the CP. Primary support for the CPH comes in FLA from the morphological and syntactic deficits of Genie, who was explicitly deprived of any linguistic input and interaction until the age of 13, besides in SLA from the incomplete achievement of native-like proficiency by most adult L2 learners (Birdsong, 2009).

Seliger *et al.* (1975), Oyama (1979), Krashen *et al.* (1979), Scovel (1981), Patkowski (1982), Harley (1989), and Meulman *et al.* (2015) confirm that the

examination of the acquisition of human languages has widely shown that children can learn faster and better than adults. While Vanhove and Kaiser (2012) state that SLA research largely adopted the CPH, Moyer (2007), however, observes that in the SLA field, that notion has not only generated much research but also created arguments and contradicting views of the relation between age and the ability to acquire/learn language skills. Thus, this paper intends to look into that controversy concerning the well-known CPH.

The critical review offered in this paper will tackle the content, rather than the methodology, in order to demonstrate in depth the degree of support and counter-support for the truth of the CPH. The culmination of the review of this paper will be revisiting the two seminal articles written by two writers on the notion of the CPH, which encapsulate the essence of the controversy. Flege (1987) and Patkowski (1990), utilized the findings of available studies in order to support opposing stands concerning the CPH. Flege challenged

the evidence for the existence of a CP in human life whereas Patkowski defended the evidence for a critical period. It will be shown that the concerns of these authors are still relevant today. However, before properly examining these two articles, it is necessary to provide a background review of the whole concept of the CPH in SLA, linked to the issue of age in relation to linguistic attainment. This review is essential both to facilitate understanding the two authors' articles on the notion of the CPH, and to provide a firm basis for our argumentation.

The CPH has been extensively researched and has crucial implications, yet great controversy surrounds it, as the next sections will demonstrate. This author therefore believes that the present reassessment of it is both timely and important to answer two general questions. Given all the research and argumentation, is it possible to say definitely that the CPH is true or not, and if not, why not? Is the issue in any case of any importance to language teachers?

Literature Review: The CPH

The CPH in its original form broadly hypothesizes that there is a CP in human life after which learning or acquisition of language becomes harder, or at any rate different, and perhaps in some respects (e.g. pronunciation proficiency) almost impossible. During this CP, the human brain is flexible and it is for this biological reason that language learning occurs naturally and easily. This period was for a long time widely held to extend from childhood to puberty (from 2 to around 12 years) (Penfield and Roberts, 1959; Lenneberg, 1967; Scovel, 1969; Lamendella, 1977; Muñoz and Singleton, 2011).

The introduction of the CPH dates back to Penfield and Roberts (1959) who claimed that the CP falls within the first ten years of the human life. Furthermore, they stated that brain plasticity of the learner vanishes once puberty is reached. Lenneberg (1967) suggested that the 'language acquisition device' in the brains of children is stimulated effectively during the critical period in a

similar fashion to other human biological functions. He argued that when L2 learners start learning young and are in frequent contact with the L2 in immersion contexts for several years or maybe decades, they will absolutely outperform other later L2 learners. Vanhove (2013) also pointed out that younger learners always significantly outperformed older learners in language acquisition.

Lenneberg further proposed two versions of the CPH. The strong version is that children must acquire the L1 before puberty, or it becomes impossible for them to learn from subsequent exposure. The weak version, however, suggests simply that language learning will be more difficult and incomplete after puberty.

Littlewood (1984) suggested that the results indicate that, after the CP, language learning becomes an artificial and laborious process, but not impossible. He explained that this view has biological foundations, though people have questioned whether there is any real evidence that puberty is accompanied by changes in the brain that are so crucial to language learning. Experience shows, Littlewood (1984) continued, that many adults and adolescents do acquire a high level of proficiency in an L2, which would scarcely be possible if they lacked an important learning mechanism. This was supported by studies conducted by Huang and Hatch (1978), and Pienemann (1984) cited in Littlewood (1984) which provided strong evidence that older learners have not lost their capacities for natural language learning. Thus the weak version of the CPH is usually adopted in SLA research: in effect, the relationship between learners' age and their ability to learn from L2 input continues after puberty but changes, so the relationship is not linear.

Lenneberg (1967) suggested that the critical period for language learning was strongly related to the widespread belief that children outperform their counterparts, adults, in relation specifically to L2 pronunciation proficiency. Furthermore, Scovel (1981) proposed an explanation that lateralization

(meaning increasing specialisation of language functions to one half of the brain, usually the left half) happening around puberty contributed to unsuccessful attempts made in order to master the sound patterns of a target language. In response to that explanation, a large number of research studies provided clear examples that children enjoy an obvious advantage over adults in this aspect of SLA. Fathman (1975), for instance, found that children aged 6 to 10 years, naturalistically exposed to English, were seen to outperform those aged 11 to 15 in pronunciation though in morphology and syntax the reverse was true. This was relatively similar to Cochrane and Sachs's results (1979) in relation to pronunciation. Providing further support, in one of Cochrane's experiments (1980) Japanese children scored higher than adults in their production of two English sounds /l/ and /r/. However, the age difference in the discrimination of the two sounds in a listening test was non-significant. The adults' abilities benefited considerably from the training in pronunciation but not the children's. Overall, the tendency in most of the studies shows that, if there were any advantage of younger children over older ones or adults, it might be only in a few areas of phonological performance and not in comprehensive linguistic proficiency.

Ellis (1985) referred to the issue that the CPH could not account for why loss of brain plasticity affects pronunciation but not other levels of language. In order to explain why some aspects of language acquisition seem to be affected differently, Seliger *et al.* (1975) however further proposed a possibility that there were multiple CPs. The process of lateralization and localization of language function could also be a gradual one, carrying on over many years. Different aspects of language might be affected by different stages in this process. This would explain why adolescents outperformed adults in grammar acquisition: around sixteen, the end of a CP affecting grammar may be reached. The CP for pronunciation, however, could end earlier. In the view of Ellis (1985), this explanation

was speculative, and in general the evidence linking the CP and age differences in learners is not clear. Nevertheless, a common view today is that there are, in effect, different CPs for different areas of the language, such as phonology and morphology (Meisel, 2011).

A somewhat different strand of research more broadly considered the relationship between age, rather than brain development, and acquisition. Generally, this approach embraced age throughout the process of acquisition as a factor, not just age of starting to learn, and considered all factors that might lead to an age effect, not necessarily just the CP. Lenneberg (1967) for example pointed out that there was contradictory data from the field: there was concrete evidence of the ability of children to learn the L2 but it was not clear that the eventual proficiency of children versus adults called upon the CPH for an explanation. In naturalistic situations, he pointed out that there are crucial other factors which can obviously affect acquisition among which are sociolinguistic conditions. Ellis (1985) also suggested that the CPH was an inadequate account of the role played by age in SLA.

The earliest evidence for the influence of age on language learning basically came from immigrant families (to Europe and Americas) whose children learnt the target language with native or near-native proficiency. In other words, the younger the learner is the more proficient he or she becomes in the target language. This involves at least three factors other than the CP which may be crucial: the precise age of arrival in the foreign language country and the volume and type of exposure to the new language. With respect to the latter, the question concerning impact on L2 acquisition of whether the exposure to the L2 is formal/instructed or informal/immersion has also been long in debate.

As a result, several applied linguists and sociolinguists viewed the effects of age of acquisition from perspectives other than the maturation of learners (i.e. the CP). Leather and James (1987), for example supported the existence of a number of personal and

social variables that limit a learner's progress and ultimate achievement, such as: social acceptance and social distance, personality variables, sex and oral auditory capabilities. Major (1987) also drew attention to examining factors other than the age, such as: L1 interference, and other factors in L2 phonology. All these should be accounted for when conducting related research on SLA.

Comprehensive literature reviews of studies dealing with age and SLA (e.g. Hatch, 1983; Stern, 1983; Dulay *et al.*, 1982; Harley 1989; Long, 1990; Ellis, 1985; Nezakat-Alhossaini *et al.*, 2014) have shown remarkable lack of concurrence in the conclusions reached by those writers. There remained controversy on the different sources proposed for any observed differences between L1 and L2 performance, i.e. whether they were due to a CP or not, and on whether or not L2 learners learning an L2 after puberty were able to succeed as well as those starting before. This confirmed the complexity of the age issue. Such complexity was also attributable to what areas of language achievement by children and adults in their SLA were measured (e.g. speech or other capabilities such as in morphology, syntax and lexicon), and how. It is therefore appropriate to conclude our literature review with a fuller account of studies that appear to support or contradict the CPH, or indeed a general age effect on SLA.

Snow and Hoefnagel-Hohle (1977), in their study of adults' superiority, confined the advantage of children to the first stages of learning only. In addition, Snow and Hoefnagel-Hohle (1978) found that English-speaking adolescents acquired Dutch more quickly than younger children. This provided clear evidence against the CPH. In America, Fathman (1975) found that learners of English aged between 11 and 15 years acquired grammar (but not pronunciation) more quickly than children aged between six and ten years. These studies involved learners with large amounts of natural exposure. Similar results with school learners emerged from other studies such as that of Burstall *et*

al. (1974) in the UK. In fact, the evidence suggested that, regardless of the volume of natural exposure, age was a major factor in L2 learning but gave a significant advantage to younger learners, or in particular children, over adults only for L2 pronunciation.

In support of an effect for pronunciation, Tahta *et al.* (1981) carried out a study of 109 subjects of different language backgrounds that resided in the UK from the age of 2 to 55 years. The purpose of the study was to examine the extent of accent transfer from L1 to L2. The results demonstrated a near significant relationship between the age at arrival and degree of accent ($r=0.657$). They concluded that age of onset of acquisition plays a crucial factor especially up to the age of 7 and after age 12 years in target language pronunciation. Such findings showed a very strong impact of age on language acquisition, with the age 12 threshold supporting a CP explanation. However they also emphasized the role of natural exposure, for younger children, as a factor operating in language learning. These results were consistent with Krashen *et al.*, (1979) who concluded that the studies covering age, rate and eventual attainment in the L2, suggested that adults and older children may initially acquire an L2 faster than children in instructed and uninstructed settings, but eventually children remain superior in L2 attainment.

In a similar study, Johnson and Newport (1989) examined 46 native Koreans and Chinese arriving in the US between the age of 3 and 39 and observed that "children are indeed better than adults in their ultimate attainment in L2" (Ibid:1). In such studies, however, it was difficult to exclude the effect of time spent learning, since those who arrived later of course may have also been learning for fewer years.

Neufeld (1980) demonstrated that adults who acquired an L2 could pass for native. Hill (1970) cited Sorenson and Salisbury who found that there was a social factor that played a significant role for adults learning an L2. The researchers suggested that those adults were highly successful. However,

Hill pointed out that more information was needed to find out whether the subjects' acquisition was as successful as that of their children.

Thogmartin (1982) presented evidence challenging previous findings that young learners were superior on sounds by testing the hypothesis that acquiring new speech sounds was easier for younger children under intensive training than older children. The results did not support the 'younger is better' hypothesis. Parallel to that evidence, Loewenthal and Bull (1984) found that American sounds could be successfully imitated neither by younger children nor older children.

Although there is a wide range of studies suggesting children's outperformance, in contrast to adult learners, at least in pronunciation, other research studies have shown the reverse where adults may produce or perceive L2 sounds as well as, or even better than, children in some situations. The explanation for that finding has not always been of a neurological-based nature (CPH). In summary, there are many researchers such as Neufeld (1979), Snow (1978, 1987), Ellis (1985) and, as will be shown later, Flege (1987) who claim that SLA is the same process whether learning starts as a child or as an adult, and that adults are really better learners because they are faster. Other linguists such as Oyama (1979), Seliger *et al.* (1975), Krashen *et al.* (1979), Scovel (1981) and Patkowski (1990) are convinced that younger learners are more successful, especially where ultimate attainment of aspects such as accent in free L2 performance are considered. Yet others, such as McLaughlin (1984), think that the available data on the CPH are unclear and that adults are at a disadvantage only in a few areas, particularly phonology.

In conclusion, it has become clear that the Applied Linguistics and SLA literature has obtained a lot of evidence to provide both support and counter-support for age effects on acquisition and the role in them of the CP. Therefore, it remains difficult to decide from such a survey whether to endorse the CPH (even in its weak form) or not.

A Deep Review of Two Key Articles

This part of the paper will attempt to arrive at a more definite conclusion concerning the CPH by considering in depth two key articles concerning it. As explained previously, since it was initially proposed by Penfield and Robert (1959), the CPH has split opinion among linguists and SLA researchers. This split has been associated with contradictory evidence concerning the CPH reached by research work in the field of L2 acquisition. The views against the CPH are in many ways crystallized by Flege (1987) in an article entitled "*A Critical Period for Learning to Pronounce Foreign Language*". In reply to this article, Patkowski (1990) represents the view in favour of the CPH in "*Age and Accent in a Second Language: A Reply to James E. Flege*" in which he rejects Flege's claims against the CPH. Although these two articles are now quite old, and much research has been done since, they can still be regarded as classic representations of most of the arguments on the issue that are still with us today. The intent of this part is therefore to explore in depth Flege's opposition to the existence of the CP and Patkowski's rejection of that opposition.

1. Synopses of the Articles

Flege's article (1987) was based on the rejection of the existence of a critical period for learning human speech. He claimed that there was no conclusive support, in the empirical and theoretical literature, for the existence of a CP controlled by brain development. Furthermore, if such existence was simply assumed, as some researchers did, then it would falsely limit the range of testable hypotheses about L2 pronunciation. In addition, Flege believed that there was sufficient direct counter-evidence in the literature that put the CPH in question. Moreover, he pointed to explanations of obvious adult-child performance differences which made reference to other factors than adult-child differences in neurological maturation or organization, and which were not able to be controlled in behavioral

research. To generalize that the critical period was responsible for child-adult acquisition differences was not valid, as seen by Flege (1987), so he strongly rejected the truth of the CPH. Mainly he claimed that: Available evidence in the literature was not sufficient; taking the hypothesis for granted was one way to mislead research in adult-child SLA differences; and children were advantaged by having other factors facilitating their learning. In principle, he addressed the CPH specifically from a 'learning to pronounce a foreign language' perspective, which is the area where, as shown above, it has seemed to be best supported by evidence.

Patkowski's article (1990) on the other hand, was based on opposition to Flege's rejection of the CPH, claiming that careful examination of research studies relevant to the CPH led to the conclusion that there was concrete evidence supporting the notion of the learner's age as a serious barrier towards eventual proficiency. His focus also was specifically on accuracy in pronouncing an L2. Patkowski (1990: p.73) claimed 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.

Patkowski's main claim against Flege was that research findings at the time supported the CPH with regard to superiority of children over adults in SLA, and that this superiority was primarily in their ultimate language ability rather than speed of learning.

2. Areas of Argument

Flege and Patkowski's disagreement is focused on whether there was, at the time of their writing, sufficient evidence for the existence of a CP in learners' lives that limits their ability to acquire L2 pronunciation. The two writers' argument extends to include other linguistic abilities and areas and also involved the eventual linguistic attainment level that learners may reach due to the impact of the

critical period. The following discussion is intended to clarify the different strands of the argumentation, which this paper maintains are still a source of contention today.

2.1. The Predictions of the CPH

One key issue concerns two predictions which Flege (1987) proposed that the CPH makes, and whether the available evidence supported them.

2.1.1. Prediction 1: "Speech acquisition must occur before the hemispheric specialization of language occurs in order to be entirely effective".

This prediction means simply that, in order for a learner to be able to optimally acquire speech, this must happen before language specialization in the brain (lateralization) takes place, and if learning happens later, it will not be as effective. Lamendella (1977) for example, as mentioned earlier, indicated that the undeveloped neurolinguistic system of children gave them an intrinsically more advantageous position for L2 learning than adults. Complementing this, Scovel (1969), pointed out that the onset of cerebral dominance, likely to take place by about age 12, prevented the learner mastering the sound patterns in an L2 without retaining a foreign accent. In fact today, using modern methods of accessing the brain, some studies show lateralization of language functions occurs much earlier, by age 7 or even earlier (Meisel 2011).

Flege asserted that the CPH therefore depended on the assumption that a CP existed but that it had no definite age limit in children's life so it was hard to test. Patkowski agreed that it was indeed known that some degrees of hemispheric specialization were present even at birth (for example, Whitaker *et al.*, 1981), and that there had been controversy regarding the age at which cerebral lateralization was complete. Patkowski continued that even Lenneberg's (1967) original formulation linked the CP to the completion of cerebral lateralization of language at puberty. Patkowski argued,

however, that the CP should not be defined in terms of a fixed age when cerebral specialization was complete. Furthermore, the presence of linguistically specialized zones in the newborn brain would likely be in line with a biological basis to language. Patkowski, preferred to link the CP to the evidence for the existence of a high level of neurological plasticity in the language zones of a child's brain that generally disappeared throughout early adolescence. This is in line with the overall observation reached by Friedmann and Russo (2015).

The main point that Patkowski emphasized, then, was that Flege's "assumption that the critical period - lateralization link is fundamental to the notion of a CPH" was misleading. On the contrary, Patkowski emphasized, it was the concept of plasticity which was fundamental. Patkowski therefore tended to shift the definition of the CP, and so Prediction 1, from lateralization, that occurred at a point in time, to specialization, which involved plasticity that generally became inactive over a period of time.

2.1.2. Prediction 2: "Speech learning after the critical period both proceeds more slowly and is ultimately less successful than before the critical period"

In rejecting this prediction, Flege relied on studies reviewed above which have demonstrated faster initial of L2 learning rates for adults such as the studies of Snow and Hoefnagel-Hohle (1977). What Flege meant to say was that, while it was possible for the literature review to provide evidence against the prediction, the CPH should be rejected. This was, however, rejected by Patkowski who pointed out that the issue of initial learning rates was not relevant as it did not validate directly the concept of the CP. Proponents of the CPH generally held that it was the ultimate L2 proficiency rather than the acquisition speed which was affected by the CP (Oyama, 1982).

Earlier, Patkowski (1982) had clarified that the age limitation of the CP prevented adult learners from eventually passing for native

in an L2 while child learners could. Walsh and Dillar (1981) along with others reviewed above claimed that L2 learners, however, could possibly fully acquire certain aspects of a foreign language, for instance morphology, but ultimate success in pronunciation was not possible basically because pronunciation was a lower order linguistic function genetically specified and consolidated in the early development of an individual. This evidence supported Patkowski's reply to Flege's claim against the second prediction, and indeed supported Patkowski's reply to Flege's claim against the first prediction regarding the biological basis of the critical period.

In order to defend the second prediction, Patkowski further stressed that the CPH concerned naturalistic language-acquisition as opposed to instructed language learning. Native proficiency was not seen as an inevitable product of learning before puberty or of pre-critical period acquisition. It was seen rather as a possible outcome under optimal sociolinguistic and other conditions. Such conditions were introduced by Flege as more important factors than the maturation factor in the eventual success of acquisition by children rather than adults.

2.1.3. Resolution

In conclusion, Patkowski argued then that the evidence that directly bore upon the CPH was evidence that concerned the ultimate pronunciation proficiency of child versus adult learners, differing in brain plasticity, in uninstructed L2 acquisition settings under optimal sociolinguistic conditions (e.g. with adequate native speaker input). This was essentially consistent with the original claim of Lenneberg (1967) that language acquisition readiness began by about 2 years and deteriorated with cerebral maturation in the early teens. He also suggested that adults unavoidably spoke an L2 with an accent if they started learning an L2 after childhood because of the firm structuring of neural processes through cerebral lateralization.

It can be said that Patkowski defeated the evidence produced by Flege with respect

to the predictions above in essence not by arguing that the evidence produced by Flege was wrong but by arguing that the predictions were wrongly worded. Prediction 1 should refer to brain plasticity rather than hemispheric specialization / lateralization. Prediction 2 should only refer to ultimate success not speed, with respect to accent, and in an ideal immersion situation. If those revisions are accepted, the available evidence appears to support Patkowski, but see the following arguments below.

In fact, the same issue of definition of the CPH survives today. As Meisel (2011: p. 204) points out:

Many of the criticisms directed against the CPH can be accounted for by the observation that they are based on insufficiently precise definitions of the CPH. In fact, the conceptualization of the CPH ... tends to be heterogeneous and covers several distinct hypotheses. This also explains why various empirical studies have come up with conflicting findings.

2.2. L1 Influence

Flege rejected the neurolinguistic-maturation-based explanation provided by the CPH for superior attainment by children when acquiring L2 pronunciation. Instead, Flege suggested that the child's superiority over adults in pronouncing L2 arose because of the latter's prior establishment of the L1 phonetic system of categories via L1 exposure. This hypothesis therefore depended on the assumption that children's L1 categories were less precisely developed than those of adults, so allowed more successful acquisition of L2 phonetic categories.

In support of this argument, Ausubel (1968) suggested that most instances of long-term learning relied heavily on prior cognitive experience, and speech learning was just one instance of this. Learners used their existing schematic information in order to recognize new sounds and letters of an L2, for instance, including the help of already stored L1 or L2 language data. Adults clearly had their L1 phonetic system well established,

so would rely on this more when producing or identifying L2 sounds, with consequent production errors or foreign accent due to L1 interference/negative transfer. Flege explained children's learning success as due to their ability to develop new phonetic categories unavailable in their L1 because of instability of the L1 phonetic system at a young age, which was not the case in adults.

Flege therefore emphasized that children's superiority was only due to such factors and not to the predictions which the CPH was built upon, such as the neurological-maturation based age factor. To sum up this part of the argument between Flege and Patkowski, it can be said that Flege attempted to reject the CPH relying on studies yielding results which did not support the greater speed and success of children's L2 acquisition, and explained those studies that do support child superiority by reference to differences in the nature of child and adult L1 phonetic systems. Patkowski, on his part, believed that the only explanation for child superiority was purely neurological maturation, mainly critical period-based. On this issue, our investigation has to an extent provided literature evidence to support both writers' claims, so it must be said that often either the CP or the lack of L1 fixity, or both, could explain examples of child SLA superiority.

2.3. Developmental Factors

Flege (1987) and Patkowski (1990) were especially informative as they brought to the discussion a range of factors that may facilitate or hinder L2 speech learning. Such factors had previously been meagrely accounted for in studies regarding the CPH and its relation to learners' age. Yet these factors could have a remarkable impact on findings related to SLA and attainment rates.

Flege argued that the CPH presupposed an overly simple view of the speech learning process, basically referring it solely to a form of biologically-based readiness. He argued that this oversimplification had led to an inappropriate acceptance of the CPH which had also led to potentially erroneous

conclusions regarding why children's speech performance really might differ from adults'. Flege explained that human speech was mental, behavioral and social, not just biological, and all these factors might have significant importance for any study of aspects of speech learning.

As a result, Flege believed that the existence of adult-child differences was likely related to a number of factors apart from any critical period, or in addition to it, because of the interrelationship of such factors with the L2 learner's age.

Developmental factors were considered one type of factor which could be relevant to comparing children to adults. They included size and physiological functioning that might exist apart from CP-related differences in neurological maturation and/or brain organization (Flege, 1987). Developmental factors included accumulated linguistic knowledge and skills (including degree of mastery of L1 as mentioned above), either from the previous learning phase a learner had completed, or from the learners' physical growth enabling them to distinguish certain linguistic characteristics better than at an earlier stage. Such factors could not easily be controlled in research studies, so might cause differences in performance results when children and adults were subjected to experiments seeking evidence for the existence of a critical period explaining L2 learning differences between children and adults. Thus it was dangerous to regard differences found in such studies as solely due to the CP or indeed as due to the CP at all.

2.4. L2 Input

Another confounding factor pointed out by Flege was L2 input. Thus Flege (1987) suggested that differences in pronunciation between adults and children may derive from quantity or quality of L2 experience. For example, Japanese children learning English in the USA tended to use English more than Japanese adults, as noted by Cochrane (1977). That happened because children had

to use English at school and speak English with a greater number of people outside the home in various contexts. Therefore, even in this L2 immersion environment, the L2 the children were exposed to, and had to use, was clearly different from that of the adult in both quantity and quality.

Burtling (1981) and Asher (1981) observed that ongoing events and objects near at hand in the children's environment were referred to more often than by their traditional counterparts, adults. Adult language use centered more often on abstract concepts without visible referents. Language addressed to children was easily understood from context, while language addressed to adults was less easily understood from context. Thus, Asher and Price (1967) and Lenneberg (1967) hypothesized that adult-child differences in pronunciation would probably vanish if L2 input and intake were actually identical for learners of diverse ages, a scenario which of course was not likely to occur and cannot be manufactured in an experiment.

Drawing attention to the existence of this factor challenged much of the CPH neurologically-based evidence for a critical period after which learning L2 pronunciation became almost impossible.

2.5. Motivation and Affective Factors

Flege (1987) further believed that adult-child differences might be due to the learners' different age in learning an L2 and consequently different necessity to adjust pronunciation. The extent of authenticity with which learners pronounced an L2 might be linked to the degree that they felt inclined, or obliged, to pronounce the L2 like native speakers. This notion again challenged the CPH assumption that only neurological maturation could control L2 learning differences between adults and children.

Supporting evidence was as follows. Macnamara (1973) for example noted that children might possibly outperform adults in L2 pronunciation because children were under more social pressure to participate in

cultural activities and social events with peers, where they had to be clearly understood, and so used as much authentic pronunciation as possible. Schumann (1978) also confirmed that affective factors had more effect than age in establishing success in L2 pronunciation.

Schumann also suggested that fear of making mistakes or of being ridiculed for communicating ineffectively in an L2 contributed to failure in L2 learning progress and thus represented a serious obstacle. Hence, one reason for children learning better could be that children from 2 to 6 years old still made language mistakes in their first language, so if they also did this when learning an L2 in an immersion context they would not perhaps be embarrassed. Their peers from whom they learn their language (e.g. Arab children learning English as an L2 in the UK) might even be unaware of the L2 children's mispronunciation or inaccurate word selection. As Bailey *et al.* (1974) said (cited in Gürsoy, 2011, p.759): Errors made by children learning English as their second language, are developmental, not interference errors as it was thought. In this sense their errors are similar to the errors of children who learn English as their mother tongue.

It was further argued that highly motivated adults also tended to identify with L2 pronunciation when damage to their language ego was minimized. However, the tolerance region for adults' pronunciation mistakes was narrower than that for children. Children, in fact, usually communicated in environments where ridicule was less likely and so had better chances to work on their mistakes and improve their pronunciation while adults did not. When these motivational and affective factors were considered, they provided another potential confounding factor in studies that concerned child-adult L2 learning differences. This also added to the challenge to the claim that the CP maturation factor was central to explaining adult-child L2 pronunciation proficiency differences.

2.6. Social Factors

Finally, Flege (1987) drew attention to

more confounding factors in order to explain that, when considering the role of the CP, it should be remembered that child-adult L2 speech differences were not purely and comprehensively associated with age-based neurolinguistic maturation differences. Social factors, in the form of the social values attached to L2 performance in a given society, also explained the relation between L2 learners' proficiency and age.

Hill (1970), and Ryan and Carranza (1975), observed that in some societies speaking an L2 was highly valued while in the USA it was not. Thus it was noticed that some adults, in contexts where an authentic accent was highly valued, might advance in L2 skills which in turn contributed to performance better than that of children. By contrast, other adults, in other social contexts, felt that it appeared disloyal to their L1 and its society to associate themselves too much with an L2 and its society by using an authentic foreign accent. Hence they tended not to progress beyond a minimum comprehensible foreign accent. Children, on the other hand, did not generally have this notion and in L2 immersion learning situations might simply try to excel in an L2 to identify with their L2 speaking mates. Such behavior had no neurolinguistic-based element.

2.7 Consequences of the Confounding Factors

Confounding factors (3.2.2 - 3.2.6) were presented as a key part of Flege's argument over potential elements affecting L2 learning/acquisition apart from the critical period factor. It was proposed that it would be almost impossible to control for all of such factors, so it was possibly too difficult to provide explicit behavioral evidence supporting the existence of a critical period for learning speech. Flege (1987) considered this to damage the CPH since it meant that it was not really a testable theory. Flege in fact considered this a key argument in disposing of the CPH.

Patkowski (1990) notably agreed with Flege (1987) on this point to a large extent. In

his article replying to Flege he admitted that the confounding factors presented by Flege inevitably co-varied with the chronological age of L2 learners and so also with effects of the CP. Patkowski pointed out that Major (1987) also cited similar factors. However, he criticized both scholars for not being able to provide a basis for altogether disposing of the idea of a CP also working alongside the other confounding age-related factors to produce the superior accent attainment of children over adults in immersion contexts. Flege showed that other existing factors might also produce the observed effects but he did not thereby prove that the CP did not also in part produce them.

Notably this theme is also still current in the literature today. As Meisel (2011, p.206), a believer in the CPH, points out, referring to age 6/7: After this age, social-psychological factors play an increasingly important role in L2 acquisition, whereas their influence is negligible during early childhood. In other words, although the kind of knowledge attainable in successive language acquisition does not depend on a single factor, maturation plays the crucial role during the first years of childhood.

This reflects a common view today that, well before puberty, any effect of brain maturation on SLA becomes swamped by other factors.

Conclusions and Implications

Our investigation of the CPH, both in general and in the light of two key articles, has reviewed the evidence and the counter evidence for the existence of the critical period, making the point that this evidence is still valid today.

In the introduction we asked whether the CPH can be definitely confirmed or disconfirmed. In essence what has been learnt can be summed up as follows:

1. Whether the CPH gains support or not from the findings of empirical studies depends on how exactly one defines and words the CPH and specific predictions based on it. Flege defines it one way, in terms

of speed of acquisition in relation to the time when lateralization of language faculties is complete, and finds counter-evidence, Patkowski defines it another way, in terms of the nativelikeness of the final acquisition state attained and the period when brain plasticity fades away, and finds support. Hence if there is no agreed definition of the CP and so of the CPH, it is essentially a theory that cannot be tested empirically.

2. There are many variables that affect SLA success, whether in general or specifically in acquiring pronunciation in immersion settings. Many of these correlate with age of learner and are not able to be controlled in empirical studies. For instance, it is impossible to find 8 year olds and 28 year olds with the same L1 ability, L2 input environment, and social and motivational characteristics. Hence it is in principle difficult to design a study that convincingly shows a separate effect of a CP. Hence again, in a second way, the CPH is virtually untestable.

In short, it is still not possible either to confirm or disconfirm the CPH. To accept the CPH and build up upon its assumptions means that future SLA studies in the area of the age-SLA relationship will be biased. By the same token, to reject the CPH completely will hinder research work and ignore a remarkable notion in the field of SLA. Progress in research can be facilitated only if the CPH is kept under consideration.

This outcome of the discussion of the papers by Flege and Patkowski seems to remain true despite all the modern research methods available for brain research these days. Meisel (2011, p.210) for example says:

Most importantly, no direct *let alone* causal relationship has as yet been established between specific differences in the linguistic behaviour distinguishing first and second language learners and the changes in brain activation detected by neuro-imaging research.

The duty of research, then, must continue to be to decide once and for all what the definition of the CPH should be. Particularly,

is it to be defined by reference to when specific changes in the brain occur, or just to certain ages? Furthermore, greater efforts need to be made to design studies which at least control the effects of some of the confounding variables. At the very least child and adult learners need to be compared who learnt in the same input environment, whether instructed or immersion, and who have learnt the L2 for the same number of years.

More importantly for practical purposes, perhaps, we also asked in the introduction what application this sort of research has, especially for second language teaching (Dardour, 2013). Initially, research on the CPH might seem irrelevant to this. After all, the CPH proposes an effect on language learning of a feature of the biological makeup of humans, and teachers have no way of changing such biological aspects of their learners. Furthermore, as has been shown above, the CPH is often regarded as applying to immersion learning of an L2, which more or less by definition is uninstructed and takes place in the world outside the classroom.

In fact, however, it can be argued that it is possible to draw many valuable conclusions for teaching from the above discussion. Essentially this is because of the many points that emerge not so much from the CPH itself, which in any case remains unconfirmed, as from the journey travelled through the literature in attempting to find a conclusive decision on the validity of the CPH. Much of this draws attention to issues of great importance for L2 teachers regardless of whether learning is influenced more by a biological CP or more by the many other possible age-related factors reviewed above.

First, regardless of whether the CP or something else explains it, there does seem to be a consensus that starting learning languages earlier is beneficial. This is of course reflected around the world today in the general tendency to lower the age at which an L2 is introduced in the school curriculum. However, and especially in countries where the L2 has no currency outside school, there are many pitfalls. This early teaching has

to be done by teachers trained in the rather different approaches needed to teach 'young learners' who, for instance, have shorter attention spans and less ability to handle abstract ideas (e.g. grammar presented as rules) than older children, and the syllabus has to be designed to include material that will capture their interest.

Second, teachers should not expect learners who start to learn in their teens or later to acquire perfect pronunciation or a nativelike L2 accent. Indeed even before that age, if learners are relying solely on classroom instruction, rather than immersion in an L2 speaking environment, the same may be true.

Third, teachers can, on the other hand, expect mastery of other areas of language such as grammar and vocabulary to be eventually attained, regardless of age or immersion, provided the classroom supplies sufficient L2 input. The last is however difficult to achieve in countries where the L2 is not spoken outside class and only around two class hours per week are devoted to it.

Fourth, there are clear advantages to immersion learning at any age, and while a classroom cannot substitute for an L2 immersion environment in daily life, there are ways in which the classroom in a country where the L2 is not in everyday use can be moved a little in that direction. These include: using the L2 as much as possible as the language of classroom management; making sure learners get to hear native speakers of the L2, or in the case of English, very advanced English as an international language speakers, through use of new technology; surrounding learners with L2 realia such as posters, authentic materials such as train tickets and application forms, depending on the topic of the class (again some can be done virtually through computer display); offering opportunities for learners to understand and use English communicatively, as would occur in a real immersion situation, even if the information or opinion communicated is extremely simple (e.g. What is your favourite food?).

Fifth, the affective dimension should not be neglected. It was apparent in the earlier discussion that learning does not occur so well where the learner is excessively anxious or has his/her ego threatened. In classrooms this often is the case since everything may come under the scrutiny of a teacher who seems only interested in identifying errors. Learners may however have more positive feelings about lessons and learn better if a teacher can adopt a less judgmental stance, and encourage more learner-centred activities where the teacher is not even able to monitor learner performance, such as group work or computer based work.

Sixth, social pressure from peers, again with an affective component, needs to be addressed. As the account earlier showed, this can work both ways: in some social contexts and also depending on age, it will work to make a learner want to be as good as possible in the L2, because peer pressure favours high L2 proficiency, but in others the reverse is true. Indeed in adolescent L2 school classrooms in countries where the L2 has no daily currency, the second is often found. That is, learners who speak in class with an accent approximating closely to a native L2 accent, or who make fewer grammar errors than their peers, may find themselves ridiculed by peers for being too foreign and no longer being 'one of us', or at the very least as not 'cool'. This is difficult for a teacher to address, but incentives or rewards can be used to combat it.

In conclusion, then, the review of a quite old idea such as the CPH, undertaken in this paper, has been beneficial. While it has not been able to demonstrate conclusively whether the CPH is true or not, the investigation of it has proved fruitful both in clarifying the way forward to perhaps be able to confirm it in the future, and for the insights that discussion of it provide into many crucial aspects of language learning and teaching.

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محاودة النظر في فرضية الفترة الحرجة في تعلم اللغة الثانية :
استعراض نقدي لمقالتيين رائدتين في هذا المجال

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الملخص

تقدم هذه الورقة البحثية نظرة جديدة يستعرض خلالها الباحث فرضية الفترة الحرجة التي تقترح أن الجانب البيولوجي من الطبيعة البشرية، المتمثل في تطور الدماغ، يفرض بالضرورة نجاح الإنسان في عملية تعلم اللغة. وتحديدًا، إذا بدأ الأطفال في تعلم لغة ما قبل وصولهم إلى سن البلوغ، يزعم البعض أنه نتيجة لطريقة تمثيل اللغة في الدماغ في تلك الفترة، فإن الأطفال يتعلمون تلك اللغة بطريقة أكثر طبيعية، وتكون نسبة نجاحهم في ذلك أكبر مما لو تعلموها في وقت لاحق. كانت هذه الفكرة محل جدل ونقاش واسع في مجال أبحاث اكتساب اللغة الثانية منذ ستينيات القرن العشرين. هنا يقدم الباحث استعراضًا نقديًا للأدلة والحجج التقليدية سواء التي تؤيد الفرضية أو التي تعارضها في الدراسات السابقة في هذا المجال. كذلك يتوج الباحث جهده في هذه الدراسة بتحليل عميق وتفصيلي للحجج المذكورة في مقالتيين رائدتين في هذا المجال، أولاهما بعنوان «هل ثمة فترة حرجة لتعلم كيفية نطق اللغات الأجنبية؟» من تأليف ج. فليدج، والثانية بعنوان «دور العمر واللكنة في اللغة الثانية: رد على مقالة جيمس إميل فليدج» من تأليف م. باتووسكي.

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