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2009

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By my signature below, I certify that my ELTE B.A. thesis, entitled *Controversial issues around the critical period hypothesis* is entirely the result of my own work, and that no degree has previously been conferred upon me for this work. In my thesis I have cited all the sources (printed, electronic or oral) I have used faithfully and have always indicated their origin.

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Vitás kérdések a kritikus periódus elmélettel kapcsolatban

Controversial issues around the critical period hypothesis

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Abstract

The existence of a critical period (CP) for language acquisition remains disputed despite its significance for SLA theory and L2 teaching. Multiple interpretations of research findings of the critical period hypothesis (CPH) have led to controversy. This thesis intends to clarify the controversies surrounding the testing of the CPH and establishes what data would constitute evidence for the hypothesis. The approach taken is to discuss certain problems with the interpretation of important empirical studies in the light of the different formulations of the CPH and the way the CP for language acquisition is understood. The main issues are: age and the acquisition of different rule types, post-maturational age-effects, the influence of the L1, and native-like attainment. My conclusions are that: data would support a CPH if after a maturational point indicating the close of the CP, age and the ultimate proficiency would no longer be correlated or there would be a change in the age-related decline; native-like achievement would be impossible after the CP, allowing for exceptional cases; and finally, results should not be reliant on combinations of L1s and L2s.

1. Introduction

The notion of critical period (CP) has its origins in ethology and experimental embryology (Bornstein, 1989), in which it denotes a phase in the development when the organism is sensitive to external stimuli leading to the emergence or change of a specific behaviour. This sensitivity usually manifests itself in the form of some kind of learning ability (Csányi, 1994). CPs were first observed in chicks, which will follow any moving object that they perceive during a short period after hatching (Bornstein, 1989). It was first hypothesized by Lenneberg (1967) that there are CP constraints also on the acquisition of language, and he claimed that language learning cannot be successful unless it takes place before puberty. Lenneberg's proposal of the critical period hypothesis (CPH) led to a large amount of research, especially in the field of second language acquisition (SLA); as Scovel (2000) put it, “few topics in applied linguistics have continued to captivate the interest of researchers and practitioners so intensively [...] as the CPH” (p. 213).

The importance of the CPH in applied linguistics can be explained by the fact that this hypothesis addresses such basic questions as the role of environmental and biological factors in language acquisition (Bialystok & Hakuta, 1999). The CPH has important implications also for the field of language teaching. It suggests that an early start to second language (L2) learning has a great significance since it is the only way to achieve native-like proficiency. The establishment of the end of the putative CP can also have an impact on language planning by influencing decisions on the age when L2 programs should begin. Furthermore, certain formulations of the CPH suggest that children and adults make use of different language learning mechanisms indicating that they could benefit from different teaching methods.

Despite the importance of the topic and the large number of studies investigating the role of age in language acquisition, there is still no agreement on the status of the CP. For example, Oyama (1976), Johnson and Newport (1989), Patkowski (1990), DeKeyser (2000),

and Scovel (2000) argue that the research evidence supports the existence of a CP for the acquisition of at least certain aspects of language such as pronunciation or grammar; however, Flege (1987), Birdsong (1992), Bialystok and Hakuta (1999), and Bongaerts, van Summeren, Planken and Schils (1997) claim to have obtained results which challenge the CPH, and they argue for alternative explanations for the observed differences between child and adult language learners.

A reason why the question whether there is a CP for language acquisition is still an open one is that the supporters of the CPH hold widely differing views on the causes, the timing, and the scope of the presumed CP resulting in a number of different versions of the CPH. Moreover, it is not specified how a CP would affect the language learning outcome. These factors contribute to the fact that there are a large number of controversial issues around the interpretation of the results obtained by empirical studies testing the CPH and there is no general consensus regarding the data that would constitute evidence for the hypothesis. Consequently, the CPH cannot be conclusively proved or refuted unless the issues that engender controversies are clarified.

The aim of this paper is, therefore, to discuss the controversial issues around the testing of the CPH and to clarify what kind of data can be interpreted as evidence for the CPH in the light of the different formulations of the hypothesis and the characteristics of the presumed CP for language acquisition. In this paper, the CPH will be discussed as it applies to SLA, and questions concerning the existence of a CP for first language (L1) acquisition will not be addressed.

The paper is structured as follows: first, I will provide a definition for the CP for language acquisition, which will be followed by an overview of the different theoretical explanations for the CP. I will then discuss some important empirical studies investigating the hypothesis with the aim of clarifying certain controversial issues that arise around the

interpretation of their findings. Finally, based on the theoretical considerations and the discussion of the empirical research, I will draw some conclusions concerning the kind of data that would constitute evidence for the CPH.

2. Definition of the critical period for language acquisition

Most of the researchers investigating or discussing the CPH do not provide an explicit definition of the CP phenomenon. Usually only some consequences of the existence of a CP, such as the impossibility of achieving native-like mastery of a L2 outside the period, are mentioned by way of definition (e.g., Larsen-Freeman & Long, 1991), or instead of a definition, one of the several explanations proposed for the CP is emphasized disregarding the lack of consensus on the causes of the CP. For example, Ioup, Boustagui, El Tigi and Moselle (1994) claim that the CP is generally related to the decline of the cognitive structures responsible for spontaneous language acquisition, while Flege (1987) states that the CP is considered to be connected to the lateralisation process. Another reason why we should be more precise concerning the notion of the CP is that the way CPs are understood in biological sciences has changed and nowadays these periods are thought to be less deterministic and irreversible, especially in the case of more developed organisms (Csányi, 1994). Consequently, it can give rise to misunderstandings if we talk about CPs without making it clear what we mean by them.

Nevertheless, some researchers have attempted to define the phenomenon that could qualify as a CP for language acquisition (e.g., Bialystok, 2002; Bialystok & Hakuta, 1999; Eubank & Gregg, 1999; Newport, 1991). These definitions approach the question from different point of views, but there are certain recurring points which can give us an idea of how CPs are understood in SLA research. The gist of the different definitions is that as a result of maturation, there is a change in the language learning ability. A period when “the

ability to learn is at its peak” (Newport, 1991, p. 111) is followed by either the termination of learning or by a more gradual decline in the learning ability, after which the capacity to learn levels off. It is important that the decline should coincide with a maturational point in the development. After the end of the CP, the possibility of learning often remains but it is usually significantly reduced and the result of learning becomes more unpredictable. Native-like achievement is not possible if the first exposure to the language happened after the close of the CP (Eubank & Gregg, 1999). There is no agreement on the underlying mechanisms that might bring about the end of the CP, but it is generally thought to be the result of either neurological or cognitive maturation. In the next section, I will provide an overview of the different explanations for the CP, and I will also discuss whether certain affective accounts of age-related differences in SLA can be considered as possible explanations for the CP.

3. Causes of the critical period

3.1. Neurobiological explanations

The idea that there are constraints on language acquisition resulting from neurological maturation can be traced back to Penfield and Roberts (1959). Although they did not use the expression *critical period* in their work, Penfield and Roberts argued that an early exposure to foreign languages is crucial for successful L2 acquisition. They based their arguments on the observation that children who sustained brain damage to the language areas in the dominant hemisphere recovered much faster from speech disturbances than adults, and the transfer of the speech functions to the opposite hemisphere was also more likely to take place in children. Therefore, they hypothesized that after age nine, the neural flexibility that characterizes the young brain is lost and language learning becomes increasingly difficult.

Penfield and Roberts's (1959) ideas were further developed by Lenneberg (1967), who proposed that there is a CP for language acquisition, which coincides with the lateralisation of

language functions into the left hemisphere of the brain. He suggested that this hemispheric specialization is a gradual process starting around the age of two and being completed by puberty. However, Lenneberg was criticized on the grounds that the neurological changes he refers to do not seem to occur at an appropriate time for the CPH. Krashen (1973, as cited in Singleton, 1989) reviewed the data that Lenneberg based his arguments on and concluded that the lateralisation process is probably completed by age five, while more recent studies suggest that laterality is present at an even earlier age, maybe even at birth.

Lenneberg (1967) was mainly concerned with L1 acquisition; nevertheless, he also expressed his views on SLA. He suggested that after puberty “foreign languages have to be taught and learned through a conscious and laboured effort” (Lenneberg, 1967, p. 176). Scovel (1969, as cited in Scovel, 2000) also proposed a connection between success in SLA and the establishment of cerebral dominance. While Lenneberg's theory applied to language learning in general, Scovel constrained the CPH and the effect of the completion of lateralization around puberty to the acquisition of accent-free pronunciation because, unlike grammar, it has a “clear neuromotor etiology” (Scovel, 2000, p. 219). Consequently, the loss of neural flexibility leads to a decline in the neuromuscular control required for the proper articulation of L2 speech sounds. Later Scovel (1981, as cited in Larsen-Freeman & Long, 1991) argued that the loss plasticity is probably caused not only by lateralization but by several different neurological processes.

Several researchers advocating a neurologically based CP claim that we have to talk about not one but multiple CPs each affecting different linguistic domains. For example, Walsh and Diller (1981, as cited in Singleton, 1989) distinguished between two types of neurons which have different maturational timetables and which, they claim, are related to different aspects of language. The early-maturing pyramidal cells play an important role in neuromuscular control; therefore, their development might result in the appearance of foreign

accents around the age of six or eight. The other type of neuron is connected to “higher order cortical functions” such as cognition and learning (Walsh & Diller, 1981, as cited in Singleton, 1989, p. 175), and its maturation is a slow process lasting for about twenty or thirty years. Consequently, it is possible to master the grammar and semantics of a L2 even after puberty while the CP for pronunciation comes to an end in childhood.

Pulvelmüller and Schumann's (1994) theory also predicts the existence of multiple CPs but as a result of a different neurological process, the so-called myelination. During myelination, glial cells “wrap the axons of neurons so that they can conduct electrical signals more rapidly” (Pulvelmüller & Schumann, 1994, p. 710). This process might cause loss of neural plasticity because if the space between the neurons is occupied by glial cells, the creation of new synaptic connections becomes more difficult. Myelination occurs early in those cortical areas where phonological and syntactic knowledge is represented, while semantic knowledge can be stored in connections that are located in late-maturing higher-order cortices. According to this theory, the acquisition of pronunciation is affected earlier by the maturation of the brain than the ability to learn syntax, but the CPs for both competences end by puberty. The acquisition of semantic knowledge shows less or no age effects.

3.2. Cognitive approaches

3.2.1. Piagetian explanations

Another major group of researchers claim that the CP is the result of maturational changes in cognition. Most of them suggest that the new cognitive strategies that emerge as a result of maturation are less adequate for language acquisition than those which are employed by children. The opinions, however, differ on the cognitive mechanisms that can impede language learning and also on the changes that lead to the development of these new strategies. First, those theories will be discussed that suggest that there is a connection

between the onset of the Piagetian formal operations stage around the age of eleven and twelve and the decline of language learning capacities. It is also worth mentioning that the explanations based on Piaget's theory are not completely independent of those approaches that consider the CP to be the result of neurological changes since Piaget related the emergence of the formal operations stage to neurological maturation (Singleton, 1989).

In his discussion of the CPH, Krashen (1975, as cited in Singleton, 1989) concentrates on the appearance of abstract thinking and the “general tendency of adolescents to construct theories” (Inhelder & Piaget, 1958, as cited in Singleton, 1989, p. 181), which are thought to be characteristics of the formal operations stage. He claims that post-puberty learners create a “conscious theory (a grammar) of the language” (Krashen, 1975, as cited in Singleton, 1989, p. 181) and, therefore, they choose a rule-based approach to learning which might interfere with the natural and more appropriate way of acquiring a language. In contrast, Rosansky (1975) argues that it is the emerging awareness of contradictions in the formal operational person that has a harmful effect on language learning. According to her, children acquiring their L1 are at a cognitive level where they can concentrate only on one aspect of a problem at a time. This limitation might provide a basis for language acquisition as it makes it possible for the child to focus on the similarities in generative principles. However, when an awareness of contradictions develops in the adolescent, he starts to recognize the differences, which interfere with his ability to concentrate only on the similarities.

3.2.2. The Fundamental Difference Hypothesis

A number of cognitive explanations have been proposed that are not based on Piaget's theory but on other supposed cognitive changes. According to Bley-Vroman's (1989) Fundamental Difference Hypothesis (FDH), there is an essential difference between L1 acquisition and post-puberty foreign language learning resulting from the fact that in adults

the innate language acquisition faculty is no longer in operation. Consequently, instead of Universal Grammar (UG) and domain-specific learning procedures, adult learners need to rely on their native language knowledge and their general problem-solving abilities. From this perspective, the end of access to the language learning device would be equivalent to the close of the CP.

DeKeyser's (2000) starting-point is also the FDH, but he concentrates on the differences between implicit and explicit learning. In his view, the CP applies to the ability of learning abstract systems such as language implicitly. The end of the CP means the loss of this ability, and adults need to employ explicit problem-solving capacities to compensate for this loss.

3.3. Affective explanations

Some reviewers of the CPH, such as Singleton (2007), interpret certain affective explanations for the differences between children and adult language learners as possible explanations for the CP. Singleton mentions for example Guiora's (1972, as cited in Singleton, 2007) theory of the language ego and Schumann's (1975, as cited in Singleton, 2007) interpretation of age related-differences as the result of the increasing social and psychological distance between the adult learner and the target language group. However, it can be argued that these theories do not predict a CP but a less deterministic optimal period for language acquisition.

In general, affective explanations suggest that children tend to be more successful L2 learners than adults because they are characterized by certain affective factors such as a high level of motivation and low inhibition that are necessary for successful language acquisition. As a result of social-psychological maturation, these factors change in a way that has negative consequences for L2 learning. Thus, these explanations suggest that adults have the same

capacity for language learning as children but their emotional state and attitudes prevent them from effectively making use of this ability (Patkowski, 1990). However, as it was pointed out by Schumann (1978, as cited in Singleton, 1989, p. 203), “unlike biological maturation [...] social-psychological maturation is not unalterable.” It can be assumed that under favourable conditions an average adult learner can recreate the ideal emotional and attitudinal state for language acquisition, while it is usually impossible to return to an earlier stage of neurological and cognitive development.

Affective theories, therefore, should not be considered as explanations for the CP since they predict that the language learning ability is influenced differently by ageing as in the case of the existence of a CP. Most importantly, they imply that successful language acquisition is possible even for adult starters while one of the defining characteristics of the CP is that native-like competence cannot be achieved after a certain age. Furthermore, by considering both the affective explanations and the above-mentioned more deterministic neurological or cognitive theories as versions of the CPH, even more problems and contradictions would arise in connection with the testing of the CPH. For instance, it would not be clear whether the identification of a large number of successful adult starters would challenge the CPH.

3.4. Summary of the different proposals

To sum up, the researchers hold widely differing views on the causes of the CP. There is also no consensus among those who believe the CP to be the result of neurological changes; explanations range from the general loss of neural plasticity to more specific processes such as lateralization, myelination or the maturation of certain neurons. Advocates of the cognitive explanations also disagree on the exact nature of the mechanisms that might impede language acquisition. The possible processes are, among others, the emergence of abstract thinking, the awareness of contradictions, and the loss of domain-specific learning procedures.

Moreover, the different theories have different implications for the scope and the timing of the CP. While according to Lenneberg's (1967) theory, the CP affects language learning ability in general, Scovel (2000) believes that it only applies to pronunciation. Other researchers suggest that there is a CP for the access to UG or for implicit language learning. If we try to summarize the different proposals concerning the close of the CP, we get quite broad age limits; the CP for pronunciation ends sometime between the age of six and puberty, while the acquisition of grammar becomes more difficult between the beginning of puberty and the age of thirty. It is also possible, however, that the CP comes to an end at infancy if it is related to lateralization.

We can see that despite the fact that the CPH is treated as a unified hypothesis, it has a number of different versions. As a result, the characteristics of the presumed CP are only vaguely defined, and during the interpretation of the research findings from the point of view of the CPH, one has to take into consideration the several different formulations of the hypothesis. These factors can lead to a number of controversies in connection with the empirical testing of the CPH and to a lack of agreement on the data that would constitute evidence for the CPH. The fact that there is no consensus regarding this question is exemplified, for instance, by Bialystok's (2002) reply to DeKeyser's (2000) study. DeKeyser conducted an empirical study investigating the CPH and Bley-Vroman's (1989) FDH. He concluded that all of his hypotheses were confirmed and the evidence supported the CPH. In her criticism of DeKeyser's study, Bialystok admits that the hypotheses were supported by the results; however, she argues that the data provides evidence against rather than for the CPH. In the next part of the paper, I will overview some important studies investigating the CPH with a focus on the controversial issues that arise in connection with the interpretation of their results from the point of view of the CPH. I will discuss the problematic points in the light of

the different formulations of the CPH and the interpretation of the CP for language acquisition.

4. Empirical research

4.1. The Johnson and Newport (1989) study

One of the most influential studies investigating the CPH is that of Johnson and Newport (1989), which examined whether there is a CP for the acquisition of grammar. The participants in this study were forty-six native speakers of Chinese and Korean, who differed from each other in terms of their age of arrival in the United States. An auditory grammaticality judgement test was administered measuring the participants' knowledge of some basic aspects of English morphology and syntax. It was found that those who arrived between the age of three and seven performed in the range of native speakers, while all the other age groups achieved significantly lower points. After the age of seven, performance declined linearly with increasing age until puberty (defined as the age of fifteen in this study), after which point age was no longer related to performance and individual variation became significant.

As I have argued that those theories which explain the observed differences between child and adult language learners by certain affective changes should not be considered versions of the CPH, it has to be examined whether the age-related results obtained by the study really reflect a maturational change in the language learning ability and it cannot be explained by affective variables that might be correlated with age. For this reason, Johnson and Newport (1989) performed correlation and regression analyses, after which the strongest predictor of performance was still the age of arrival. Consequently, they drew the conclusion that the findings support the existence of maturational constraints on language acquisition. We can see that these results are indeed consistent with the CPH and with the pattern of learning

outcome predicted by the definition of the CP for language acquisition. An important question is whether this conclusion is tenable in the light of the criticism levelled at the study and whether the clear-cut results can be replicated with different participants and languages.

4.2. The criticism of Johnson and Newport (1989)

The Johnson and Newport (1989) study was strongly criticized by Bialystok (1997). One aspect of the results that she found especially problematic was the fact that on the grammatical judgment test, the late-starters were more successful at certain rule types than at others. Moreover, when the same test was repeated in a written form by Johnson (1992), there were only three rule types out of the twelve that the late-learners could acquire less effectively than the early-starters. Bialystok argued that these results are incompatible with the CPH since a maturational constraint on language acquisition would not affect different grammatical structures differently. However, Bialystok disregards the fact that, as it was emphasized by Johnson, the test was relatively easy and was designed to measure the knowledge of basic English grammar. More complex questions testing difficult aspects of grammar might have yielded results that show significant age effects on the other rules types as well. In addition, there is nothing in the CPH that would predict that post-puberty language learners will find all grammatical structures equally difficult. The CPH only suggests that adults need to make use of learning mechanisms or neurological representations that are less adequate for language acquisition than the ones used by children and that do not lead to complete mastery of a L2. Johnson and Newport also suggested that the differences in rule type difficulty are not simply the result of the influence of the L1; therefore, these findings can also be interpreted as “reflections of what is generally difficult or easy for a late learner” (Johnson & Newport, 1989, p. 88). In the light of these considerations, I would argue that the fact that the participants found certain rule types more difficult than others do not challenge the CPH.

Another criticism voiced by Bialystok (1997) raises an important issue in connection with the verification of the CPH. She claims that the reanalysis of Johnson and Newport's (1989) data revealed that age and performance are not completely unrelated after puberty and a linear decline with increasing age can be detected even in adulthood (see Figure 1). Furthermore, the statistical analysis indicated that the significant change in learning outcome occurred not around the age of sixteen but around twenty. Bialystok suggests that this pattern does not support the CPH. Other researchers such as Birdsong and Molis (2001) also claim that the presence of age effects after the completion of maturation constitute counter-evidence to the CPH since this hypothesis predicts that there are constraints on language acquisition resulting from maturation. In other words, if language acquisition during the CP is based on certain mechanisms whose maturation (or the maturation of other structures related to these mechanisms) brings about a decline in linguistic performance, this decline should not continue after maturation is over.

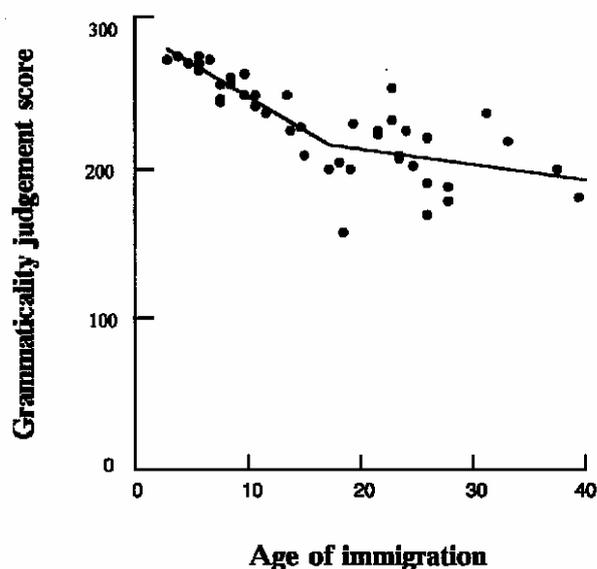


Figure 1. The performance of Johnson and Newport's (1989) subjects on the grammaticality judgement test by age of arrival.

Note. From *The structure of age: In search of barriers to second language acquisition*, by E. Bialystok, 1997, *Second Language Research*, 13, p. 122.

However, it is possible to account for the post-maturational age effects within the framework of the CPH. As I have already mentioned, some explanations for the CPH are based on Bley-Vroman's (1989) FDH, which claims that adults employ general cognitive processes for language acquisition since after the end of the CP they no longer have access to domain-specific learning mechanisms. It has been shown that several general cognitive mechanisms that play a part in language acquisition gradually deteriorate with age (Bialystok & Hakuta, 1999); therefore, a linear decline in linguistic performance is expected after the close of the CP (Moskovsky, 2002). Thus, the fact that age has an effect on language learning outcome even in adulthood does not necessarily refute the CPH since it is in accordance with certain formulations of the hypothesis.

Nevertheless, there is one type of evidence related to the curve of learning outcomes which is crucial for the CPH. There might be a negative relationship between age and performance in adulthood, but a continuous decline in learning abilities from childhood until death is incompatible with the notion of CPs: it is only the sign of ageing. It follows from the definition of the CP that there should be a discontinuity in linguistic performance connected to a maturational point which indicates the end of the CP (Hakuta, Bialystok, & Wiley, 2003). If we examine the graph containing Johnson and Newport's (1989) data reanalyzed by Bialystok and Hakuta (1994, as cited in Bialystok, 1997), we can discover this essential discontinuity; the slope of the curve which shows performance on the grammatical judgment test changes around the age of eighteen. It also seems to be an important qualitative change because it signifies the appearance of large individual variation in performance as opposed to the relatively uniform achievement of the early starters.

Finally, it needs to be discussed whether the fact that the reanalysis of Johnson and Newport's (1989) data indicates that the discontinuity in linguistic performance is connected to a later point than it was originally found is problematic for the CPH. This contradiction is

partly related to the lack of agreement on the age when the CP ends. In order to compare the performance of early and late arrivals on the test, Johnson and Newport divided the participants into two main groups. As there is no agreed upon age for the close of the CP for grammar, Johnson and Newport assumed that the cut-off age is related to puberty, which is the most frequently mentioned dividing line in the discussions on the CPH. The relevant statistical analyses was performed separately for those who arrived between the age of three and fifteen and for those who arrived after the age of seventeen; consequently, the discontinuity in the performance was discovered around the age of sixteen. However, since this age-division was chosen to some extent arbitrarily, the possibility remains that there is a better cut-off age for the data. This possibility was not examined by Johnson and Newport, but Bialystok and Hakuta's (1994, as cited in Bialystok, 1997) analysis revealed that the real change in the participants' performance might occur at the age of twenty. This later age is not incompatible with the CPH since, for instance, Walsh and Diller's (1981, as cited in Singleton, 1989) theory suggests that the ability to acquire L2 grammar might start deteriorating around the age of twenty as a result of the maturation of certain neurons. Moreover, adolescence is also supposed to end around this age (Roenneberg et al., 2004).

We can conclude, therefore, that the results obtained by Johnson and Newport (1989) are consistent with the CPH. However, the reanalysis of their data indicates the importance of considering the lack of consensus on the close of the CP during the testing of the CPH and the necessity of examining whether the discontinuity in learning outcome is really related to maturation, otherwise the validity of the findings can be questioned. Other studies investigating the effects of age on language acquisition raise further issues that need to be addressed. In the followings, the replication of Johnson and Newport's study by Birdsong and Molis (2001) will be discussed.

4.3. The Birdsong and Molis (2001) study: The influence of the L1

Birdsong and Molis (2001) conducted their study by using the same methods and testing instrument as Johnson and Newport (1989). However, the grammaticality judgement test was administered to native speakers of Spanish, which is a typologically much more closely related language to English than Chinese or Japanese. The distribution of the Spanish participants' scores on the test revealed a pattern of age effects which was to some extent different from the findings of the original study. Unlike in the case of the Johnson and Newport study, there was no significant decline in performance between the age of seven and fifteen, and the participants generally achieved higher points than the Chinese and Japanese subjects. Moreover, after the age of seventeen, a strong negative relationship between age and performance was observed, and individual variation did not increase to such an extent as it was expected (see Figure 2).

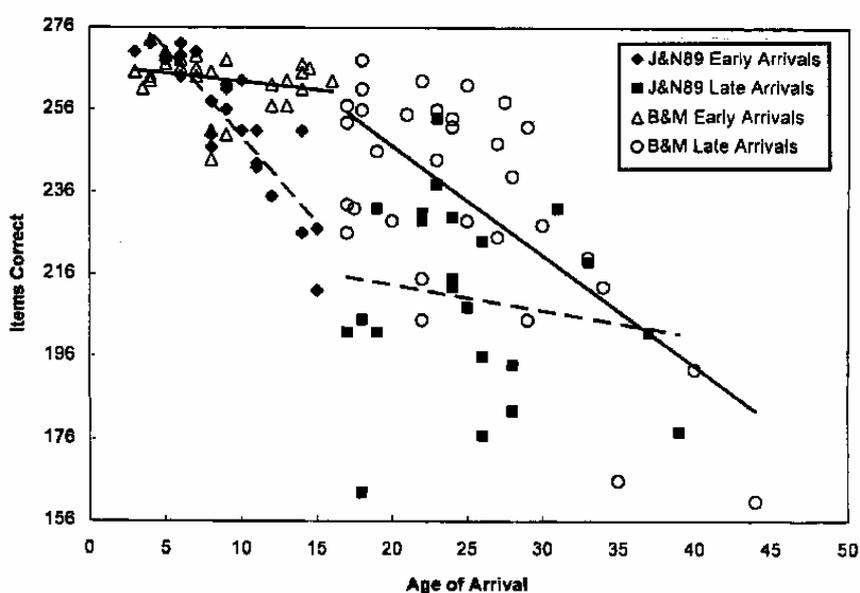


Figure 2. Number of items correct as a function of age of arrival in Birdsong and Molis (2001) and Johnson and Newport (1989). Birdsong and Molis: solid lines; Johnson and Newport: dashed lines.

Note. From *On the evidence for maturational constraints in second-language acquisition*, by D. Birdsong and M. Molis, 2001, *Journal of Memory and Language*, 44, p. 240.

Birdsong and Molis (2001) do not draw any definitive conclusion concerning the implications of their results for the CPH, but they suggest that the differences in the findings, probably attributable to the effect of the L1, can be problematic for the CPH since maturational constraints on L2 acquisition should affect all instances of L2 learning similarly. Nevertheless, it can be argued that certain influences of L1 and L2 pairing on the outcome of language learning are expected irrespective of whether there is CP or not. For instance, if there are a large number of similarities between the languages, as it is the case with English and Spanish (Birdsong & Molis, 2001), there are fewer grammatical structures that are completely new for the L2 learner. Consequently, fewer rule types will cause problems for older learners on grammaticality judgment tests (DeKeyser, 2000), which can explain why the participants of the Birdsong and Molis study performed better than the Chinese and Japanese subjects. Moreover, since the relatively simple test of the Johnson and Newport (1989) study was probably less demanding for the Spanish native speakers, the lack of an age-related decline before the age of sixteen can be the result of ceiling effects, and it is possible that a more advanced test would have revealed a decline in performance before puberty. Therefore, these findings do not necessarily provide a challenge for the CPH. Nevertheless, further studies employing rigorous tests of grammatical competence need to be conducted with different language pairings to determine whether there are significant differences in the age when the decline in proficiency starts.

I have already mentioned that the appearance of a discontinuity in performance around a maturational point is crucial for the verification of the CPH since it is one of the defining characteristics of CPs. This kind of pattern of age effects should appear regardless of the L1-L2 pairing since if the type of evidence that indicates the existence of a CP could be obtained only by certain languages, it would indicate that the phenomenon underlying these results is not universal and, therefore, not maturational in nature. The data obtained by Birdsong and

Molis (2001) is also characterized by this important discontinuity; the slope of the regression line changes around the age of seventeen.

I have already argued that a decline with increasing age after the close of the CP is not necessarily problematic for the CPH. In the case of the Birdsong and Molis (2001) study, however, the negative relationship between age and performance after puberty is significantly stronger than the one obtained by the reanalysis of Johnson and Newport (1989) in Bialystok and Hakuta (1994, as cited in Bialystok, 1997). The increase of individual variance is also smaller. These differences between the two studies suggest that the way age affects ultimate attainment in L2 acquisition is influenced by the L1. The nature of this influence of the L1 is usually not addressed in studies discussing the CPH; therefore, the question whether the results obtained by the Birdsong and Molis study are compatible with the CPH remains an open one. The problems that arise in connection with the interpretation of the findings indicate the importance of clarifying the extent to which differences in the pattern of age effects as a function of the L1 and L2 is compatible with the CPH since this hypothesis can only be verified if it is shown that a CP affects L2 acquisition generally regardless of the pairing of languages.

4.4. The question of native-like attainment

All the studies we have looked at so far investigated the CPH by measuring the ultimate competence of a large number of subjects varying in terms of the age when they were first exposed to a L2. However, there is another approach to the testing of the CPH which is based on the prediction that those who start learning a L2 after the end of the CP will not be able to achieve native-like mastery of the language. As Long (1990, as cited in Birdsong, 1992, p. 707) suggested “the easiest way to falsify [claims for a critical period in L2A] would be to produce learners who have demonstrably attained native-like proficiency despite having

begin exposure well after the closure of the hypothesised sensitive periods.” Clearly, it would be an obvious challenge to the hypothesis if it was shown that under the right conditions, a significant proportion of late-starters are capable of native-like achievement in a L2. However, it is questionable whether the identification of a few exceptional learners would necessarily refute the CPH since some researchers, for instance Scovel, claim that these individuals are simply not affected by CP constraints and they “represent the exceptions found within plus two or three standard deviations from the norm” (Scovel, 2000, p. 217). The findings of some studies examining the distinctive characteristics of exceptional learners also imply that the refutation of the CPH is not as simple as was suggested by Long.

Schneiderman and Desmarais (1988) identified two post-puberty language learners who were judged to be native speakers of French by four native Francophones on the basis of tape-recorded interviews. It was hypothesised that these findings do not challenge the CPH because these individuals have a special brain organization for language learning and, consequently, they are exceptions to the CP. The hypothesis was tested by examining whether the subjects show greater reliance on the right hemisphere when processing language, whether they use unusual strategies for performing memory tasks and show an exceptional ability to acquire new codes. It was also examined whether they exhibit any of the so-called Geschwind cluster factors such as left-handedness, allergies, schizophrenia, which can be connected to anomalous brain organization. All of the tests produced positive results indicating that the two language learners retained the greater neurocognitive flexibility that characterizes children. Two other studies concentrating on successful adult language learners (Ioup et al., 1994 and Novoa, Fein, & Obler, 1988, as cited in Bongaerts et al., 1997) reported that their subjects were characterized by the same signs of exceptional brain organization. Consequently, instead of challenging the CPH, these studies provide support for the hypothesis. Therefore, Long's criterion needs to be modified since in order to refute the CPH, it has to be demonstrated that

there are adult-starters who managed to acquire a L2 at a native-like level without being characterized by certain special neurological or cognitive features that could exempt them from the effects of the CP.

5. Conclusion

The fact that there are a wide range of opinions on the characteristics and the nature of the presumed CP can give rise to a number of controversies around the interpretation of research findings from the point of view of the CPH. Therefore, the aim of this paper was to establish what kind of data would constitute evidence for the CPH. On the basis of the discussion of the theoretical literature and some empirical studies, I can draw the following conclusions concerning this question.

First of all, as it follows from the definition of the CP for language acquisition and as it was demonstrated by the findings of Johnson and Newport (1989), the linguistic performance of those who started learning a L2 at early childhood should be equal to or approximate the performance of native speakers. After this period, a gradual decline is expected; age and performance is negatively related until the end of the CP. The close of the CP is indicated by a significant change in the ability to learn a L2 around a maturational point which is generally thought to be puberty. However, as it was exemplified by the different cut-off ages established for Johnson and Newport's data, it also needs to be taken into consideration that a wide-variety of ages have been proposed for the close of the CP. Based on the different interpretations of the CPH, the qualitative change in the learning ability can manifest itself in two main ways: age and proficiency become either unrelated after the maturational point or there is a discontinuity in the age-related decline suggesting that certain mechanisms that play a part in adult language acquisition might deteriorate with age. The latter possibility is predicted for instance by Bley-Vroman's (1989) FDH.

Since those explanations that consider affective factors to be the cause of the age-related differences do not necessarily predict the existence of a CP, it has to be demonstrated that the type of results described above cannot be explained by certain affective variables, and age as an indicator of maturational state should be the strongest predictor of performance. More evidence for the CPH would be the lack of native-like attainment among those who started L2 learning after the end of the CP. However, Schneiderman and Desmarais's (1988) study indicated that the existence of a few exceptional learners is not necessarily challenging to the hypothesis if it can be demonstrated that they are different from the normal population of language learners and they are not affected by CP constraints for some reason. Finally, as I argued in connection with the Birdsong and Molis (2001) study, a pattern of age effects that indicates the existence a CP should be observed irrespective of the languages examined. Participants might achieve generally higher or lower proficiency depending on the closeness of the L1 and L2, but the results should show the defining characteristics of CPs such as discontinuity around a maturational point. Based on the way the CP for L2 acquisition is currently understood, the type of results outlined above would support the CPH.

The controversial issues discussed in this paper have further implications for the testing of the CPH. The disagreement over the interpretation of the lack age of effects on the acquisition of certain rule types in Johnson and Newport (1989) and the lack of age-related decline before puberty in case of the Birdsong and Molis (2001) study indicated that the test measuring the participants' knowledge of the L2 should be rigorous and challenging enough. Otherwise, the results concerning certain age groups or rule types might reflect ceiling effects instead of the influence of age making the interpretation of the findings more problematic.

There are limitations which need to be considered regarding this paper. The conclusions are based on the discussion of only a few important studies, which were concerned mainly with the nature of age-constraints on the acquisition of grammar. Other

studies investigating the CPH might raise further controversial issues and problems that would need to be clarified in order to make the verification or the refutation of the CPH possible. Furthermore, certain questions raised by the Birdsong and Molis (2001) study concerning the influence of the L1 on L2 learning in different ages remained unanswered.

In order to clarify these issues surrounding the influence of the L1, more research needs to be done with different L1s and L2s investigating how the pairing of languages modify the effect of age on linguistic performance, and the implications of the findings for the CPH need to be examined. Finally, as far as the contradictory opinions on the characteristics of the CP are concerned, further research is necessary into the nature of CPs in the development of humans and into those processes that might underlie a CP for L2 acquisition to increase our understanding of the way age can affect L2 learning.

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