CPH's influence on different teaching methods between children and adult language learners

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Since Critical Period Hypothesis (CPH) was raised in 1959 by Penfield and Roberts, the debate has never been stopping whether there is an age period, outside which the second language acquisition (SLA) cannot be perfect. The CPH research always attracts the most attention in the SLA field, because the L2 education system will be completely revolutionized once the period is finally discovered. According to E. Lenneburg (1967), the widely accepted father of CPH, this period should be earlier than puberty, after when the learner's second language ability will never achieve the native level. The biological theory underlining this hypothesis is the mechanism of human brain whose hemisphere for language is supposed to have no or at least little room to develop after a certain age, and for Lenneberg, that age is the puberty (Lenneberg, 1967). Although the explanation sounds quite reasonable, evidence doesn't suffice to prove the existence of the period, making it still a pending question after so many years till now.

Controversy over CPH

Controversy mainly lies in two aspects: whether the critical period exists and when it ends. Let's talk about the second aspect first, assuming the period does exist. Only the end age being settled can the CPH be meaningful to the language education. However, literature never makes any agreement on this question. Penfield and Roberts, as the forerunners of the hypothesis, sets the end year as nine when the brain loses plasticity (Penfield and Roberts, 1959), while Lenneberg's idea, as already mentioned, is puberty (Lenneberg, 1967). Lenneberg's term is vaguer but, instead of a definite age, seems more rational, since the development of brain couldn't be uniform among all the humans: girls usually maturate earlier than boys, and some individuals are precocious than others because of innateness or diets. To confirm how long puberty ranges, a lot of research thereafter are made, results diverging that end-age could be from 3 to 17 in terms of different researchers (Ruben, 1997; Meisel, 2008; Hartshorne, Tenenbaum and Pinker, 2018; Dollmann, Kogan and Weißmann, 2020). Such a wide scope of ages seems of few uses to impose any instruction on the language acquisition.

Why there is much difference made among the researchers? It might be the different subjects they choose, or the methodologies they adopt. One possible explanation is the facets of language they test. Meisel (2008) tests the inflection of morphemes; Dollmann et al. (2020) have the focus on the way of speaking; Hartshorne and his coworkers' conclusion comes from syntactic acquisition (Hartshorne, Tenenbaum and Pinker, 2018). Combining their research, we can get an evolved version of the hypothesis--Multiple Critical Period that the development of different language abilities ends at different ages. Granena and Long (2013) propose, according to their empirical study, a sequence of

critical language acquisition periods when windows of learning opportunity close in an order of phonology, lexis and collocation, and last morphosyntax. This hypothesis gives strong convincement to the idea that the younger the better of learning L2, but it is not faultless. If the sequence is certain, then learners who do a perfect job in their phonological period will guarantee their perfect acquisition in the later periods because they are always at the right age of critical periods. However, many L2 speakers who have nativelike pronunciation also make syntactic problems, and in addition, there are always L2 learners who start their learning in the later period but pronounce perfectly. It seems this sequential tendency does not suit everybody, or say, not all the learners experience such a critical sequence at a critical range of age, the variable results once again making the hypothesis not so meaningful. Even whether there are clear boundary between each period is challenged, such as the integrated learning of vocabulary and syntax, which the literature has proved (Sinclair, 1991). Nevertheless, all the empirical evidence manifests the age makes difference of language acquisition.

Before we go on exploring thee above-mentioned controversy whether the Critical Period exists, we had better scrutinize the aim of the hypothesis again. The doctrine of it is that later learners of a new language cannot achieve the nativelike proficiency. The core idea as well as the problem is whether there exists the nativelike proficiency. We will analyse it in both social and psychological perspectives. Does a native speaker speak the standard language? That's always a problem for sociolinguists to clarify. Living area, social status, educational level, idiosyncrasy, and maybe other factors, these all contribute to the language a native speaker speaks. The local inhabitants of south France speak way differently from their counterparts in north France. Which one speaks better or more standardly? Even there is a standard version, like Chinese mandarin, it is all a social-political thing, not much else, otherwise the people in Taiwan couldn't say they speak mandarin because their vocabulary, pronunciation and even a bit of syntax are so different from Chinese mainland. Besides, the language spoken by a university professor, which seems with high prestige, is not favoured by the working class who stand for large population. Then whose language is more nativelike, for a L2 learner? Kachru (1985, 1994; 2006)'s World Englishes theory explains this in much detail, and some of his ideas can also be applied to other languages. His three-circle theory of English communities put the English speakers of USA, UK, Canada, Australia and New Zealand in the inner circle, and English speakers of other countries in the outer circle and expanding circle (Kachru, 1985). We can see that the population of English speakers in outer and expanding circles are much larger than inner circle, and their English versions are also an important part in different sorts of communication. The reason people want to pursue the style of inner circle is, rather than the language itself, because of economic and political power through which the inner circle countries control the power of English education and mass-media. In other words, the English used in the outer circle and even expanding circle can also be understood as a kind of nativeness, if only regarded linguistically.

Considering from the psychological angle, nativelike proficiency is even a false proposition. If we adopt nativelikeness as the benchmark to test the proficiency, then we need to set the full marks as well as the pass mark. Full marks, of course, should be the perfect competence of a monolingual speaker. what about the pass mark? How close to that competence could be regarded enough nativelike? This question may never have an answer, because L2 speakers, in a sense, never speak and think like a monolingual. The L1 and L2 are not stored apart in the two "balloons" in the brain, but they always interact with each other (Baker, 2001, p. 165). Anything learned in L1 can transfer to L2, and vice versa. Cummins (1992)'s Common Underlying Proficiency model, as well as its dual iceberg representation, illustrates the mechanism very well. There are two separate icebergs which symbolize two languages float in the ocean, but underneath the water, the two in fact belong to a huge base iceberg that cannot be seen in the air. That base iceberg is common underlying proficiency, the cognition system shared by both languages. From that metaphor, we can easily find the language processing system of L2 speakers, is different from the monolingual speakers. Cognition system shared by two languages, the L2 learning is inevitably influenced by the L1, and the L1 will be affected by L2 as the learning progresses, too. That's the reason why codeswitching cannot be completely eliminated but only reduced, even if much attention has been paid. Therefore, we may conclude that the nativelikeness is very harsh and unrealistic. A total copy of monolingual way of speaking and thinking is impossible for the bilinguals. It is very unfair to use the ability of monolingual native speakers to benchmark the bilingual L2 learners.

Back to explore the existence of critical period, we need to make it clear why it never gets the universal approval. Firstly, there are always exceptions. Not few numbers of late L2 learners show nativelike proficiency (we will still use nativelikeness for convenience, though it is against by the author), shown not by anecdotes but also by previous research. Kinsella and Singleton (2014) study 20 anglophone adults who are late learners of French. Most of them started their first intensive exposure to French after 20 and stayed in France for more 20 years. 3 of the subjects get the perfect score in both accentual and lexico-grammatical tests and even cannot be recognized by the native speaker as non-native. Such a result seems to subvert the basis of CPH, but reason could also be attributed to aptitude. People with aptitude for language learning usually have the ability to identify and memorize new sounds, understand the function of words, sense the grammar from examples, and have a good memory of new words (Lightbown and Spada, 2001). In terms of Gardner (1993), they probably have very strong linguistic intelligence, which may be the reason that help them exceed the limitation of critical period.

Secondly, the critical period is not exclusive. Other factors also play an important role in second language acquisition and no one can make a determined assertion that one factor is more important than another. Still use the result of Kinsella and Singleton (2014) as the example. All three nativelike subjects, showed in the interview, that they spent long time with the goal of passing for native. More interestingly, the other 3 who have perfect score in lexico-grammatical test but with their accents identified as non-native, never

had the same interest in doing so. The result can naturally lead us to the assumption that they would have also acquired nativelike accents if they have such a motivation. Therefore, the deduction is tenable that the adult learners, compared to child learners, prefer to keep their own accent because of self-identity. Learning opportunity is another possible factor that can hinder later learner's nativelike proficiency. Early studies about CPH are mainly imposed on immigrants whose age of migration used as the index in L2 learning (Snow and Hoefnagel-Hohle, 1978; Patkowski, 1980; Johnson and Newport, 1989). Though the results of these studies prove that the subjects migrate at early age usually perform better in L2 than ones migrate at adult age, the researchers also mention the possibility of learning hours. Adults usually have fewer hours than children in learning, and even those hours are also fragmented. Compared with children in school, adults have less opportunity to learn regularly and systematically. As for the comprehensible input which is regarded as the crucial and necessary in language acquisition (Krashen, 1981), the quantity that adults can accept is far less than that of children. Adults acquire L2 mostly in the working environment where the language input is harder than being comprehensible, and adults are prone to love in L1 community or L1-accent-influenced L2 community where the perfect L2 input is insufficient. Socioeconomic status can also be used to predict the success of late L2 learner. Unlike the children whose school education is compulsory, adults in a lower status are less likely to have opportunity of education, and thus more possible to keep a strong bond with their L1 communities. In summary, age is an important factor in L2 learning, but it acts more on the situation than on the capacity of learning (Marinova-Todd, Marshall and Snow, 2000).

The third reason that prevents the CPH universally accepted is the lack of convincible evidence of discontinuity. Mentioned in last paragraph, research on immigrants shows the negative correlation between age and L2 achievement, only problem being unclear whether it is because of capacity or learning situation. Even if we put aside the reason and focus only on the relationship, we have another question to answer. If learning ability gradually declines as age increases, then the existence of critical period is very questionable. In other words, there must be a rapid drop of learning ability at a certain age can prove the closure of critical period. The research models, for a long time, cannot identify the rapid decline from the gradual one. The latest studies by Hartshorne et al. (2018) and Chen and Hartshorne (2021) use brand-new computational models to depict the L2 learning rate on syntactic structure. Both studies confirm the rapid fall of learning rate, respectively at 17.4 years old and 18.4 years old. Though the ages are surprisingly much older than expected, they are not that farfetched to be understood as the end of puberty.

However, recent research on neuroscience seems not to support CPH. The fundamental reason of CPH, according to Lenneburg (1967) and Penfield and Roberts (1959), is the finalization of brain development called lateralization after when the brain loses its plasticity. At their time, such a hypothesis couldn't be proved because of the technological limitation. After 21st century, the electroencephalography and magnetic

resonance imaging begin to be applied to the neuroscience, and thus research such as ERP and fMRI are used to neurolinguistic field. ERP research uses electroencephalography to record the brain wave after certain stimulus. To respond to the stimuli, the corresponding neurons are activated at the same time in the brain, which causes a small voltage-change in the brain. Those changes are recorded to make a wave spectrum in terms of amplitude, direction, and timing. From the difference of the spectrums, we can find how our brains react to different stimuli, and furthermore speculate how they work in processing all sorts of information. Recent ERPs research show that adults' brains are much more plastic than people thought before. Later L2 learners' spectrums become more and more similar to native speakers' when they gradually achieve better L2 level (DeLuca *et al.*, 2019). Bowden *et al.* (2013) study the two groups of university students who start to learn Spanish after university, one group for 1 year, and the other for 3 years as well as 1-2 semesters' immersion abroad. The result is both two groups of semantic processing is of no difference with Spanish native speakers. The syntactic processing of one year learner is very different from native speaker, but the three-year students' show very nativelike mechanism. It tells us clearly late learners can also achieve nativelike proficiency at least in semantics and syntax, and the level of brain plasticity is not due to age but to the L2 proficiency. The L1 attrition study by Kasparian and Steinhauer (2016) on Italian lexicon shows similar result. They use ERPs to test the immigrants in Canada whose L1 is Italian and late Canadian Italian learners. Their findings confirm that it is the language proficiency that makes the difference of brain processing, not the age: the highly proficient Italian learner, immigrants with few attritions, and the native Italian speakers have the similar pattern; patterns of the learners with low proficiency and of immigrants with many attritions are quite the same. At least in vocabulary and morphosyntactic field, the ERP refutes CPH. fMRI is another technology that used to scan brain parts without any invasion to the skull. Via radio frequency pulses and magnetic fields, it depicts the image of brain parts that participate in the mind processing. Applying fMRI, researchers can test the regional changes in the volume and/or density of white and grey matter, as well as changes in connectivity between different areas of the brain (Singleton and Leśniewska, 2021), those changes manifesting the plasticity of the neurons. In neurolinguistic research, scans are usually made before the language learning and a period after learning to see if there is any change on brain caused by the language. The results relate the L2 acquisition with the change if grey and white matter volume in language regions (DeLuca *et al.*, 2019). Kasparian and Steinhauer (2016) makes a comparison on the white matter tracts between the child learners and adult learners, finding that the white matter structure change is attributed to everyday L2 use, irrespective of the critical period or the length of L2 learning. With the research on both ERP and fMRI combined, we can make the conclusion that CPH is not supoorted by most studies in neuroscience.

CPH's influence on education

CPH has a very strong influence on teachers' and parents' concept of language education, though the existence of it is still in dispute with more and more negative evidence. The earlier the better is the belief of many families in China, causing many babies are sent by their parents to the early English training centres, even though the mandate starting age of learning English is 7. However, starting to learn English at an earlier age doesn't mean the better performance in the school. Practical evidence of the secondary school shows that the gap between the students who have earlier experience of English and those who haven't are levelled up as the learning goes on. That means the later starters can also acquire as much L2 knowledge as the early starters, and their learning rate is even higher during this age period. The research by Snow and Hoefnagel-Höhle (1978) proves the finding in secondary schools. They point out that the adolescences are the best group of L2 learning, far better than the children and adults in vocabulary, syntax, listening and pronunciation. The only items that child learners perform better after a period of learning are morphology and story comprehension and telling. The probable reason of that according to the researchers, is the adolescences care little about the spelling and no interests in the stories that children love.

The CPH's popular among the average people causes another problem, that is, the discouragement of adult learners. Holding the idea that they cannot catch up with the child learner, or even cannot achieve a good level of L2, they are prone to quit learning easily as long as they encounter the bottleneck. In fact, as we have talked about the reason why CPH is not universally approved of, there are other factors in L2 learning, such as motivation, learning belief, and learning situation. These factors, if we don't say they are more important, are at least contributes the same as the age. Furthermore, the aim of L2 learning also counts a lot. As we mentioned above, being nativelikeness is a false proposition, while being able to accomplish your own goal through L2 is the correct thing.

Nevertheless, CPH is not always harmful to education. If we change the name of critical period to advantageous period, we may get better implications. Several research on Multiple Critical Period gives evident conclusion that they find the age ranges of learning phonology, lexis and collocation, and morphosyntax. From a logical perspective, such a sequence is impossible, as we have proved, but can we say their empirical data are useless? It is possible to suspect the learners at these age ranges have a strong but not critical potential of language learning. As Baker (2001) says, "While there are no critical periods of language learning, there are advantageous periods. Early childhood and school days are two advantageous periods." Therefore, if we adopt suitable methods in teaching the children and school students, we may get an easier job to make them accomplish the same L2 level.

Differences in teaching children and adults

Since we have already clarified that critical period of L2 learning is not so critical, at least most research saying so, then we can argue that adult learning is by no means different in its nature from child learning. It nevertheless means we could adopt the same methods to teach them, because the characteristics of their learning activity diverge so much. In the next passages, I will analyze their difference and give instructions of teaching methods. My context is only confined to China where the situation is so different from the immigrant countries.

Input is the first difference we need to talk about. The L2 input for both children and adults are insufficient, compared to the immigrants in other countries. However, child learners have more systematic learning circumstance where language courses are regularly taught, usually 8-10 hours a week. They have more input, all of which are comprehensible, making the acquisition very effective. Besides, the interaction between classmates is also good input as well as the induction of output. Since all the classmates are more or less at the same level, their interaction should perfectly meet i+1 principle (Krashen, 1982). Adult learners usually don't have the comparable input. Even if the university students only have 4 hours' class per week, let alone the ones who have a job. Thus, for the adult learner, the emergency is to increase the input. If they choose to take a systematic course regularly, that is the best way of improvement. But for the ones who need to work hard to feed their families, regular complete time might be quite an illusion. How to make full use of their segmented time is very essential. Spare time can be taken to add input, watching L2 TV program, using L2 mobile app, listening to L2 music. It is very helpful for them to make a simulation of natural acquisition in L2 countries. The main point is trying to make the input more comprehensible, from easier ones to harder ones, or the already scarce time is even wasted. For the children whose input are quite much, the input should be more elaborated and varied. Visual input, audio input, and even other perceptive input, all could be integrated in the classroom.

Motivation, compared to other ones, may be the most important factors in language learning. The research of Kinsella and Singleton (2014) tells us clearly all perfect Anglophone French learner, no matter in accentual and morphosyntactic tests, are all high motivated. Compared to child students, adult learners are less and more complexly motivated. Let's start from the classroom students whose biggest motivation should unexceptionally be the evaluation of the school, either the score of the exam or the remark of the teacher. They will be highly motivated by achieve the goal of getting high score or teacher's praise. Interest is another stimulus of motivation, as the old proverb says, "interest in the best teacher." Some students, not all, are also motivated by a sense of exploration, keeping knowing new things being their achievement. Few students consider competition as a stimulus of motivation, one unacceptable for most people, so they pursue the joy of managing to beat others. Graham Crookes and Richard Schmidt (1991) propose several methods in classroom to motivate students, including:

1. Periodical giving positive feedback to strength self-confidence.
2. Remarking the forthcoming activities to arouse the interests of the students.

3. Varying the activities, tasks, and materials to avoid boredom.
4. Using co-operative rather than competitive goals to release intense.

The adult learners' motivation, though follow a similar pattern, are more complicated. Their goal of learning could be a L2 relative job, migration, a promotion, academic reading, a L2 country tour, reading L2 books, or pure interest, etc. These goals weigh from the heaviest to the lightest in motivation. Usually, the learner who has to find a L2 relative job or who want to migrate are most motivated, while the ones learn out of interest give up easily. Not only the working adults but also university students are very pragmatic with making a living. Positive feedback, interesting tasks, and exploration are still useful but not as motivational as before when they were children. Pressed by the burden of work and life, anything irrelevant to feed themselves and their families seems unnecessary. So, the instruction of university language education put high emphasize on the integration of L2 with career skills, and my teaching experience agrees with the instruction that most attentive moment in classroom is talking about the how it is important in future jobs.

Children and adults have different learner beliefs about how the language should be taught. Children's understanding about the world, life and value is not fully developed, so they don't have very strong beliefs about language teaching and learning. What they have is the interest to the activities and the sense of likes or dislikes of the teacher. Therefore, a teacher that always makes the classroom in a happy atmosphere is very successful among the students. Whether the knowledge is managed to be acquired is not the problem concerned by the students, but usually by their parents. It is always the parents in China that appeal to the school about no efforts made after they test the ability of their children. For the child learner, it is very essential to adopt task-based learning which is intriguing and inspiring. Through taking initiative to complete the interesting tasks, students unconsciously learn the language, which makes up the shortcoming of their beliefs. Meanwhile the completion of the mission enhances their motivation, thus leading to a positive cycle of learning. Adults' situation is the opposite. They have very strong belief of every component in teaching-learning circle. In their concept, there should be an ideal teacher, ideal teaching materials, ideal environment, ideal teaching model, ideal classmates, etc., though their concepts might be very opposite to the correctness. Lucky thing is their negative attitude toward the real situation, despite obvious dissatisfaction, does not so severely influence the learning effect as the child learners do. Being more disciplined and self-monitored, they usually use their own learning strategy instead of the ones they totally disagree with. Task-based learning is also advocated, but not as essential as in child learning. More metalinguistic teaching models which are very harmful in child teaching can also be used, such as paraphrase and grammar translation which might fit the demand of the students that only want to read the academic literature.

Last but not least, we have to adjust our teaching methods to the students' needs. Children and adults are very different groups. Child students are more uniform, despite

their characters and intelligence types. What we language teachers are trying to do is to cultivate everyone with a high L2 communication ability, which means a comprehensive development of listening, speaking, reading, and writing. It can be disserted that all child learners have the same learning aim, although an aim in fact made by their parents. Thus, our teaching objectives for all of them are the same, with minor adjustment to the individual character and intelligence. Adult group is much more divergent, each member having different need. For the learners who wants to keep their national identities, imposing accent is very unwise and harmful; for the ones who only wants to read academic articles, force drill of fluent utterance is a waste of time; for the workers who only need daily communication, beautiful articles are useless. Only accurately aiming at their need can make the teaching most satisfying and effective. And maybe, it is the divergency and the uniformness that lead to the observation of critical period, with the result that children achieve all success but adults only parts.

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