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ANNOTATION

This thesis focuses on the critique of the Critical Period Hypothesis in second language acquisition. The theoretical part defines the core concepts of both the second language acquisition and the Critical Period Hypothesis through the method of a historical overview. The practical part aims to review studies which provide results contradicting parts of the Critical Period Hypothesis.

KEYWORDS

Second language acquisition, critical period, age of acquisition

TITUL

Kritika hypotézy kritické periody: přehledová studie

ANOTACE

Tato práce se zabývá problematikou hypotézy kritické periody v osvojování cizích jazyků. Teoretická část obsahuje definice základních konceptů, jež jsou použity ve studiu osvojování cizích jazyků a v hypotéze kritické periody. Cílem praktické části je poskytnutí souhrnu studií, jejichž výsledky existují v rozporu s hypotézou kritické periody.

KLÍČOVÁ SLOVA

Osvojování cizích jazyků, kritická perioda, věk osvojení cizího jazyka

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LIST OF ABBREVIATIONS

CPH – Critical Period Hypothesis

SLA – second language acquisition

SLL – second language learning

L1 – first language

L2 – second language, foreign language

LAD – language acquisition device

INTRODUCTION

Over the last 60 years, we have seen significant developments within the study of second language acquisition (SLA) and, thus, also noticeable innovations in the way both the first languages (L1) and the second languages (L2) are taught. One of the hypotheses which arose around the 1960s is the Critical Period Hypothesis (CPH), which puts an emphasis on the role of age in the process of SLA, in many cases placing it as the primary determinant in the L2 learner's ability to acquire new languages. However popular at the time of its inception, the 'younger = better' (Singleton and Ryan 2004, 61) stance on L2 acquisition has been continually challenged by many authors. This split surrounding the importance of age in L2 acquisition in literature inspired the topic of this thesis – the critique of the Critical Period Hypothesis in second language acquisition. This thesis is thus written with the notion that, while a massive amount of data is available on the topic of SLA, the role of age within the hierarchy of factors playing a role in L2 acquisition has not been entirely resolved.

This thesis consists of the theoretical and the practical parts. The theoretical part then consists of two chapters. The first of these chapters is dedicated to the concept for which the CPH was formulated for – the second language acquisition. In this first chapter, we initially look at the issues caused by the ambiguous character of the term second language acquisition. In the second section of the first chapter, we then turn to the concepts associated with SLA: learning, acquisition, acquisition order research, input, output, and implicit and explicit memory. Besides the concepts, this section also provides a review of the perspectives on SLA that have arisen over the decades - behaviourist, innatist, cognitive and socio-cultural perspectives. The selected concepts and perspectives are reviewed through a historical tour of the field of SLA, starting with the first half of the 19th century and ending with the most recent decades.

The second chapter is dedicated to the Critical Period Hypothesis. The first section of this chapter provides an overview of the work and legacy of Noam Chomsky, namely the innatist perspective, Universal Grammar and Generative Grammar, who paved the way for the formulation of the CPH. The second section is then dedicated to introducing the CPH and concepts surrounding the CPH, specifically the age of acquisition, ultimate attainment, neuroplasticity and the critical period.

The practical part is then contained within the third chapter. The initial parts of this chapter serve as an introduction to the theory of literature reviews, as well as the methodology behind

the selection and analysis of the studies. What follows are sections dedicated to reviewing the different interpretations authors of the studies have for the core concepts of the CPH, that is, the age of acquisition and the critical period. The chapter then takes a closer look at different strands of studies – cross-sectional and longitudinal studies. The studies within these two groups are then examined based on their aims, and the methods they use. Lastly, we look at some of the conclusions which can be deduced from the results of the studies.

THEORETICAL PART

1 Second language acquisition

In order to be able to dive into the CPH research and its critique, it is first necessary to cover the essentials of the system the CPH was formulated for – second language acquisition. Firstly, this section of the thesis will define what SLA is while also looking at the perils SLA researchers face due to the polysemous character of the concept of SLA.

Secondly, through a selective historical review of SLA, this section will look at concepts and perspectives that pertain to the topic of SLA, describing the inceptions and developments of selected concepts and perspectives.

1.1 Defining second language acquisition – the ambiguity conundrum

As a term, second language acquisition comprises two parts – second language and acquisition. Merriam-Webster's online dictionary defines a second language as 'a language that is learned in addition to the language a person first learned as a young child' (2024). This simple definition leaves room for ambiguity. Based on Merriam-Webster's definition, we can understand that a second language is a single instance of a language that is learned right after L1. The other way we could understand a second language is as any language a person acquires after L1.

To avoid the issues mentioned in the previous paragraph, researchers within the field of SLA tend to define what their interpretation of a second language is, as is apparent in probably the most influential text of Gass and Selinker (2008, 1), who see second language as 'a language beyond the native language' Ellis (1997, 1) also decides to embrace this broader interpretation of a second language, saying that it is 'any language that is learned subsequent to the mother tongue'. Ellis chooses to go further by specifying that it is necessary to note that 'second is not intended to contrast with foreign', which he further elaborates upon by noting that a second language can be a language absorbed while living in a country where it is spoken; thus the term second language is more fitting in the eyes of Ellis (1997, 1). The second part of the phrase – acquisition, also has a definition in Merriam-Webster's online dictionary. However, for our purposes, it is more fitting to use the definition for the verb acquire, which, according to Merriam-Webster, is 'to come to have as a new added, characteristic, trait, or ability (as by sustained effort or natural selection)' (2024), with the 'sustained effort' part of this definition being a common crux of this definition, as will be seen below.

Many SLA researchers, notably Ellis (1997, 3), see the term second language acquisition as meaning any form of a learning process which leads to the acquisition of L2, be it in a structured (intentional) – e.g. in a classroom or through a language course -, or naturalistic way – e.g. through living in a country and absorbing its spoken language passively. Another approach to the issue of terminology is that of Lightbown and Spada (2021, 244), who use the phrase second language learning (SLL) alongside SLA. For Lightbown and Spada, the terms SLA and SLL are entirely interchangeable, both sharing the definition of ‘developing the ability to use a language other than the one/s a person is already able to use’. Lightbown and Spada add a third term into the mix – instructed second language acquisition (ISLA) - which, for Lightbown and Spada, is reserved for ‘L2 acquisition that takes place in a classroom or in other formal contexts in which the primary purpose is L2 learning’ (2021, 240). Gass and Selinker take a similar approach to Lightbown and Spada when taking on the terminology issue, defining SLA as ‘the learning of a non-native language in the environment in which that language is spoken’ but also using the term foreign language learning alongside SLA. Gass and Selinker define foreign language learning as ‘the learning of a non-native language in the environment of one’s language’ (2008, 7).

1. 2 The History of Second language acquisition

1.2.1 From the inception to the 1970s

Prior to the 1960s, the leading perspective in the field of language acquisition, and therefore SLA, was the behaviourist perspective. This approach was built upon the foundations set by J. B. Watson in the 1910s and then transferred into linguistics by B. F. Skinner and others throughout the 1950s (MacCorquodale 1970, 83). The main premise under which the behaviourists operated was that language learners acquire language through stimulus-response interaction (Demirezen 1988, 135-139). The teaching methods utilising this approach would then use a system consisting of imitation, reinforcement and reward – i.e. a rule would be introduced to a learner, which the learner would adopt, the rule would then be tested or repeated over and over again, and finally the learner would be rewarded for learning the rule (Bloom, Hood, and Lightbown 1974; Demirezen 1988, 137-138). The primary issue of the behaviourist approach lies in the lack of focus on ‘gaining insight into and understanding’ how languages are learned (Chomsky 1965, 19-21).

The 1960s and 1970s were the initial decades during which we could see SLA research establishing itself as a separate discipline. According to Ellis (2021, 191), an issue that existed during this era was the almost exclusive focus on naturalistic L2 learners, meaning learners

that acquired L2 in an informal setting, usually with no instructions – in a way similar to how children acquire L1 (Gass and Selinker 2008, 78). Considering this major limitation of the research of these decades, it is still necessary to recognise that the 1960s and 1970s produced priceless findings which opened many doors for future research.

Ellis suggests that the main finding of this era was the proposition that learners follow a ‘more-or-less universal and invariable route’ when acquiring specific parts of L2 (2021, 191). Researchers of the era would explain this phenomenon through the existence of an internal faculty which is universally present in all language learners. For example, Corder (1967, in VanPatten and Benati 2015, 2-3) called this faculty the ‘internal syllabus’, while Chomsky called it an ‘acquisition device’ in his theory of Universal Grammar (see 2.1 for a more thorough explanation). Later in this chapter, we will see how this concept of an internal faculty maintained its importance throughout the 1980s and onwards.

VanPatten and Benati bring attention to the bloom of the acquisition order research in the 1970s (2015, 3), which was primarily represented by Dulay and Burt (1973, 1974 and 1975), who carried out what is now called the morpheme studies. Mitchell, Myles, and Marsden (2019, 39-44) describe how the morpheme studies were carried out as a response to Brown (1973), who, based on the results of his study, came to find that there were 14 grammatical morphemes in English, which arose in child L1 learners in a constant order. Interestingly, Dulay and Burt’s results for L2 learners in all three of their morpheme studies were consistent with Brown’s findings for L1 learners, albeit in a slightly less prominent manner (Mitchell, Myles, and Marsden 2019, 40). These findings were more or less confirmed by other researchers of the decade. In 1974, the existence of a consistent acquisition order of L2 was corroborated by Bailey, Madden, and Krashen (1974) and Larsen-Freeman (1975), who found that the acquisition order exists for L2 learners regardless of their L1, while Larsen-Freeman’s study also concluded that the acquisition order is present in both instructed and non-instructed learners (Murakami and Alexopoulou 2016, 3-5). Bailey, et al. (1974), Fathman (1975) and Kessler and Idar (1979) carried out cross-sectional studies which found that the acquisition order for L2 was universally present in L2 learners of all ages (Kwon 2005, 2-3).

It was in this decade that Corder set apart the terms input and intake (1967, 165). Input is defined by Lightbown and Spada (2021, 240) as ‘the language that the learner is exposed to (either written or spoken) in the environment, while Ellis (1997, 138) defines intake as ‘that portion of the input that learners attend to and take into short-term memory’. Ellis builds upon

the definition of intake by noting that this input adopted by a learner can further become part of their interlanguage.

Interlanguage is another concept which saw its birth in the 1970s (VanPatten and Benati 2010, 2-3), this time in the mind of Larry Selinker in an article eponymous with the concept and published in the *International Review of Applied Linguistics* (1972, 209-231). In his 1972 article, Selinker defines interlanguage as 'a separate linguistic system based on the observable output which results from a learner's attempted production of a target language norm'. Lightbown and Spada (2021, 240) add to this definition by specifying that this interlanguage carries the characteristics of both L1 and L2, and that interlanguages of various languages often share a number of characteristics.

1.2.2 The 1980s – Krashen's Monitor Model

Throughout the 1980s, Stephen Krashen formally introduced a set of hypotheses, seminal for later SLA research, comprehensively called the Monitor Model (Lightbown and Spada 2021, 110-112). Due to the importance of Krashen's model for later research, this subsection will primarily consist of an overview of these five hypotheses. However, it is important to stress further that some of Krashen's findings will be more thoroughly examined in a later chapter.

While Lightbown and Spada (2021) use the terms learning and acquisition interchangeably, Krashen contrasted these terms in the first of his hypotheses - the acquisition-learning hypothesis. For Krashen, acquisition and learning were two distinct processes. Krashen called acquisition 'similar, if not identical, to the way children develop ability in their first language', stressing that it is a largely subconscious process (1982, 10) and that it is the process which accounts for the more significant part of the language a person adopts. As for learning, Krashen sees it as a process for which the output is a person's ability to recognise and express the rules of a language or know the 'grammar' of the language (1982, 10).

The second one of Krashen's hypotheses was the natural order hypothesis, which was created in the wake of Brown's (1973) and Dulay and Burt's (1973, 1974, 1975) studies, which are all mentioned above. In this second hypothesis, Krashen tried to amend some of the irregularities in the conclusions of the morpheme studies, which were pointed out by Hakuta (1976) and others (Idigoras Corporan 2015, 18). Krashen thus revised the results of the morpheme studies with improved criteria for analysis, from which he then formulated his hypothesis. The natural order hypothesis kept the definition for the acquisition order used by the morpheme studies, but Krashen stated how this natural order is, in fact, not entirely identical for L1 and

L2 acquisition, yet that both orders of acquisition share a number of similar patterns (1982, 12-15).

The monitor hypothesis was largely built upon the foundations of Krashen's first two hypotheses. In the Monitor hypothesis, Krashen elaborated upon his proposal that acquisition is the primary process in obtaining a new language, with a proposal that learning plays the role of a monitor or an editor, which only serves as a tool that modifies utterances produced on the basis of the 'acquired competence' (1982, 15-20). Krashen goes deeper into this proposal by stating that these learned, or 'conscious rules' can only be utilised under certain conditions – the user of the language has to have enough time to recall the rules of the language system, the user has to focus on the rules, and, most importantly, the user has to know these rules – which essentially means that language users will produce different utterances, with different error patterns, based on whether the three conditions are met, or not (Krashen 1982, 16-18; Mitchell, Myles, and Marsden 2019, 46).

According to Krashen, the question his fourth input hypothesis tried to answer was 'probably the most important' question of linguistics: 'How do we acquire language?' (1982, 20). Krashen states that this fourth hypothesis operates with the notion that both the acquisition-learning hypothesis and the natural order hypothesis are both correct (1982, 20). The input hypothesis consists of four parts, the first of which simply establishes that 'the input hypothesis relates to acquisition, not learning'. The second of the four parts proposes that 'we', the language learners, 'acquire by understanding the language that contains structures beyond our current competence ($i + 1$)' and that we do so 'with the help of context or extra-linguistic information' (Krashen 1982, 21). This proposal requires us to define what Krashen means by ' $i + 1$ ' - simply put, ' $i + 1$ ' stands for the stage which follows stage ' i ' - i.e. if ' i ' is stage 1, ' $i + 1$ ' would be stage 2. The third part of Krashen's hypothesis states that 'when communication is successful, when the input is understood and there is enough of it, $i + 1$ will be provided automatically'. In the fourth part, Krashen proposes that production ability cannot be taught directly but rather "emerges" over time, on its own". (Krashen 1982, 21- 22)

Krashen's final hypothesis is the affective filter hypothesis, which suggests that there exists a filter that can either partially or entirely halt a person's language acquisition. Krashen provides an example in a scenario within which a teacher maintains a low-stress environment in a classroom, meaning that the affective filters of students would be set to 'low' intensity

and thus, the students should be able to acquire a high amount of acquired competence based on the input provided (1982, 30-32).

Looking beyond Krashen's findings, the 1980s were also a period during which the theory of Universal Grammar saw essential developments and a period during which SLA research further benefited from the integration with research in already established disciplines – linguistics, sociolinguistics and discourse analysis (Ellis 2021, 191-193). Ellis uses a fitting description of 'the expansion period' for the 1980s, as 'during this period SLA broadened the scope of its enquiry considerably (Ellis 2021, 191).

The honourable mentions, which were excluded from the main summary provided by this subsection on SLA research in the 1980s due to their comparatively lower importance for this thesis, are Kellerman (1983) and Ringbom (1987) with their research surrounding language transfer – the positive and negative influence of L1 in SLA, and Thomas (1983) and Blum-Kulka, House, and Kasper (1989) with their additions to the field of second language pragmatics – the study of how meaning is constructed and interpreted in communication (Gass and Selinker 1992, 1-3; Ellis 2008, 51; Ellis 2021, 192).

1.2.3 The 1990s to where we stand today

The first half of the 1990s was primarily dedicated to the refinement of existing theories which had their origins in previous decades, notably some hypotheses from Krashen's Monitor Model (Ellis 2021, 193). This decade also saw the rise to prominence of two new perspectives on both SLA and language acquisition as a whole – the cognitive perspective and the sociocultural perspective (Lightbown and Spada 2021, 112-123).

Swain and Lapkin found that researchers prior to the 1990s put a large emphasis on the role of input while largely ignoring or denying the role of output (1995, 371). According to Hassan (2022), Swain (1995) suggested in her Comprehensible Output Hypothesis that 'output is just as crucial as input, if not more so' (2022, 6). Lightbown and Spada add that for Swain, it was 'the demands of producing comprehensible output' that 'push the learners ahead in their development (2021, 119).

The histories of cognitive psychology and language studies are closely interwoven, which is apparent by the fact that Chomsky's (1956) paper on the theory of language is considered to be one of the publications that stood at the brink of modern cognitive psychology (Eysenck and Keane 2020, 2). The cognitive perspective on language acquisition attempts to fill in the blanks which were found in the theories and hypotheses of previous decades. Ellis suggests

that this perspective ‘allowed for modularity’, that is, ‘the existence of different components of language that are learned in different ways’ (1997, 71); thus, psychologists and linguists used the knowledge from the expanding field of neurobiology to try to find which cognitive processes played a role in language acquisition (Lightbown and Spada 2021, 113-123).

Due to their close relationship, three cognitive processes deserve to be listed together: attention, awareness and noticing. All three processes have been closely examined and mapped by Schmidt’s noticing hypothesis, which was formulated over the 1990s (Gass and Selinker 2008, 248-249). In his hypothesis, Schmidt suggests that in order to acquire an L2, the learner has to be ‘actively attending to’ (1994, 219, cited in Schmidt 1995, 18) the instructions with which they are presented; thus, the learner has to engage their attention and be aware of the instructions at the level of noticing in order to acquire L2 (1995, 1-10).

The role of memory was also closely examined within the cognitive perspective on SLA, specifically, the engagement of declarative and procedural memory in L2 acquisition. Declarative memory, or explicit memory, is primarily used to store information about unique personal experiences, along with factual and semantic knowledge (Eichenbaum, 2004). Procedural memory, or implicit, or also nondeclarative memory, saves information gathered from repeated experiences, which a person can then automatically recall, often subconsciously (Gabrieli 1998, 90). Lightbown and Spada (2021, 14) suggest that Anderson (1995) and DeKeyser (1998, 2001, 2007) came to the conclusion that it is beneficial for an L2 learner to practice language until the information about it moves from declarative to procedural memory, enabling them to produce fluent utterances. Anderson and DeKeyser also suggest that in later stages of learning, declarative memory becomes a hindrance in the fluency of production (Lightbown and Spada 2021, 14).

The final perspective on SLA is the sociocultural perspective, which emphasises the role of the L2 learner’s surroundings – the zone of proximal development – in the process of L2 acquisition. Lightbown and Spada (2021, 123) note that there is an apparent likeness to Krashen’s comprehensible input hypothesis in that they both emphasise the importance of the role of the L2 learner’s surroundings. The innovation of the sociocultural perspective lies in that it adds a new dimension to the equation, that is, the role of learner’s internal self-produced input, which they form as the result of their interactions with their surroundings – this input is often called the private speech (Winsler 2009).

The 2000s and onwards have been primarily defined by significant turns in many scientific disciplines. In linguistics, this turn was seen in the complex dynamic systems theory, initially presented by Larsen-Freeman (1994, in Hiver, Al-Hoorie, and Evans 2021). However, most complex dynamic systems theory research was carried out throughout the 2010s (Hiver, Al-Hoorie, and Evans 2021). The complex dynamic systems theory can be described as an amalgam of theories, which views language learning as a fluid process of dynamic adaptation (Cameron and Larsen-Freeman 2008, 157, cited in Weideman 2010, 231), which is highly individual (Larsen-Freeman 2019, 68), and thus has to be approached in an individual manner and with the expectation of constantly changing variables.

2 Critical Period Hypothesis

This chapter will primarily focus on the Critical Period Hypothesis (CPH) itself. Firstly, we will look at the circumstances that paved the way for the formulation of the CPH; those are Noam Chomsky's ideas and the innatist perspective on SLA. Secondly, this chapter will review the core of the CPH and selected terminology associated with CPH research.

2.1 Noam Chomsky – innatism, Universal Grammar and Generative Grammar

As mentioned in a previous section dedicated to introducing the concepts of SLA theory, the first widespread perspective on SLA was the behaviourist perspective, with its stimulus-response interaction. The 1950s produced a fresh perspective on language acquisition, which, until then, had been overwhelmingly dominated by a focus on the learner's surroundings. The parentship of this new perspective is most commonly accredited to Noam Chomsky, who, in 1957, presented his ideas in the *Syntactic Structures* (Olson, Faigley, and Chomsky 1991, 1-3; Mitchell, Myles, and Marsden 2004, 32-52). With this new innatist perspective, a portion of the focus within the studies of language acquisition was shifted to finding out how exactly a learner contributes to the process of their language acquisition.

According to Mitchell, Myles, and Marsden, Chomsky directly critiqued two aspects of the then-mainstream behaviourist approach. Firstly, Chomsky had an issue with the fact that, in their approach, the behaviourists did not account for the fact that language learners can produce new sentences which they have not learned directly – i.e. they used the rules of the language system, rather than only mimic what they have observed, or heard. Secondly, Chomsky pointed out that the existing theories on language acquisition could not properly explain how language learners, especially children, can acquire language with the speed they

do, considering that many structural properties of language are incredibly complex; thus, it should not be possible to be acquired ‘on the basis of the samples of language to which children are exposed’ (Mitchell, Myles, and Marsden 2004, 30-33). Taking these issues into account, Chomsky developed his own theories, which tried to cover the gaps left by the behaviourists.

‘Plato’s problem’ is the name some researchers, including Chomsky, use for the issue found when observing the gap between the input a language learner is presented with and the learner’s knowledge of many abstract principles beyond what they had been directly exposed to (Slabakova 2021, 222-223). As was mentioned in a previous chapter, in the 1960s and 1970s, many researchers operated under the notion that there exists an internal faculty, which Chomsky often called the language acquisition device (LAD). The LAD could be seen as, in a way, similar to Krashen’s monitor – both the LAD and the monitor serve as a ‘constraint’ during the process of language production (Lightbown and Spada 2021, 109), albeit in a very different manner. While Krashen’s monitor would be something that is acquired through learning, the LAD would be a biological mechanism, which is present in all humans by default (Liu and Liu 1998). This assumed existence of a universal internal device, built-in within the brains of all humans, would be the core principle of the innatist perspective on language acquisition.

Universal Grammar (UG) is a linguistic theory that was introduced by Chomsky in the decades following his 1957 *Syntactic Structures*. The core of this theory lies within the assumption that, in different languages, there exist grammatical principles, which are universal among all of these languages. However, this does not mean that these principles operate in the exact same manner, but rather that each language approaches these principles in its own way.

Ellis (2008, 65-66) provides an example in the form of a comparison of how two languages, in this case English and Japanese, use reflexives. Ellis’s example features the sentence ‘The actress blamed herself’, where ‘actress’ is the reference to the reflexive ‘herself’. Ellis then suggests we use another sentence: ‘Emily knew the actress would blame herself’. English, on one hand, only allows for ‘local binding’ of reflexives - meaning that we can only use a reflexive to refer to an element of a clause the reflexive is a part of; thus, we can assume that, in the second sentence, ‘herself’ can only refer to ‘actress’. On the other hand, Japanese allows for both ‘local’ and ‘long-distance’ binding, meaning that the reference to ‘herself’ in

the second sentence could be either 'Emily' or 'actress' (Ellis 2008, 65-66). This example shows that both English and Japanese recognise the principle of reflexive pronoun binding, yet in each of these languages, this principle operates in a different manner. Chomsky and supporters of the UG proposed that these universal patterns should be considered in the studies of SLA. Thus, to improve L2 learning efficiency, we should identify these universal principles, compare the ways in which they are present in different languages, and then stress these differences when teaching languages. It is necessary to mention that the theory of UG was built upon the assumption that the LAD exists in its presumed form (Lightbown and Spada 2021, 20-21).

Next, we will take a look at an approach that Chomsky popularised rather than introduced - Generative Grammar. With it, Chomsky tried to answer a crucial question, which aligns with the general philosophy of Chomsky's work: 'How can a finite set of rules generate an infinite number of sentences in a language?' Somewhat paradoxically, it is challenging to precisely define what generative grammar is, besides it being a set of grammar rules for language production (Wasow 2003, 295-300).

To summarise, a good part of Chomsky's work – be it hypotheses, theories, or any other research- has been focused on answering this question: How can people have so much knowledge about language, even if they are presented with so little data?

2.2 Defining the CPH and related terms

2.2.1 The age of acquisition and ultimate attainment

A common concept found within research is the age of acquisition, commonly defined as the age of first exposure to a target language (Singleton and Ryan 2004, 44). Although this definition is pretty universally shared, the definition of another term – ultimate attainment - is a little more convoluted. Singleton and Ryan (2004) note that there is a debate about whether ultimate attainment is a valid term. Cook comments on this issue by saying that 'the question of what ultimate attainment means in second language is not yet resolved' (in Singleton and Ryan 2004, 109). Granena and Long (2013) use the term ultimate attainment as meaning the final point a person's abilities reach. According to Granena and Long, this endpoint would be the reaching of native-like levels within the target language (2013).

2.2.2 The Critical Period and the Critical Period Hypothesis

The existence of a critical period is an essential concept within the Critical Period Hypothesis (CPH). Throughout the 1930s and onwards, an Austrian zoologist, Konrad Lorenz, carried out

research on the ethology of ducks and geese. Lorenz found that during a very specific early period in their lives, ducklings and goslings are prone to mimic the behaviour of their parents through the process of imprinting (1935, 262). Although the term critical period was not directly used in the early stages of Lorenz's research, this period in the lives of ducklings and goslings later came to be known as just that - the critical period (Tzschentke and Plagemann 2006).

The research within the fields of linguistics and didactics, which are both closely tied to biology and neurobiology, adopted the concept of the critical period quite sometime later. Two decades after Lorenz's imprinting research, Penfield and Roberts (1959) saw that there was a similar trend in human biology (Singleton and Ryan 2004, 406). However, it was Eric H. Lennenberg who, based on his own findings, formally introduced the Critical Period Hypothesis. Besides introducing the Critical Period Hypothesis, Lennenberg's 'Biological Foundations of Language' opened the door for a newfound focus on age-related SLA research (Gass and Selinker 2008, 406). Singleton and Ryan add that '*the idea* of a critical period for language acquisition was in the past accepted for the most part without question' (2004, 4).

Similarly to the second language acquisition, the term critical period allows for a range of ambiguity. As mentioned above, the concept of a critical period was not an invention of linguists but rather an adopted term for an observation, akin to the observation produced in zoology and ornithology, that there are critical periods in the developments of animals, humans included, when animals are highly adept at acquiring specific skills, be it through the process of mimicking their parents, or through the use of the previously mentioned innate faculty. Lennenberg defines the critical period as a period in a person's life after which 'automatic acquisition from mere exposure to a given language seems to disappear, and foreign languages have to be taught and learned through a conscious and labored effort' (1967, 176, cited in Gass and Selinker 2008, 406). Lennenberg's definition suggests that the ultimate attainment of L2 can still reach native-like proficiency. We can recognise two forms of the Critical Period Hypothesis: the 'weak form' and the 'strong form' (Birdsong and Mollis, 2001). On one end of the spectrum, Oyama provides a comparatively stricter definition of the critical period, defining it as a period 'after which complete acquisition is impossible or extremely unlikely' (1982, 21, as cited in Patkowski 1990, 75). Oyama's definition could thus be considered as a critical period pertaining to the 'strong form' of the Critical Period Hypothesis. On the other end of the spectrum, we can find a new term, the sensitive period, which, as stated by Singleton and Ryan, suggests the existence of a period

with a less dramatic drop-off in a person's ability to acquire an L2 after its end (2004, 406). The concept of the sensitive period would then be associated with the 'weak form' of the Critical Period Hypothesis (Birdsong and Mollis, 2001).

According to Singleton and Ryan (2004, 33), as well as Gass and Selinker (2008, 406), Lennenberg specifically identified that the critical period starts around the age of two and ends around the age of 13-14. Lennenberg rationalised this finding by linking his interpretation of a critical period with the gradual development of a brain's lateralisation (Singleton and Ryan 2004, 33). By lateralisation, we mean the specialisation of the brain's hemispheres to serve specific purposes.

The time frame during which the critical period takes place has been at the centre of much discussion ever since Lennenberg proposed that this critical period takes place between the ages of two and 13-14 (1967, 176). According to Johnson and Newport's findings, the cutoff for this critical period is roughly between the ages of 3 and 7 when it comes to fluency in spoken production (1989). However, Johnson and Newport also note that there were many variables that they did not fully account for in their studies (1989). Ruben (1997) partially corroborated Johnson and Newport's results. However, Ruben stated that it is only the critical period for syntax that does indeed happen within the range mentioned by Johnson and Newport in 1989. According to Ruben, the syntactic abilities decline after the 4th year of a person's life. Ruben further stated that the critical period for phonology happens way earlier, according to Ruben, 'between the 6th month of fetal life and the 12th month of infancy' and that the critical period for semantics ends way later, that is, sometime after the person reaches the age of 15 or 16 (Ruben 1997). The second half of the 1990s and 2000s saw the introduction of new data into the SLA and CPH research thanks to the developments in non-invasive brain imaging (Heim, et al. 2019).

2.2.3 Non-invasive brain imaging

The study of the involvement of specific parts of the brain in language processing was not pioneered by Lennenberg, as we can see when peering further into the history of neurobiology, specifically the second half of the 19th century. In the 19th century, Broca observed that patients with a specific kind of aphasia, nowadays called Broca aphasia, had lesions on an area within the posterior part of their left frontal lobe. Based on this finding, Broca deduced that this part of the brain must be responsible for language production (1861). Similarly, in 1874, Wernicke associated another type of aphasia, this time the Wernicke

aphasia, with an underdeveloped or otherwise impacted area in the temporal lobe of his patients; thus, Wernicke concluded that this area was responsible for the comprehension of language (Acharya and Wroten 2017). Both Broca and Wernicke based their research on pathological findings. This trend of only using pathological findings was preserved in much of the later neurolinguistic research, which meant that most data researchers had available to them on the neurological development of the brain came from ‘head and brain injuries in patients’ (Heim, et al. 2019). The 1990s saw the induction of a new potential into the field of neurolinguistics, that is, the invention of functional magnetic resonance imaging - a form of non-invasive neuroimaging technique which maps the changes of neural activity in the patient’s brain (Heim, et al. 2019, 72-73). The introduction of functional magnetic resonance imaging into linguistic research produced new findings, such as those made by Kuhl (2010), who examined propositions made by innatists, such as Chomsky and Skinner, more than 50 years prior to her research, and found that a good part of them have stood up to the test of time.

PRACTICAL PART

3 Literature review

3.1 Literature review theory

Mareš (2013, 429) suggests that there are two elementary types of literature reviews. The first type of a literature review most commonly exists as part of a more extensive academic work – specifically, it functions as an introduction to the existing research on the topic of the work. This literature review is often used in bachelor's, master's or doctoral theses and often makes up a major portion of their theoretical parts. The second type is a literature review serving as its own fully self-contained academic work – the primary function of which is to map the existing research within a selected field.

This thesis will contain both types of Mareš's literature reviews. For the purpose of this thesis, it is helpful to define the primary aims and requirements of the latter type of literature review. Mareš identifies four necessary requirements for this type of literature review. First, the author of the literature review should explain the relevancy of the topic of their review, followed by the author selecting appropriate works which fit into the context of the review. Afterwards, the author of the literature review should formulate appropriate research questions, through which they then correlate the theoretical background of the review to the contents of the reviewed works (Mareš 2013, 436).

3.2 Methodology

The initial research was done within the online libraries of Web of Scholar and Scopus, using a combination of keywords – age, second language, critical period, Critical Period Hypothesis and ultimate attainment. The initial selection featured 37 studies and articles, but was then further refined to seven studies, mostly through limiting the date of publication to be post 2015. This selection was then later supplemented with three more studies. This was done mainly to provide a greater variety of data to the original selection.

The primary aim of this literature review is to provide an overview of SLA studies which have produced findings that more or less disagree with the 'strong version' of the Critical Period Hypothesis, which states that - there is an age of acquisition, after which the ultimate attainment of L2 cannot reach native-like levels.

This review will then further examine the results of the studies through answering three proposed questions:

What terminology do the selected studies use for the concepts surrounding CPH? (age of acquisition and critical period)

What are the aims of the selected studies and which methodologies did they use?

What are the findings of the selected studies?

3.3 Overview of selected studies

Saito (2013) set out to examine the role of age of acquisition in ‘language production attainment’. Saito (2013) specifically focused on the production of word-initial /ɪ/ in ‘high-proficiency English-Japanese bilinguals’, which the study examined through three sets of tests. By examining the results from the word reading, sentence reading and picture description tasks, it was concluded that the age of acquisition does indeed play a role in the ultimate attainment of L2 in spoken production. However, Saito (2013) found that the role of the age of attainment was not as crucial as to warrant the use of the term critical period. The results of the study instead suggest that the learning ability of L2 learners gradually slows down with their age. In his proposal for future research, Saito (2013) says that his study did not analyse the possible involvement of L1 in L2 acquisition.

This interaction of L1 and L2 in SLA was examined by Birdsong and Mollis (2001), who carried out a cross-sectional study which had a very specific aim – to replicate ‘the exact methods’ and use ‘the same materials’ as Johnson and Newport in their 1989 study, but to use these methods and materials to examine a sample of L2 speakers with a different L1, and thus challenge Johnson and Newport’s results which seemed to confirm the existence of a critical period. While Johnson and Newport (1989) used Korean and Chinese L1 speakers, Birdsong and Mollis (2001) used Spanish L1 speakers. While the study provides a general finding suggesting a ‘negative correlation’ between L2 attainment and the age of learning onset, it also comes to two important conclusions. Firstly, that a ‘near-native’ proficiency is possible for late L2 learners, and secondly, that there is a significant importance of L1 in the ultimate attainment of L2.

In his subsequent study, Saito (2015) expanded upon his first study by examining a much more comprehensive array of determinants. This second study examines a similar set of L2 speakers – English L2 speakers with Japanese as their L1. However, the aim of the study was

extended to include the examination of ‘accentedness’ (linguistic nativelikeness) and ‘comprehensibility’ (ease of understanding), but also the focus group’s segmental, prosodic, lexical and grammatical proficiency. The study’s findings confirmed that there is an apparent advantage in early L2 exposure but also that this advantage is not as significant in many areas of SLA. On the one hand, the areas which, according to the study’s results, feature a significant negative correlation between age and native-like ultimate attainment are prosody and pronunciation. On the other hand, the results for speech rates, vocabulary, and grammar show either no difference or a very mild difference between early L2 learners and late L2 learners. It is thus implicated that late L2 learners can achieve native-like levels in a second language, and thus, that age is not the only deciding factor in the ultimate attainment of L2. This study also expands upon the issue raised in Saito’s first study by acknowledging that the influence of L1 in L2 learning is significant, but also that there is an apparent reciprocity in this relationship, with L2 having an effect on a learner’s L1.

Wang, Liang, and Chen (2023) carried out a study focused on response times in various tasks in groups of L1 Chinese students with an early and late age of acquisition in English as their L2. The primary aim of the study was to find how important both the L1 and L2 ages of acquisition are in SLA. The central premise of the tasks within the study was the identification of words based on whether they are actual words. In later stages, this was done based on whether the words lexically and semantically fit into presented sentences. The study found in the first two of its three experiments that, regardless of their age, participants had faster response times and more accurate guesses when identifying words they had acquired at earlier phases of L2 acquisition. In its last experiment, the study found that when identifying shorter words, the ages of acquisition of either language had almost no effect, while when identifying longer words, the early learners of L2 had significantly better results. The main findings of this study for this review are that the ages of L1 and L2 acquisition have varying effects on the ultimate attainment of L2 depending on the criteria we examine and that there is very little interaction between these two ages.

The interaction of L1 and L2 is also examined by Pfenninger and Singleton (2019) in their study focusing on bilinguals who learned German and French in primary school and later started acquiring English as their L2. Thanks to the unique situation of Swiss bilinguals, the study was able to use a giant focus group and, thus, produce results that were less prone to small sample size bias. The study was also fairly unique thanks to its focus on the function of family in L2 learning, which Pfenninger and Singleton found to be crucial in the outcome of

L2 learning. Thanks to its longitudinal character, the study was able to compare the language progress of the focus group of bilinguals to that of the control group of monolinguals over the span of five years. The results of the study suggest that when it comes to the age of acquisition, it was much more important for the ultimate attainment of English in bilinguals than in monolinguals. Another conclusion we can draw from the results of the study is that while an early start in L2 learning seemed to be of an advantage at the beginning of the study, the results of early and late learners did level out towards the end of the study; thus, suggesting that early age of acquisition is not the be-all-end-all in the ultimate attainment of L2.

Bilingualism and its role in L2 acquisition are also examined by Gottardo, Al-Janaideh, Paradis, Soto-Corominas, Chen, and Amin (2023), who aimed to find whether the age of acquisition has an impact on the acquisition of English in Syrian refugees who arrived in Canada and only started learning English as an L2 upon their arrival. This study thoroughly examined both the L1 and L2 abilities of the focus groups, which were represented by children ages six to eight and nine to thirteen. Similarly to Pffeninger and Singleton (2018), Gottardo, Al-Janaideh, Paradis, Soto-Corominas, Chen, and Amin (2023) suggest that the role of age is often exaggerated when it comes to SLA. Besides its primary finding about the age of acquisition, the study also found that the older group of children was more prone to use their L1 knowledge in their studies of L2, thus implying that it might be helpful to leverage this fact in the L2 teaching of older learners. It is important to note that the results also revealed that the participants within the ‘older’ group had noticeably higher levels of L1 knowledge, which could have played a role in them using this knowledge more in SLA.

Another study which includes the L1 and L2 interaction in SLA is that of Stålhammar, Hellström, Eckerström, and Wallin (2022), who conducted a study on ‘Swedish speakers from 34 different countries’. This large variety in the participants’ national background suggests that there was also a massive variety in L1 of these speakers, which prompted Stålhammar, Hellström, Eckerström and Wallin (2022) to divide the learners L1 into their language groups – i.e. Germanic, Italic-Romance, Finno-Ugric, Slavic and ‘other’. While the main aim of the study was to examine how non-native speakers perform in a naturalistic use of Swedish when compared to native speakers, the study also produced useful findings when it comes to the L1 to L2 transfer. Swedish L2 learners, whose L1 is part of the Germanic family of languages, performed better in most of the neuropsychological tests they were presented with, while those with L1 belonging to the Slavic family of languages performed comparatively worse in

these tasks. This finding may suggest that the L1 to L2 transfer is more efficient when the two languages are closely related – i.e. Swedish and other Germanic languages. In contrast with the findings of Gottardo, Al-Janaideh, Paradis, Soto-Corominas, Chen, and Amin (2023), Stålhammar, Hellström, Eckerström, and Wallin (2022) found a reverse impact of age of acquisition on L1 to L2 transfer, that is that the later the L2 learners age of acquisition is, the less likely they are to use their L1 knowledge in L2 acquisition.

Dollmann, Kogan, and Weißmann (2019) examined L2 learners of another Germanic language, German. The primary aim of this study was to examine whether the CPH can be considered a valid hypothesis by looking at the acquisition of spoken L2 proficiency. Through a longitudinal study carried out on immigrants to Germany, Dollmann, Kogan, and Weißmann (2019) found that there is some merit to the CPH, with participants with lower ages of arrival having consistently better scores than those with higher ages of arrival. However, we can also conclude from the results that other factors may play a more important role in L2 acquisition - notably individual cognitive abilities, the learning strategies used in SLA and the learner's environment.

The study of Friederici, Steinhauer, and Pfeifer (2002) investigates syntactic L2 acquisition with a different approach than all previous studies in this review - using non-invasive brain imaging, specifically event-related brain activity. What also sets this study apart is that it does not use an existing language but rather a language explicitly constructed to be used in this study called BROCANTO. The study's focus group was taught this new language through a board game designed to serve as an equivalent of natural language acquisition. The use of artificial language, alongside the use of non-invasive brain imaging, allowed for results which can rarely be reproduced in more traditional studies. Rather than examine proficiency in ultimate L2 attainment, the study sought to find whether there are similar differences in the event-related brain activities in the groups of non-proficient natural L2 learners vs. proficient natural L2 learners and similar groups of artificial L2 learners. Along with the finding that the waves within the pairs of groups were, in fact, similar, the study also found that the age of acquisition in any of the groups did not play a significant role.

Similarly to Friederici, Steinhauer, and Pfeifer (2002), the study carried out by Legault, Grant, Fang, and Li (2019) used non-invasive brain imaging. However, Legault, Grant, Fang, and Li (2019) carried out a longitudinal study on Spanish L2 speakers across two semesters of them learning this L2 in order to observe the long-term effects that language acquisition has on the

structure of the brain. The study used two types of non-invasive imaging. Firstly, structural magnetic-resonance imaging was used to track changes in brain structure, such as increases in ‘grey matter volume’ and changes in the structure of gyri associated with language production. The structural imaging showed a higher amount of brain changes in L2 learners with a lower age of acquisition, thus indicating a higher amount of neuroplasticity, which then decreases with age. Secondly, functional magnetic resonance imaging was used to track changes in ‘functional connectivity’ and showed a similar trend to structural imaging within the association of age and rate of changes.

3.4 Definitions of the age of acquisition

The authors within the selected studies do generally agree on a similar definition of age of acquisition. However, some authors add certain specifics to their definitions, which often leads to changes in the used terminology. It is also helpful to note that many authors of the studies tend to use existing definitions for the age of acquisition or terms synonymous with it.

Seven of the studies directly use the term age of acquisition.

In his first study, Saito (2013) defines the age of acquisition as ‘the first intensive exposure to the target language’. This definition is then also used for Saito’s (2015) second study.

Wang, Liang, and Chen (2023) adopt the definition of the age of acquisition from Rochford and Williams (1962), that is, ‘the age at which people learn a word, which is a robust variable affecting word recognition’.

Legault, Grant, Fang, and Li (2019) note that the term age of acquisition ‘describes the age at which a participant first learned a new language’.

Gottardo, Al-Janaideh, Paradis, Soto-Corominas, Chen, and Amin (2023) prefer the definition of age of acquisition used by Birdsong (2006), that is, ‘the age at which a learner becomes immersed in an L2 environment, where the L2 is the dominant societal language’. Gottardo, Al-Janaideh, Paradis, Soto-Corominas, Chen, and Amin (2023) also use the age of arrival in their study, which they use interchangeably with the age of acquisition.

Friederici, Steinhauer, and Pfeifer (2002) use the terms age of exposure and age of acquisition synonymously throughout their study, although they do not provide definitions for either of them. We can still deduce that they use these terms to refer to the age of the first exposure to L2.

In their study, Birdsong and Mollis (2001) use a plethora of terms besides the age of acquisition – age of learning onset, age of L2 immersion, age of arrival and age of first exposure. While the definitions for each term are not provided, they are all used almost synonymously to refer to the age of first direct exposure to L2.

Pfenninger and Singleton (2019) also use a battery of different terms – age of onset, age of foreign language learning, age of exposure, age of foreign language acquisition onset - which all refer to the same concept, that is, the age of first direct exposure to L2.

Dollmann, Kogan, and Weißmann (2019) use the terms age of learner and age of onset in their study. They do not provide definitions for these terms, but we can again deduce their meaning based on the context in which they are used. Thus, the age of the learner refers to the current age of the examined L2 learner at the time of the study, while the age of onset refers to the age of initial exposure to the L2.

3.5 Definitions of the critical period

Within the selection of studies, only six studies either directly use the term critical period or work with a synonymous concept.

Saito (2013) embraces DeKeiser and Larson-Hall's definition of a critical period, that is, 'the concept of an endpoint, a point beyond which learning becomes difficult or impossible' (2005, 97, as cited in Saito 2013). In Saito's (2015) second study, the term is not defined, but it can be assumed that Saito works with the same definition as in his first study.

Another study that directly includes the critical period is Birdsong and Mollis's (2001) study. In their study, Birdsong and Mollis (2001) use the critical period alongside the sensitive period, which they use interchangeably, both referring to the comparatively stronger version of the period, that is, a period after the end of which 'the linguistic competence ultimately attained by the subject under study has proved to be deficient' (Eubank and Gregg 1999, in Birdsong and Mollis 2001).

A similar vision can be found in the study of Dollmann, Kogan, and Weißmann (2019), who also use the sensitive and critical periods interchangeably, both referring to the age 'after which native-like proficiency is less likely' in the learning of L2.

While they do not directly mention the critical period, Stålhammar, Hellström, Eckerström, and Wallin (2022) work with the concept of the critical period. That is, Stålhammar,

Hellström, Eckerström, and Wallin (2022) acknowledge in their results that there is an age after which L2 acquisition is more difficult.

3.6 Aims and methodologies of the selected studies

The studies within this part will be sorted into two groups based on whether they are longitudinal or cross-sectional studies. The studies within each group will be described based on their aims, the methodologies they used, and the results they produced.

3.6.1 Cross-sectional studies

Seven out of the ten studies, thus a majority, fall within fall under the classification of cross-sectional studies.

Aims of cross-sectional studies

The primary aim of Gottardo, Al-Janaideh, Paradis, Soto-Corominas, Chen, and Amin's (2023) study was to investigate the role of age in L2 acquisition of children who are, outside of their family life, significantly immersed in the environment of their L2. Stålhammar, Hellström, Eckerström, and Wallin's (2022) aim was to examine the effects of L2 learning on neuropsychological performance. For Friederici, Steinhauer, and Pfeifer (2002), the goal was to investigate the relation between specific brain activity patterns during language learning and the age of language acquisition. Wang, Liang, and Chen (2022) examined the effects of age of acquisition on the processing speed of L2 words. Saito's (2013) first study sought to find the effects of age on the phonological acquisition of a specific consonantal sound. Saito's (2015) later study extended this search to a much wider array of markers of phonological proficiency, but also to other linguistic domains – notably vocabulary, semantics and grammar). The study which stands out in its aim within the cross-sectional studies is that of Birdsong and Mollis (2001), whose sole aim was to reexamine the postulate of a previous study carried out in 1989 by Johnson and Newport.

Methods used in cross-sectional studies

In the initial phase of their study, Wang, Liang, and Chen (2023) used questionnaires in order to determine the ages at which the participants in their study learned specific words. During all three experiments of the study, the participants were sat in a 'quiet room' under very particular conditions – i.e. facing the screen at the exact same angle and being seated at the exact same distance from the screen, with the parameters of the screen and text presented on it

being the exact same for every participant. Each experiment then consisted of a different task, which was carried out under the same conditions listed above.

As the participants of their studies were purely children, Gottardo, Al-Janaideh, Paradis, Soto-Corominas, Chen, and Amin (2023) distributed questionnaires to the parents of the participants, surveying for information such as the age of arrival of the ‘Syrian refugee’ children to Canada, or the prior schooling of participants in both L1 and L2. Both the tests and the testing conditions were set according to both the American Psychological Association and Canadian Psychological Association. The participants were administered both Arabic (L1) and English (L2) tests, which examined their performance in five separate abilities – word and pseudoword reading, phonological awareness, morphological awareness, vocabulary and non-verbal reasoning.

The two other studies which utilise immigrants to Canada are those of Saito (2013, 2015), who used purely L1 Japanese speakers with English as their L2. The 2013 study featured only oral tasks, which were focused on the participants’ correct pronunciation of word-initial /ɪ/ in both spontaneous and controlled situations. This 2013 study used a set of three tasks, which were meant to elicit the use of the consonantal sound. In his 2015 study, Saito uses a similar methodology, yet this time shedding the focus on the word-initial /ɪ/, and rather examining a number of other aspects of L2. The tests were designed to determine the participants’ proficiency in many areas of L2 - phonological, vocabulary, grammar and semantics.

Stålhammar, Hellström, Eckerström, and Wallin (2022) conducted their study on 322 participants, who were selected from over 30,000 participants in the Swedish CARDIOpulmonary bioImage Study. The final 322 participants were then presented with a ‘battery’ of standardised neuropsychological tests aimed at testing the participants’ reaction speed, attention and memory. The results were then processed through a statistical analysis.

Birdsong and Mollis’ (2001) study mimicked the methodology of Johnson and Newport’s 1989 study, which means their study used a similar amount of early and late L2 learners with a similar mean age of acquisition as the Johnson and Newport study. The two groups of learners were then presented with the original 1989 questionnaire and tape with tests. The only difference was in the judges of the tests, which were a different set of native English speakers.

Possibly the most intriguing of the studies when it comes to methodology, the study of Friederici, Steinhauer and Pfeifer (2002) constructed an artificial language called

BROCANTO specifically for the purposes of the study. This artificial language, which consisted of a ‘limited 14-word vocabulary’, was structured to be similar to natural languages in its grammatical rules. The study featured two groups, one which was not taught BROCANTO, and a second group which was taught the rules of BROCANTO through a tabletop game, which was, again, created specifically for the purposes of this study. The game was designed to mimic the way L2 is learnt in a natural setting. The participants from both groups were then presented with exercises in which they were meant to identify the grammatical correctness of sentences in BROCANTO while simultaneously having their electrical brain potentials measured.

3.6.2 Longitudinal studies

The studies of Dollmann, Kogan, and Weißmann (2020), Pfenninger and Singleton (2019) and Legault, Grant, Fang, and Li (2019) used the longitudinal approach in their SLA studies.

Aims of longitudinal studies

For Dollmann, Kogan, and Weißmann (2020), the aim was to establish the individual importance of language aptitude, general cognitive factors and contextual factors in L2 learning. Further, Dollmann, Kogan, and Weißmann (2020) wanted to examine whether CPH is a valid theory in its most extreme form. Pfenninger and Singleton’s (2019) aim was to investigate the claim of ‘laypeople’ that ‘starting L2 instruction early yields linguistic advantages.’ The aim of Legault, Grant, Fang, and Li (2019) was to examine structural changes in the brains of L2 learners over a period of time during which they were gradually acquiring L2.

Methods used in longitudinal studies

Dollmann, Kogan, and Weißmann (2020) used data from ‘the German extension of the Children of Immigrants Longitudinal Survey in Four European Countries’. The survey was carried out in yearly intervals over the span of 6 years. The primary method used in this study was face-to-face interviews, which served to determine the spoken proficiency of participants in the study.

In the study of Pfenninger and Singleton (2019), the participants were sorted into four groups. The first group consisted of Swiss monolinguals with German as their L1, while the second group consisted purely of bilinguals with native-like proficiency in another language besides German. The third group were also bilinguals with German as their L1, this time with a lower

proficiency in another language. Lastly, the fourth group consisted of immigrants to Switzerland who had acquired proficiency in German as their L2. Participants in all four groups were learning English as their L2. In the initial stages of the study, questionnaires were distributed to the parents of the participating children in order to ascertain external factors in the children's acquisition of English L2. A set of tests was used to examine proficiency in various areas of English L2 learning – i.e. listening comprehension, lexical richness and fluency of spoken production.

Legault, Grant, Fang, and Li (2019) used a relatively small sample of 24 L2 learners of Spanish. The entire group consisted of native English speakers. The study consisted of two sessions, with the second session occurring four months after the first session. In the first of the two phases of the study, participants were presented with four separate linguistic tasks. The first was a language decision task, in which the participants decided on the correctness of presented words in Spanish and English, followed by a second task, which focused on the 'semantic judgement' abilities. In the third task, the participants were presented with a pre-existing vocabulary test originally designed by Dunn, Padilla, Lugo and Dunn in 1986 (Legault, Grant, Fang, and Li 2019). Lastly, the 'language history questionnaire' was used to assess the participants' linguistic background and age of acquisition. In the second phase of the study, the 'Flanker test' and a 'letter number sequencing task' were used to measure the cognitive abilities of the participants. The participants' brain activity was measured throughout all of these tests using functional magnetic resonance imaging, later followed by a structural magnetic resonance imaging at the end of each session.

3.7 Selected findings

There is a portion of authors who, albeit with a range of explicitness, disagree with the primary thesis of the CPH, that there is an age after which attaining native-like proficiency is impossible or even just harder. An extreme account of CPH critique can be found in the study of Birdsong and Mollis (2001), who conducted their study as a direct response to a study supporting the existence of a critical period. Birdsong and Mollis (2001) thus replicated the initial study and found that it needed to be revised, as their study produced results directly disproving the existence of a critical period.

The findings of both of Saito's (2013, 2015) studies indicate that the age of acquisition does play some role in the SLA. However, similarly to Birdsong and Mollis (2001), Saito's findings do support the notion that the CPH is not completely correct, albeit in a less

pronounced manner. Saito's results show a gradual decline in language learning abilities, which may lead to an eventual inability to reach native-like levels of L2.

Another direction of findings which deserves to be examined is the notion that while there may be an age factor, other factors play either a similarly significant, or more significant role in the effectiveness of L2 learning. Wang, Liang, and Chen' (2023) and Pfenninger and Singleton's (2019) studies both found that the role of family and its support can be one of these key factors. Dollmann, Kogan, and Weißmann (2020) findings suggest that an essential factor in L2 learning is feedback and the form of instructions, with which the learner is presented.

We can also deduce from the findings of the neuro-linguistic studies, that L2 learning induces changes in the brain structure, especially changes in areas of the brain responsible for language comprehension and language production (Legault, Grant, Fang, and Li 2019). Similarly, the process of L2 acquisition also appears to cause changes in the internal wiring of the brain (Legault, Grant, Fang, and Li 2019; Friederici, Steinhauer, and Pfeifer 2002). Lastly, the study of Legault, Grant, Fang, and Li (2019) found no significant difference based on the age of learners, while Friederici, Steinhauer, and Pfeifer (2002) did find that the younger the participants in their study were, the more pronounced the changes in brain strain were for them.

Other results suggest that there exists the concept of a language transfer, notably L1 to L2. Interestingly, the studies of Wang, Liang, and Chen (2023), Gottardo, Al-Janaideh, Paradis, Soto-Corominas, Chen, and Amin (2023) and Stålhammar, Hellström, Eckerström, and Wallin (2022) all find an interaction of L1 and L2, yet for some this interaction is positive, and for others it is negative. Similarly, the results of all three studies put a different level of emphasis on the importance of L1.

CONCLUSION

While a popular theory among the layperson community, the Critical Period Hypothesis in second language acquisition has been thoroughly examined throughout the almost six decades of its formal existence. However, as is apparent throughout the ten studies included in this literature review, the academic community has yet to reach a consensus on whether the CPH has survived the test of time. Even just looking at the terminology used in the reviewed studies and other publications seen throughout this thesis, many authors use different terms for the same concepts, notably the age of acquisition and the critical period, thus making the issue even more challenging to navigate.

To consider age as the sole determinant of an L2 learner's success is, by many, considered to be a thing of the past. However, in the reviewed studies, we can observe a contrasting range of opinions and results on this matter, which may suggest that age is not the be-all-end-all of all the factors in SLA. The role of L2 learner's environment plays a major role in many of these studies. This environment is often represented by the learner's family and friends. The environment is proposed to have various levels of impact on the process of L2 learning, with the results of some studies suggesting that it overshadows the role of age in SLA. A similar role is accredited to the input that a learner receives throughout the process of L2 learning, be it a structured or non-structured input.

The research within the study of SLA has benefited from the use of functional magnetic resonance imaging and other non-invasive brain imaging techniques, allowing researchers to observe new data that the researchers during the early years of CPH did not have available. It is thus surprising that some of this new research supports some of the older hypotheses, albeit not in their entirety. This is also a case for the CPH, as can be evident in some of the selected findings, which hint towards at least a partial confirmation of Lennenberg's proposition that neuroplasticity declines with age.

Although a staggering number of studies are available within the field of SLA, the concept of the L1 to L2 language transfer is an area of L2 acquisition that deserves to be examined more thoroughly. The findings of the selected studies appear to be split as to whether the effect of L1 is a positive or a negative factor in L2 acquisition.

Lastly, as is apparent in the neurolinguistic studies, new methods can often yield fresh results but can also shed light on issues hindering the progression of the field of SLA. We can thus only wish that the future holds new developments in brain imaging and other screening

methods, which would provide even more valuable results and allow us to solve some of the puzzles which the learning processes represent.

RESUMÉ

Tato bakalářská práce se zabývá problematikou hypotézy kritického období v rámci osvojování cizího jazyka. Toto téma bylo zvoleno z toho důvodu, že v dostupné literatuře je relativně zřejmý rozkol autorů, ať už pohlížíme na rozmanitost v terminologii, jež je často užívána v kontextu studia této problematiky, či na rozkol v hierarchii důležitosti jednotlivých faktorů při osvojování cizího jazyka. Hlavním cílem této práce je poskytnout čtenáři náhled na tuto problematiku pomocí přehledové studie zaměřené na publikace, které svými výsledky alespoň do jisté míry vyvrací hypotézu kritického období v rámci osvojování cizích jazyků. Tyto publikace byly zvoleny tak, aby byly s různými předpoklady, a jež se zaměřovaly na různé oblasti osvojování cizích jazyků.

Tato práce je rozdělena na dvě hlavní části, tedy, na část teoretickou a část praktickou. Teoretická část je složena ze dvou kapitol. První kapitola je dále rozdělena na dvě podkapitoly. První z těchto podkapitol se věnuje definicím příslušícím ke konceptům, jež jsou často propojovány s osvojováním cizího jazyka. Definice osvojování druhého jazyka je zde rozdělena do dvou částí - tj. osvojování a druhý jazyk, jejichž definice v angličtině přináší mnoho potíží, ať už kvůli své polysémii, tak kvůli rozcházejícím se definicím v publikacích mnoha autorů.

Druhá podkapitola kapitoly první se věnuje historii výzkumu v osvojování cizích jazyků. V průběhu této podkapitoly lze najít historický přehled formálních pohledů na osvojování cizích jazyků - tj. behavioristický, inatistický, kognitivní a socio-kulturní. V rámci této podkapitoly téže nalezneme vysvětlení základních pojmů používaných v rámci studia osvojování cizích jazyků, jako je například učení (learning), osvojování (acquisition), pořadí osvojování (order of acquisition), jazykový vstup (input) a výstup (output), explicitní a implicitní paměť (declarative and procedural memory), a jiné. Tato druhá podkapitola je členěna do tří sekcí, jež se každá věnuje jinému období historie výzkumu, a stejně tak jiným konceptům jež jsou s tímto výzkumem spojeny. Výrazná část podkapitoly je věnována výzkumu Stephena Krashena. Ačkoliv mnohé z jeho hypotéz jsou již dnes vyvráceny, jejich vliv na výzkum v rámci oboru osvojování cizích jazyků je nezpochybitelný.

Druhá kapitola teoretické části se poté již převážně věnuje hypotéze kritického období pro osvojování cizích jazyků. V rámci první podkapitoly této druhé kapitoly nejprve najdeme náhled na myšlenky konkrétních autorů, jež napomohly vzniku hypotézy kritického období pro osvojování cizích jazyků. Jmenovitě jde převážně o myšlenky Noam Chomskyho, jež

otevřely pomyslná vrátka pro hypotézu kritického období. Relativní důraz je zde kladen na individuální myšlenky, které byly později využity právě v hypotéze kritického období.

Druhá podkapitola druhé kapitoly se zaměřuje na definování terminologie, jež je spojena s hypotézou kritické periody v osvojování cizích jazyků. Tato terminologie je zvolena přímo pro využití v praktické části této práce. V této podkapitole lze nalézt vysvětlení následujících termínů: kritická perioda (critical period), věk osvojení cizího jazyka (age of acquisition), výsledná úroveň znalostí cizího jazyka (ultimate attainment). Poslední ze sekcí této podkapitoly se věnuje neinvazivním zobrazovacím technikám, jmenovitě funkční magnetické rezonanci (functional magnetic resonance imaging).

Praktická část je pak obsažena v třetí kapitole, a je rozdělena na osm podkapitol. První z těchto podkapitol se věnuje teoretickému pojetí přehledových studií, s důrazem na různé náležitosti, jež by přehledová studie měla mít. V druhé z těchto podkapitol jsou vydefinovány specifika přehledové studie. Konkrétně se zde hovoří o způsobu, kterým byly studie selektovány, a dále o výzkumných otázkách, které byly formulovány pro analýzu obsaženou v následujících sekcích. Tyto otázky mají za cíl poskytnout kostru pro další analýzu. První z těchto otázek vyslovuje cíl přehledové studie zjistit, pokud autoři studií používají podobnou terminologii, když hovoří o konceptech spojených s osvojováním cizích jazyků. Další dvě otázky jsou pak zaměřeny na prvotní cíle studií, výzkumné metody použité ve studiích, a nakonec závěry, ke kterým autoři studií došli.

Třetí podkapitolu třetí kapitoly se zabývá přehledem studií. V rámci tohoto přehledu je možné najít obecné informace o jednotlivých pracích, včetně důvodů, proč dané práce byly pro tuto přehledovou studii zvoleny.

Čtvrtá podkapitola pohlíží na způsoby, kterými výzkumní pracovníci používají pojem věk osvojení cizího jazyka (age of acquisition). V této kapitole se lze dozvědět, že většina studií buďto přímo používá tento termín, nebo alespoň pracuje s konceptem, který by odpovídal definici tohoto termínu.

Pátá podkapitola je velmi podobná podkapitole předchozí ve svém cíli. Tímto cílem je tentokrát odhalení toho, pokud výzkumní pracovníci používají termín kritická perioda (critical period) při zkoumání studia cizích jazyků. Zjištěním této podkapitoly je skutečnost, že jen velmi malá frakce studií používá tento termín. Některé studie dokonce volí alternativní termín, jako je například citlivé období pro osvojování cizího jazyka (sensitive period).

Šestá podkapitola je zaměřena na průřezové studie, což jsou studie, které si nejprve zvolí své ohniskové a kontrolní skupiny, na kterých poté testují své hypotézy v rámci jednoho sezení. Výhoda těchto studií spočívá v jejich potenciálu vytvořit obrovské množství dat, s relativně nízkou náročností pro výzkumné pracovníky, kteří se nemusí zabývat tím, jestli se účastníci studií vrátí na opakovaná sezení. Tyto studie jsou v této studii zastoupeny většinou.

Sedmá kapitola je věnovaná studiím longitudinálním. Tyto studie jsou typické svým dlouhodobým charakterem. Ačkoliv náročnost jejich provedení je vysoká, tyto studie poskytují nepostradatelná data pro výzkum osvojování cizích jazyků, jež je téměř vždy záležitostí dlouhodobou.

Osmá podkapitola shrnuje závěry, jež vyvstávají z výsledků vybraných studií. Z výsledků studií je možné vyvodit hned několik závěru. Prvním z nich je to, že autoři se i po téměř 60 letech formální existence lingvistiky nejsou schopni shodnout na důležitosti věku ve studiu cizích jazyků. Někteří autoři vidí věk jako relativně nepodstatný, zatímco jiní ho vidí jako hlavní faktor v předpovídání úspěšnosti osvojování cizích jazyků. Dalším z těchto závěrů je, že mnozí autoři vidí prostředí, ve kterém se daný člověk učí cizímu jazyku, jako velice důležitou složku osvojování jazyků. Další studie poté vidí jako rozhodující roli mateřského jazyka, jež stojí v popředí konceptu jazykového přenosu (language transfer).

Výsledkem této přehledové studie je tedy závěr, že ačkoliv studií a publikací věnujícím se osvojování cizích jazyků je nespočet, autoři se jen zřídka shodují na svých závěrech. Ve svém úplném závěru pak práce navrhuje, že modernizace oboru, která je patrná například v existenci oboru neurolingvistiky, může znamenat příval nových poznatků v blízké budoucnosti.

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APPENDIX – Table of studies featured in the literature review

Study	Linguistic branch	Aims	Methodology	Findings
Saito, K. (2013). Age Effects on Late Bilingualism: The Production Development of /r/ by High-Proficiency Japanese Learners of English.	Phonology	To find the effects of age in phonological production of word-initial /r/	Oral tasks which elicited the use of /r/	Critical Period Hypothesis is too strict, Cognitive Aging Hypothesis is much more plausible
Dollmann, J., I. Kogan, & M. Weibmann (2020). Speaking Accent-Free in L2 beyond the Critical Period: The Compensatory Role of Individual Abilities and Opportunity Structures.	Pragmatics	To establish the importance of language aptitude, general cognitive factors and contextual factors in L2 learning	A six-year study. Primarily used face-to-face interviews	There is a significant role of individual cognitive abilities, learning strategies used in SLA, and the learner's environment in the process of L2 learning.
Birdsong, D., & M. Molis (2001). On the Evidence for Maturational Constraints in Second-Language Acquisition.	Psycholinguistics	To reexamine the results of Johnson and Newport's (2019) study	Recreation of Johnson and Newport's (1989) study. The same questionnaires and original tapes for tests	Near native-like proficiency is possible for late learners Positive L1 to L2 transfer
Wang, J., L. Liang, & B. Chen (2023). The Age of Acquisition Effect in Processing Second Language Words and Its Relationship with the Age of Acquisition of the First Language.	Sociolinguistics	To observe the effects of age of acquisition on the processing speed of L2 words	Three experiments all testing reaction speed of participants	There is a two-way interaction of L1 and L2, with the strength of each interaction fluctuating when we examine it under specific criteria
Friederici, A. D., K. Steinhauer, & E. Pfeifer (2002). Brain Signatures of Artificial Language Processing: Evidence Challenging the Critical Period Hypothesis.	Syntax, neurolinguistics	To investigate the relation between specific brain activity patterns during language learning and the age of language acquisition	Designed an artificial language BROCCANTO for the study. Taught the language through a board-game. Tested identification of grammatical correctness	Age of acquisition does not play a major role in L2 acquisition. L2 learning changes the brain's wiring.

Study	Linguistic branch	Aims	Methodology	Findings
Pfenninger, S. E., & D. Singleton (2019). Starting Age Overshadowed: The Primacy of Differential Environmental and Family Support Effects on Second Language Attainment in an Instructional Context.	Sociolinguistics, psycholinguistics	To investigate the claim of 'laypeople' that 'starting L2 instruction early yields linguistic advantages.'	Used questionnaires in initial stages to determine background information. Tests examined listening comprehension, lexical richness and fluency of production	Early start can be an advantage; the older the learner is, the more does proficiency level-out
Stålhammar, J. P., Hellström, Ch. Eckerström, & A. Wallin (2022). Neuropsychological Test Performance among Native and Non-Native Swedes: Second Language Effects.	Lexicology, neurolinguistics	To examine the effects of L2 learning on neuropsychological performance	Used a battery of neuropsychological tests, which tested reaction speed, attention and memory	L1 to L2 transfer is more pronounced when the language families of L1 and L2 are related to each other.
Gottardo, A. R. Al-Janaidh, J. Paradis, A. Soto-Coroninas, X. Chen, & N. Amin (2023). Age, Experience and Language and Literacy Skills in English-Arabic Speaking Syrian Refugees.	Phonology, psycholinguistics	To investigate the role of age in L2 acquisition of children almost fully immersed in their L2	Used questionnaires for parents of participants Tests for five abilities – word/pseudo-word reading, phonological awareness, morphological awareness, vocabulary and non-verbal reasoning	L1 knowledge is more and more important as the learner ages. The role of age in L2 acquisition is minor.
Legault, J., A. Grant, S. Y. Fang, & P. Li (2019). A Longitudinal Investigation of Structural Brain Changes during Second Language Learning.	Syntax, psycholinguistics	To examine structural changes in the brains of L2 learners over a period of time during which they were gradually acquiring L2	Used a 'language history' questionnaire Used 'Flanker test' and a 'letter number sequencing task' Measured brain activity changes	L2 acquisition changes both the structure of the brain and the brain's wiring.
Saito, K. (2015). The Role of Age of Acquisition in Late Second Language Oral Proficiency Attainment.	Phonology	To find the effects of age in L2 acquisition of vocabulary, phonology, syntax and grammar.	Tests which were aimed at testing both the phonological, grammatical, lexical and semantical skills of the participants	L2 learners can achieve a native-like proficiency in language even in later stages of their lives, with high ages of acquisition.