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Chapter 6. Can we learn and master a new language as adults? Absolutely!

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Most of us will have heard at some point that it is impossible to learn a new language as adults. But is this really true? Fascinating studies of our brains show that adults are actually very much capable of learning a new language well enough to perfectly function in that new language, and to simultaneously resemble a native speaker – even when the language was learnt later in life.

Flicking through the science section of a magazine or a newspaper, you may have come across articles describing why mastering a new language as an adult is “impossible” and destined to fail. This popular belief has dominated our way of thinking for many years and has prevented swaths of people from taking the step to learn a new language. In this chapter, we will refer to this belief as a *rumor* because our main goal here is to challenge its truth value. We even go as far as (spoiler-alert) scientifically deconstructing the rumor altogether: the rumor is inaccurate because we are perfectly capable of operating as well as communicating in a new language. What is even more important is that in doing so, some speakers bear a striking resemblance to native speakers. Impressive, right? By the end of this chapter, you will know what we mean by all of this and why this can be the case.

“Acquiring” our native language

Before we get into dismantling the rumor, we need to provide some context on how the native language is acquired and how it compares to learning a new language later in life. “Learning” how to use your native language is something that simply *happens* to most of us during early childhood. When examining the age-old question about how babies acquire a language, scientists have come

up with a fairly elaborate answer. At birth, new-borns can already discriminate between their native language and a language with a different rhythm. At two months, they start developing more specific knowledge of their own native language and can discriminate it from other foreign languages they have never heard before. At around four months of age, infants have developed preferences for different properties of language, for example, specific tones or sounds of the language they are exposed to. At around six months of age, infants show an understanding of the meaning of some words (although we cannot be sure whether the meaning is the same as that for adults). It is also around that age that infants attempt to combine sounds in their language to “produce” language for the first time—they start babbling, like *dadada* (or produce repetitive syllables, in more scientific terms). At the age of eight months, infants know that certain syllables co-occur together more often compared to other syllables. In turn, this helps them to discover words and their boundaries. The production of the first real words comes shortly after around the age of ten to twelve months. Between seventeen and twenty months of age, those same infants start putting together words to form simple sentences. Amazingly, at only three years of age, most children can produce relatively complicated sentences with the words in the correct order. At around six years of age, children have accumulated an awe-inspiring vocabulary of about 8,000 words.¹²⁰

Another notable fact is that children acquire their native language without really needing explicit instructions: parents do not typically sit down with their new-borns and explain the grammatical rules of a language. When parents correct their children on something they said, for example, the classic “swimmed” instead of “swam”, research has shown that these corrections do not actually have a big impact on the development

¹²⁰ For more information about the development of the native language or a new language in children and adults, please see the book by Maria Teresa Guasti entitled “*Language Acquisition: The Growth of Grammar*. MIT Press, 2017”; and the book by Albert Costa entitled “*The Bilingual Brain: And what it tells us about the science of language*. Penguin UK, 2017”.

of language in children. In other words, children do not necessarily take feedback from their parents on board. Instead, children use what is called *positive evidence* to develop their native language: they simply use the language they hear in their immediate environment to extract words and grammatical rules. This ability to pick up on specific linguistic patterns emerges early during development and perseveres all the way through to adulthood. All in all, acquiring and developing the native language typically happens quite automatically throughout early childhood and is very remarkable. What makes native language development even more special is the fact that the timeline is not unique to a specific language. In fact, most children follow a similar timeline, regardless of the native language they are exposed to in their environment. Therefore, think about what children across the world have typically been able to achieve at six years old—quite extraordinary, right? However, let us remember that language development is not yet complete at the age of six. There is still much more to learn, for example, how to read, how to put sounds into writing, how to use language efficiently in dialogues, how to form passive sentences (“The apple was eaten by the boy”) and—a very handy skill—how to use sarcasm and irony to confuse others in conversations, among others.

You may also know some children who *happen* to learn two languages from birth. For example, this might be because their parents or guardians speak two different languages around the house. These children are often called *simultaneous bilinguals*. Growing up, they typically have a comparable command of both languages and can easily engage in one language or the other without being explicitly aware of this. In other words, in these cases understanding and speaking both languages rely on largely automatic and subconscious processes.

Learning a new language: the case of late language learners

Now, what about those who learn a new language not as babies, but as older children or adults? They belong to a different group of learners, namely *late language learners*. In particular, adult late language learners are our main interest in this chapter. What is the

difference between the simultaneous bilinguals we described above and late language learners, and how is it connected to our ability to learn a new language? As mentioned before, simultaneous bilinguals are exposed to two or more languages *from birth*. This often results in overall quite high proficiency levels in the languages they speak from an early age. In contrast, late language learners typically acquire a new language *after* they have already learnt their native language (this is also known as *sequential* bilingualism). Looking at data on how many people in the European Union speak an additional language (either from birth or learnt later), we know that more than two thirds of working-aged adults between 25 and 64 years of age speak one or more additional language. In Sweden, Denmark, Latvia, Estonia, and Malta this number climbs to almost 100%, meaning that in those countries essentially everyone speaks at least one additional language. Therefore, most of the population in Europe has learnt how to speak multiple languages, making it even more important to get all the facts right since it concerns so many people.

Late language learners are a particularly fascinating group because they are actually in an optimal position to learn a new language. For starters, most of them do not have to worry about learning how to read and write anymore. Next, they are typically extremely motivated to learn a new language as it is often a matter of explicit choice (or sometimes necessity). There are probably hundreds of different, very valid reasons to learn a new language as adults and to effectively become adult late language learners: taking language classes for a job in a new country, learning the language of a partner or of friends, being able to chat with the new neighbors or locals, talking to the cat we know has Italian owners and which seems to love the little bench on our balcony, or simply to take up a new personal challenge. Most importantly, late language learners are *already* equipped with a fully developed language system, namely that of their native language. Therefore, they already have a good idea of the words in another language (*vocabulary*), their meaning (*semantics*), their pronunciation (*phonology*), the grammatical rules that govern it (*syntax*), the way that words and sentences are written (*orthography*) and on how to use all of the

above in an appropriate communicative and social context with other speakers (*pragmatics*). In other words, they have *been* through the entire process of learning a language, while probably being blissfully unaware of this happening at all. Therefore, when late language learners get started on, well, a new language, they can rely on their experience and understanding of their native language to facilitate the learning process. This is less the case for simultaneous bilinguals, who essentially learn two languages in parallel and therefore cannot draw from a fully-formed language just yet. To illustrate this, have you ever talked to an adult taking language classes and heard them say that they find a particular aspect of a new language “easy because it is similar to their native language”? Such remarks indicate that late language learners make both conscious and unconscious links between their native language and the new language to be learnt. This meta-linguistic insight into both their native language and the new language is worth gold and shows that late language learners are well-equipped for learning a new language.

All of these skills are even more impressive when we consider that learning a new language is by no means a piece of cake. For example, it can sometimes be difficult for some late language learners to learn the grammatical rules or the sounds of the new language (yes, especially those – think about how often you have had friends complain about finding it difficult to improve their accent). Depending on the learner and the circumstances under which the new language is learnt, there can be low proficient and high proficient late language learners. While learning and mastering a new language as adults can be challenging, scientific evidence suggests that some late language learners can actually reach proficiency levels that are close to native speakers. What we mean by this is that late language learners can achieve language levels in the new language considered to be extremely *similar* to native speakers of that language, against the wide-spread rumor that this is impossible. The important distinction here is between being highly similar to native speakers (which this chapter is all about) vs. being identical to native speakers. So, how can this be happening?

To get everyone onto the same page, what does it really mean for late language learners to *master* a new language to begin with? First, we have the *learning* aspect, for example, expanding your vocabulary, learning phonology and grammar and so on. Second, we have the *processing* aspect, namely the ability to use, understand and produce sentences and to have a functional command of the new language. Importantly, looking at how people use or process the new language can give us a good idea about how *successful* (or not) the learning process has been and what the similarities with native speakers are. This will be exactly the type of evidence that we are discussing below.

Into the thick of it: dismantling the rumor

At the core of the rumor that learning and mastering a new language as adults is impossible is the notion that the *age of acquisition* of the new language plays a significant role. In other words, people commonly believe that languages can *only* be successfully learnt by children up to a certain age. There are numerous studies which have investigated the role of age of acquisition in adult language learning in great detail. If age of acquisition was truly *the* (only) determining factor, then we would expect at least two things: first, that child late language learners (i.e., those children who learnt a new language later during late childhood rather than from birth *after* they had already acquired their native language) would still make different errors compared to adult late language learners. However, studies have consistently found that child late language learners and adult late language learners make surprisingly similar types of errors when communicating in a newly learnt language. For example, adult late language learners behave similarly to those children with respect to the grammar of the new language. Second, if age of acquisition was really the only determining factor, it would also mean that we would never expect any late language learner to reach proficiency levels similar to native speakers in any linguistic domain. Yet, studies found that both child and adult late language learners can become highly functional in more than one language and reach high proficiency levels in multiple languages. More important, research overwhelmingly suggests that late language learners can in

fact be remarkably similar to native speakers in domains such as grammar, vocabulary, or in the use of language in a particular context, as we will discuss in more detail below. In other words, contrary to the wide-spread rumor, reaching levels similar to native speakers is perfectly achievable in many domains even if the language acquisition process started during adulthood. Note that we are not arguing here that the age of acquisition plays *no* role at all in mastering a new language. However, if late language learners can still achieve extremely high functionality in the new language in some domains, then the age of acquisition must be less of an important factor, less than people think. With this, the foundations of the rumor are beginning to slowly crumble since it is looking like perhaps learning a new language as adults may well be possible, after all.

Now, let us zoom into research which has specifically investigated the question whether achieving a high command of grammar similar to native speakers is possible for adult late language learners. One way to answer this question would be to, for example, compare the ability of late language learners and native speakers to detect grammatical errors. Consider hearing a sentence such as “The girl *ride* to school on her bike.” where there is a grammatical error on the verb (*ride* instead of *rides*). The fundamental question here is whether late language learners’ brains will behave similarly to native speakers when they apply or process grammatical rules in the new language. But how could we know if the brains of different speakers behave similarly to each other?

One very effective approach is to compare the *neural activity patterns* in the brains of late language learners and native speakers to examine their sensitivity to detect grammatical errors. If we were to find similar neural activity patterns for processing grammatical errors in at least some of the late language learners and native speakers, this would suggest that the mastery of grammatical rules in the new language reached a level which resembles that of native speakers. In other words, similar neural activity patterns would mean that achieving a high command of grammar similar to native speakers is possible, even if the new language was learnt later in life.

A popular technique used to investigate the neural activity patterns connected to grammatical errors is *electroencephalography* (EEG). EEG measures the electrophysiological state of the brain and allows researchers to track so-called *event-related brain potentials* (ERPs). Fundamentally, it is a non-invasive technique to connect changes in the brain's neural activity to a specific event, for example, detecting a grammatical error in a sentence. ERPs have featured in studies on language for many years because they provide an incredibly precise window into the brain's neural activity and also the timing of the underlying processing mechanisms compared to simply pressing a button to respond. Therefore, studying the neural activity connected to language processing can shine light onto the ongoing brain mechanisms in real time.¹²¹

The ERP most commonly linked to the detection of grammatical errors is the so-called *P600 component*. Generally speaking, the P600 component is a positive-going wave with a voltage (yes, voltage!) peak around 600 milliseconds after the event,¹²² e.g., the grammatical error. The *P600 effect* refers to higher voltage amplitudes for sentences containing a grammatical error compared to sentences without, for example. In other words, the P600 effect shows that there is a measurable difference in the way that the brain adapts its neural activity in response to an ungrammatical sentence compared to a grammatical sentence. More concretely, the P600 effect indicates that the brain has detected grammatical errors and is rapidly performing repairs on the sentence in order to construct a grammatically sound one.

Early studies on this topic claimed that late language learners were nothing like native speakers when detecting grammatical errors such as in the sentence above.¹²³ For example, some ERP studies looking at the processing of grammatical errors in native speakers vs. late language learners failed to provide evidence for a

¹²¹ If you are interested in gaining an even broader insight into how the brain deals with learning languages in adulthood, read chapter 5 by Pereira Soares et al. in this same book.

¹²² Steinhauer, White, & Drury, 2009.

¹²³ Clahsen, & Felser, 2006.

P600 effect in adult late language learners.¹²⁴ In turn, this implied that adult late language learners, in particular those with lower proficiency levels, may not be sensitive to grammatical errors to begin with and could therefore never resemble native speakers.

However, much more recent research using ERPs consistently reports highly comparable P600 effects for adult late language learners and native speakers. For example, one study directly compared the P600 effect between low and high proficient late language learners of German, lower and highly proficient late language learners of Italian as well as native speakers of German and native speakers of Italian.¹²⁵ Results showed that the P600 effect was remarkably similar across the highly proficient late language speakers of German and Italian and the native speakers. The less proficient late language learners also showed a P600 effect, although slightly delayed compared to the native speakers. Therefore, both lower and highly proficient adult late language learners showed a sensitivity to grammatical errors. This result is in direct contrast with studies suggesting that the P600 effect may be absent in late language learners and subsequently, that they are less sensitive to grammatical errors or not at all.¹²⁶ More importantly, the highly proficient late learners displayed similar ERP patterns compared to native speakers in the detection of grammatical errors. This shows that at least some late language learners can develop grammatical processing abilities in the new language¹²⁷ which resemble native speakers.¹²⁸

Extending on those findings, another study dug even deeper into the ERP signal connected to grammatical errors.¹²⁹ Fundamentally, the ERP signal is composed of waves of different frequencies, which are measured in Hertz (Hz). Since the early twentieth century, we

¹²⁴ Rossi & Prystauka, 2020.

¹²⁵ Rossi, Gugler, Friederici, & Hahne, 2006.

¹²⁶ Rossi, Kroll, & Dussias, 2014.

¹²⁷ Gillon-Dowens, Vergara, Barber, & Carreiras, 2010; and Van Hell & Tokowicz, 2010.

¹²⁸ Sabourin, Stowe, & De Haan, 2006.

¹²⁹ Rossi, & Prystauka, 2020.

know that specific frequencies are linked to specific cognitive processes (e.g., detecting grammatical errors vs. listening to music). In other words, the composition of frequencies in our brains constantly changes depending on the task we are performing. The frequencies present in an ERP signal are typically grouped into so-called *frequency bands*.¹³⁰ Researchers can quantify the amount, or *power* of a specific frequency band present in the ERP signal and connect it to a cognitive process. For example, the frequency range between 4 Hz and 8 Hz is also known as the *theta* frequency band.¹³¹ Studies examining the processing of grammatical errors found an *increase* in theta frequency power in the ERP signal for grammatical errors compared to correct sentences in native speakers of Dutch.¹³² With respect to the ERP signal characteristics of late language learners and native speakers, one study directly compared the composition and frequency band power of the ERP signal in late language learners and native speakers of Spanish.¹³³ The results showed that both the composition of the ERP signal and the frequency band power were remarkably similar across both groups. From studies such as these, it becomes clear that late language learners not only show comparable ERP patterns to native speakers when processing grammatical errors, but also a similar composition of the frequencies within the ERP signal as in native speakers. In turn, this again suggests that some language learners process grammatical errors remarkably similarly to native speakers. Subsequently, this represents evidence in favor of the ability of adults to learn and master a new language: in order to succeed at these tasks and for the ERP signal to be similar to native speakers, learning of the grammar must have been extremely successful in at least some late language learners. Now, the rumor about this actually being completely impossible is sounding less and less plausible, right...?

¹³⁰ Bastiaansen, Oostenveld, Jensen, & Hagoort, 2008.

¹³¹ Güntekin, & Basar, 2007.

¹³² Bastiaansen, Van Berkum, & Hagoort, 2002.

¹³³ Rossi, & Prystauka, 2020.

In addition to having a firm grasp on grammar, a second critical aspect of learning and mastering a new language is to be able to understand the incoming auditory input. Unlike in reading, there is no equivalent for the blank spaces between words and the possibility to go back and reread a word during a normal face-to-face conversation. Instead, when we are having a conversation with someone, there is a rapid and constant flow of acoustic and linguistic input that we need to process to understand what is being said. During this process, our brain takes on the role as a sort of fortune teller that tries to predict *upcoming* information based on the incoming linguistic input.¹³⁴ Take the example of hearing the sentence “I drink my coffee with milk and *sugar*.” We know from research that our brain tries to *predict* the final word *before* we even hear the full sentence. In this example, our brain will have predicted the word “sugar” as the final word of the sentence by the time we get to “and.” For this, our brain uses the information from the first part of the sentence to make a reasonable prediction of what could come next in the sentence. In this, it determines that “sugar” is the most fitting word in this context. However, when we hear a sentence such as “I drink my coffee with milk and *dog*,” it will make our brain raise an eyebrow or two: while this sentence is technically grammatically correct, the word “*dog*” does not fit with what our brain had predicted (because people do not typically put dogs into their coffee, or at least, we hope not). In those cases where predictions are violated and there is a mismatch with the auditory input, i.e., the word “dog” instead of the word “sugar”, another event-related (ERP) brain potential is produced, namely the *N400 component*.

The N400 component is one of the most-researched ERP components in the field of language sciences, with the first studies dating back to the 1980s. The N400 component is a negative-going wave with a voltage amplitude peak around 400 milliseconds after a specific event. Taking the example sentence of “I drink my coffee with milk and *X*,” N400 voltage amplitudes are larger if the word “*dog*” is presented compared to when the word “*sugar*” is presented.

¹³⁴ Ito, Martin, & Nieuwland, 2017.

The resulting *N400 effect* therefore indexes this mismatch between what the listener was expecting and what they effectively heard. Subsequently, the N400 component is seen as a biological marker for embedding words within their appropriate context. Just like the P600 component, the N400 component is another excellent tool to examine the claim that adult late language learners can master a new language at a level that resembles native speakers. The reasoning here is the following: if late language learners are able to resemble native speakers in predicting incoming auditory input, then we would expect the N400 effect in late language learners to look similar to the one in native speakers. Subsequently, this would mean that late language learners are comparable to native speakers in their ability to predict upcoming linguistic input. There are some studies which suggest that the act of prediction may be less effective in late language learners because reading and comprehension are more effortful for late language learners.¹³⁵ Subsequently, it was proposed that prediction mechanisms are widely different in native speakers compared to late language learners and that the corresponding neural patterns differ drastically between the two groups,¹³⁶ meaning that a resemblance is virtually impossible.

However, other studies using EEG and ERPs have examined more systematically whether late language learners can show N400 patterns that are similar to native speakers. Those studies, which included sentences like our example from before, report highly similar N400 effects in late language learners compared to native speakers. This shows that at least some late language learners do engage in predicting the upcoming word in a sentence similarly to native speakers, although possibly not in the exact same way. In other words, these results show that just like in native speakers, the brains of late language learners also act as fortune tellers and are surprised when their predictions do not match the incoming auditory input. Therefore, in line with our discussion around the P600 component, the ERP signal composition and frequency power, we present evidence from the N400 component that the

¹³⁵ Clahsen & Felser, 2006.

¹³⁶ Martin, Thierry, Kuipers, Boutonnet, Foucart, & Costa, 2013.

neural signatures for language prediction can be extremely similar in late language learners and native speakers. In turn, this is evidence that it is indeed very well possible to virtually resemble native speakers in a new language, even as an adult language learner.

Conclusion

The rumor that learning and mastering a new language as adults is impossible has dominated our way of thinking for many years. Yet, examining the current scientific evidence, the emerging picture is quite different: overall, striking similarities are found between the neural activity patterns observed in some adult late language learners, particularly with high proficiency levels, and native speakers. This shows that adult language learners can reach high proficiency levels resembling native speakers, even if this new language was learnt later in life. While it may not be possible for *all* late language learners, the answer to our original question of whether adults can learn and master a new language, the answer is a resounding *yes*. There are many, many late language learners among us who are the living proof for this. Therefore, as a message to anyone who is doubting whether or not to pick up a new language—the evidence is strongly in your favor, so *go for it!*