Maturational Constraint: The Effect of Age of Acquisition on Second Language Comprehension and Pronunciation in Second Language Acquisition

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Abstract

It is a common belief that children, when compared to adult, acquaint themselves easier with a foreign language. This phenomenon has been described as the “critical period hypothesis” by Long and Lenneberg. Second language fluency can be subdivided in language comprehension and pronunciation. This paper argues that age of acquisition (AoA) has a negative effect on comprehensibility and pronunciation in second language (L2) acquisition. Only few early, and none of the late learners exhibited actual native-likeness across grammatical and phonological tasks. Age has a substantial effect on how bilinguals represent words. Either in spoken or sign language, adults who experience little or no accessible language in early human development dramatically alters their capacity to learn language throughout life. AoA has a significant effect of regular frequency words, with increasing AoA correlating with increased frequency effect for regular words and decreasing correct grammatical judgment at morpheme level. A possible interpretation of higher activation in cortical areas involved in language comprehension could imply that language acquired earlier in life (L1) is less effortful than L2 when acquired later. Cortical representation of language comprehension becomes more focussed within superior and middle temporal areas during late childhood. Moreover, AoA is linearly and negatively related to activation levels in anterior language regions and positively related to activation levels in posterior visual regions. For the prediction of a foreign accent, AoA is found to be the most influential predictor. Overall, grammatical and phonological intuition decrease with high AoA, with AoA ranging from 1-6 to be the most likely to perform native-like.

Introduction

Good proficiency in second languages (L2) has become more important over the last decade, especially in Dutch culture. More than ever, schools and universities are focused on bilingualism, with special emphasis on the English nativism. It is a common belief that children, when compared to adult, acquaint themselves easier with a foreign language. This phenomenon has been described as the “critical period hypothesis” by Long [1] and Lenneberg [2]. Second language fluency can be subdivided in language comprehension and pronunciation. It is important and relevant to evaluate whether maturational constraints, especially age of acquisition (AoA), have a profound effect on these two factors because of their significance in second language education and testing. If different age categories have diverse ways of L2 acquisition, instructive methods could greatly benefit from varied learning strategies. This paper argues that age of acquisition (AoA) has a negative effect on comprehensibility and pronunciation in second language (L2) acquisition.

Comprehensibility & Pronunciation

Comprehensibility can be evaluated at many different levels, including grammatical, phonological and syntax. In general, native-likeness forms an indirect measurement of proficiency, which combines language production and comprehensibility. Native-likeness can be interpreted in 3 different ways: to self-identify as a native-like speaker of the target language, to be perceived as a native speaker by native speakers of the target language and to be a native-like speaker of the target language. Abrahamsson
and Hyltenstam aimed to identify individuals who would potentially constitute the evidence necessary to reject the critical period hypothesis [3]. They argued that only one example of absolute native-likeness in L2 acquisition beyond this period would be sufficient to undermine Lenneberg’s hypothesis. All of the participants were evaluated by at least one judge (n=7), but none by all, indicating individual preferences. With regards to AoA, only a few of the early (AoA<7) learners and none of the late learners (AoA >7) exhibited actual, linguistic native-likeness across a broad range of tasks (grammatical and phonological) when their performance was evaluated in detail. Silverberg & Samuel used a similar target group in a study on effect of age on L2 comprehension, which showed a very strong influence of age on how bilinguals represent and access words in their second language [4]. A lexical decision priming paradigm with semantic, mediated form and form primes showed inhibitory effects of form primes for highly proficient late learners, whereas the less proficient group produced no priming effect. These results indicated that age has a substantial effect on how bilinguals represent and access words in L2. A longitudinal study on the acquisition of 6 English grammatical morphemes by native Mandarin-speaking children and adolescents found similar results when scrutinizing language to word level. Analysis revealed that there was a negative correlation between AoA and morphological acquisition in second language [5].

It begs the question whether age constrains the outcome of all language acquisition, whether the language is first or second. Because of the usual late(r) onset of sign language acquisition in deaf children, this groups forms a good example of late acquisition. Sign language utterances are structured at the syntax, morphology, phonology, and semantic levels [6]. Timed grammatical judgement and untimed sentence picture matching in a research to test the grammatical abilities of English deaf (previously exposed to language) and hearing adults showed that early bilinguals spoke and signed at native level, despite being hearing or deaf. By contrast, the learning capacity of deaf adults who experienced little or no exposure to language altered their ability to learn a new language drastically [7].

Previous examples have illustrated how age of acquisition influences L2 acquisition, mostly measured over a long(er) period between AoA and first testing. Intensive second language courses show insight in the early changes and limitations of age on L2 acquisition. The development of second language auditory processing in German college students was evaluated over a period of 4 months (1 month language course, 3 months while studying in the country of L2) in which they achieve a level of proficiency enabling them to study at a Dutch University. Although German and Dutch share large parts of phonology, lexicon, and syntax, semantic predictability effect after four months was limited to the last part of the sentence, suggesting that the German L2 speakers still needed more semantic context than native Dutch speakers to successfully predict upcoming target words [8]. In a different study, syntax and reading comprehensibility were tested in an English past tense production task in L2 by means of regular and irregular past tense frequency effects. Age of acquisition had a significant effect for regular frequency words, with increasing age of acquisition leading to increasing frequency effects for regular words. Results suggested that higher age of AoA implies greater dependence on storage of words, where explicit knowledge in L2 is more dominant than in early AoA [9].

**Neural Organisation of L2**

Several environmental factors have been proposed to affect the neural organisation of language, including the age of L2 acquisition and the degree of proficiency attained in each of the spoken languages. According to Perani, “In the initial stage of L2 acquisition, lexical items of the second language are processed by directly translating them through their equivalent in the first language, whereas in later learning stages, when proficiency increases, they become more concept-mediated without translation” [10]. The cerebral pattern of activation was examined during lexical search and retrieval in well-defined, early acquisition, high proficiency bilinguals by means of measurement of different daily context. Participants were asked to participate in a verbal fluency task while being measured by fMRI, in which word retrieval in response to phonological cues was of interest. Age of Acquisition remains an important factor, even in high scoring early bilinguals. Neuronal activation is greater when generating words in L2 than at comparable level in L1. A possible interpretation is that retrieving words acquired early in life is less effortful than retrieving...
words acquired later. At the macroscopic cerebral level additional neural resources are involved when generating words in L2 at a comparable level of language performance to that of L1. A possible interpretation is that the generation of words, in the language acquired first in life, is less difficult and therefore requires less complicated neuronal network.[10]

An AoA-related increase of language lateralization towards the left hemisphere is evident within the frontal cortex, most prominently in premotor areas during a beep stories task and vowel identification task evaluated by fMRI. Different activation patterns are positively related to an age effect in older participants. Cortical representation of language comprehension becomes more focussed within superior and middle temporal areas during late childhood in adolescence, but not more lateralized. Language comprehension is represented more bilaterally than language production, and a hemispheric dissociation with left-hemispheric language production but bilateral or right hemispheric language comprehension is not uncommon even in healthy right-handed subjects[11]. The grammar of sign languages, like that of spoken ones, is hierarchically organized. As stated before, sign language utterances are structured at the sentence (syntax), word (morphology), sub-word (phonology), and semantic (word and sentence meaning) levels. Therefore, a study of the organizational aspects of the brain in natives in sign language contributes to the further understanding of language lateralization. The age-onset of acquisition is typically different and later. Thus, neuroimaging of deaf adults as they performed two linguistic tasks with sentences in American Sign Language (grammatical judgement and phonemic-hand judgment) was studied. Age of acquisition was linearly and negatively related to activation levels in anterior language regions and positively related to activation levels in posterior visual regions for both tasks [6].

Assessing pronunciation and “accentedness” requires a reasonably large sample size in L2 acquisition; an L1-homogenous sample of speakers of a language typologically distant from the target L2 must be used in order to control for the L1 variable as well as to prevent errors in identifying near-native bilinguals. A study into L2 pronunciation and age measured grammatically judgment task, a speech production tasks and an oral language proficiency task in Mandarin participants with English as L2. AoA was found to be the most influential predictor of foreign accent, while the AoA variable exerts a stronger impact on speech production than on grammar. There were also many more bilinguals who achieved near-native proficiency in grammar than in speech production [11]. As age of acquisition increases, the age at which participants show accent—ness also increases, while grammatical judgment test for mophosyntax steadily decreases [12]. When measuring morphosyntactic instinct through an aural GJT and phonetic instinct by a test of categorical perception of voice onset time (VOT), strong negative correlations between AoA and ultimate attainment (AU) were demonstrated for both grammatical and phonetic intuition, but only among early learners (AO 1-15). According to Abrahamsson, “native-like instincts of both grammatical ad phonetic aspects ceased to occur at age 13, and the probability of performing within the native-speaker range on both these aspects of the L2 was greatest among those with AoA 1-6 years” [13].

Conclusion
In summary, only few early, and none of the late learners exhibited actual native-likeness across grammatical and phonological tasks. Age has a substantial effect on how bilinguals represent words. Either in spoken or sign language, adults who experience little or no accessible language in early human development dramatically alters their capacity to learn language throughout life. AoA has a significant effect of regular frequency words, with increasing AoA correlating with increased frequency effect for regular words and decreasing correct grammatical judgment at morpheme level. A possible interpretation of higher activation in cortical areas involved in language comprehension could imply that language acquired earlier in life (L1) is less effortful than L2 when acquired later. Cortical representation of language comprehension becomes more focussed within superior and middle temporal areas during late childhood. Moreover, AoA is linearly and negatively related to activation levels in anterior language regions and positively related to activation levels in posterior visual regions. For the prediction of a foreign accent, AoA is found to be the most influential predictor. Overall, grammatical and phonological intuition decrease with high AoA, with AoA ranging from 1-6 to be the most likely to perform native-like.
In conclusion, Age of Acquisition does have a negative effect on overall language comprehension and “accentedness”, but only after the age of 6. Late learners need more semantic content to understand a sentence, while syntactic clues or often already sufficient for native speakers. Higher cortical activation in posterior visual regions late L2 speakers indicates a more extensive and less optimized language processing, evaluating sentences longer at word level before sentence comprehension. Lateralization of second language was not discussed in this paper, although it would be interesting for further research. Additionally, cross-lingual effects of L1 and L2 should always be taken into account when evaluating not only the rate of L2 acquisition, but also comprehensibility and pronunciation. These results may facilitate educators in facilitating and adjusting learning strategies for L2 acquisition.

References