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Age effects in second language learning, so obvious and so misunderstood

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Children are better at learning languages than adults, everybody knows that. But exactly what aspects of language learning are they better at, under what conditions, and why? Nobody knows that for sure (but we have some good hypotheses). What seems like a simple fact that anybody can observe when an immigrant family moves into the neighborhood (say, the children speaking like native speakers of their age after a few years, and the adults still sounding very foreign) is, in fact, quite complicated and difficult to investigate.

First of all, it is NOT true that children are "faster" learners than adults. When a family goes abroad for a long vacation or a job assignment, then after a couple of months the adults will have learned more than the children (assuming they get roughly similar amounts of exposure to the language). What children ARE better at is slowly getting better, so that, if the family decides to make the move permanent and keep living in the country where the L2 is spoken, then after five or ten years the children are

probably indistinguishable from native speakers, while the parents, whenever they meet new people, are asked "where are you from?". This speed vs. ultimate attainment difference was made very clear in the classic article by Krashen, Long, and Scarcella (1979).

This phenomenon of age-dependent success in second language learning has been studied by academics since at least the 1950's, and the quantity of research has increased steadily since around 1990. Lenneberg (1967) was the first one to use the term 'critical period' to refer to his age-dependent phenomenon in human language learning. He too, in this great classic, made a very important distinction that is often ignored even today: it's not that adults cannot learn a language anymore when they are 40, and not merely that they cannot do it as well as a children, but that "automatic acquisition from mere exposure to a given language seems to disappear after this age, and foreign languages have to be taught and learned through a conscious and labored effort" (p. 176).

Taking all of this into account, it should be clear that we cannot speak meaningfully about child-adult differences in L2 learning without making the distinction between speed and ultimate attainment, and between what we have now come to call explicit and implicit learning (with or without awareness of what is being learned); ignoring one or two of these distinctions has led to a lot of confusion. It follows from these distinctions, for instance, that classroom learners are not relevant to this "critical period" concept: in their case we cannot look at ultimate attainment, because they are still far from that point, and we cannot look at implicit learning, because their learning is almost entirely explicit, both because of the way the language is presented to them and because of the very limited exposure time available. The ideal participants in research that is strictly about the critical period are immigrants who arrived in a country at different ages, who had no teaching in the target language, and who never had linguistic training. Needless to say, such participants are hard to come by, as at least the younger arrivals will almost always have had some teaching in (and probably also about) the target language.

We need to make a further distinction between different domains of language (e.g., Granena & Long, 2013). Pronunciation is the area most obviously affected by age, in the sense that people who acquired the second language after age 16 or so almost always have a noticeable accent for the

rest of their lives, while those who learned the language before age 6 or so are normally indistinguishable from native speakers (except perhaps on very fine-grained laboratory tests).The age effect in grammar may be less obvious in casual encounters, but it is quite strong in most empirical studies. Semantics is a bit more controversial, but if one distinguishes lexical from phrasal semantics, then it is clear that while vocabulary tends not to show much of an age effect (except in collocations), the semantic distinctions made in the grammar (e.g. verbal aspect, definite and indefinite articles) are very hard to acquired past the critical period. For a more detailed overview of findings in various domains, see DeKeyser (2012).

One should not overstate these differences, though. On the one hand, one of the reasons pronunciation problems are so obvious compared to grammar issues, is that even a few minutes of speech contain a good sample of most sounds and sound combinations; that certainly cannot be said about grammar, as many structures are fairly infrequent, especially in the speech of second language learners. On the other hand, further distinctions can be made within phonology and grammar. Not all aspects of pronunciation or grammar present the same kind of learning problem (in the sense of challenging the same cognitive mechanisms), and therefore they may be affected by age differentially (e.g. segmental vs. suprasegmental phonology, phonetics vs. phonemics, word order vs. morphology, or regular vs. irregular morphology).

Various other methodological issues can blur the picture even further. Many studies try to take a representative sample of L2 learners, whereas others (e.g. Abrahamsson & Hyltenstam, 2009) only look at very advanced learners. Clearly, different tests need to be used with these different kinds of participants if one wants to avoid floor or ceiling effects. Needless to say, the native language also needs to be taken into account. If many of the structures tested are shared by L1 and L2, that will reduce the learning problems and therefore the size of the age effect. It is recommended, therefore, only to work with participants of the same native language, or at least to analyze the data for speakers with different L1s separately.

At any rate, fairly fine-grained tests data are needed. Self-assessments are much too coarse for the purpose of research on age effects and may also show a bias due to participants' preconceived notions about age effects. Census data, for instance, as used in Hakuta, Bialystok, and Wiley (2003),

are not useful for our purposes. On the other hand, however, virtually all age effect studies have had too few participants to allow for a fine-grained statistical analysis (e.g., for looking at age-proficiency correlations separately for different age ranges, or for partialing out the effects of variables such as level of education, age at testing, verbal aptitude, or working memory). Therefore, one should strive to collect data from very large numbers of participants, through a consortium of universities, for instance, or via the internet (for further methodological considerations, see DeKeyser, 2013).

A very interesting example of the latter is the study by Hartshorne, Tenenbaum, and Pinker (2018). These researchers managed to get over 600,000 people to participate in their study by making it available on the internet and by construing it as a game: participants were going to find out to what extent the computer was able to guess their native language (or in the case of native speakers, their native dialect). The tests covered a wide variety of elements of English grammar, and the large number of participants allows for various kinds of sophisticated statistical modeling, including trying to separate the age of acquisition at which a decline is detected from the age at which learning ability must have declined. Given that language learning takes several years, the capacity to learn must have declined not at whatever age of onset *x,* at which a decline is found in the data, but at *x + y,* where y is the number of years it takes to learn the language after the acquisition process has begun (to my knowledge, this was first pointed out by Hyltenstam and Abrahamsson (2003)). Hartshorne et al. found the average point of decline to be at age 17.4. That may seem to come surprisingly late at first sight, but this is the age at which the learning abilities decline (*x + y)* and corresponds to an age of onset *(x)* of several years *(y)* earlier. This study will be discussed for many years to come, because, on the one hand, it has spectacular findings on the basis of sophisticated research with a very large number of participants, but on the other hand, it also has a number of problems that make it hard to interpret its findings, e.g. the failure to distinguish specific native languages rather than language families, and a number of unavoidably arbitrary decisions in the statistical modeling.

For the time being then, we have substantial evidence for a critical period in the sense of the age during which the capacity for (implicit) second language learning declines. It does not make much sense to argue

about whether this decline takes place between ages 4 and 12, between 6 and 16, or between 10 and 18, as the decline probably is not exactly simultaneous for phonology, morphology, syntax, and semantics, with even different time frames for individual problems within these areas. On top of that, there must be individual differences for the critical period, just like one cannot give an exact age for which puberty begins for everybody.

At the same time, it is important to note that there is no consensus at this point about what exactly the cause of this well-documented decline is, even among those who stress that the phenomenon is truly maturational in nature, i.e. due to unavoidable cognitive / neurological development, and not to changes in the environment (quality and quantity of input), in motivation, or in "L1 entrenchment" (strength of interference from the first language). Personally, however, I believe that the fundamental reason is a gradual shift from reliance on implicit to reliance on explicit learning processes, which is suggested by the increasing importance of aptitude for explicit learning with age (e.g. DeKeyser, 2000; DeKeyser, Alfi-Shabtay, & Ravid, 2010), and by the increasing role of structural salience (known to be more important for explicit than for implicit learning) with age (DeKeyser, Alfi-Shabtay, Ravid, & Shi, 2017).

Most importantly of all, it cannot be stressed enough that the findings from the literature about age effects in largely naturalistic language learning, which is virtually the entire literature, do not directly imply that "earlier is better" under any circumstances. Children may be better than adults at implicit language learning through massive exposure, but those are not the conditions offered by a foreign language classroom. When children are offered only a few hours a week of input (which may be impoverished in various ways on top of that), they are not going to learn any more than adults from that, on the contrary. As conditions of minimal exposure necessitate more explicit learning, and as that is certainly what is typically offered in the foreign language classroom, older children do better than younger children under those circumstances, and adolescents and adults better than children. This "the older the better" phenomenon, documented in a variety of research projects in Spain (García Mayo, 2017; Garcia Mayo & Garcia Lecumberri, 2003; Muñoz, 2006, 2007, 2014), Switzerland (Pfenninger, 2014; Pfenninger & Singleton, 2016), and Germany (Jaekel, Schurig, Florian, & Ritter, 2017), does not contradict the idea of a critical period; it just shows how learning a second language from

a few hours a week in a classroom setting calls on different learning mechanisms compared to implicit learning from massive exposure, and the critical period hypothesis only applies to the latter. The only exception to "the older the better" may be the acquisition of phonology. The critical period for the age effect in phonology often seems to come earlier and be more noticeable in ultimate attainment than is the case for other domains of language (e.g., Abrahamsson & Hyltenstam, 2009). Here early exposure may have an advantage, even in a classroom context (Muñoz, 2006), but of course the painful irony is that grade school foreign language teachers are typically not native speakers, and if there is one thing that native speakers are needed for, it is to provide perfect input for the acquisition of phonology.

In conclusion, then, while age of learning may often be the strongest predictor of ultimate attainment in immigrant contexts, when it comes to foreign language learning, the quality of age-adapted teaching and individual differences in aptitude and motivation are much more important than just starting early.

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