

## **GCRI Interview: Talking about the Bilingual Brain**

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**Q.:** Is there data from functional brain imaging studies indicating that different neural pathways are activated in adults who learned a second language early in life (2L1) compared to those that learned a second language later (L2)?

**Prof. Ullman:** In brief, yes. Quite a few studies by now suggest that people who are early bilinguals, or who learn a second language very early, are more likely than adult learners of a second language to use the same parts of their brains that native speakers use. However, it is often difficult to tease apart age of acquisition and years of exposure. That is, if a 30-year-old early bilingual shows native-language-like (L1) brain patterns, is it because he learned the language at a very young age, or because he has had nearly 30 years of practice with the language? In contrast, a 30-year-old who began learning an L2 at 20 not only learned late, but also has had fewer years of experience. It's very hard – though not impossible – to tease apart the contributions of age of acquisition and years or amount of exposure. (For example, you could compare an early bilingual, at age 30 to people who began learning at 20, at age 50, thus equalizing their years of exposure – 30 in both cases here – but then their chronological ages would be different, which is yet another confound. These are the kinds of problems that make science both hard and fun). In fact, more and more brain imaging evidence suggests that even adult learners of L2 can show native language-like brain patterns with enough exposure to the L2. Interestingly, some evidence suggests that the *type* of exposure also matters, with immersion-like but not classroom-like exposure leading to native language brain patterns.

Finally, is it really advantageous to learn a foreign language with the same brain systems you use for your native language? It's not clear yet, but the answer is probably yes – not only because these brain systems likely confer similar advantages to L2 that we enjoy with native language, but also because of what we know about these brain systems: namely, they appear to be more automatic and rapid and have better retention than the brain systems that L2 learners often depend upon.

In summary, if you want to learn a foreign language with the same brain systems you use for your native language, then younger is better, but more experience is too, and other factors like immersion probably also matter.

**Prof. Meisel:** This is indeed the case. In fact, my research team at the 'Collaborative Research Center on Multilingualism' (Sonderforschungsbereich Mehrsprachigkeit), together with colleagues from the Department of Neurology at the University of Hamburg recently published the results of an fMRI study confirming just this. We compared processing of syntactic

information in French and German among three groups. Group A were native speakers of French (L1) who had learned German as a second language (L2) after the age of 12 years. Group B was comprised of L1 German learners of L2 French. Group C was made up of bilingual (2L1) speakers of French and German who had acquired the two languages at a very early age, i.e. from birth or at least before age three. In both groups A and B, processing the L2, when compared to the respective L1, resulted in higher levels of activation, mainly of the left inferior frontal cortex, whereas early bilinguals showed no activation difference in any of these areas. Moreover, processing of the L2 involved some parts of the brain not typically activated by L1 or 2L1 speakers.

We interpret these findings to indicate that the age of acquisition influences syntactic processing. But this conclusion is a matter of some controversy, and we need more research in order to be able to state with more confidence that the observed differences in brain activation are indeed primarily due to differences in the age of onset of acquisition rather than the level of proficiency attained by these individuals or the length of exposure to the languages. In our own study, we made sure that all participants were highly proficient in both languages. We therefore believe that proficiency cannot explain our findings. But obviously this does not mean that the issue has been settled.

I might add that these results of brain imaging studies correlate with findings by linguistic analyses contrasting L2 with L1 and 2L1. They suggest that a native competence can only be attained if the age of onset happens very early in life. In other words, they support the idea that age of onset plays a crucial role in language acquisition. In my view, this type of interdisciplinary research is particularly promising. If different research questions are pursued in different scientific traditions and applying different research methods but reach identical or similar conclusions, I find this quite convincing.

**Q.:** When children learn a second language at an early age, how important is the human contact element in that learning? Could they learn the second language as well from a video program, computer game or “interactive long-distance” instruction?

**Prof. Meisel:** This is, unfortunately, not a topic which I investigated myself. But I know that studies exist which are currently trying to answer this question. It is of considerable interest to parents, for example in a situation of family bilingualism in an otherwise monolingual environment where additional exposure to the ‘weaker’ language might be helpful for the acquisition process. Another situation of child bilingualism where this has been investigated concerns hearing children of deaf parents. To my knowledge, these studies show that communicative interaction is of prime importance for the success of language development at an early age, i.e. during the first five or six years of life. In other words, if the children are not engaged in interactive exchanges, the effect of these kinds of exposure to the other language, via TV programs, videos, etc., is extremely limited. Note that this refers to cases where these situations constitute a substantial part of the children’s exposure to the language. Whether second language learning, especially in older learners, can be enhanced by this kind of additional input via electronic media is, of course, an entirely different question.