



Cognitive processes in language learning and speech production

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Within Hong Kong and the South East Asian region, the Division of Speech and Hearing Sciences (DSHS), plays a leading role in linguistics research, employing neuroscience methods to understand speech production and problem-related speech pathology. In Hong Kong’s multi-lingual environment – where many speak Cantonese, English and Mandarin – a particular area of study is cognitive differences involved in speaking Mandarin and English. Some thinking suggests that native mono-lingual Mandarin speakers and native monolingual English speakers process language in different ways.

Our research reveals more convergence than divergence, but that the age of acquisition of a second language is significant. The older the person, the more divergence there is, the younger the more convergence. But at any age the language environment – bilingual versus monolingual – is a vital factor. Early bilingualism leads to cognitive advantages over the lifespan. Bilinguals when compared to monolinguals are faster at information processing and

conflict resolution in non-verbal tasks. Incredibly, these effects are already present in bilingual infants.

Monitoring of the brain to see which areas are used in language learning has found that there is a “language muscle” that is exercised more by bilingual speakers. The bilingual experience strengthens the executive control network creating more connections between brain areas of this network.

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Since with learning brain changes occur, if bilingual speakers are using that “muscle” more, there will be a knock-on effect for other learning outcomes.

As well as immediately obvious benefits, bilingualism has other longer – term advantages for healthy ageing. Our laboratory was the first to show that bilingual seniors, aged 50-plus, have more grey matter in the left temporal lobe of the brain. Since the cognitive reserve is greater in bilinguals, it can delay dementia by up to five years.

Our work on cognitive process also has implications for children with reading problems such as dyslexia, maths problems (dyscalculia), and comprehension problems associated with autism and dementia, and we have made important discoveries on exactly how brain damage (aphasia) affects bilingualism.

The field has seen growth worldwide over last 20 years, and has really taken off in the last decade. Centres have been set up in key universities around the world, and the DSHS collaborates with many of them including Cambridge, UCL, Oslo and Penn State.

The most significant research problem we are tackling is to perform cross-linguistic studies comparing linguistically distant languages such as Indo-European languages (Hindi, Persian, Russian) versus Ural-Altaic languages (Turkish), African languages and isolated languages spoken in remote areas of the world (Papua Guinea, Amazonia). Apart from providing us with general rules for the organization of the bilingual brain and the management of bilingual aphasia, such studies may provide a glimpse into the evolution of the human brain and language processing.