



When asked to draw a flower that does not exist, monolingual kids tended to omit flower parts (*left*). Bilinguals often added content, depicting, say, a “camel-flower” (*right*), a hint that their thinking is more sophisticated.

one requiring them to recall and rearrange a series of numbers and the other to retrace a pattern of hops made by an animated frog on a computer screen.

All these cognitive differences imply that learning a second language tweaks the structure of the developing brain. Although standard brain-scanning technology, functional MRI, is not generally recommended for young children, a relatively new noninvasive neuroimaging technique called functional near-infrared spectroscopy now enables scientists to compare the brains of bilingual children with their monolingual peers. So far studies indicate that the language areas of monolingual and bilingual brains develop similarly, but certain regions, such as the inferior frontal cortex, which is involved with both language and thinking skills, appear to be more active in bilingual children, particularly when they are reading.

Researchers say the best way to become proficient in a second language is to start young and practice often. “Language training has to be systematic,” Kovács says. Daily exposure to the second language is ideal, experts note. Children growing up in multilingual environments can reach this level of exposure naturally, but those from monolingual backgrounds may need more intensive instruction. One solution may be immersion schools, which teach some classes in a nonmajority language, such as Spanish or Chinese. Funding and staffing these programs are difficult, but they are becoming more popular in the U.S. and Canada. “Some students come out fluent; others not as much, but the benefits are clear,” Bialystok says. “Everyone should be allowed to be bilingual.” **M**

(Further Reading)

- ◆ **New Discoveries from the Bilingual Brain and Mind across Lifespan: Implications for Education.** Laura-Ann Petitto in *Mind, Brain, and Education*, Vol. 3, No. 4, pages 185–197; 2009.
- ◆ **The Benefits of Multilingualism.** Jared Diamond in *Science*, Vol. 330, pages 332–333; 2010.

Words of Wisdom

By Lauren Migliore

Becoming fluent, or even just reasonably competent, in more than one language not only advances a child’s thinking skills, it also confers cognitive gains in adulthood. In particular, something about being bilingual seems to bolster the brain against mental decline. In 2010 psychologist Ellen Bialystok and her colleagues at York University in Toronto reviewed the mental health and education records, including language training, of 211 patients diagnosed with dementia. They found that as a group, the 102 patients classified as bilingual had been diagnosed 4.3 years later (and reported the onset of symptoms 5.1 years later) than had the 109 monolinguals, despite all of them having roughly equivalent cognitive function and similar occupational demands while they were all healthy. These data, which confirm those from an earlier study, indicate that bilingualism may help delay the onset of dementia.

Knowing a second language somehow seems to moderate the effects of encroaching pathology in the brain. In another study in 2010 Bialystok’s team scanned the brains of 450 monolingual and bilingual patients diagnosed with Alzheimer’s-like dementia for lesions and structural changes. The subjects all displayed a similar degree of cognitive function, but the bilingual subjects’ brains showed more atrophy and damage in regions involved in long-term memory, language recognition and auditory perception. Bialystok hypothesizes that by virtue of being bilingual, the patients can somehow compensate for the greater structural damage.

Speaking more than two languages may offer an even better defense. In 2011 researcher Magali Perquin of the Public Research Center for Health in Luxembourg and her colleagues reported evaluating the neuropsychological health of 230 elderly men and women who spoke two to seven languages. They found that the people who spoke three or more languages were one quarter as likely to be mentally impaired than those who spoke just two. That greater amounts of language learning seem to offer stronger protection buttresses the contention that this training is constructing some kind of cognitive shield.

Such findings fit with the more established idea that learning and education thwart intellectual decline by building up the brain’s overall capacity for thought—its so-called cognitive reserve. In particular, psychologist César Ávila Rivera and his colleagues at Jaume I University of Castellón in Spain reported in 2010 that bilingual adults are quicker and more efficient at certain tasks involving the use of skills known as executive functions, such as planning and problem solving. Of course, a person’s mental capacity can influence his or her ability to learn a new language, raising the possibility that the bilingual speakers had better cognition to begin with. But other work has indicated that learning a second language can promote beneficial brain changes. For example, it can boost the neuronal cell density in certain areas important for cognitive functioning. And research underscoring the cognitive advantages of growing up bilingual [see *accompanying article*] reinforces the notion that something about learning to say *oui*, *sí* or *hai* helps to shore up the thinking parts of your brain.

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