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The Consequences of Bilingualism for the Mind and the Brain

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Until recently, research on language processing and its cognitive basis assumed that monolingual speakers were the model subjects of study and that English provided an adequate basis on which universal principles might be generalized. In this view, bilinguals were considered a special group of language users, much like brain-damaged patients, children with language disorders, or deaf individuals who use a signed language to communicate. Each of these special groups held genuine interest for the field, but their performance was not taken to provide primary evidence for the purpose of adjudicating the classic debates about the representation of language in the mind and brain. In the past two decades, this situation has changed with the realization that bilingualism is not an exceptional feature of a small group of language users but a common state of affairs in many places in the world.

The rapid increase in research on bilingualism has spawned all of the usual academic conferences and professional journals. But more critically, it has enabled the insight that bilinguals provide a unique lens for cognitive scientists, neuroscientists, and clinicians who seek to understand the trajectory of cognitive and language development, its basis in the brain, and the nature of disorders that may be manifest when more than a single language is engaged. The article by Bialystok, Craik, Green, and Gollan that appears in this issue of *Psychological Science in the Public Interest* provides an outstanding summary of these recent developments on bilingualism and its consequences. Bialystok et al. demonstrate that, contrary to the earlier view that bilingualism is a special case, the acquisition and use of multiple languages reveal new discoveries about the mind and the brain that would not be possible from studies focused only on monolingual use of the native language.

What lessons can we take from Bialystok et al.'s review of this emerging area of research? The message that is perhaps most relevant to the goal of placing psychological science in the public domain is that bilingualism is a good thing. Contrary to the view that young children will be confused by exposure to more than one language and harmed by delays in development, the research to date demonstrates that exposure to two languages from birth enables children to recognize and distinguish speech in both languages. The course of development for bilingual-learning children may differ in subtle ways from that of monolingual children, but bilingual children are not harmed by the multiple exposure. To the contrary, the past 20 years of research suggests that by the time bilingual children are 3 or 4 years old, not only have they acquired the ability to recognize speech in two languages but their cognitive development is also advantaged relative to their monolingual counterparts. Bialystok herself has been a pioneer in demonstrating that bilingualism confers positive consequences to young children in the domain of executive function and attentional control. Bilingualism appears to play a significant role in enhancing young children's ability to ignore irrelevant information, reducing the competition that is imposed by cognitive conflict, and enabling an understanding of the arbitrariness of the way words are mapped to concepts.

More recently, Bialystok and Craik together have extended this research program to show that the bilingual advantage extends into old age. Cognitive aging affects the same executive functions that the earlier research on children had shown were affected by bilingualism. It was therefore a reasonable conjecture that bilingualism might also benefit the elderly at a time in life when cognitive resources decline. These studies provide dramatic evidence that life as a bilingual provides protection against the typical cognitive declines observed in old age. Bilingualism is not an antidote to cognitive aging, so you might read this issue of *Psychological Science in the Public Interest* fully before you rush off to Spanish class! But in precisely those domains that are vulnerable to aging, bilingualism appears to modulate the rate of cognitive decline. Performance on tasks that are purely cognitive, with little explicit linguistic content, is superior for older bilinguals than it is for older monolinguals.

The skeptics among you might wonder if bilinguals are advantaged for some other reason. Perhaps bilingual children

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have been nurtured in a richer environment, or elderly bilinguals have been better educated. If conclusions were drawn from a small set of studies, it might be possible to maintain healthy skepticism about the bilingual advantage. But strikingly, there is now persuasive evidence supporting the claim of a bilingual advantage that generalizes across different languages and cultural contexts. For the research on the elderly in particular, it would seem difficult to access precisely how actively each language has been maintained over the course of an individual's entire life. This makes the persistence of the observed advantages all the more impressive because it suggests that, if anything, studies are likely to underestimate the actual magnitude of the consequences of bilingualism.

But is bilingualism solely an advantage, or are there downsides as well? Bialystok et al. discuss the disadvantages that have been observed for bilinguals in the realm of the size of vocabulary knowledge and in the speed of lexical access. And it is here where there is finally a clue as to what might be the source of bilinguals' enhanced inhibitory control. Coauthors Green and Gollan have each made important contributions to the recent literature on bilingualism in studies of how bilinguals select the language they intend to speak and how the control processes that enable that selection process might be represented in the mind and the brain. A persistent finding in the recent work on the comprehension and production of words and sentences in each of a bilingual's two languages is that both languages are active even when the bilingual intends to use only one of the languages. If bilinguals cannot intentionally switch off one language when they intend to use the other, there is a constant demand to select among competing alternatives. Cross-language competition may impose the requirement for bilinguals to learn to reduce that competition by effecting control over the selection process. It may also have the consequence of making language processing a bit slower or apparently less efficient at times relative to the same process when only a single language is available.

The positive consequence of the hypothesized need for control is that bilinguals become mental jugglers with extensive expertise in precisely those tasks that create a finely tuned advantage in executive function. Bialystok et al. review the support for this idea from recent neuroimaging studies that demonstrate brain activity that appears to engage those structures thought to be responsible for control functions. Although it is certainly true that individuals may acquire expertise in a variety of skill domains, it is difficult to imagine a skill that is used more frequently than language. In this account, successful bilingual language processing is hypothesized to demand a very high level of skill in inhibitory control that then spills over from language itself to cognition more generally.

There is much more to be learned about the causal mechanisms that are responsible for the observed effects of bilingualism. The evidence on the relation between bilingual language processing and cognition is largely correlational, and understanding specifically which aspects of language experience produce the reported cognitive consequences will be a high priority in the agenda for the next phase of research. Likewise, as is clear from the section of the article that addresses clinical issues, there is a critical need to have an account of typical bilingual language development that will provide sufficient detail to permit the construction of assessment tools that differentiate the performance of ordinary bilingual performance from disordered performance. There are important considerations for clinical practice in addition to theoretical implications for models of language representation and processing.

The scholarly and engaging article that Bialystok and colleagues have written provides a comprehensive summary of what is known to date and challenges the field to recognize that bilingualism is here to stay—as a universal reflection of human experience and as a powerful tool for investigating language and cognition.