



Discussion forum

Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances



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ARTICLE INFO

Article history:

Received 1 March 2015

Reviewed 1 April 2015

Revised 19 April 2015

Accepted 22 April 2015

Published online 7 May 2015

ABSTRACT

The hypothesis that managing two languages enhances general executive functioning is examined. More than 80% of the tests for bilingual advantages conducted after 2011 yield null results and those resulting in significant bilingual advantages tend to have small sample sizes. Some published studies reporting significant bilingual advantages arguably produce no group differences if more appropriate tests of the critical interaction or more appropriate baselines are used. Some positive findings are likely to have been caused by failures to match on demographic factors and others have yielded significant differences only with a questionable use of the analysis-of-covariance to “control” for these factors. Although direct replications are under-utilized, when they are, the results of seminal studies cannot be reproduced. Furthermore, most studies testing for bilingual advantages use measures and tasks that do not have demonstrated convergent validity and any significant differences in performance may reflect task-specific mechanism and not domain-free executive functions (EF) abilities. Brain imaging studies have made only a modest contribution to evaluating the bilingual-advantage hypothesis, principally because the neural differences do not align with the behavioral differences and also because the neural measures are often ambiguous with respect to whether greater magnitudes should cause increases or decreases in performance. The cumulative effect of confirmation biases and common research practices has either created a belief in a phenomenon that does not exist or has inflated the frequency and effect size of a genuine phenomenon that is likely to emerge only infrequently and in restricted and undetermined circumstances.

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<http://dx.doi.org/10.1016/j.cortex.2015.04.014>

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1. Introduction

Parents, educators, cognitive scientists, and bilinguals themselves have taken a keen interest in the consequences of bilingualism for language skills, cognitive abilities, and general quality of life. All things considered, we wish to make clear at the onset that we believe that the advantages of bilingualism across a host of personal, economic, social, and cultural dimensions overwhelmingly preponderate any disadvantages. This article examines a much narrower question: Does bilingualism enhance executive functioning as reflected in performance advantages in nonverbal tasks? Executive functions (EF) consist of a set of general-purpose control processes that are central to the self-regulation of thoughts and behaviors and that are instrumental to accomplishing goals. For purposes of exposition and organization the theoretical framework developed by Miyake and Friedman (2012) is adopted. Miyake and Friedman reported evidence for three components of EF: updating, shifting (or switching), and inhibiting with the caveat that inhibition may not be separable from updating and switching.

There is a widely held view that bilinguals enjoy an advantage over monolinguals in EF. Bialystok (2011) stated that “Studies have shown that bilingual individuals consistently [emphasis added] outperform their monolingual counterparts on tasks involving executive control” p. 229. In a follow-up review it was reported that “... bilinguals at all ages [emphasis added] demonstrate better executive control than monolinguals matched in age and other background factors” (Bialystok, Craik, & Luk, 2012, p. 212). Similarly, Kroll and Bialystok (2013) observed that “... studies of executive function demonstrate a bilingual advantage, with bilinguals outperforming their monolingual counterparts on tasks that required ignoring irrelevant information, task switching, and resolving conflict [emphasis added]” (p. 2). Mercier, Pivneva, and Titone (2014) state that “... bilinguals are advantaged relative to monolinguals in non-linguistic cognitive control... over the life-span during normal aging... and pathological aging” p. 90.

In contrast, based on the evidence discussed in this target article we conclude that either bilingualism does not enhance EF in any circumstance or only in very specific, but undetermined, circumstances. Some readers may find it surprising that after more than a decade of intense study the question of whether bilingualism enhances general EF is still controversial. One might hope that this forum will contribute to the attenuation of that controversy by finding more common ground with regard to a host of methodological problems that plague this research topic (and many others in psychological science).

2. The published database is biased

Biases in decision making on the part of researchers, reviewers, and editors lead to a published database that is not representative of all studies. Rosenthal (1979) coined the phrase “file drawer problem” to describe the strong tendency of researchers to set aside experiments with null results rather than submit them for publication. When researchers do

resist the temptation to place their null results in a file drawer they do so with the understanding that publishing null results, particularly ones that counter earlier published findings, will be difficult. Reviewers and editors are well trained to respond favorably to results that are significant, novel, counterintuitive, and newsworthy, but not if the novelty takes the form of a failure to replicate an “established” finding. In these cases, reviewers and editors may remind themselves that null results could be Type 2 errors or the product of poor methodology. Mahoney (1977) showed that experienced reviewers for a psychology journal (who believed they were providing real reviews) were biased in favor of positive results over mixed, negative, or null results.

The field of bilingualism is not immune to these biases. de Bruin, Treccani, and Della Sala (2015) provided evidence that the combined effects of researchers deciding what to submit and editors deciding which articles to publish were leading to a bias favoring studies with bilingual advantages over those reporting null and negative results. The primary evidence stemmed from examining the fate of 104 conference abstracts presented at 52 different national and international conferences. Fifty-two were eventually published in a scientific journal. Studies with results fully supporting the hypothesis that there are bilingual advantages in EF were most likely to be published (68%), followed by studies with mixed results, and those clearly challenging the hypothesis were published the least (29%).

De Bruin et al. also report the results of a meta-analysis on the set of the published articles. The average weighted difference was $d = +.30$ and following Cohen's (1992) guidelines this is a small effect. However, any biases against null or negative effects will have inflated the true effect size and it is clearly smaller by an unknown amount. The funnel plot reported in de Bruin et al. shows several extreme scores with low precision and they are all positive effects. The asymmetry is very much expected for this meta-analysis because we already know that there were many abstracts with null or negative findings that were never published. De Bruin et al. note that the amount of bias favoring bilingual advantages in the total set of 104 abstracts is only the tip of the iceberg as it is reasonable to assume that additional researchers with null and negative results decided not to submit them for presentation at a major conference. If those triaged to the file drawer before submission to a conference could be added to the unpublished conference abstracts, they could cancel out the small effect size found in the meta-analysis of those conference abstracts that were eventually published. In the next section we present the case that the true effect size may, indeed, be zero.

3. The posited case that bilingual advantages in EF do not exist

Several lines of evidence converge on the strong possibility that managing two languages does not enhance general EF despite the many published results showing that bilinguals significantly outperform monolinguals on tasks assumed to measure EF. To logically challenge the thesis of bilingual advantages in EF one must propose that either the reported

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