Cognitive Consequences of Bilingualism

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Research has overwhelmingly shown that when a bilingual person uses one language, the other is active at the same time. When a person hears a word, he or she doesn't hear the entire word all at once: the sounds arrive in sequential order. Long before the word is finished, the brain's language system begins to guess what that word might be by activating lots of words that match the signal. If you hear "can," you will likely activate words like "candy" and "candle" as well, at least during the earlier stages of word recognition. For bilingual people, this activation is not limited to a single language; auditory input activates corresponding words regardless of the language to which they belong.

Some of the most compelling evidence for language co-activation comes from studying eye movements. We tend to look at things that we are thinking, talking, or hearing about. A Russian-English bilingual person asked to "pick up a marker" from a set of objects would look more at a stamp than someone who doesn't know Russian, because the Russian word for "stamp," "marka," sounds like the English word he or she heard, "marker." In cases like this,

language co-activation occurs because what the listener hears could map onto words in either language. Furthermore, language co-activation is so automatic that people consider words in both languages even without overt similarity. For example, when Chinese-English bilingual people judge how alike two English words are in meaning, their brain responses are affected by whether or not the Chinese translations of those words are written similarly. Even though the task does not require the bilingual people to engage their Chinese, they do so anyway.

Having to deal with this persistent linguistic competition can result in language difficulties. For instance, knowing more than one language can cause speakers to name pictures more slowly and can increase tip-of-the-tongue states (where you're unable to fully conjure a word, but can remember specific details about it, like what letter it starts with). As a result, the constant juggling of two languages creates a need to control how much a person accesses a language at any given time. From a communicative standpoint, this is an important skill—understanding a message in one language can be difficult if your other language always interferes. Likewise, if a bilingual person frequently switches between languages when speaking, it can confuse the listener, especially if that listener knows only one of the speaker's languages.

To maintain the relative balance between two languages, the bilingual brain relies on executive functions, a regulatory system of general cognitive abilities that includes processes such as attention and inhibition. Because both of a bilingual person's language systems are always active and competing, that person uses these control mechanisms every time she or he speaks or listens. This constant practice strengthens the control mechanisms and changes the associated brain regions.

Bilingual people often perform better on tasks that require conflict management. In the

classic Stroop task, people see a word and are asked to name the color of the word's font. When the color and the word match (i.e., the word "red" printed in red), people correctly name the color more quickly than when the color and the word don't match (i.e., the word "red" printed in blue). This occurs because the word itself ("red") and its font color (blue) conflict. The cognitive system must employ additional resources to ignore the irrelevant word and focus on the relevant color. The ability to ignore competing perceptual information and focus on the relevant aspects of the input is called inhibitory control. Bilingual people often perform better than monolingual people at tasks that tap into inhibitory control ability. Bilingual people are also better than monolingual people at switching between two tasks; for example, when bilinguals have to switch from categorizing objects by color (red or green) to categorizing them by shape (circle or triangle), they do so more rapidly than monolingual people, reflecting better cognitive control when changing strategies on the fly.

Changes in Neurological Processing and Structure

Studies suggest that bilingual advantages in executive function are not limited to the brain's language networks. Researchers have used brain imaging techniques like functional magnetic resonance imaging (fMRI) to investigate which brain regions are active when bilingual people perform tasks in which they are forced to alternate between their two languages. For instance, when bilingual people have to switch between naming pictures in Spanish and naming them in English, they show increased activation in the dorsolateral prefrontal cortex (DLPFC), a brain region associated with cognitive skills like attention and inhibition. Along with the DLPFC, language switching has been found to involve such structures as the anterior cingulate cortex (ACC), bilateral supermarginal gyri, and left inferior frontal gyrus (left-IFG), regions that are also involved in cognitive control. The left-IFG in particular, often considered the language production center of the brain, appears to be involved in both linguistic and non-linguistic cognitive control.

The neurological roots of the bilingual advantage extend to subcortical brain areas more traditionally associated with sensory processing. When monolingual and bilingual adolescents listen to simple speech sounds (e.g., the syllable "da") without any intervening background noise, they show highly similar brain stem responses to the auditory information. When researchers play the same sound to both groups in the presence of background noise, the bilingual listeners' neural response is considerably larger, reflecting better encoding of the sound's fundamental frequency, a feature of sound closely related to pitch perception. To put it another way, in bilingual people, blood flow (a marker for neuronal activity) is greater in the brain stem in response to the sound. Intriguingly, this boost in sound encoding appears to be related to advantages in auditory attention. The cognitive control required to manage multiple languages appears to have broad effects on neurological function, fine-tuning both cognitive control mechanisms and sensory processes.

Beyond differences in neuronal activation, bilingualism seems to affect the brain's structure as well. Higher proficiency in a second language, as well as earlier acquisition of that language, correlates with higher gray matter volume in the left inferior parietal cortex. Researchers have associated damage to this area with uncontrolled language switching, suggesting that it may play an important role in managing the balance between two languages. Likewise, researchers have found white matter volume changes in bilingual children and older adults. It appears that bilingual experience not only changes the way neurological structures process information, but also may alter the neurological structures themselves.

Improvements in Learning

Being bilingual can have tangible practical benefits. The improvements in cognitive and sensory processing driven by bilingual experience may help a bilingual person to better process information in the environment, leading to a clearer signal for learning. This kind of improved attention to detail may help explain why bilingual adults learn a third language better than monolingual adults learn a second language. The bilingual language-learning advantage may be rooted in the ability to focus on information about the new language while reducing interference from the languages they already know. This ability would allow bilingual people to more easily access newly learned words, leading to larger gains in vocabulary than those experienced by monolingual people who aren't as skilled at inhibiting competing information.

Furthermore, the benefits associated with bilingual experience seem to start quite early—researchers have shown bilingualism to positively influence attention and conflict management in infants as young as seven months. In one study, researchers taught babies growing up in monolingual or bilingual homes that when they heard a tinkling sound, a puppet appeared on one side of a screen. Halfway through the study, the puppet began appearing on the opposite side of the screen. In order to get a reward, the infants had to adjust the rule they'd learned; only the bilingual babies were able to successfully learn the new rule. This suggests that even for very young children, navigating a multilingual environment imparts advantages that transfer beyond language.

Protecting Against Age-Related Decline

The cognitive and neurological benefits of bilingualism also extend into older adulthood. Bilingualism appears to provide a means of fending off a natural decline of cognitive function and maintaining what is called "cognitive reserve." Cognitive reserve refers to the efficient utilization of brain networks to enhance brain function during aging. Bilingual experience may contribute to this reserve by keeping the cognitive mechanisms sharp and helping to recruit alternate brain networks to compensate for those that become damaged during aging. Older bilingual people enjoy improved memory and executive control relative to older monolingual people, which can lead to real-world health benefits.

In addition to staving off the decline that often comes with aging, bilingualism can also protect against illnesses that hasten this decline, like Alzheimer's disease. In a study of more than 200 bilingual and monolingual patients with Alzheimer's disease, bilingual patients reported showing initial symptoms of the disease at about 77.7 years of age—5.1 years later than the monolingual average of 72.6. Likewise, bilingual patients were diagnosed 4.3 years later than the monolingual patients (80.8 years of age and 76.5 years of age, respectively). In a follow-up study, researchers compared the brains of bilingual and monolingual patients matched on the severity of Alzheimer's symptoms. Surprisingly, the brains of bilingual people showed a significantly higher degree of physical atrophy in regions commonly associated with Alzheimer's disease. In other words, the bilingual people had more physical signs of disease than their monolingual counterparts, yet performed on par behaviorally, even though their degree of brain atrophy suggested that their symptoms should be much worse. If the brain is an engine, bilingualism may help to improve its mileage, allowing it to go farther on the same amount of fuel.

Cognitive Benefits from Bilingualism and Second Language Study

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Many university students tend to think of foreign language study as little more than a difficult subject that they probably will not use in their future careers. Indeed, foreign language courses can be very difficult and students often quickly forget much of what they have studied. For these students, foreign language study is challenging and discouraging. Some of our students know that foreign language learning can be an important skill that they may need in their future work, especially the learning of English language. They may also realize that many future employers may assess foreign language ability when considering who they will hire. Sadly, students are very often unaware of the numerous cognitive benefits and academic benefits of foreign language learning. During the past three decades research has revealed that learning a foreign language can result in enhanced memory and thinking skills, increased attentional control, and may even increase and extend cognitive function throughout one' s life. Here, the general research findings of the cognitive benefits of foreign language study will be reviewed.

Bilingualism is everywhere

It is not a monolingual world. More than half of the world' s population can speak in more than language. Sources have reported that 66% of children live in bilingual homes and know at least two languages(1,2,3). Most educated persons can be expected to understand some rudimentary vocabulary and knowledge useful phrases from one or more languages. Other professionals may require a functional knowledge of several languages. Certainly, if you plan on an academic career or if you wish to travel internationally, you may want to be fluent in English. However, beyond these well known social benefits of being bilingual there are some important cognitive benefits to acquiring a second or third language.

Cognitive Enhancement

It turns out that bilingual persons have enhanced executive working memory functioning when compared with people who only know one language. This means that bilinguals tend to out -perform monolinguals on some cognitive tests requiring attentional control, such as the Stroop Test. Bilinguals also out -perform monolinguals on task switching and on multiple tasks. These findings indicate that bilinguals have enhanced cognitive control and cognitive flexibility which in turn is associated with enhanced learning capacity (13,15,16,17). Bilinguals also exhibit an enhanced selective listening capacity. Research using fMRI have found that bilinguals have larger neural responses than people

who have only one language. Not surprisingly, bilinguals often learn additional languages and other information faster than monolinguals.

Students who study a second language also tend to tend better cognitive performance than those who do not study foreign language(5,6,7,9,10,11,13,16,17,18). Students who do study a foreign language have higher scores on standardized tests. There is also positive relationship between bilingualism and intelligence. There is a correlation between high school foreign language study and higher academic performance at the college level. Learning a foreign language increases the student' s linguistic awareness. Research suggests that language learners develop a more positive attitude toward the target language and to speakers of that language. There is a correlation between bilingualism and attentional control on cognitive tasks, and on general memory skills. Bilingual students have better verbal and spatial abilities and better problem solving abilities.

What is so special about becoming bilingual that would produce these cognitive benefits? The answer is that when a when a monolingual is using her language she activates related words, so the person uses mental effort to select the word needed and to suppress other word candidates. In the case of the bilingual, she is using one of her languages, but research has found that both languages are activated in the brain, so the bilingual needs to have much more control of her two

lexicons. Thus, the bilingual develops a higher level of attentional control and other types of cognitive control(9,10,11,12,15). Over a lifetime, the bilingual individual not only develops a higher level of attentional control(26), but also additional cognitive capacities, such as cognitive reserve(26,27,28, 31).

Cognitive Reserve

There are some terrible diseases which destroy the patient' s brain tissue and eventually results in death. Two of the most well-known are Alzheimer disease and multiple sclerosis (MS). In both of these conditions there is loss of brain matter and a loss of cognitive functioning. However, there are some individuals keep much of their cognitive abilities longer than other patients with the same level of brain loss. The ability to continue normal functioning, or to have less impaired function, even as disease is damaging their brain is referred to as "cognitive reserve." Interestingly, patients who exhibit cognitive reserve tend to be highly educated individuals or they are bilinguals(18,19,20,21,31). In one Alzheimer disease study which compared bilingual and monolingual patients found that bi-lingual patients reported symptoms of the disease 5 years later than the monolingual patients. Post-mortem examination revealed that the bilingual patients had significantly more brain atrophy, but had functioned at a higher level than the monolingual patients.(21)

It has been established that adult second language acquisition can bring to the adult learner some of the

cognitive enhancements that younger bi-linguals experience; that is, foreign language acquisition even at relatively older ages results in improved attention, memory and other executive functioning. It is, therefore, reasonable to advocate for lifelong bilingual language acquisition, and to encourage lifelong bilingual capability.

Bilingualism and the Development of Executive Function: The Role of Attention

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Until about 50 years ago, popular belief and "scientific evidence" converged on the conclusion that exposing children to more than one language was a potentially dangerous experience. The expectation was that children would display "mental confusion" (1) and show signs of "mental retardation" (2). This view was eventually challenged by a study by Peal and Lambert (3) in which monolingual French and bilingual French-English children completed a battery of tests. The researchers predicted that monolingual and bilingual children would be equivalent on measures of nonverbal intelligence but that bilinguals would obtain lower scores on verbal measures. To their surprise, bilingual children outperformed their monolingual peers on essentially all of the tests, including nonverbal intelligence. In contrast to the earlier descriptions, therefore, Peal and Lambert argued that bilingual children showed enhanced "mental flexibility", perhaps as a consequence of having to switch between languages. Thus was born the idea of a "bilingual advantage" and an active area of research investigating its qualitative nature, its limiting boundaries, and its possible causes soon followed.

A large body of research has now documented benefits of bilingualism for children's cognitive development, although some studies do not find such outcomes (4). These contradictory results may be due to such factors as differences in populations, criteria for bilingualism, or experimental tasks (see 5 for discussion); in fact, a range of outcomes is not surprising given the enormous variation across the studies and across bilingual experiences. A complete understanding of the effect of bilingualism on development, therefore, requires

clarifying the conditions necessary for these effects to emerge and a more precise conception of the possible mechanisms that enable them.

Bilingual Effects on Cognitive Development

There is substantial evidence that the language environment that children experience influences the quality of the cognitive systems they develop (6), so it should not be surprising that bilingualism is an important factor in developmental outcomes. The earliest systematic evidence for a beneficial effect of bilingualism came from studies of children's metalinguistic awareness (7). Bilingual children generally outperformed monolinguals on tasks assessing their understanding of abstract language structure, but the implications of these findings became apparent when it was found that these metalinguistic advantages were largely confined to tasks that included conflict and required control to manage that conflict (8). Hence, the reported bilingual advantage in metalinguistic ability was less about language processing and more about cognitive ability.

The shift from an interest in examining the effect of bilingualism on language-related outcomes to its effect on cognition led to a body of research documenting tasks in which bilingual children outperformed their monolingual peers (review in 9, meta-analysis in 10). Most of the tasks in which bilingual advantages are found are considered to be indicators of executive function (but see discussion below). The usual explanation is that both languages are always active in bilinguals, so the domain-general executive function system is incorporated into language processing to direct attention to the target language and in so doing becomes reorganized, fortified, or both (11). Thus, bilingualism "trains" executive function through its constant recruitment for language selection. An enhancement of executive function is not trivial: executive function is a major predictor of academic success (12) and academic success predicts long term health and well-being (13).

One well-accepted view of executive function is the tripartite model proposed by Miyake and colleagues consisting of inhibition, updating (working memory), and shifting (14, 15). Following this model, if executive function is involved in language processing for bilinguals, then it would be important to identify the precise component that is involved and possibly boosted through this experience. Several researchers have proposed candidates for this effect, with the most common suggestion being inhibition on the assumption that the non-target language is suppressed to avoid interference. However, clear evidence endorsing any one of these components, including inhibition, has not emerged (16). Tasks (e.g., flanker task) and conditions (e.g., incongruent trials) that clearly require inhibition are indeed performed better by bilinguals than monolinguals, but this is often in the context of similar bilingual advantages on other tasks or conditions for which no inhibition is required (e.g., congruent trials) (17) or bilingual advantages in some types of inhibition but not others (e.g., response inhibition versus interference suppression) (18). Thus, there is little evidence for the specificity of bilingual effects on inhibition. What has been reported instead is a wide range of tasks on which bilingual children typically (but not always) outperform monolinguals.

Identifying the Source of Bilingual Advantage

In an attempt to identify the components of executive function affected by bilingualism, several studies have used a version of the flanker task, with the most frequent choice being the children's Attentional Network Task (19). In this task, children see a line of five fish in which the central fish is designated as the target and the four flanking fish point in either the same (congruent trials) or opposite (incongruent trials) direction. Children are required to "feed" the target fish by indicating the direction it is facing with a keypress. Studies generally report faster or more accurate performance by bilingual children (20). However, as in the adult literature, the bilingual advantages in this task are typically found on both congruent and incongruent trials (21) even though no explicit inhibition is required on congruent trials since no misleading information is presented.

Instead of inhibition, therefore, some researchers have proposed that the source of the bilingual advantage is in monitoring (22, 16), a concept similar to shifting in Miyake's model but broader than any individual component. In some sense, inhibition is included in monitoring; as one shifts across options, the irrelevant cue or response must be suppressed. One task that incorporates both inhibition and monitoring is the dimension change card sort task (DCCS; 23). A set of cards depicting bivalent stimuli (e.g., colored shapes) needs to be sorted first by one dimension (color) then re-sorted by the other (shape). Young children find this difficult and fail to reclassify the stimuli in the second sorting round. Successful performance requires that children ignore the previous dimension (inhibition) and shift attention to the newly relevant dimension (monitoring). In several studies, bilingual children have been more successful than their monolingual age-mates on this task (24, 25), extending bilingual advantages to multiple components of executive function.

Monitoring also includes the notion of working memory in that successful monitoring requires holding a rule in mind over a set of procedures. Studies assessing possible working memory differences in monolingual and bilingual children have produced mixed results, with some showing no difference between groups (26) and others showing better performance by bilinguals (27). In the adult literature, language group differences in working memory are also inconsistent, although bilingual advantages are more likely to be found when the working memory task is based on nonverbal materials than verbal stimuli (28). Thus, under some conditions working memory is also improved by bilingualism.

These studies investigating bilingual advantages in inhibition, monitoring, and working memory tend to use simple tasks based on specific aspects of processing, in part because the goal is to identify one component of executive function as uniquely responsible for developmental differences in bilingual children. Using this approach, no single component has emerged as decisive. However, another group of studies has taken a broader approach and used tasks that incorporate more integrated reasoning ability. These tasks are difficult to categorize in terms of individual executive function components although they certainly require executive functioning for their solution. The general result is that tasks that are effortful and include perceptually conflicting information are performed better by bilinguals.

One set of studies in this category is investigations of theory of mind. There is considerable debate about the correct interpretation of theory of mind and the role of language proficiency,

social awareness, and other factors in its development, but many accounts highlight the central role of executive functions in performing these complex tasks (29 but see 30 for a different view). The tasks are perceptually misleading as well; the appearancereality task deliberately distorts the identity of an object by making it look like something else and the false belief task alters the function of a known visual target in a brief narrative. But theoretical debate aside, there is an established set of tasks that most researchers agree assess this complex ability. Research comparing performance of monolingual and bilingual children has generally reported better performance by bilinguals (31, 32). Interestingly, an adult adaptation of a false belief task that used eye-tracking methodology showed that bilingual adults looked less at the incorrect option than monolinguals, paralleling error performance in children (33). To the extent that executive function is involved in theory of mind performance, its definition must be based on a more holistic conception than is conveyed by the components inhibition, shifting, and working memory as none of these individual components is obviously primary.

Other conceptually complex visual tasks such as creating novel drawings (34), resolving the dual representation in ambiguous figures (35, 36), and calculating visual perspective (37) have all been shown to be performed better by bilingual children than by their monolingual peers. Although these tasks involve some form of monitoring and inhibiting, they are not traditionally considered to be tests of executive function. Both the lack of consensus for the responsibility of a single executive function component and evidence for bilingual advantages in tasks that are more integrative leave unsolved the precise link between bilingual experience and the reported cognitive advantages.

Connection to Language Use

The assumption in the adult literature is that the bilingual advantage in nonverbal executive functioning can be traced to the use of that system to resolve conflict from jointly-activated languages, making it more efficient across a range of tasks. Support for the claim of joint language activation comes from behavioral (38), eye-tracking (39), ERP (40), and fMRI studies (41). There are two implications of the view that this management of language conflict is the primary mechanism for the bilingual effects on cognition.

The first implication follows from the interpretation that these effects are essentially caused by experience-dependent training and so requires evidence that the advantage increases with more bilingual experience. In a recent study, monolingual participants who undertook a yearlong university-level course in either Introductory Spanish or Introductory Psychology were tested before and after the course on executive function tasks with ERP recordings (42). One task was a nonverbal go-nogo task for which two previous studies have shown ERP waveform differences between monolinguals and bilinguals (but no behavioral differences), with bilingual electrophysiology consistent with better performance (43, 44). In the first session, all participants were equivalent on this measure, but in the second session, the ERP results for participants in the Spanish group significantly shifted towards those reported for bilinguals in the previous studies. Thus, even a small amount of experience learning a second language produced changes in these fundamental processes even in the absence of behavioral differences.

A relation between outcomes and degree of bilingual experience was also found in a study with children. Bialystok and Barac (45) reported two studies of children who were learning a second language through immersion education. None of the children was fully bilingual but they had spent different lengths of time in the program and achieved different levels of proficiency in the second language. Using regression analysis to relate background and learning variables to outcomes, both studies showed that language proficiency predicted performance on metalinguistic tasks, but the length of time spent in the immersion program predicted performance on nonverbal executive function tasks. Thus, for both adults and children, the bilingual advantage in nonverbal executive function emerges with more bilingual experience.

The second implication is that if bilingual advantages depend on managing linguistic conflict, then performance differences between monolinguals and bilinguals should not be found until the individual has built up adequate linguistic representations to create competition between them and sufficient experience in managing them to affect the developing executive function system. The youngest children in the early studies reporting bilingual advantages were 3½- or 4-years old (e.g., studies on theory of mind or DCCS). By this age, children are reasonably verbal, and bilingual children can communicate effectively in both languages. But would bilingual advantages be found in younger children? The first study to investigate this question examined children from 29- to 60-months old performing a number of simple tasks that involved different aspects of control (46), such as a tapping task (if the experimenter taps once, the child taps twice) and reverse categorization (put big animals in the bucket marked baby and little animals in the bucket marked mommy). Even at the youngest age, bilingual children outperformed monolingual children on most tasks.

More dramatic, however, is evidence that differences in performance as a function of language environment can be found in the first year of life. Kovacs and Mehler (47) recorded anticipatory eye movements to a reward that appeared on one side of a display following an auditory cue in 7-month old children who were being raised in monolingual or bilingual homes. After a learning set, the position of the reward changed, so infants needed to override their learned response and look to the opposite side. Only bilingual infants could achieve this; monolingual infants continued to execute the habitual response even though no reward was present. In another study, Singh and colleagues (48) studied habituation and concept formation in 6-month old infants and reported that infants being raised in bilingual homes performed better than monolingual infants on measures of stimulus encoding and recognition. In terms of executive function, the bilingual infants in these studies showed more flexibility and perhaps more inhibitory control over a simple behavior. There is no doubt that managing the conflict from jointly-activated languages is a crucial part of the explanation, but evidence from preverbal infants shows that such conflict management alone is inadequate to explain the emergence of nonverbal executive function differences between monolinguals and bilinguals in early childhood.

If not Language, then What?

It is clear that competition between languages is crucial for the emergence of bilingual advantages in executive function, but two factors challenge that view as the exclusive

mechanism. First, monolingual adults routinely experience conflict from competing representations, even linguistic ones (e.g., “cup” vs. “mug”) but these conflicts are not considered to enhance executive functioning. Second, infants have only rudimentary representations of language yet differences between monolingual and bilingual infants are apparent by 7 months. What could be the trigger for the processing differences that lead to enhanced executive function in bilinguals, including infants?

One possibility comes from studies of infants processing a stimulus that is very salient in their environments: talking faces. In two studies, Werker and colleagues (49, 50) presented infants with a silent video of a face that was reading sentences in one language and after infants habituated, switched to a different language and continued reading. The question was whether infants could detect the language change from visual cues alone as evidenced by regained interest in the video. In both studies, the bilingual infants noticed the language switch but monolingual infants did not. This was the case both when the two languages were the same as those in the infants’ environment (50) and when they were completely different from those heard by the bilingual infants (49). Whatever infants were using to make this discrimination was more general than the facial features associated with known languages.

The possibility raised by these studies is that bilingual experience changes the way that attention is directed to the environment. For the infant, the presence of two languages that introduces two sets of sounds, cadences, structures, speakers, and facial configurations draws attention to the contrasts between the systems. Contrasts create novelty, thus attracting more attention and possibly more intense processing than similarity. Thus, bilingual babies may simply attend more carefully to subtle environmental differences. If so, these strategies both improve attentional processing and lead to the creation of more complex representational structure that includes two languages. Once two representational structures are established, the executive function is recruited to maintain attention to the target language. This account is different from the view that the non-target language is inhibited: infants are not resolving conflict between lexical features but rather identifying organized systems that are subtly different and require attentional processing to discriminate.

Older children and adults do not need to infer the presence of two language systems through bottom-up attentional processing because they know that the languages are distinct. However, just as infants direct attention to contrasts between the environmental languages, children and adults are drawn to the contrasting features of the jointly-activated languages. Therefore, it is not only that the two languages are jointly activated but also that bilinguals attend to both languages that creates the need for a general selection mechanism such as the executive function to be recruited into language processing to avoid interference. Put this way, the bilingual advantage is not in inhibition; rather it is the failure of bilinguals to inhibit attention to the non-target language that leads to the involvement of executive function and the eventual consequences for its development and function. Importantly, none of the evidence endorses a particular component of executive function as being responsible for this selection; instead, a more “unified” conception of effortful processing (cf., 14) appears to operate. The cognitive and neural dimensions of this unified executive function are the subject of current investigations.

When Peal and Lambert (3) demonstrated cognitive advantages for bilingual children, their

research changed the assumptions about how this perfectly normal experience affected children's development. Although there is still much we do not know, it is a sign of the success of this research that these assumptions have changed. Current studies that report no difference between groups present themselves as a challenge to claims that there are bilingual advantages rather than to claims that there are bilingual disadvantages, although both interpretations are statistically equivalent outcomes of a null result. We have come a long way from the time when the prevailing belief was that children could be harmed by the languages people spoke to them.