Bilingual Language Learning in Children

June 2, 2016

Authors:

Naja Ferjan Ramírez, Ph.D. is a research scientist at the University of Washington's Institute for Learning & Brain Sciences.

Patricia K. Kuhl, Ph.D. is the Bezos Family Foundation Endowed Chair in Early Childhood Learning, Co-Director of the UW's Institute for Learning & Brain Sciences, Director of the NSF-funded Science of Learning Center, and Professor of Speech and Hearing Sciences.

Contents

Introduction

Children who experience two languages from birth typically become native speakers of both, while adults often struggle with second language learning and rarely attain native-like fluency. With roughly two thirds of the world's population estimated to understand or speak at least two languages, bilingualism has become the norm rather than the exception in many parts of the world. In the United States, the rate of bilingualism is lower than the world's average. Nevertheless, almost 25 percent of U.S. children hear a language other than English at home, a number projected to grow as a result of continued immigration and births to immigrant parents. Although some might be concerned that bilingualism puts children at risk for language delay or academic failure, research does not support this. To the contrary, studies consistently show that, besides the obvious practical and economic gains, bilingualism leads to a number of cognitive advantages. Emerging research supports the view that the capacity to learn language can be equally applied to two languages as to one. Nevertheless, bilingual children's language growth, like their language exposure, is split between two languages. As a consequence, bilingual language learning, while similar to monolingual language learning in many aspects, also differs from it in important ways. This report compares the major milestones in bilingual and monolingual language acquisition, outlines the reasons behind the frequently observed variability in bilingual language learning, and describes the cognitive benefits of bilingualism.

1. Bilingual and monolingual language and literacy development

Language learning in the first year of life: One of the most impressive abilities of young infants is to discover the finite set of "phonetic units" (the consonants and vowels) that are used to make up the words in their native language. This process is called phonetic learning and represents a vital step in language acquisition as it reliably predicts language advancement up to 30 months of age (Kuhl et al., 2008). Until about 6 months of age, infants are capable of hearing the differences between the consonants and vowels that make up words universally across all languages. By 12 months of age, discrimination of sounds from the infant's native language significantly improves, while discrimination of non-native sounds declines (Kuhl et al., 2006). Infants' initial universal ability becomes more language specific, like that of an adult, by 12 months of age.

Studies show that early phonetic learning is driven by two processes: infants' abilities to remember the most frequently heard sounds (a computational skill) (Saffran, Aslin, & Newport, 1996) and infants' social skills (Kuhl, Tsao, & Liu, 2003). Brain science has shown that, as the child learns, physical changes in the brain that reflect learning can be measured. These measures reflect the amount and quality of language that the child hears (Kuhl, 2004).

How is phonetic learning affected by exposure to two languages? Some behavioral studies suggest that infants exposed to two languages show a temporary decline in phonetic perception; however, other studies report that bilingual infants follow an identical learning trajectory as their monolingual peers. The complexity of the findings likely reflects variability among bilingual infants as a function of different amounts of exposure to each language, or the inherent difficulty of conducting behavioral research

with preverbal infants.

An alternative approach is to conduct tightly controlled, safe, non-invasive, and infant-friendly brain imaging studies that do not require a behavioral response and thus avoid this confounding factor. Recent studies suggest that bilingual infants' brain responses show that they are learning two languages by 12 months of age, indicating that they are on the same timetable as monolingual infants learning one language (Ferjan Ramírez et al., 2016). However, there is some evidence that bilingual infants may remain capable of discriminating the phonetic distinctions of the world's languages at a time when their monolingual peers have already narrowed their perception to native language sounds (Ferjan Ramírez et al., 2016; Garcia-Sierra et al., 2011; Petitto et al., 2012). This may be an advantageous and a highly adaptive response to increased variability in the speech that bilingual children hear.

Research shows that the infant brain is more than capable of learning two languages simultaneously. Young children learn language rapidly; however, the quality and quantity of language they hear plays a key role in the learning process. One study shows that infants exposed to a new language at 9 months of age in play sessions by a live tutor learn in just 6 hours to discriminate foreign language sounds at levels equivalent to infants exposed to that language from birth. However, no learning occurs if the same material on the same schedule is presented via video or audiotapes (Kuhl, Tsao, & Liu, 2003). Thus, early language learning is critically dependent on social interactions, and on the quality of speech that children hear.

Studies with bilingual infants show that their language growth is directly related to the quality and quantity of speech they hear *in each language* (Ramírez-Esparza et al., 2016). Youngest infants learn best in one-on-one interactions when they hear lots of infant-directed speech or "parentese" – which has a higher tone of voice and exaggerated pitch contours. In bilingual babies, the amount of infant-directed speech heard in one-on-one interactions in a particular language is directly related to the growth of that language, and not related to growth of the other language (Ramírez-Esparza et al., 2016). For example, hearing lots of high-quality English predicts the growth of English, but it does not predict the growth of Spanish. Correspondingly, the strength of bilingual infants' brain responses to each language reflects the amount and quality of speech that they hear in each language (Garcia-Sierra et al., 2011).

Taken together, in monolingual and bilingual children alike, language growth reflects the quality and quantity of speech that infants hear. Young infants learn best through frequent, high-quality, social interactions with native speakers.

Vocabulary and grammatical development: Young children exposed to two languages from birth typically begin producing their first syllables and their first words at the same age as children exposed to a single language. Furthermore, the bilingual course of vocabulary and grammatical growth looks very much like the trajectory followed by monolingual children; the kinds of words children learn, and the relationship between vocabulary and grammatical growth in each language replicate the monolingual pattern (Conboy & Thal, 2006; Parra, Hoff, & Core, 2011).

Nevertheless, the effect of bilingual experience on language production and comprehension is often reported as a lag in vocabulary and grammatical acquisition. Although some studies have shown that bilingual children are within monolingual norms

for the age at which they achieve basic vocabulary and grammatical milestones of language development, several studies report that bilinguals control a smaller vocabulary in each language than monolinguals, and lag behind on grammatical measures when skills are measured on a single language (Hoff et al., 2012). Given the extensive research showing that children's language skills reflect the quantity of language that they hear, these findings are not surprising. Bilinguals split their time between two languages, and thus, on average, hear less of each language. Importantly, however, studies consistently show that bilingual children *do not* lag behind monolingual peers *when both languages are considered*. For example, bilingual vocabulary sizes, when combined across both languages, are equal to or greater than those of monolingual children. Similar findings are reported on measures of grammatical knowledge (Hoff et al., 2012; Hoff & Core, 2013). As in monolingual development, the rate of vocabulary and grammatical growth in bilingual children correlates with quality and quantity of speech that they hear in each language (Place & Hoff, 2011; Ramírez-Esparza et al., 2016). In agreement with these findings, bilingual children's brain activity in response to words in each language is related to their experience with each language. Specifically, bilingual children's more dominant language exhibits more mature brain activation patterns compared to their less dominant language (Conboy & Mills, 2006).

Learning to read: Reading is a complex process acquired through explicit training, typically after a child has learned to speak in full sentences. Studies with monolingual children demonstrate the critical role of oral language in reading and academic success. Thousands of U.S. children find themselves in situations where they must acquire the fundamentals of reading in a language that they do not speak, or where their linguistic knowledge is extremely poor. Not surprisingly, studies often report that bilingual immigrant children perform worse than monolingual English children in reading acquisition. However, research demonstrates that exposure to two languages *increases* phonological awareness, which is the ability to recognize and manipulate the sound units of language and is one of the best predictors of reading ability (Bilaystok, Luk, & Kwan, 2005; Eviatar & Ibrahim, 2000). Bilingual children acquire two phonological systems and thus receive additional "practice" manipulating the sounds of language. Importantly, studies reliably show that phonological awareness skills in bilingual children easily transfer from one language to another. This has been shown for English-Spanish bilinguals (Lindsey, Manis, & Bailey, 2003), English-French bilinguals (Comeau, Cormier, Grandmaison, & Lacroix, 1999), and English-Chinese bilinguals (Luk & Bialystok, 2008).

Taken together, bilingual research replicates the findings of studies with monolingual children and confirms that having a larger vocabulary of spoken words in the language of reading instruction is advantageous. While further studies are needed to advance our understanding of how bilingual children of varying linguistic and social backgrounds develop literacy skills, the currently available research indicates that continuous access to two languages assists children in their language and literacy development by facilitating sound-symbol awareness, grammatical knowledge, and vocabulary knowledge.

2. Variability in bilingual learning

Bilinguals are a heterogeneous group, as there is not one, but many possible ways to acquire two languages (different contexts, different ages, simultaneously or sequential acquisition, different language pairs). As a consequence, bilingual language acquisition rates and levels of ultimate proficiency are characterized by higher variability compared to monolingual language learning.

One important factor to consider is socioeconomic status (SES). In the U.S., a large proportion of bilingual children come from immigrant families that live below the poverty level and have, on average, lower levels of education compared to non-immigrant families. Children who grow up in poverty tend to hear less language than children from high SES families. Furthermore, the language that they hear tends to be less varied and less positive than that of children from high SES families. The effects of low SES on early language growth are evident very early in development and widen with age, a finding that has become widely known as "the 30 million word gap" (Hart & Risley, 1995).

U.S. immigrant children growing up in poverty often begin formal schooling speaking a language other than English and start acquiring English during the preschool years. A common pattern is that a child becomes increasingly English-dominant when formal schooling begins, while growth of other language(s) decelerates. Unfortunately, many such children fail to acquire sufficient English to keep pace with their peers, not because they are bilingual, but because they do not have a strong foundation in *any* language. However, research studies conducted in countries that actively support bilingualism (for example Canada or Belgium) show that children exposed to two languages are not at greater risk for language delay (Paradis, Genesee, & Crago, 2011). Furthermore, there is no evidence that giving up one language will result in improved outcomes of another language; in fact, learning one language can facilitate the acquisition of another language, and a strong basis in one language promotes school achievement in another language (Bialystok, 2001).

Another important factor in determining bilingual language outcome is the age at which children begin learning each language. While learning a foreign language is always possible, children who hear two languages from infancy ("early bilinguals") generally achieve greater mastery than those with late bilingual exposure ("late bilinguals" (Johnson & Newport, 1989; Flege, MacKay, & Meador, 1999). In accordance with these findings, brain responses to early-acquired second languages are stronger and more mature compared to responses to later-acquired second languages (Neville et al., 1997; Weber-Fox & Neville, 1996). Structural brain studies indicate that bilingual adults have greater brain tissue density in areas related to language, memory, and attention, with the highest levels of tissue density among those who were exposed to two languages before the age of 5 years (Mechelli et al., 2004).

3. Cognitive benefits of bilingualism

Contrary to the once held concern that bilingualism causes confusion, research shows that simultaneous exposure to two languages is related to several cognitive benefits. Part of the concern about confusion arises due to "code mixing" or "code switching."

Bilingual children occasionally combine words or phrases of both languages when interacting with their peers, parents of teachers. It is important to understand that code switching is natural for bilingual adults and children and reflects the fact that bilinguals often know certain words better in one language than in the other. Code switching in bilingual adults and children is rule governed, not haphazard, and bilingual children follow the same principles as bilingual adults (Paradis, Nicoladis, & Genesee, 2000). Bilingual children as young as 2 years of age show sensitivity to the language choice of their interlocutor and increase the proportion of words from a given language to match the language of their conversational partner (Genesee, Nicoladis, & Paradis, 1995).

Rather than causing confusion, it is now understood that the constant need to manage attention between two languages fosters children's thinking about language per se, and leads to increased metacognitive and metalinguistic skills (Bialystok, 2007). Bilingual infants as young as 7 and 12 months have been shown to be more flexible learners of language patterns compared to monolingual infants (Kovacs & Mehler, 2009). Bilingual toddlers exhibit a prolonged period of flexibility in their interpretation of potential words (Graf Estes & Hay, 2015), and bilingual 2- and 3-year-olds are more flexible learners of additional labels for previously known actions or objects, whereas monolingual children often find it difficult to learn labels for actions or objects that already have a name (Yoshida, 2008).

A growing body of evidence also suggests that bilinguals exhibit enhancements in executive functioning, which have been observed in children, young adults and middle-aged and older adults (Bialystok, Craik, & Luk, 2012). The primary processes of the executive functioning systems are switching attention, flexible thinking (cognitive flexibility), and updating information in working memory. Bilingualism requires the constant managing of attention to the target language. Research suggests that experience with two languages enhances the relevant brain networks, making them more robust for executive functioning throughout the lifespan. Interestingly, the accumulating effect of dual language experience translates into protective effects against cognitive decline with aging and the onset of Alzheimer's disease (Craik, Bialystok, & Freedman, 2010). Recent brain studies indicate that differences between monolinguals and bilinguals in executive functioning are present at an early age (Ferjan Ramírez et al., 2016), and persist throughout the school years (Arredondo et al., 2016) and into adulthood (Abutalebi et al., 2011; Stocco & Prat, 2014).

Summary

A growing body of research indicates that the experience of bilingualism alters not only the scope of language acquisition and use, but also a broader scope of cognitive processing from a very young age onward. Bilingual children perform equally well or better than monolinguals *when both languages are considered*. Studies suggest that optimal learning is achieved when children start learning two languages at an early age (i.e. between birth and 3 years of age) through high-quality interactions with live human beings, and both languages are supported throughout the toddler, preschool, and school years. Supportive environments for bilingual learning encourage parents and caregivers to use the language in which they are most fluent and comfortable, value both languages

equally, and view bilingualism as an asset that brings about important cognitive, social, and economic benefits.

References

- Abutalebi, J., Della Rosa, P.A., Green, D.W., Hernandez, M., Scifo, P., Keim, R., Cappa, S.F., & Costa, A. (2012). Bilingualism tunes the anterior cingulate cortex for conflict monitoring. *Cerebral Cortex*, 22, 2076-86.
- Arredondo, M.M., Hu, X.S., Satterfield, T., & Kovelman, I. (2016). Bilingualism alters children's frontal lobe functioning for attentional control. *Developmental Science*. Available online: http://onlinelibrary.wiley.com/doi/10.1111/desc.12377/abstract
- Bialystok, E. (2001). *Multilingualism in development: Language, literacy, and cognition*. Cambridge, UK: Cambridge University Press.
- Bialystok, E. (2007). Acquisition of literacy in multilingual children: A framework for research. *Language Learning*, 57(1), 45-77.
- Bialystok, E., Luk, G., & Kwan, E. (2005). Bilingualism, biliteracy, and learning to read: Interactions among languages and writing systems. *Scientific Studies of Reading*, 9, 43-61.
- Bialystok, E., Craik, F., & Luk, G. (2012). Bilingualism: Consequences for mind and brain. *Trends in Cognitive Sciences*, 16, 240-250.
- Craik, F., Bialystok, E., & Freedman, M. (2010). Delaying the onset of Alzheimer disease: Bilingualism as a form of cognitive reserve. *Neurology*, 75, 1726-1729.
- Comeau, L., Cormier, P., Grandmaison, E., & Lacroix, D. (1999). A longitudinal study of phonological processing skills in children learning to read in a second language. *Journal of Educational Psychology*, 91, 29-43.
- Conboy, B. T., & Thal, D.J. (2006). Ties between the lexicon and grammar: Cross-sectional and longitudinal studies of bilingual toddlers. *Child Development*, 77, 712-735.
- Conboy, B. T., & Mills, D.L. (2006). Two languages, one developing brain: Event-related potentials to words in bilingual toddlers. *Developmental Science*, 9, F1-F12.
- Eviatar, Z., & Ibrahim, R. (2000). Bilingual is as bilingual does: Metalinguistic abilities of Arabic-speaking children. *Applied Psycholinguistics*, 21, 451-471.
- Ferjan Ramírez, N., Ramírez, R.R., Clarke, M., Taulu, S., & Kuhl, P.K. (2016). Speech discrimination in 11-month-old bilingual and monolingual infants: A magnetoencephalography study. *Developmental Science*. Available online: http://onlinelibrary.wiley.com/doi/10.1111/desc.12427/abstract
- Flege, J.E., MacKay I.R.A., & Meador D. (1999). Native Italian speakers' perception and production of English vowels. *Journal of the Acoustical Society of America*, 106, 2973-2987.
- Garcia-Sierra, A., Rivera-Gaxiola, M., Percaccio, C.R., Conboy, B.T., Romo, H., Klarman, L., Ortiz, S., & Kuhl, P.K. (2011). Bilingual language learning: An ERP study relating early brain responses to speech, language input, and later word production. *Journal of Phonetics*, 39, 546-557.
- Genesee, F., Nicoladis, E., & Paradis, J. (1995). Language differentiation in early bilingual development. *Journal of Child Language*, 22, 611–631.
- Graf Estes, K., & Hay, J. (2015). Flexibility in bilingual infants' word learning. *Child Development*, 86 (5), 1371-1385.
- Hart B., & Risley, T.R. (1995). *Meaningful Differences in the Everyday Experiences of Young American Children*. Baltimore, MD: Brookes Publishing.
- Hoff, E., & Core, C. (2013). What clinicians need to know about bilingual development. *Seminars in Speech and Language*, 36 (2), 89-99.
- Hoff, E., Core, C., Place, S., Rumiche, R., Señor, M., & Parra, M. (2012). Dual language exposure and early bilingual development. *Journal of Child Language*, 39, 1-27.
- Johnson, J.S., & Newport, E.L. (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology,* 21, 60-99
- Kovacs, A. M., & Mehler, J. (2009). Flexible learning of multiple speech structures in bilingual infants. *Science*, 325 (5940), 611-612.
- Kuhl, P.K., Conboy, B.T., Coffey-Corina, S., Padden, D., Rivera-Gaxiola, M., & Nelson, T. (2008). Phonetic learning as a pathway to language: New data and native language magnet theory expanded (NLM-e). *Philosophical Transactions of the Royal Society B*, 363, 979-1000.

- Kuhl, P. K., Stevens, E., Hayashi, A., Deguchi, T., Kiritani, S., & Iverson, P. (2006). Infants show a facilitation effect for native language perception between 6 and 12 months. *Developmental Science*, 9, F13-F21.
- Kuhl, P.K. (2004). Early language acquisition: Cracking the speech code. *Nature Review Neuroscience*, 5, 831-843.
- Kuhl, P. K., Tsao. F.-M., & Liu, H.-M. (2003). Foreign-language experience in infancy: Effects of short-term exposure and social interaction on phonetic learning. *Proceedings of the National Academy of Sciences,* 100, 9096-9101.
- Lindsey, K.A, Manis, F.R., & Bailey, C.E. (2003). Prediction of first-grade reading in Spanish-speaking English language learners. *Journal of Educational Psychology*, 95, 482–494.
- Luk, G., & Bialystok, E. (2008). Common and distinct cognitive bases for reading in English-Cantonese bilinguals. *Applied Psycholinguistics*, 29, 269-289
- Mechelli, A., Crinion, J.T., Noppeney, U., O'Doherty, J., Ashburner, J., Frackowiak, R.S., & Price, C.J. (2004). Neurolinguistics: Structural plasticity in the bilingual brain. *Nature,* 431, 757.
- Neville, H.J., Coffey, S.A., Lawson, D.S., Fischer, A., Emmorey, K., & Bellugi, U. (1997). Neural systems mediating American Sign Language: Effects of sensory experience and age of acquisition. *Brain and Language*, 57, 285-308.
- Paradis, J., Genesee, F., & Crago, M. B. (2011). Dual language development and disorders: Bilingualism and second language learning (2nd ed.). Baltimore, MD: Brookes.
- Paradis, J., Nicoladis, E., & Genesee, F. (2000). Early emergence of structural constraints on code-mixing: Evidence from French–English bilingual children. *Bilingualism: Language and Cognition*, 3, 245-261.
- Parra, M., Hoff, E., & Core, C. (2011). Relations among language exposure, phonological memory, and language development in Spanish–English bilingually developing 2-year-olds. *Journal of Experimental Child Psychology*, 108, 113-125.
- Petitto, L.A., Berens, M.S., Kovelman, I., Dubins, M.H., Jasinska, K., & Shalinsky, A. (2012). The perceptual wedge hypothesis as the basis for bilingual babies' phonetic processing advantage: New insights from fNIRS brain imaging. *Brain and Language*, 121, 130-143.
- Place, S., & Hoff, E. (2011) Properties of dual language exposure that influence 2-year-old's bilingual proficiency. *Child Development*, 82, 1834-1849.
- Ramírez-Esparza, N., Garcia-Sierra, A., & Kuhl, P.K. (2016). The impact of early social interactions on later language development in Spanish-English bilingual infants. *Child Development* (in press).
- Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-month old infants. *Science,* 274, 1926–1928.
- Stocco, A., & Prat, C.S. (2014). Bilingualism trains specific brain circuits involved in flexible rule selection and application. *Brain and Language*, 137, 50-61.
- Weber-Fox, C., & Neville, H.J. (2001). Sensitive periods differentiate processing of open- and closed-class words: An ERP study of bilinguals. *Journal of Speech, Language, and Hearing Research*, 44, 1338-1353.
- Yoshida, H. (2008). The cognitive benefits of early multilingualism. *Zero to Three*, Vol. 2, 26-30.