



Empirical study

Bilingualism and phonological awareness: Re-examining theories of cross-language transfer and structural sensitivity

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ABSTRACT

The purpose of this study was to examine the relationship between bilingualism and phonological awareness by re-evaluating *structural sensitivity theory* and expanding *cross-language transfer theory*. The study was conducted with three groups of 1st and 2nd graders matched in age, SES and nonverbal IQ: a) monolingual English-speaking children from a general education program, b) native Japanese-speaking children from a Japanese-English two-way immersion bilingual program and c) native English-speaking children from the same bilingual program. An odd-man-out task that took into account the phonological and orthographical contrasts between English and Japanese was developed to assess onset awareness. The results showed that the bilingual children outperformed their monolingual peers in processing onsets that are shared between the two languages, which provided empirical support for the first hypothesis derived from *structural sensitivity theory* and highlighted the importance of contextual variability in bilingual metalinguistic processing. The second hypothesis derived from *structural sensitivity theory*, which predicated that bilingual advantage would be more evident in processing novel stimuli, was not confirmed in the present study. The absence of the predicted group difference may be attributed to the disparity in the extent of novelty of the stimuli and the difference in the comparability of participants' degrees of bilingualism between the present study and previous research. Finally, expanding existing research, results from this study showed that cross-language transfer can occur at a phonetic featural level. Future research and theoretical implications were discussed.

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1. Introduction

The past two decades have witnessed a dramatic worldwide growth in the number of young children developing language and literacy skills in two languages. In the United States alone, the number of two-way immersion bilingual programs has increased by 25% in the past decade (Center for Applied Linguistics, 2014). In many East Asian countries, English has become a required subject in the early elementary grades or even in kindergarten (Butler & Iino, 2005). In light of the increasing awareness of maintaining a heritage language and acquiring a foreign language in early childhood, a series of scientific investigations has been conducted on how early bilingual experience would affect children's development of metalinguistic awareness, that is, their ability to manipulate linguistic units and to reflect upon structural properties of language (Kuo & Anderson, 2008).

While various aspects of metalinguistic awareness have been investigated among second language learners (e.g., Kieffer, Biancarosa, & Mancilla-Martinez, 2013; Kieffer & Lesaux, 2012; Kim et al., 2015; Kuo & Kim, 2014), *phonological awareness*, the ability to manipulate and reflect upon the units and structures of a language's sounds, has received the most attention in bilingual cognition and literacy research (Bialystok, 2001, 2002; Kuo & Anderson, 2010, 2012). This unique attention is attributed to the role of phonological awareness as a precursor to reading. It has been well-established in the literature that beginning readers who are more capable of attending to sub-syllabic sound units can more rapidly map written symbols onto sound units and, therefore, are more likely to be successful in decoding and reading. The relationship between phonological awareness and decoding has been documented in research with learners of alphabetic languages (e.g., Bradley & Bryant, 1983; Nithart et al., 2011; Schneider & Naslund, 1999; Soltani & Roslan, 2013; Wagner, Torgesen, & Rashotte, 1994; Wagner et al., 1997; Wimmer, Landerl, & Schneider, 1994), as well as learners of logographic languages (Ho & Bryant, 1997), and among first language learners (e.g., Bradley & Bryant, 1983; van de Sande, Segers, & Verhoeven, 2013) as well as second language learners (e.g., Dixon,

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Zhao, & Joshi, 2010; Geva & Ryan, 1993; Gottardo & Mueller, 2009; Uchikoshi, 2013).

1.1. Cross-language transfer theory

Most of the observed bilingual advantage in phonological awareness has been construed in terms of cross-language transfer. Following the classical theory of transfer (e.g., Osgood, 1949), cross-language transfer can be defined based on specific common elements. At the most fundamental level, the theory predicts that the learning of language A facilitates the learning of language B if: a) the two languages share a linguistic feature, such as a particular phoneme or a particular phonological structure, and b) that particular linguistic feature is more prominent or complicated in language A than in language B. Positive transfer is unlikely to occur if neither or only one of the conditions are met; instead, negative transfer would occur, especially in the assessment of the less-dominant language, when the dominant language has a simpler or less salient linguistic feature (e.g., Bialystok, Majumder, & Martin, 2003; Dupoux, Kakehi, Hirose, Pallier, & Mehler, 1999).

Positive bilingual effect on phonological awareness has been documented among bilinguals who speak pairs of languages varying in phonological complexity, orthographic depth and typological affinity. In one of the pioneering studies in the field, Campbell and Sais (1995) showed that Italian–English bilingual kindergartners, despite being slightly younger, outperformed their English-speaking monolingual peers on a phonemic odd-man-out task and on a syllable deletion task. The bilingual advantage was attributed to the more regular syllable structure of Italian versus English, which may make it easier for the Italian–English bilingual children to attend to syllables and phonemes. Similar bilingual advantage was also reported in a study by Bruck and Genesee (1995) with English-speaking first-graders who attended either an English-speaking school or a French immersion school. The children in the French immersion program outperformed their monolingual peers in measures of syllable awareness. The authors argued that the bilingual advantage may have stemmed from the saliency of syllables in French compared to English.

Research has demonstrated that bilingual advantage in phonological processing is not limited to the awareness of segmental units, such as onset, rimes or syllables, and can be extended to awareness of suprasegmental features. In a study with Mandarin-speaking monolingual children and Cantonese–Mandarin speaking children, Chen et al. (2004) showed that bilingual children outperformed their monolingual peers on tone awareness. These bilingual children spoke Cantonese at home and learned to speak and read in Mandarin at school. Their advantage in tone awareness was credited to the richness of tones in Cantonese over Mandarin.

The aforementioned findings on bilingual advantage have been observed among young children who were literate in only one of their two languages. Similar bilingual advantages among children who are literate in both languages have also been documented. Bialystok et al. (2003) showed that Spanish–English and Hebrew–English bilingual children outperformed their English-speaking monolingual peers on phoneme awareness assessed in English, the weaker language of the bilinguals. The observed bilingual advantage was ascribed to the greater transparency of Spanish and Hebrew over English. Spanish and Hebrew (i.e., the Ktic menuqad script) have much more consistent grapheme-to-phoneme correspondences than English. Such bilingual advantage may be moderated by the amount of exposure to the more transparent script. In a cross-sectional and longitudinal study with French monolingual and French–Occitan bilingual 3rd, 4th and 5th graders, Laurent and Martinot (2010) revealed that the bilingual advantage in phoneme segmentation and phoneme permutation was only found among the 4th and 5th graders but not the 3rd graders.

With a push for the early introduction of English in schools in many different parts of the world (Butler & Iino, 2005), the effect of bilingual experience on phonological awareness has been studied in groups of children with different amounts of instruction in the second language as well. Chen, Xu, Nguyen, Hong, and Wang (2010) conducted a study with Chinese-speaking children in three different programs: the *non-English* (NE) program, where English instruction was not provided; the *regular English* (RE) program, where English instruction was provided twice a week for 40 minutes each time, and the *intensive English* (IE) program, where English instruction was offered for a total of 10 hours every week. Through their longitudinal data, Chen et al. (2010) demonstrated that English instruction expedited the development of phonological awareness in Chinese, and this effect derived from the relative greater transparency of English over Chinese.

Cross-language transfer theory has also explained null and negative effects among bilinguals who speak different pairs of languages. For example, in a study with English-speaking monolingual children and Punjabi–English bilingual children in first grade, Chiappe and Siegel (1999) did not find any bilingual advantages in phonological awareness, as measured with phoneme recognition, location identification, phoneme deletion, and substitution. Additionally, in a series of studies by Bialystok and her colleagues, it was found that Mandarin–English bilingual children in kindergarten through second grade either scored the same as or more poorly than their English-speaking monolingual peers on phonological awareness measures, depending on the tasks being used, which included phoneme substitution, syllable deletion, phoneme onset deletion, and phoneme counting tasks (Bialystok, Luk, & Kwan, 2005; Bialystok et al., 2003; Bialystok, McBride-Chang, & Luk, 2005). In these studies, the two languages of the bilingual children either shared fewer linguistic features or the particular shared linguistic features were less prominent or complicated in the additional language than the language shared with the monolingual children.

In summation, in most of the studies that have reported bilingual advantage in phonological awareness, the bilingual participants had experience in an additional language with one of the following features: a) simpler or more regular phonological structures (e.g., Campbell & Sais, 1995); b) more salient segmental units (e.g., Bruck & Genesee, 1995); or c) an alphabetic writing system (e.g., Bialystok et al., 2003, 2005; Kang, 2012). The presence and absence of a bilingual advantage revealed in the above-mentioned research are consistent with the predictions made by cross-language transfer theory. However, cross-language transfer theory alone cannot account for observed bilingual advantage where a) the additional language has less prominent linguistic features (e.g., Marinova-Todd, Zhao, & Bernhardt, 2010) or b) the assessment involved phonological units that do not exist in the bilingual's dominant language (e.g., Chen et al., 2004) or in either of their two languages (e.g., Kuo & Anderson, 2012). These empirical studies will be described in more detail in the next section.

1.2. Structural sensitivity theory

To complement the *cross-language transfer theory*, Kuo and Anderson (2012) proposed *structural sensitivity theory*. The theory postulates that children with regular exposure to more than one language may have “greater readiness to reorganize linguistic input and impute linguistics structure” (Kuo & Anderson, 2012, p. 457). The theory argues that bilingual facilitation, characterized by a heightened sensitivity to structural aspects of language, stems from several sources. First, bilingual children constantly need to overcome interlingual interferences, which provide them an opportunity to focus their attention on the structural features of language. Second, with access to more than one linguistic system, bilingual children have the advantage over their monolingual peers in noticing the

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