Journal of Experimental Child Psychology 159 (2017) 16–33

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

Vowels, consonants, and lexical tones: Sensitivity to phonological variation in monolingual Mandarin and bilingual English–Mandarin toddlers

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ARTICLE INFO

Article history:
Received 15 July 2016
Revised 19 January 2017

Keywords:
Bilingualism
Spoken word recognition
Lexical tone
Phonological development
Language acquisition

ABSTRACT

Although bilingual learners represent the linguistic majority, much less is known about their lexical processing in comparison with monolingual learners. In the current study, bilingual and monolingual toddlers were compared on their ability to recognize familiar words. Children were presented with correct pronunciations and mispronunciations, with the latter involving a vowel, consonant, or tone substitution. A robust ability to recognize words when their labels were correctly pronounced was observed in both groups. Both groups also exhibited a robust ability to reject vowel, tone, and consonant mispronunciations as possible labels for familiar words. However, time course analyses revealed processing differences based on language background; relative to Mandarin monolinguals, Mandarin–English bilingual toddlers demonstrated reduced efficiency in recognizing correctly pronounced words. With respect to mispronunciations, Mandarin–English bilingual learners demonstrated reduced sensitivity to tone mispronunciations relative to Mandarin monolingual toddlers. Moreover, the relative cost of mispronunciations differed for monolingual and bilingual toddlers. Monolingual toddlers demonstrated least sensitivity to consonants followed by vowels and tones, whereas bilingual toddlers demonstrated least sensitivity to tone, followed by consonants and then by vowels. Time course analyses revealed that both groups were sensitive to vowel and consonant variation. Results reveal both similarities and differences in monolingual

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http://dx.doi.org/10.1016/j.jecp.2017.01.009

and bilingual learners' processing of familiar words in Mandarin Chinese.

Introduction

Indisputably, a pivotal part of building up native language proficiency is the construction of a vocabulary. While this process has been extensively charted in monolingual learners, there has been increasing interest in bilingual lexical development. Parents, educators, and researchers are often concerned about the consequences of bilingualism for native language uptake. Comparisons based on standardized assessments have often suggested that bilingual children may acquire a native vocabulary more slowly in *each* language, reflected by reports that they have smaller single-language vocabularies than monolingual children (e.g., Hoff et al., 2012; Lindsey, Manis, & Bailey, 2003; Mahon & Crutchley, 2006; Oller, Pearson, & Cobo-Lewis, 2007; Pearson, Fernández, & Oller, 1993; Umbel, Pearson, Fernández, & Oller, 1992). Although comparisons of children's vocabulary sizes provide a very valuable means by which to contrast bilingual and monolingual learners' word knowledge, a complementary approach is to investigate children's abilities to correctly recognize the words that they have learned. This line of research investigates the "microstructure" of the emergent mental lexicon by tracking children's responses to words in real time. In the past, this approach has conventionally entailed investigating children's responses to hearing known words when they are correctly pronounced and mispronounced. Maintaining representations of familiar words that are phonologically precise is an important requisite for vocabulary development; children need to efficiently recognize familiar words as they are produced. Moreover, the ability to do so foreshadows later language development (Marchman & Fernald, 2008).

With approximately 70% of all children raised in a multilingual environment (Crystal, 1997), it is important to understand how children's developing vocabulary is shaped by their language environment. Although there has been a recent shift toward investigating lexical processing in bilingual children, the majority of these studies have focused on bilingual learners of consonant–vowel language systems (non-tone languages) (Fennell & Byers-Heinlein, 2014; Fennell, Byers-Heinlein, & Werker, 2007; Mattock, Polka, Rvachew, & Krehm, 2010; Ramon-Casas & Bosch, 2010; Ramon-Casas, Swingley, Sebastián-Gallés, & Bosch, 2009). However, given that the majority of the world's languages use lexical tone to distinguish meaning (Yip, 2002), non-tone languages (e.g., Germanic and Romance languages) represent a statistical minority. This distributional bias in language sampling is potentially limiting because theories about language development are then disproportionately informed and constrained by Germanic and Romance languages (e.g., Dutch, English, French, German, Italian, Spanish). The goal of the current study was to address two empirical lacunae: first, how bilingual and monolingual children differ in lexical processing and, second, how spoken word recognition unfolds in learners of a widely spoken tonal language, Mandarin Chinese.

Previous investigations comparing bilingual and monolingual toddlers' phonological representations revealed differences in language processing based on language background. In a study by Fennell et al. (2007), English monolingual toddlers were able to learn two words that formed a minimal pair distinction ([bih] and [dih]) at 17 months of age, whereas English–French bilingual toddlers were only able to learn these minimal pairs at 20 months. It was posited that the additional cognitive burden associated with bilingualism (e.g., identifying target phonetic system, inhibiting interference from the non-target language, dual labeling) postponed bilingual infants' abilities to recruit their phonological sensitivities when learning new words (Fennell et al., 2007). However, conclusions drawn from Fennell and Colleagues (2007) suggesting a bilingual delay in using phonemic detail have since been modified by later studies. For instance, when English–French bilingual toddlers were presented with bilingual productions of similar minimal pair tokens, 17-month-olds were sensitive to phonetic detail when learning new words (Mattock et al., 2010). To further investigate this postulate,