Differences in Articulatory Skill Between Monolinguals and Multilinguals of Different Backgrounds: An Acoustic Study of Tongue Twisters

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The effects of bilingualism on cognition have been examined in both behavioral and neuroimaging studies, and the resulting picture is that bilingualism is beneficial to cognitive development (Bialystok et al., 2012). Recent findings in the field of bilingual cognition suggest enhanced phonetic and phonological learning ability in bilinguals compared to monolinguals (Spinu et al., 2018, Antoniou et al., 2015, Tremblay & Sabourin 2012). These advantages are thought to lie beyond the explanatory power of a single process or cognitive ability (Crinion et al., 2006).

The most frequently investigated mechanism potentially underlying the cognitive differences between monolinguals and bilinguals has been executive function (Bialystok 2018). A general conclusion is that bilingual advantages stem from enhanced ability to actively select relevant information and suppress potentially interfering information (Anderson et al. 2018). When considering phonetic and phonological learning, however, we are faced with greater involvement of sensorimotor mechanisms, since audition, perception, and articulation all play a part in the learning of new sound patterns. This points out the need for investigating alternative mechanisms that could support the cognitive differences resulting from language experience of various types.

For example, the possibility arises that bilinguals' advantage in phonetic learning may - at least in part - be due to superior motor control, as their articulators have had daily practice with more than one set of sounds since early childhood. In a sense, bilinguals could be said to have more 'athletic' articulators. The main purpose of the current study is to determine whether articulatory differences exist between mono- and bilinguals through the analysis of tongue-twister production, following Goldrick & Blumstein (2006), and McMillan & Corley (2010).

We investigated articulatory skill in monolinguals (n=19) and different types of multilinguals (n=21). The latter were divided into early bilinguals (consistent exposure to both of their languages before age 5, n=8), mid bilinguals (exposure to L2 between 5-10, n=5), late bilinguals (L2 exposure between 10-13, n=3) and trilinguals (n=5). All speakers were undergraduate students in the CUNY network. The stimuli comprised 64 sequences that each contained four syllables (e.g., *kif tif tif kif*) and had to be repeated 3 times to a beat of a metronome (150 beats per minute). The recordings were rated by a trained listener, who gave a score of 1 for each accurately produced onset and coda consonant, and a score of 0 otherwise.

The results show that while there are no overall differences in accuracy between the two main groups (monolingual vs. multilingual), bilinguals who were first exposed to their second language later in life (between 5-15) tend to exhibit an advantage in the articulation of tongue-twisters (Fig. 2, from Dugaillard & Spinu, 2019). To eliminate issues arising from subjective assessment, an acoustic analysis is underway consisting of manual alignment of the sequences produced by the participants and subsequently obtaining quantitative information about duration, voicing, and formant frequencies. This will enable us to address subtler differences between the groups, such as partial voicing, degree of coarticulation, etc.

To conclude, we have found a bilingual advantage in articulatory skill as expressed in tongue twister accuracy during a fast production task. Contrary to expectations, the advantage was restricted to a specific subset of bilingual speakers, i.e. those who had acquired their second language between 5-15 years of age. These findings open new research directions and underscore the importance of directly measuring bilingual language proficiency and incorporating this information to experimental design (DelMaschio & Abutalebi 2018, Sulpizio et al. 2019).

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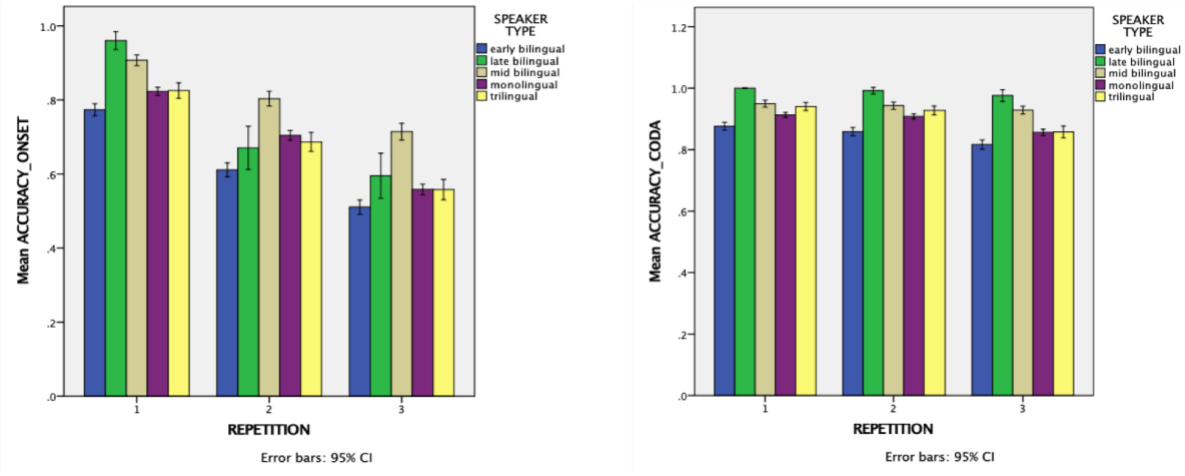

Figure 1: mean accuracy for onsets (left) and codas (right) for each repetition, broken down by speaker type (monolingual, early/mid/late bilingual, and trilingual).