THE ROLE OF ECHOIC MEMORY IN THE INITIAL LEARNING OF A SECOND DIALECT: THE CASE OF BILINGUALS

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Research shows that bilinguals tend to be better at learning foreign languages in adulthood and generally outperform monolinguals on certain linguistic tasks, e.g. manipulating language in terms of discrete phonemic units (Bialystok et al. 2005), novel word acquisition (Kaushanskaya and Marian 2009), and auditory processing (Krizman et al. 2012). In light of these observations, we address the question of whether the "bilingual advantage" also applies to phonological learning.

We compared 17 monolingual English and 12 French-English bilinguals (from Quebec, Canada) in a production experiment. Prior to training the subjects recorded a set of sentences in their own English dialect. They were then trained to produce English with a SE English accent (Sussex). The training consisted of listening to short sentences produced by a native speaker, following which the subjects were prompted to imitate each sentence right after hearing it. The (post-training) testing consisted of reading again the sentences that had been previously recorded in the native accent, this time trying to reproduce the new accent to the best of their ability (and in the absence of audio prompts). Several aspects of their speech were (or are currently being) measured, e.g. the realization of word-final voiceless coronal stops (100% glottalized in the Sussex dialect but not in the native dialect of our subjects), intonation patterns (in statements, yes-no questions and tag questions), and vocalic contrasts. For each measure, algorithms were devised to compute similarity scores between native and non-native production, in order to attempt the quantification of each individual’s overall degree of accentedness.

To date, we have completed the analysis of the word-final coronal stops, based on manual inspection and classification of each stop as (1) canonically released, (2) unreleased, (3) glottalized, and (4) flapped (following, in part, Sumner and Samuel 2005). We hypothesized that, if any learning occurred, subjects’ production of final coronal stops after training would be significantly different from their baseline. For the monolingual group, no significant differences were noted. For the bilinguals, the rates of release and flapping were significantly reduced and that of glottalization increased (Figure 1). Turning to individual results, while 2 of the 17 monolingual speakers displayed a significant increase in glottalization, 7 of the 12 bilinguals did so.

![Figure 1](image-url)
We also measured pitch contours. We used general pitch patterns (flat, falling, rising) as well as pitch excursions such as sudden rises and falls in order to determine similarity to native production and compute a final score for each sentence. Preliminary results from 12 speakers show a significant main effect of language background with bilinguals (mean similarity score = 77%) having outperformed monolinguals (mean similarity score = 58%). We also found significant differences among the three intonation patterns examined, with the mean similarity score for yes-no questions being significantly higher as compared to tag questions. Also underway is the measurement of vocalic cues (F1 and F2), with the goal of comparing the monolingual and bilingual vowel spaces to the vowel space of the native Sussex speaker they heard in training.

To account for the advantage already noted in the bilingual performance, we discuss the concept of echoic memory (Calabrese 2011), a mechanism by which sensory representations of speech uttered by others can be stored and checked against different mental representations, until the acoustic patterns stored in echoic memory can either be ascribed to existing phonological representations (e.g. becoming able to parse correctly mispronunciations due to a speech defect), or converted to licit phonological representations (e.g. L2 acquisition of a non-native sound). If, as compared to monolinguals, bilinguals have an increased ability to modify the mapping between existing representations and new articulatory instructions, one possible explanation is that an advantage in subcortical encoding of sound (Krizman et al. 2012) may play an important part in this process. The stronger the subcortical encoding, the longer availability of acoustic information in echoic memory, which leads to sounds being processed more efficiently. A direct result of this would be enhanced encoding strategies, e.g. more time for phonological (re)analysis. This would enable bilinguals to learn successfully new mapping configurations, such as the Sussex word-final /t/ being realized as a glottal stop. Bilinguals have been shown to outperform monolinguals in tasks involving episodic memory recall (Ljungberg et al. 2013), but the question of whether their sensory memory, particularly phonologically related (echoic memory) presents advantages remains open. Our results indicate that this may be the case.

Our study thus adds to the body of work suggesting that there is an advantage of bilingualism in second dialect learning in adulthood, and suggests an explanation in terms of perceptual strategies in which echoic memory is involved. We also contribute to the recent body of research suggesting that imitation of an action can result in improved understanding of that action (Adank et al. 2010). Other questions that our findings will enable us to address include: (1) is any of the acoustic cues measured more salient than the others or easier to learn upon initial exposure, (2) do individual speakers focus on and learn cues independently of each other, or (3) can certain speakers acquire all or most of the features of a new accent at the same time, in integrated fashion? Finally, as a direction for future research, (4) can these measures be employed to quantify accentedness in a realistic manner, consistent with native speakers’ judgments?

References


