Phonetic and Phonological Learning in Monolinguals and Bilinguals

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Experimental studies show a number of cognitive consequences of bilingualism, sometimes referred to as a 'bilingual advantage', although the term has recently been losing popularity [5]. The reported lack of replicability of some of these studies is thought to arise from the difficulty of quantifying the bilingual experience [2, 4] and from the fact that some of the posited advantages of bilingualism are thought to be most evident in childhood and old age, but 'muted' in adulthood [3]. Emerging areas of research where a consistent bilingual advantage *has* been identified with young adults include studies on phonetic and phonological learning (PPL) [1, 6]. In the current study, we further explore PPL in mono- and bilinguals. We add to previous work by employing an artificial accent deviating from standard North American English (as spoken in NYC) in limited and precise ways - and hence more easily measurable than a natural accent, and by presenting participants with full sentences (as opposed to words or syllables in isolation). Our main goal is to determine whether the previously observed bilingual advantage in PPL is replicable and extends to novel learning circumstances.

Thirty monolingual and thirty early bilingual[1] undergraduate students (mean age = 19.7) were trained on an artificial accent produced by a native speaker of North American English. The artificial accent differed from standard North American English in four distinct ways:

1. **Diphthongization** of mid front lax vowels e.g. *bed* [bɛd] → [bjɛd]
2. **Schwa epenthesis** in voiceless s-clusters e.g. *spy* [spaj] → [səpaj]
3. **Tapping** of intervocalic [l] e.g. *color* [kʌlɚ] → [kʌɾɚ]
4. **Tag question[2] intonation change** to a falling-rising (MLH) contour.

The consistent presence of all features in the artificial accent was verified acoustically. The experimental procedure started with the recording of 40 baseline sentences containing all structures of interest, followed by a training phase in which the participants listened to and imitated 40 sentences spoken in the novel accent. In the testing phase, they read the baseline sentences again, aiming to reproduce the novel accent in the absence of audio prompts.

The analysis included (a) categorical judgments provided by a trained phonetician, marking the presence or absence of each target feature and resulting in a mean accent score for each subject, and (b) the measurement of continuous acoustic parameters such as formant trajectories, intensity, consonant/vowel duration, and pitch contours. Preliminary results based on the analysis of 38 participants (19 from each group) show more effective learning in bilinguals across the board (Fig. 1). Generally speaking, both groups were more successful at reproducing the novel features during the training (imitation) phase. Different learning patterns between the two groups were observed in the testing phase, however: for instance, tapping was not learned at all by monolinguals, whereas it was learned by bilinguals at the same rate as the other features.

Turning to the acoustic findings, Fig. 2 shows the average formant values throughout the vocalic portion for the diphthongization stimuli (e.g. *bed*). Both monolinguals and bilinguals displayed higher F2 in the training (imitation) phase, however, only bilinguals maintained this pattern in the testing phase. Fig. 3a shows the pitch contours in tag questions for the model speaker and Fig. 3b for the two experimental groups. Even though the mean accent scores indicate that fewer monolinguals learned the novel MLH pattern for tag questions (Fig. 1),

[1] Bilinguals exposed to two languages before age 3 and who reported native or near-native proficiency in both.
[2] Tag questions (e.g. *isn't it?*) are typically produced with either falling or rising intonation. Our model speaker's default pattern was rising intonation.

acoustic measurements show that they were able to reproduce it more accurately (and in particular the falling contour) than the bilinguals when they did learn it. Other analyses, addressing the specific properties of tapping and schwa epenthesis, are currently underway.

To conclude, our preliminary findings suggest more effective learning of a novel accent by bilinguals following brief initial exposure, and thus add to the body of work on the cognitive advantages of bilingualism. At the same time, we found evidence that some monolinguals learned the novel tag question intonation more accurately, perhaps as a result of having recruited more conscious resources in PPL, which enhanced their sensitivity to processes occurring over longer durations or in final sentential position (a recency effect).

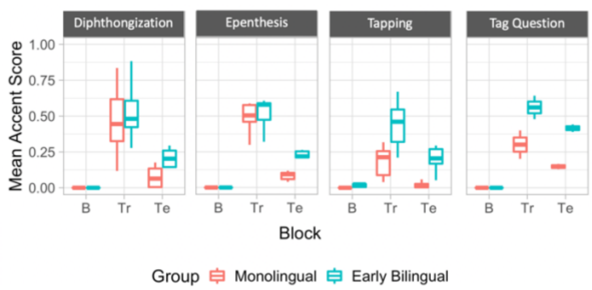

Fig. 1: Mean accent score for monolinguals and early bilinguals in 3 conditions: B(aseline), Tr(aining) and Te(sting) for the 4 different new patterns present in the artificial accent to which they were exposed.

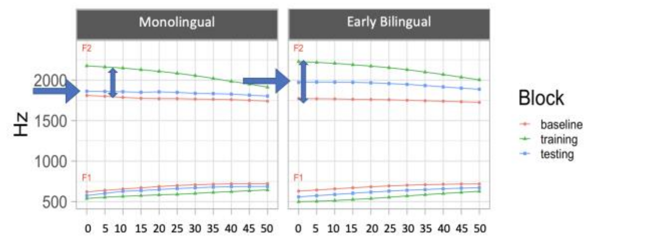

Fig. 2: Average F1 and F2 values throughout vocalic duration for the diphthongization stimuli (mid front lax vowels). Bilinguals produced higher F2 at the vocalic onset in testing, consistent with the presence of a palatal glide.

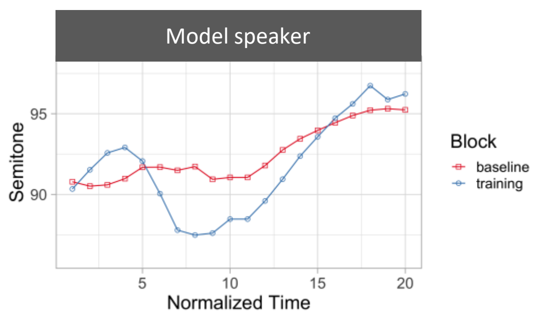

Fig. 3a: Mean pitch contours in tag questions for the model speaker. Baseline refers to her natural production and 'training' refers to the artificial accent she produced and to which the participants were exposed.

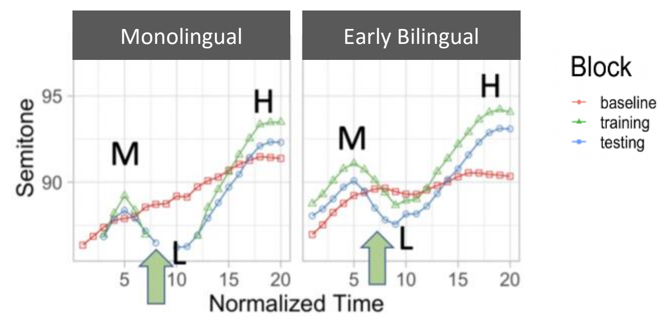

Fig. 3b: Mean pitch contours in tag questions for the two groups. The training and testing phase contours are based only on accurately produced tag questions (that is, for questions for which the human rater identified the presence of a MLH pattern). Monolinguals' low tones more accurately resemble the model speech.

Selected References

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