Exploring the connection between phonetic learning and auditory sensory memory in monolinguals and bilinguals

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Bilingualism has been linked with improved function regarding certain aspects of linguistic processing, e.g. manipulating language in terms of discrete units (Bialystok et al. 2012), novel word acquisition (Kaushanskaya & Marian 2009), and learning unfamiliar sound patterns in novel accents (Spinu et al. 2018). A study in which subjects learned vocabularies that differentiated words using foreign phonetic contrasts (Antoniou et al. 2015) reports that bilinguals possess an advantage over monolinguals in phonetic learning. Other experimental work with non-native contrasts (Tremblay & Sabourin 2012) suggests that multilinguals and bilinguals have enhanced speech perception abilities compared to monolinguals.

Two non-mutually-exclusive approaches attempt to explain these results in the literature. One is related to executive function, relying on attentional mechanisms and speculating that more effective learning is achieved through active selection of relevant information and suppression of potentially interfering information (Anderson et al. 2018). The other approach emphasizes the role of sensory mechanisms (Calabrese 2012, Spinu et al. 2018), specifically auditory sensory memory (ASM). Bilinguals have already been shown to perform better than monolinguals in tasks involving auditory processing (Krizman et al. 2012) and episodic memory recall (Ljungberg et al. 2013), but the questions whether (1) bilinguals' ASM skills are also enhanced, and (2) phonetic skill and ASM are correlated, remain open, however. Our study investigates phonetic learning skills and ASM in the same subjects from two groups: early (simultaneous) bilinguals and monolinguals.

We have designed an experiment consisting of two tasks: (1) a digit span task with and without suffix effect[1] in order to measure ASM, and (2) a novel accent training task consisting of training the participants on an artificial accent of English through listening and imitation of a limited number of sentences (see Adank et al. 2010 for the role of imitation in language processing). Our target groups of participants are monolinguals (n=20) and early bilinguals whose L1 is English and L2 Spanish (n=20). The artificial accent has already been recorded and used in a different experiment (Spinu, Hwang, and Pincus, in progress) and differs from standard North American English in four distinct ways: (1) diphthongization of mid front lax vowels, e.g. *bed* → *bee-ed*, (2) schwa epenthesis in between the first and second consonant in voiceless s-clusters, e.g. *spy* → *su-py*, (3) tapping of intervocalic l sounds, e.g. *happily* → *happidy*, and (4) changing the

[1]The suffix effect (Crowder 2014, Bloom 2006) refers to the impairment in recall caused by adding an irrelevant speech item to the end of a spoken sequence. In the standard suffix procedure, subjects hear lists of randomly organized digits or letters, followed by either a suffix (e.g., the word 'go') or a silent interval of equivalent duration (Pilotti et al. 2002). When the recall of the suffix lists is compared with the recall of the control lists, there is a reliable increase in errors for the items in the proximity of the suffix, with the terminal item displaying the largest increment in errors. This phenomenon is called the suffix effect. The effect of the suffix on the terminal item is thought to reflect, for the most part, an automatic form of processing typical of the functioning of ASM.

intonation in tag questions (e.g. *aren't we?*) from a typical rising (or falling) contour to a novel falling-rising contour. In addition, the bilingual participants will complete a short language proficiency test such as the one offered online by the Cervantes School to determine their level (https://www.cervantes.to/test_inicial.html). This task was motivated by recent suggestions from the literature on the neurobiology of bilingualism to directly measure language proficiency and incorporate it to experimental design (DelMaschio & Abutalebi 2018, Sulpizio et al. 2019).

In conclusion, we expect our results to shed more light on the connection between cognitive and sensorial functions in speakers of diverse linguistic backgrounds. In particular, we expect to see a bilingual advantage, modulated by language proficiency, in both auditory sensory memory and phonetic learning, adding to the body of work on the cognitive benefits of bilingualism.

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