SPANISH-ACCENTED ENGLISH IS SPANISH TO ENGLISH-LEARNING 5-MONTH-OLDS

Melissa Paquette-Smith & Elizabeth K. Johnson

University of Toronto
m.paquette.smith@mail.utoronto.ca; elizabeth.johnson@utoronto.ca

ABSTRACT

Infants use prosody to distinguish between rhythmically-distinct languages, but in multilingual settings infants often encounter speakers who learned one or more of their languages later in life. Late learners of a language typically carry over the timing of their L1 into their L2. Can infants tell when a single heavily-accented speaker switches between two rhythmically-distinct languages? Or do infants have difficulty tracking which language this person is speaking? Here, we address this question by examining 5-month-olds' ability to discriminate native Spanish from English speech samples produced by either a L2 English speaker (Experiment 1) or a L1 English speaker (Experiment 2). Infants succeeded in discriminating the two languages in Experiment 2, but not in Experiment 1. This suggests that infants perceived the Spanish-accented English as more Spanish-like than English-like. These findings underscore the importance of considering real-world speaker-related language variability in models of infant speech perception and language development.

Keywords: rhythm class, infant speech perception, language discrimination, accent perception, L2

1. INTRODUCTION

In a multilingual environment it is important for infants to be able to tell apart the languages they hear. Otherwise, it would be difficult for infants to learn the phonological structure of each individual language. Although research suggests that infants' language discrimination abilities are initially limited to differentiating languages from different rhythmic classes (e.g., stress-timed English and syllable-timed Spanish) [5], this situation changes rapidly. By 5-months of age, infants can discriminate their native language from any other language, even if it is rhythmically similar (e.g., Spanish-learning infants can discriminate Spanish and Catalan [2] and English-learning infants can discriminate English and Dutch [6]). However, at 5 months of age, infants still have difficulty differentiating between two unfamiliar rhythmically-similar languages. For example, 5-month-old English learners have difficulty distinguishing between syllable-timed Spanish and syllable-timed Italian [6]. The fact that 5-month-olds can only tell apart two unfamiliar languages if they are rhythmically-distinct highlights the importance of rhythm in defining infants' early language discrimination abilities.

Interestingly, most infant language discrimination work to date has focused on monolingual children. Moreover, the language samples that monolingual children have been asked to discriminate between have always been produced by native speakers of each language. But in the real world, children often hear multiple languages, and encounter a mixture of native and non-native variants of these languages. Thus, our current understanding of how children tell apart languages may not be entirely ecologically valid. That is, the language discrimination abilities of infants that have been documented in the lab may not accurately reflect how children raised in multilingual settings come to distinguish between the languages in their environment.

The need to consider real-world language input in language discrimination studies has not been entirely overlooked. A few studies have examined the language discrimination abilities of bilingual infants. In general, it appears that the language discrimination abilities of bilingually-raised children are largely unaffected by having multilingual input [2, 3]. However, there is some evidence that the rhythmic similarity of the languages that bilingual infants are learning can impact their ability to tag and sort the meaningful phonetic contrasts in each language. For example, some research suggests that infants learning two syllable-timed languages (i.e., Spanish and Catalan) have greater difficulty dealing with overlapping vowel distributions compared to infants learning languages from different rhythmic classes (i.e., Spanish and English) [1, 7]. Thus, rhythm has been suggested to play an important role in determining how infants will handle bilingual input.

Although research is beginning to investigate how bilingual infants tell apart languages, it is still not known how infants cope when one or more of the languages are accented. No studies have investigated infants' ability to discriminate speech samples produced by speakers with strong non-native accents. We know that non-native speakers often carry over some of the timing from their native language into their second language [10], which could make it more difficult for infants to discriminate between those languages. For example, if an English learning infant hears L2 English spoken by a native Spanish speaker, will they be able to tell that the speaker's Spanish-accented English is English rather than Spanish?

Our first experiment addresses this question by testing English learning 5-month-olds' ability to discriminate native Spanish from Spanish-accented English. We predict that to 5-month-olds, Spanish-accented English will sound very much like Spanish.

2. EXPERIMENT 1

Past studies have shown that young infants use prosody to discriminate between rhythmically-distinct languages. For example, English learners can discriminate between Spanish and English because Spanish is syllable-timed and English is stress-timed. But no studies to date have asked whether infants can distinguish between an unfamiliar language and a heavily accented variant of a familiar language. This question is important because many children who are being raised in multilingual settings will routinely encounter non-native variants of their native language(s).

In this experiment, we ask whether infants can distinguish between native Spanish and Spanish-accented English. Using a variant of the Headturn Preference Procedure [4], infants were habituated to either 3 minutes of native Spanish or 3 minutes of Spanish-accented English. A single native Spanish speaker who learned English late in life produced all the habituation and test materials. In the test phase we measured infants' looking times to samples of the old (habituated) language and the new language. We predicted that if infants can distinguish the speaker's Spanish samples from her Spanish-accented English samples then they should look longer to listen the new over the old (habituated) language. Conversely, if infants are unable to detect a difference between the speaker's Spanish and L2 English, then they should demonstrate no preference for the new over the old language samples at test.

2.1. Method

2.1.1. Participants

Thirty-two 4.5 to 5.5-month-old infants were tested (Range = 137 - 166 days, M_{Age} = 154.22 days). Infants heard English 90% of the time, and had virtually no (less than 1%) exposure to Spanish or Spanish-accented English. Thirteen infants were removed from the study due to fussiness (6), parental interference (4), experimenter error (1), and failure to orient to the lights (2).

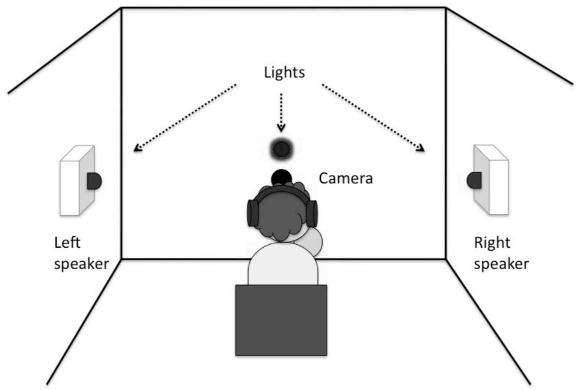

Figure 1: Headturn Preference Procedure

2.1.2. Stimuli

The stimuli set consisted of 40 English and 40 Spanish sentences modelled after Nazzi et al., [5]. The entire set of 16 to 18 syllable sentences was recorded in adult-directed speech by a female L2 English speaker. The speaker learned Spanish from birth and began learning English as an adult. At the time of recording the speaker had only recently arrived in Canada. Given that there may be fluency differences between the speakers' L1 and L2, the speaker was allowed to practice until she could produce the L2 sentences fluently. The habituation passages were created by splicing together 20 sentences of one language with 250ms of silence between each sentence. The sets of 20 sentences were then repeated once to create different counterbalanced orders of the approximately 3-minute Spanish and English habituation phases. The test phase passages were created by splicing together groups of 5 sentences of the same language.

2.1.3. Design

Infants were randomly assigned to one of eight counterbalanced orders. Half of the infants were habituated to 20 Spanish sentences and the other half were habituated to 20 Spanish-accented English sentences. The test phase consisted of 8 trials. Four of the trials contained previously unheard sentences from the old (habituated) language (5 sentences per trial) whereas the other four trials contained sentences from the new language. The order in which the recordings were presented as well as which recordings were selected to be played in the habituation and test phases was counterbalanced across children.

2.1.4. Procedure

Infants were habituated and tested using a modified single speaker variant of the Headturn Preference Procedure [4] used in Nazzi et al., [5] (see Figure 1). Infants sat on their parents lap in the centre of a sound-attenuated booth. Parents were instructed to wear headphones and listen to masking music to ensure that they could not bias their child's responses. In the habituation phase, the auditory passage played continuously regardless of where the infant was looking. However, in order to familiarize infants with the experimental design and the location of the lights, the centre and sidelights flashed depending on where the infant looked. In the test phase the presentation of both the auditory stimuli and the flashing lights was contingent on the infant's looking behaviour.

At the start of every trial a blue light positioned directly in front of the infant would flash. When the infant looked at the blue light then one of the red lights located 90 degrees to the infant's left or right side would begin flashing. In the test phase, when the infant turned their head to look at the side light, the passage would begin to play from a speaker located directly behind the light. If the infant looked away from the light for more than 2 seconds, the passage would stop and the next trial would begin. Looks away under 2 seconds were subtracted from the infant's total looking time. An experimenter, located outside the booth, coded the infant's looking behaviours online using a live video monitor.

2.2. Results and Discussion

The mean orientation time towards the old (habituated) and new language test trials was computed for each participant. The first two trials (one new and one old) were removed from analysis as previous studies have suggested that they can be unstable [8, 9].

A paired-samples t-test indicated that infants failed to look longer to the new language (M = 8.40, SD = 4.19) than the old (habituated) language (M= 7.96, SD = 5.05), $t(31)$=0.65, p = .52 (See Figure 2), suggesting that infants were unable to tell apart the speaker's native Spanish from her Spanish-accented English. However, there could be a number of alternative explanations for infants' inability to distinguish between the Spanish and Spanish-accented English samples produced by the L2 English speaker. It may be that the experimental design was not sensitive enough to reveal infants' abilities. In order to ensure that our paradigm is able to detect differences in the ability to discriminate languages, our second experiment tests whether infants are able to tell apart language samples produced by an unaccented bilingual speaker.

3. EXPERIMENT 2

In Experiment 2 we use the same procedure as Experiment 1 to examine whether infants can discriminate English and Spanish language samples produced by a bilingual speaker. If infants are successful at this task then this is an indication that 5-month-olds are not struggling with the procedure in Experiment 1; rather it is the accent of the speaker that is impacting their ability to tell apart languages.

3.1. Method

3.1.1 Participants

Thirty-two 4.5 to 5.5-month-old infants were tested (Range = 143 – 169 days, M_{Age} = 157.24 days). Infants were exposed to at least 90% English at home, and had minimal (less than 1%) exposure to Spanish or Spanish accented English. Ten infants were removed from the study due to fussiness (6) and failure to orient to the lights (4).

3.1.2 Stimuli

The same 40 English and 40 Spanish passages were recorded by a female English-Spanish bilingual who learned both languages from birth.

3.1.3 Design

The design was identical to Experiment 1 except for the use of a bilingual speaker instead of the L2 English speaker.

3.1.4 Procedure

The procedure was identical to Experiment 1.

3.2. Results and Discussion

As in Experiment 1 we computed the mean looking time to the old and the new language trials (excluding the first two trials). The results of a paired-samples t-test indicated that infants exposed to the bilingual speaker could differentiate the new language samples (M = 8.69, SD = 3.72) from the old (habituated) language samples (M = 7.46, SD = 3.81), $t(31)$ = 2.83, p < .01. Infants' successful discrimination of Spanish and English in this experiment suggests that the lack of discrimination seen in Experiment 1 was not an artifact of the method, rather it is an indication that infants have difficulty differentiating language samples when they are produced by an accented speaker.

(like Spanish and Italian) [6].

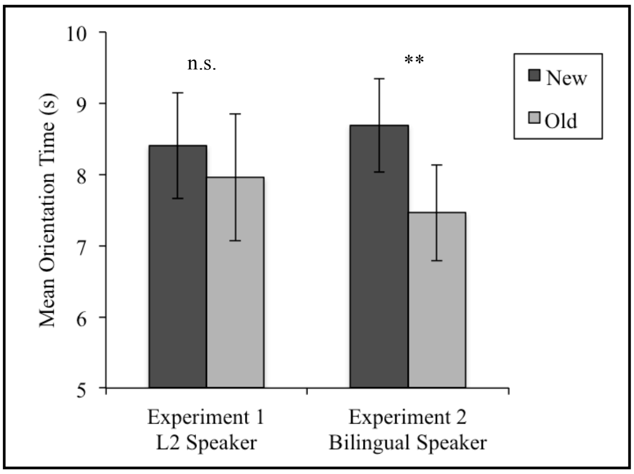

Figure 2: Mean orientation times to the new language samples and old (habituated) language samples in Experiments 1 and 2. Error bars represent the standard error of the mean.
*$p < .05$, **$p < .01$

3. GENERAL DISCUSSION

In a multilingual society infants are often exposed to languages spoken by both native and non-native speakers. Although infants can use rhythm to tell apart languages, we have demonstrated here that language discrimination is more difficult when the speaker speaks with a non-native accent. This is the first study to examine language discrimination using non-native samples. These findings contribute to our understanding of how infants learn to discriminate languages in the face of real-world variability in accents and dialects.

The ease with which infants can distinguish between the languages spoken in their environment can impact how readily they acquire the phonological structure of their native tongue(s). In Experiment 1 English-learning infants had difficulty discriminating Spanish from Spanish-accented English. We know that infants readily distinguish between Spanish and English samples produced by native speakers [5] and by 5 months of age they can also discriminate their native language (in this case English) from any other language, regardless of rhythmic similarity [6]. Our findings suggest that when exposed to an L2 English speaker, monolingual English infants perceived the speaker's Spanish–accented English to be more Spanish- than English-like. This is presumably because the speaker spoke English with a Spanish rhythm. Thus, even though Spanish-accented English is a variant of English (their native language), infants perceived it like a foreign syllable-timed language. Hence, infants' performance in Experiment 1 is reminiscent of studies where infants are asked to discriminate between two rhythmically similar foreign languages (like Spanish and Italian) [6].

Although this is an indication that non-native accents can impact infants' ability to discriminate languages, we acknowledge that L2 English speakers vary in how heavily they carry over the rhythm of their L1. Here, we tested infants on a heavily-accented speaker. The outcome of the current study would have likely been different if the speaker's accent was subtler. It is also possible that infants might be better able to deal with L2 accents if the speaker and the child share the same native language. For example, monolingual English-learning infants may be more able to discriminate accented language samples when they are spoken by a native English speaker whose L2 is English-accented than a foreign language speaker whose English is foreign-accented.

This is the first line of research to compare infants' ability to discriminate language samples from non-native accented and an unaccented speaker. Our initial findings from this experiment underscore the importance of considering real-world language variability in models of infant speech perception and have implications for infants growing up in bilingual language environments. Follow up work will test whether infants raised in bilingual environments might be more sensitive to language changes even when the speaker is accented.

3. REFERENCES

[1] Bosch, L., Sebastian-Galles, N. 2003. Simultaneous bilingualism and the perception of a language-specific vowel contrast in the first year of life. *Language and Speech 46,* 217–243.

[2] Bosch, L., Sebastian-Galles, N. 2009. Evidence of Early Language Discrimination Abilities in Infants From Bilingual Environments, *Infancy 2*, 37–41.

[3] Bosch, L., Sebastián-Gallés, N. 1997. Native-language recognition abilities in 4-month-old infants from monolingual and bilingual environments. *Cognition 65*, 33–69.

[4] Johnson, E. K., Zamuner, T. 2010. Using infant and toddler testing methods in language acquisition research. In: Blom E., Unsworth S. (eds), *Experimental Methods in Language Acquisition Research*. Amsterdam: John Benjamins Publishing Company, 73-94.

[5] Nazzi, T., Bertoncini, J., Mehler, J. 1998. Language discrimination by newborns: Toward an understanding of the role of rhythm. *Journal of Experimental Psychology: Human Perception and Performance 24*, 756–766.

[6] Nazzi, T., Jusczyk, P. W., Johnson, E. K. 2000. Language Discrimination by English-Learning 5-Month-Olds: Effects of Rhythm and Familiarity. *Journal of Memory and Language 43*, 1–19.

[7] Sundara, M., Scutellaro, A. 2011. Rhythmic distance between languages affects the development of speech

perception in bilingual infants. *Journal of Phonetics 39*, 505–513.

[8] Van Heugten, M., & Shi, R. (2010). Infants' sensitivity to non-adjacent dependencies across phonological phrase boundaries. *Journal of the Acoustical. Society of America 128*, 223–8.

[9] Vouloumanos, A., Werker, J. F., Nelson, K., Luce, C. 2004. Tuned to the signal: the privileged status of speech for young infants. *Developmental Science 3,* 270–276.

[10] White, L., Mattys, S. L. 2007. Calibrating rhythm: First language and second language studies. *Journal of Phonetics 35*, 501–522.