

Segmental information as a cue for bilingual input separation: vowels, consonants, and phonotactics

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Bilingual infants need to develop ways to distinguish two different languages in the input speech stream. Studies on language discrimination have suggested that rhythm plays a crucial role in this process (Sundara & Scutellaro, 2011). However, it remains unclear how languages that are rhythmically similar could be separated. A recent study by Zacharaki & Sebastian-Galles (2021) found that 4.5-month-old infants could discriminate languages based on differences in vowel distributions, suggesting that segmental information could be an important factor. However, little is known about the effectiveness of segmental information in language separation. The current study uses computational modeling to assess how segmental information (vowels, consonants, phonotactics) could be used as a cue for separation of two rhythmically similar languages: English and Dutch. The effectiveness of these cues is tested using different degrees of input mixing, thereby assessing each cue's robustness to mixed language input. Bilingual input was simulated using segmental transcriptions from English and Dutch speech corpora, which were combined in different mixing proportions. Four different probabilistic models were implemented: (1) a broad C-V model that distinguishes consonantal from vocalic segments, (2) a model based on vowels, (3) a model based on consonants, and (4) a phonotactics model which calculates biphone probabilities over combinations of segments (consonants and vowels). Figure 1 shows that, while broad C-V labels are insufficient to separate the two languages, having access to vowel information greatly increases language separation accuracy. Importantly, vowels achieve a higher accuracy than consonants. The phonotactics model achieves the best performance, showing that more complex segmental information has the potential to improve bilingual input separation. These results show that vowels are indeed effective, and, while vowels are likely the earliest segmental cue available, additional information regarding consonants and phonotactics could potentially be used for further enhancement of the infant's input separation capabilities.