

Differences in Speech Discrimination Between Monolinguals and Bilinguals as Evidence of MMN Response

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Background

- Mismatch negativity (MMN) reflects discrimination of auditory and speech contrasts and are fairly automatic responses and can be modulated with attention (Näätänen et al., 2007).
- Late negativity is reorienting to the stimulus change (Datta, et al., 2010).
- Bilinguals differ from monolinguals in executive function abilities (Patra, Bose & Marinis, 2019).
- Bilinguals who have acquired English prior to the age of five show similar processing of non-phonemic English contrasts to English monolinguals, but differences in attention to speech (Datta et al., 2019)

Research Questions and Hypothesis

- Will early bilinguals monitor the environment differently than American English monolinguals?
 - We predicted the both bilinguals and monolinguals would monitor the auditory environment differently.
- Will early bilinguals and monolinguals show differences in ability to ignore/suppress an interfering, non-target speaker voice?
 - We predicted that bilinguals would show greater suppression of the non-target speaker voice

Task

- Participants passively listened to two speaker voices while watching a muted movie.
- Participants actively listened to the two speaker voices and counted the number of times they heard the target voice.

Data Acquisition

- 64 channel Netstation Amplifiers
- Hydrocel 65 electrode net
- Sampling rate 500 Hz, filter bandwidth .01-100 Hz
- Eprime used for to control stimulus delivery
- Data lowpass filtered at 30 Hz offline

Participants

- Early Bilinguals (N=5)
 - L1: Spanish
 - L2: English, acquired prior to 5 y.o.
- English Monolinguals (N=6)
 - No self reported proficiency in any other language.

Stimuli

Tokens

- 3 tokens each [a], [e] and [æ]

Paradigm

Auditory oddball

- Standards [a][e]; Deviants [æ][a]

Conditions

Passive: ~25 min in duration

Active: ~25 min in duration

Speaker Voices

High pitch voice:

- Average F0:
 - 164.4 Hz - 173.2Hz
- Average intensity:
 - 69.4- 70 dB

Low pitch voice:

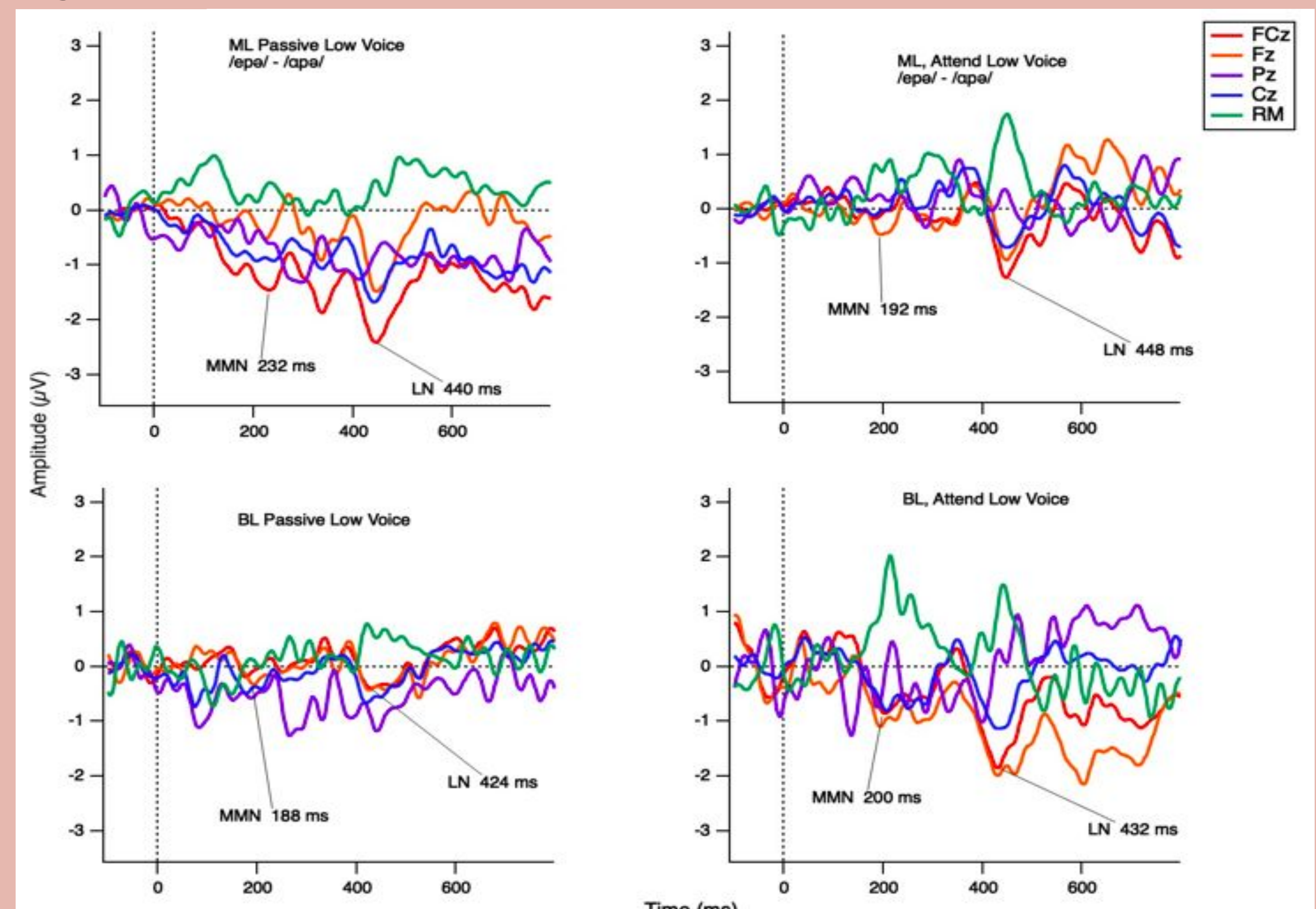
- Average F0:
 - 103.7 Hz- 177.0 Hz
- Average intensity:
 - 63.6dB - 69.6 dB

Conclusion

These findings indicate differences in how monolinguals and bilinguals process potentially competing speech information. They have implications for developmental disorders, such as auditory processing disorder and specific language impairment.

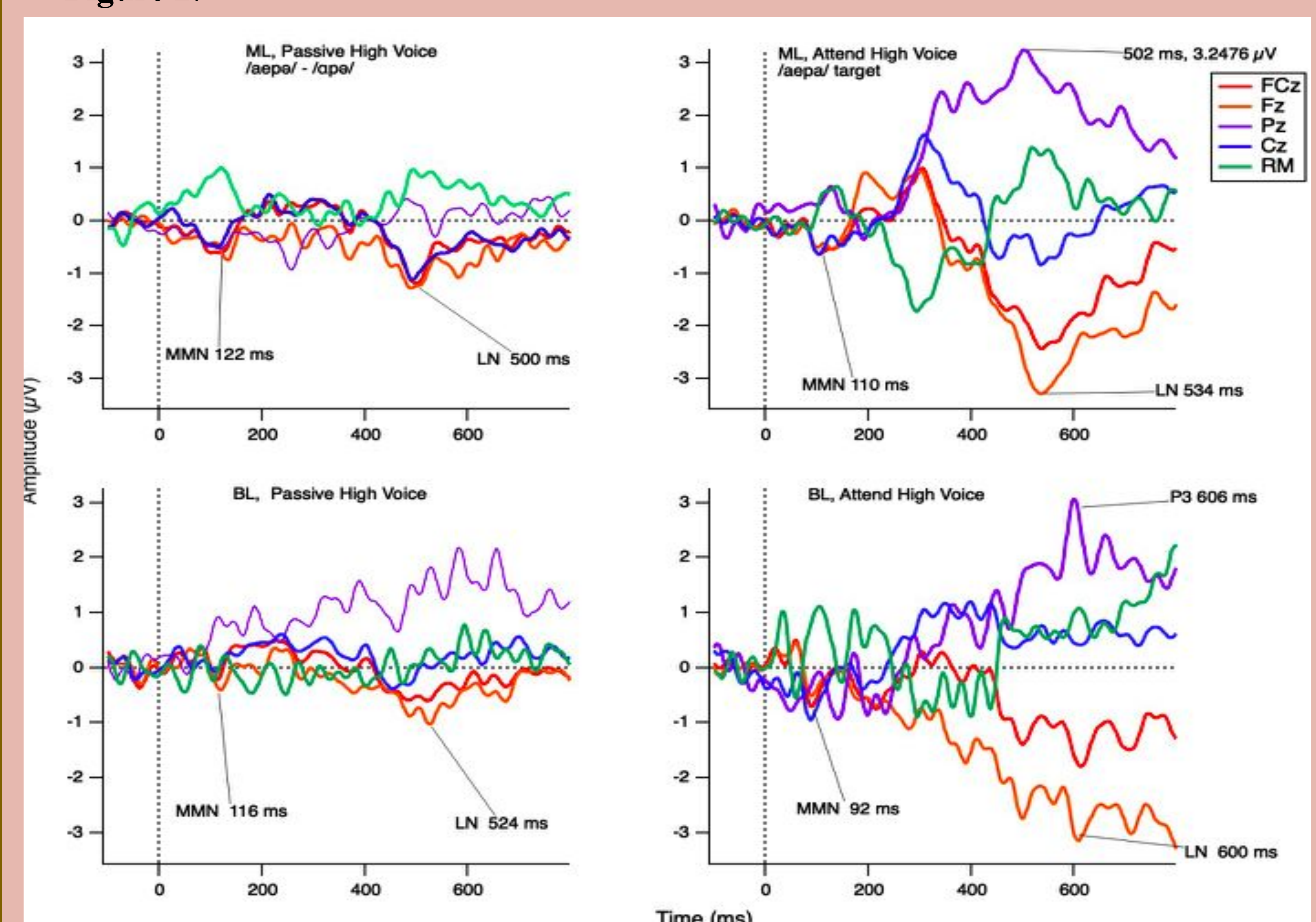
Results

Figure 1.



- Monolinguals showed P3 to the attended voice target and attenuation of the response to the unattended voice in the Attend Condition (upper graphs in Fig. 1 and Fig 2).
- Bilinguals showed P3 to attended voice target, but also showed evidence of attention to the non-target “low” voice, with a small P3 in evidence (lower graphs in Fig. 1 and 2).
- Monolinguals show as slow negative shift to the the low voice in the passive condition. This may be the processing negativity (PN) and indicate attention shifts to the low voice in this condition.

Figure 2.



- These preliminary data indicate that the paradigm can address our research question.
- Monolinguals versus bilinguals appear to be navigating the auditory environment differently.
- When asked to attend to a specific voice, monolinguals show clear evidence that they are doing this, but in the passive condition, it appears that the low voice may capture attention.
- In contrast, bilinguals appear to less effectively “suppress” the non-target voice in the Attend condition.
- Future directions include adding more participants (16 per group) to determine whether these preliminary patterns are significant.
- Examine processing when shifting the target from one voice to the other.

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