Language and aging: Neurocognitive correlates of accent processing

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Many older adults have increased difficulty processing spoken language[1], including accented speech. Decreased hearing acuity is often cited as the cause[1], but this is not unequivocally supported by research.[2] If hearing acuity alone was responsible for this difficulty, listeners would show equivalent difficulty in processing both foreign- and native-accented speech, which has not been shown to be the case[1]. In addition to decreased hearing acuity, older adults often show decreased performance in cognitive and linguistic measures implicated in language processing, such as working memory, processing speed, or verbal skills[1,3,4], but it remains unclear to what extent these factors also affect the comprehension of foreign- and native-accented speech in older adults. Therefore, we examined older adults' processing of foreign- and native-accented speech, and explored how this is affected by variation in cognitive and linguistic abilities. As previous studies on foreign-accented speech processing in older adults have only used behavioral measures, we recorded EEG/ERPs to examine the neurocognitive signatures of listening to foreign- and native-accented sentences.

Current Study: We examined foreign- and native-accented speech processing by older adults (N=17; 60-80 years, within the normal hearing acuity range), recording ERPs and collecting behavioral individual difference measures*. ERP signal magnitude and individual difference measures were correlated.

Methods: Hearing acuity was assessed prior to the experiment. During the EEG experiment, participants listened to 240 sentences (stimuli from Grey & Van Hell (2017), where young adult processing of accented speech was examined -- 120 native- American-English accented, 120 Chinese-accented English; 30 syntactically well-formed, 30 syntactically anomalous (pronoun mismatch), 30 semantically well-formed, 30 semantically anomalous); they also answered occasional comprehension questions. Post-EEG recording, participants answered questions about accented speech they had just heard and prior experiences with accented speech.

Results/Conclusion: Participants were highly accurate in comprehension of both native (M=91%; SD=8.9) and non-native (M=87%; SD=8.2) accented speech. ANOVAs were conducted on the 300-500ms (N400) and 500-900ms (P600) windows. In the 300-500ms time-window, the ANOVA showed a significant main effect of accent (p=0.049) and for Distribution (p=0.028). A significant interaction was found for accent x well-formedness (p=0.000). Follow-up analyses on this interaction showed significant sensitivity to semantic violations in native-accented speech, but not to foreign-accented speech (F(1,17), = 18.74, p = .000) (see Figure 1A). For pronoun errors (see Figure 1B), the ANOVA showed a significant main effect of accent (p=.022) in the 300-500ms window. No significant effect was found to pronoun errors in the 500-900ms time window, for native- or foreign-accented speech.

With respect to how cognitive and linguistic variables correlate with response magnitude: hearing acuity correlated significantly with accuracy in native-accented, but not in foreign-accented, sentence comprehension. To the foreign-accent, only listener attitude correlated with ERP response magnitude, with more negative language attitudes corresponding to greater response magnitude to semantic errors in the foreign-accent (r = -0.484; p= 0.04). These results show that older adults have difficulty processing foreign-accented speech (in terms of sensitivity to both semantic and pronoun errors), more so than native-accented speech; these findings differ from those of Grey and Van Hell (2017), where younger adults demonstrated significant sensitivity to semantic violations in native- and foreign-accented speech. Hearing acuity alone cannot account for these findings, and variation in cognitive and linguistic abilities largely did not affect the result pattern. These results will be discussed in terms of changes in foreign-accented and native-accented speech comprehension across the lifespan, and how speech perception models can integrate a lifespan perspective.

* Individual difference measures were: Language Attitudes, AX-CPT, Verbal Fluency, Author Recognition, Pronunciation, Corsi, Reading Span, and Implicit Associations.

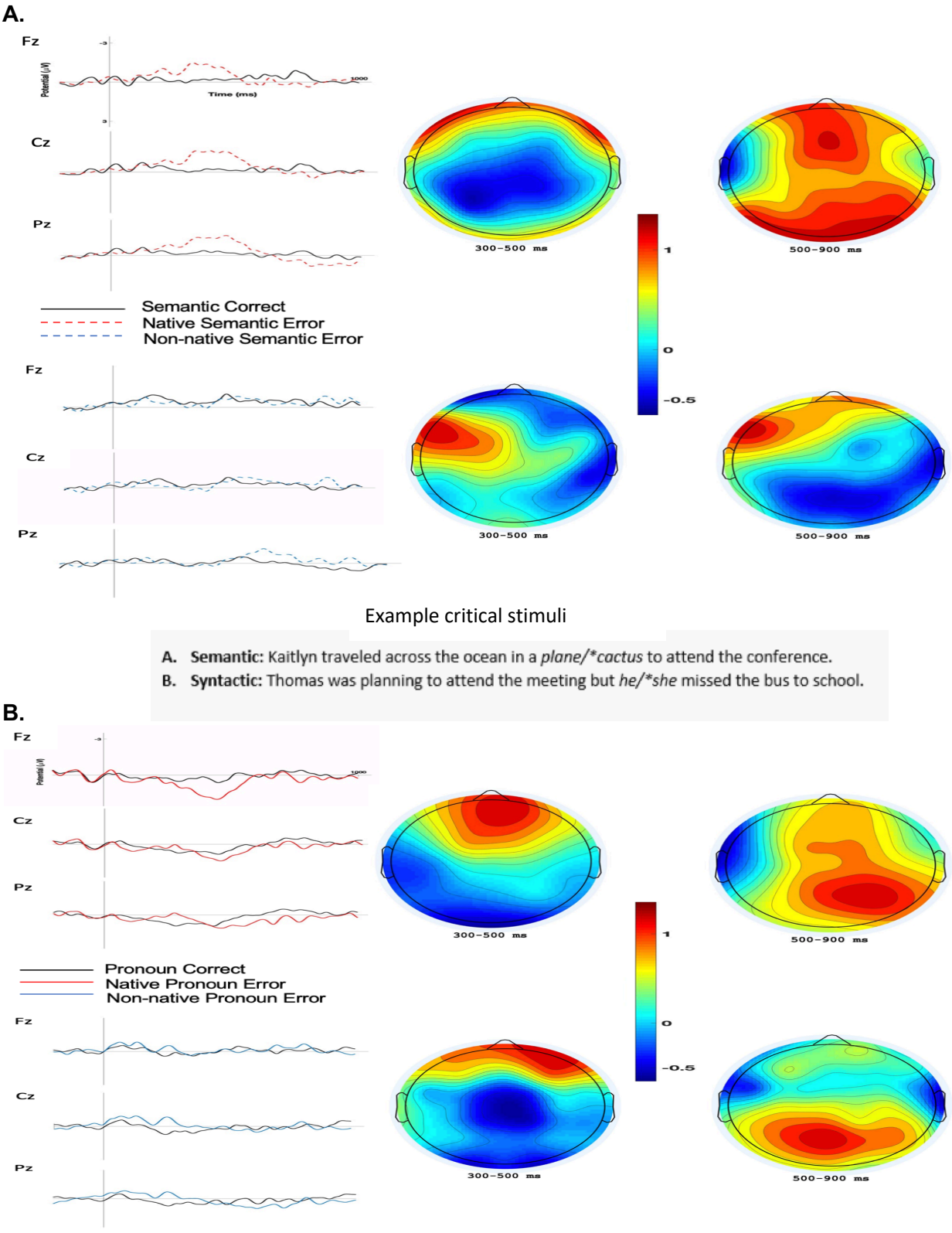

Figure 1. A. Semantic & **B.** Grammatical processing of native and foreign-accented speech. Topographic maps show scalp distribution of activity in error minus correct conditions.

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