Localizing Individual Differences in L1 Syntactic Processing: An MEG study

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Language comprehension is complex and requires the integration of many different components of language, including word meaning (semantics), and the way in which these words are put together to form a sentence (syntax). Models of native language (L1) comprehension have been based on the assumption that L1 individuals show homogeneity in language proficiency and in corresponding brain activity. However, a growing body of research has shown that proficiency is not homogeneous among L1 users, and that variability in this and other cognitive factors could influence the way in which each individual processes language. Recent research from our lab and others indicates that components of the event-related potentials (ERPs) elicited during sentence processing varies between individuals as a function of language proficiency, for violations of both semantic and syntactic expectations (Newman et al., 2012; Dubinsky et al., 2015).

The current investigation used magnetoencephalography (MEG) to investigate the time course, strength, and localization of brain activity associated with syntactic processing while reading written sentences, and how these vary among individuals as a function of language proficiency and scores on standard cognitive tests. Participants were presented with syntactically unacceptable (for example, *I want to banana the eat for lunch*) and syntactically acceptable (*I want to eat the banana for lunch*) sentences, and neural responses recorded with MEG. Participants were recruited from the general (non-university) population and recruitment emphasized diversity in age, sex, and socioeconomic status (SES). Individual differences were

measured along numerous dimensions, including standardized tests of language proficiency (TOAL-3; TOWRE), working memory (OSPAN; reading span), attention (Simon and flanker tasks), and speech-in noise perception, along with demographic and SES variables. Based on our earlier work using ERPs, we predicted that brain activity associated with syntactic violations would be modulated primarily by language and SES measures; source localization of MEG signals was used to help identify the brain areas involved in these modulations, rather than just the scalp electrical potentials. Initial results demonstrated the expected modulation of sensor-level MEG data in the 600-800 ms time range typically observed in ERP studies with similar design. Further results and wider implications of these findings are discussed.