Title: Effects of Meaningfulness in Left Angular Gyrus and Right Insula

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Introduction: We present a joint analysis of data from a study of sentence-level semantic processing using functional magnetic resonance imaging (fMRI) and event-related potentials (ERP). EEG and fMRI data provide complementary evidence on neurocognitive processes (Calhoun et al, 2006). The current study examines the neural dynamics of Meaningfulness Effects in sentence comprehension. The Meaningfulness Effect was defined as greater activity to Expected/Unexpected versus Anomalous words, and was contrasted with the Expectancy Effect, which is the response to Expected versus Unexpected/Anomalous words. We expected to see a late effect of Meaningfulness in the ERP data and a distributed pattern in the fMRI data that includes left middle temporal gyrus (LMTG) and left angular gyrus (LAG). We further expected that Meaningfulness Effects in LAG would be significantly correlated with reading comprehension skill.

Method: On each trial, a sentence was presented for four seconds, followed by either a pseudoword or a word that was Expected (E), Unexpected (U), or Anomalous (A). Participants were to determine whether the last word made sense or not. During the fMRI session, participants performed the semantic judgment inside a 3-Tesla scanner. During the ERP session, we acquired brainwave data from 256 head-mounted sensors. Analyses from ERP and fMRI sessions were then performed.

Results: The fMRI analysis showed distinct networks active for the contrast E>U&A (Expectancy effect) and E&U>A (Meaningfulness effect). ERP analysis showed the predicted

N400 Expectancy effect. In addition, we found a late effect of Meaningfulness over right frontal regions.

Conclusion: Meaningfulness has often been confounded with Expectancy in prior work (Dien et al, 2003). The present study provides new evidence for processes that are unique to meaning integration. Our findings suggest a novel relationship between Meaningfulness and effects in LAG and right insula. We are presently using joint ICA to look at the relationship between Meaningfulness effects in right insula (fMRI) and corresponding effects in the ERP data.