Event-related potential effects of visual sequential learning are related to receptive vocabulary ability

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Introduction Sequential learning (SL) is a cognitive process allowing people to perceive and learn environmental patterns. Since language acquisition requires learning temporal patterns of speech, SL is thought to be essential for language development and performance. However, to date, the neural evidence supporting such a relationship between SL and language performance is scarce.

Method We explored this relationship using event-related potentials (ERP) with a non-verbal visual SL task in 17 adults (11 females, 18-49 years), who also completed the *Peabody Picture Vocabulary Test* (*PPVT-IV*). In the SL task a "predictor" preceded a non-verbal target with varying probability.

Results indicated that ERPs to the predictors were modulated by these probabilities, demonstrating that SL occurred. These ERP effects interacted with the PPVT score [750-850ms post-predictor onset: $F(2,14)=4.44$, $p=.032$] and with the PPVT and a topographic factor [100-200ms post-predictor onset: $F(4,28)=6.21$, $p=.006$].

Conclusion These results suggest that language learning/processing is affected by the brain's ability to learn sequential patterns. Specifically, acquiring knowledge of the meaning of words appears to rely upon basic sequence processing mechanisms that are involved with encoding probabilistic regularities in environmental stimuli. From a developmental perspective, learning the meaning of words first requires learning to segment words in continuous speech – which itself requires learning the probabilistic patterns of sounds occurring in speech. These findings provide some of the first evidence that the neural correlates of these basic learning mechanisms is related to language ability in adults.