Language Learning Efficacy in Adults is Predicted by the Electrophysiological Markers of Native-Language Processing

Sara D. Beach\textsuperscript{1,2}, Zhenghan Qi\textsuperscript{1}, Amy S. Finn\textsuperscript{1}, Jennifer Minas\textsuperscript{1}, Calvin Goetz\textsuperscript{1}, Brian Chan\textsuperscript{1}, John D. E. Gabrieli\textsuperscript{1}

\textsuperscript{1}Massachusetts Institute of Technology \textsuperscript{2}Harvard University

- Language-learning outcomes in adulthood vary markedly across individuals.
- Behaviorally, native-language skills have been shown to form the basis of learning aptitude [1].
- Individual differences also manifest in the N400 and P600, the canonical neural indices of semantic and syntactic processing, respectively [2,3].
- Given that there are distinct neural signatures of semantic and syntactic processing, we asked whether the native-language N400 and P600 predict adults' ability to learn the vocabulary and grammar of a novel language.
- We found a double dissociation such that the N400 predicts vocabulary learning and the P600 predicts grammar learning.

### Study Design

- N = 38 typical young adults
- Pre-Training EEG
- Training / Test Day 1
- Training / Test Day 2
- Training / Test Day 3
- Training / Test Day 4
- Test Day 1
- Test Day 2
- Test Day 3
- Test Day 4

### Native-Language Markers

#### Semantic Processing

- The rider put the saddle on the pool (horse).
- **N400**
- **P600**

#### Syntactic Processing

- Kent's uncle sells *us* (us) his old cars.

### Individual Differences in ERPs

- Response Dominance to Semantic Processing
- Response Dominance to Syntactic Processing

### Prediction Results

- Individuals' N400 and P600 effect magnitudes are not significantly correlated (p's > 0.288).
- Response Dominance Indices show a continuum of typical to less-typical responses. Quantifying responses in this way leads to the same pattern of brain-behavior correlations as are obtained with N400 and P600 effects.

### References