Laying the tracks for memory integration: Processing of the first premise

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Introduction

- Memory integration is a critical process in accumulating knowledge (Spalding et al., 2018)
- Individual variability in self-derivation through memory integration is pronounced (**Figure 1**) and relates to cognitive and academic skills (Esposito & Bauer, 2017; Varga et al., 2019)
- Neural effects at encoding have previously been examined in participants who perform at approx. 50% correct in a self-derivation task (Varga & Bauer, 2017a)

Given the relevance of self-derivation to academic achievement, it is important to investigate neural underpinnings and cognitive correlates of low versus high performers

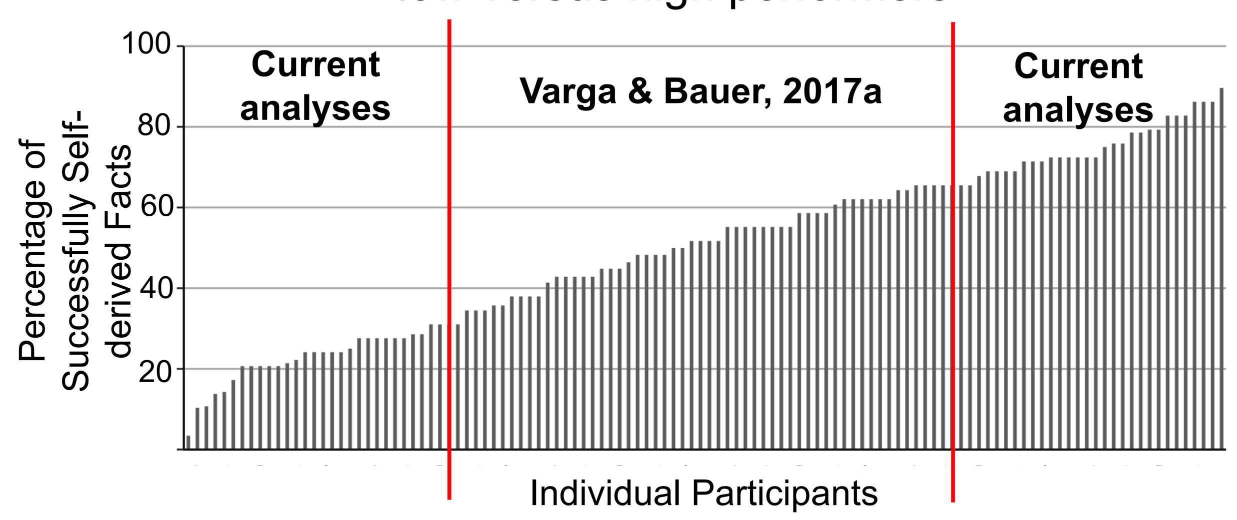


Figure 1. Individual participants' performance (adapted from Varga & Bauer, 2017b).

Methods

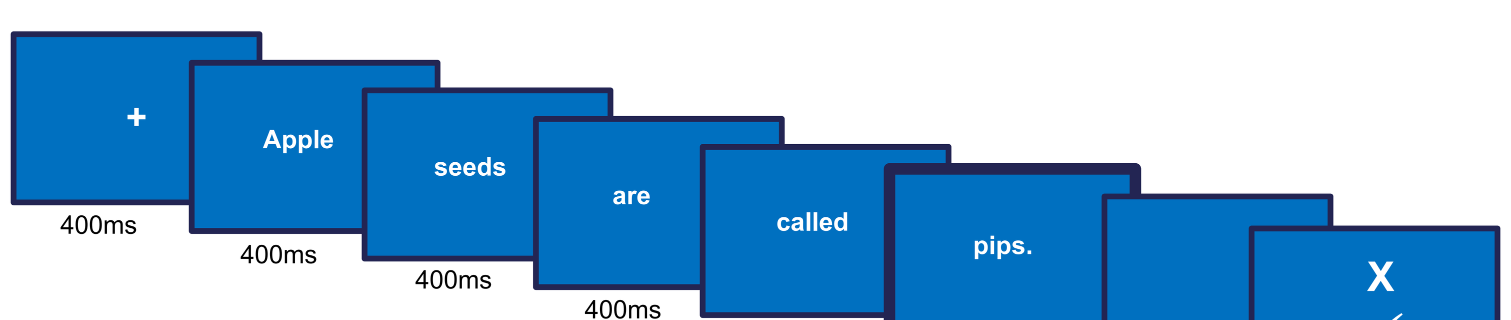
Participants:

21 low performers and 16 high performers excluded from original analyses (N = 37; 20 female); M age = 19.72(*.98*)

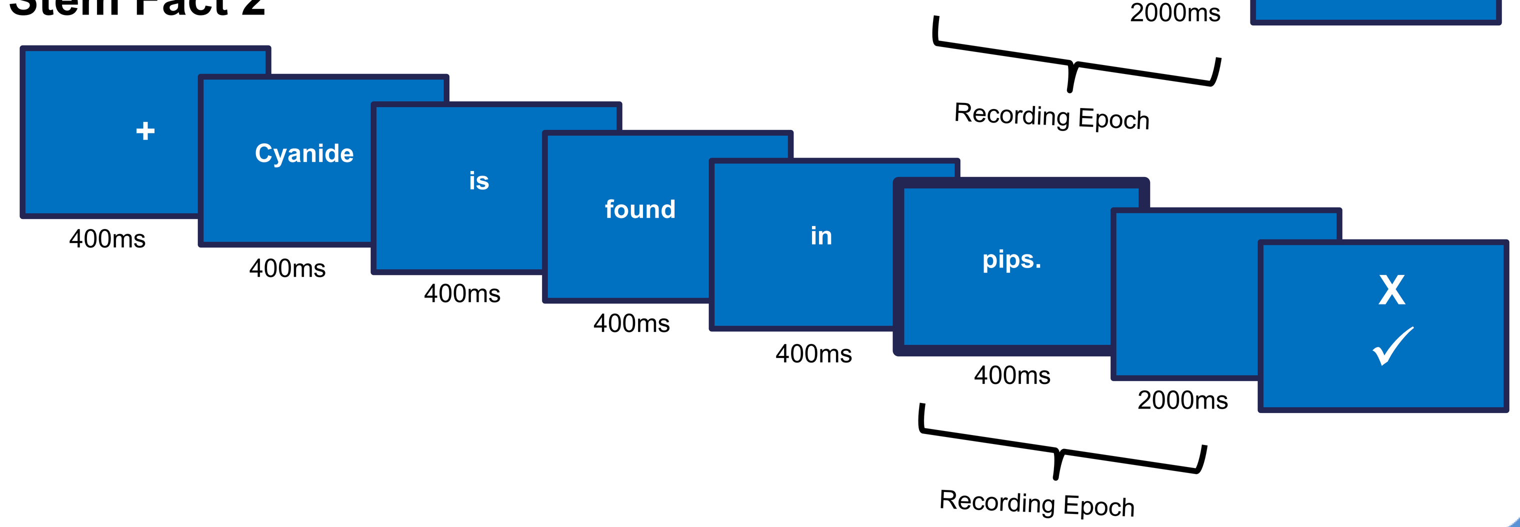
Procedure:

60 novel, related facts ("stem" facts) to be integrated
Presented one word at a time; ERPs time-locked to onset of last word

Stem Fact 1



Stem Fact 2



Methods cont'd.

Preprocessing:

Preprocessing performed using the MATLAB toolbox EEGLAB. Artifact rejection - visual analysis and independent components analysis (ICA)

Analysis:

Only incorrect trials included for low performers and correct trials for high performers
Time windows: used full latency multichannel cluster windows of stem 1 and stem 2 effects identified in Varga & Bauer, 2017a; two encoding phase time windows were analyzed: 1122-1349 ms and 1424-1706 ms (from Varga & Bauer, 2017a)

Channel inclusion: 75% rule
Fp1, F7, F3, Fz, Cz, FP2, F4, FC6, FC5, FC2, FC1, C4, C3, T7, T8, CP6 CP2

Results – Varga & Bauer, 2017

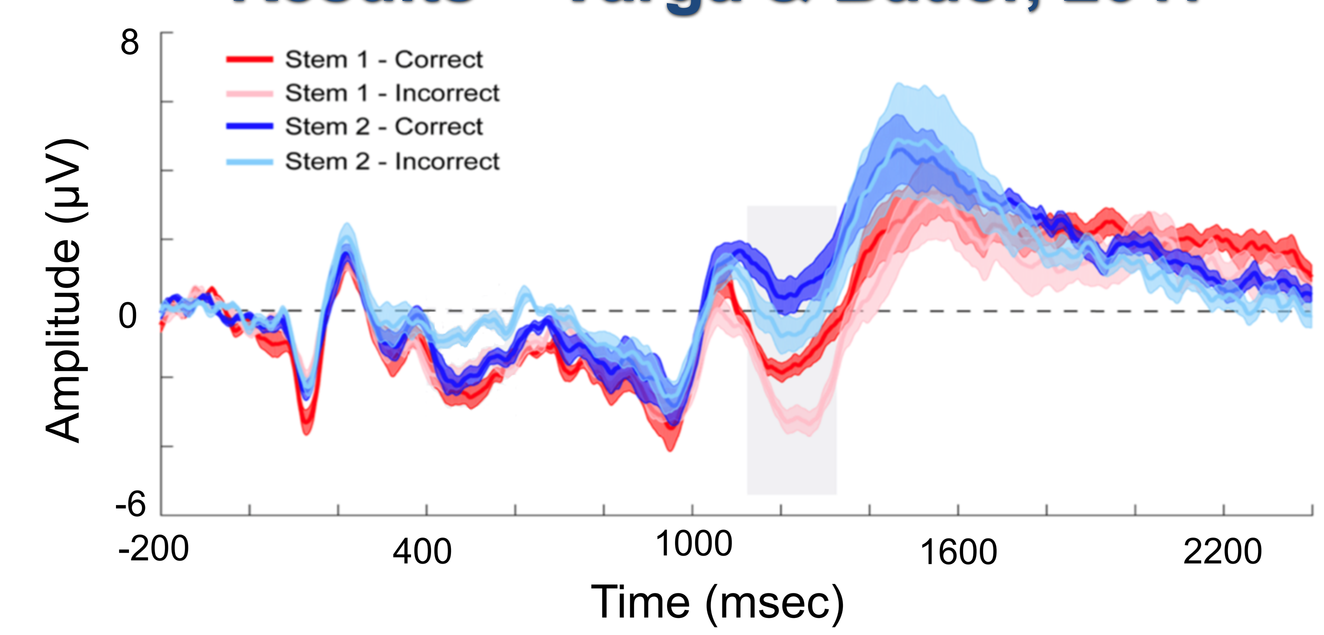


Figure 2. from Varga & Bauer, 2017a; Grand average event-related potential (ERP) waveform at encoding for frontal, frontocentral, and centroparietal electrode sites

Results – Current Analysis

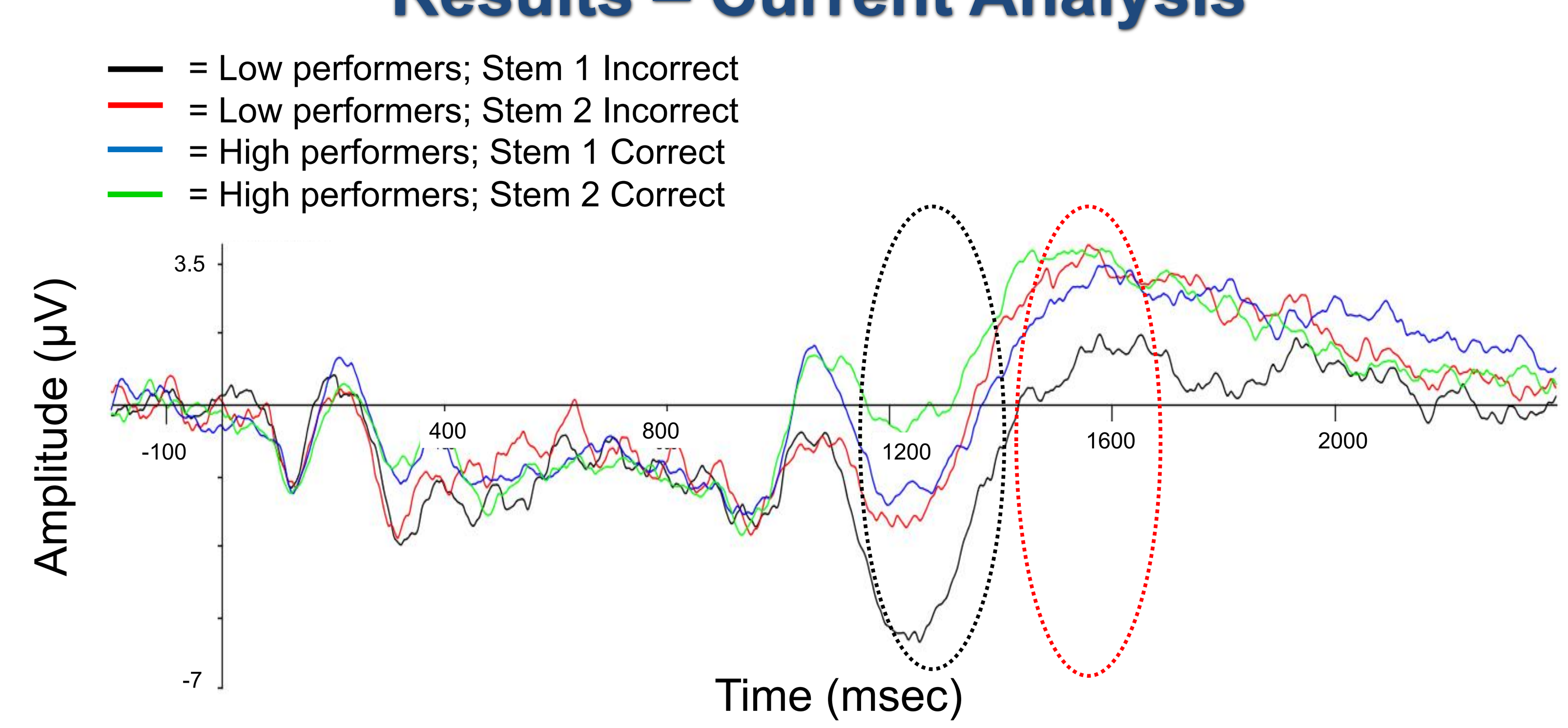


Figure 3. Grand average ERP waveform at encoding. Black circle demarcates time window 1 (1122-1349 ms) and red circle demarcates time window 2 (1424-1706 ms)

- Time window 1: Main effect of stem (F(1,35) = 24.92, p<.001, η_p^2 = .42) and performance (F(1,35) = 5.78, p = .022, η_p^2= .14)
- Time window 2: Main effect of stem (F(1,35) = 6.13, p = .018, η_p^2 = .15)

Results cont'd. – Cognitive Correlates

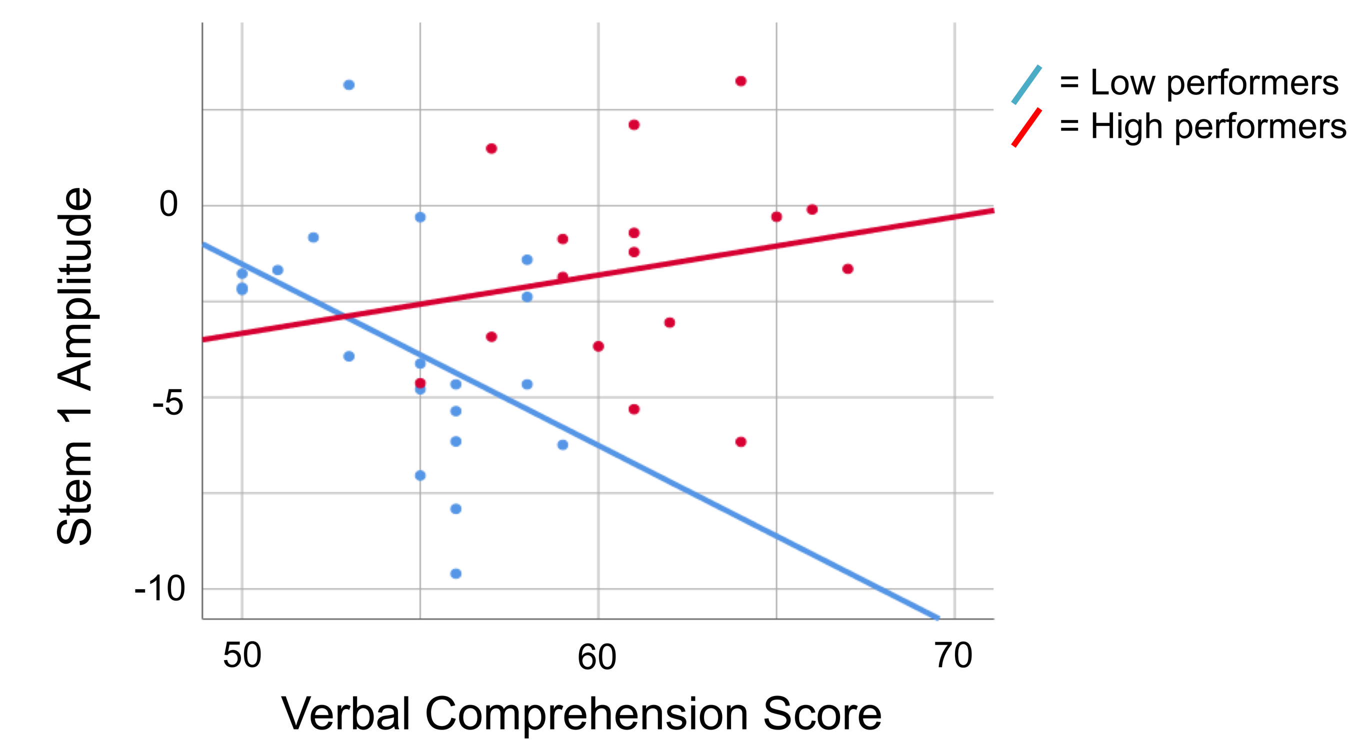


Figure 4. Relation between stem 1 amplitude and verbal comprehension summed score at time window 1 (1122-1349 ms)

- For low performers, verbal comprehension score significantly predicts stem 1 at time window 1 (R^2 = .20, p = .046) and time window 2 (R^2 = .41, p = .002)
- For high performers, verbal comprehension score does not relate to stem 1 at either time window (R^2 = .04 and .003, p = .472 and .847, respectively)

Preliminary Conclusions and Future Research

- Low performers and high performers may process the first premise in an integration task differently
- This differential processing may be related to encoding of semantic meaning, as indexed by the relation between incorrect trials for low performers and verbal comprehension scores
- Future directions: Potential baseline effects? Do high performers look the same as low on incorrect trials? Correlation with task performance?

References

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