

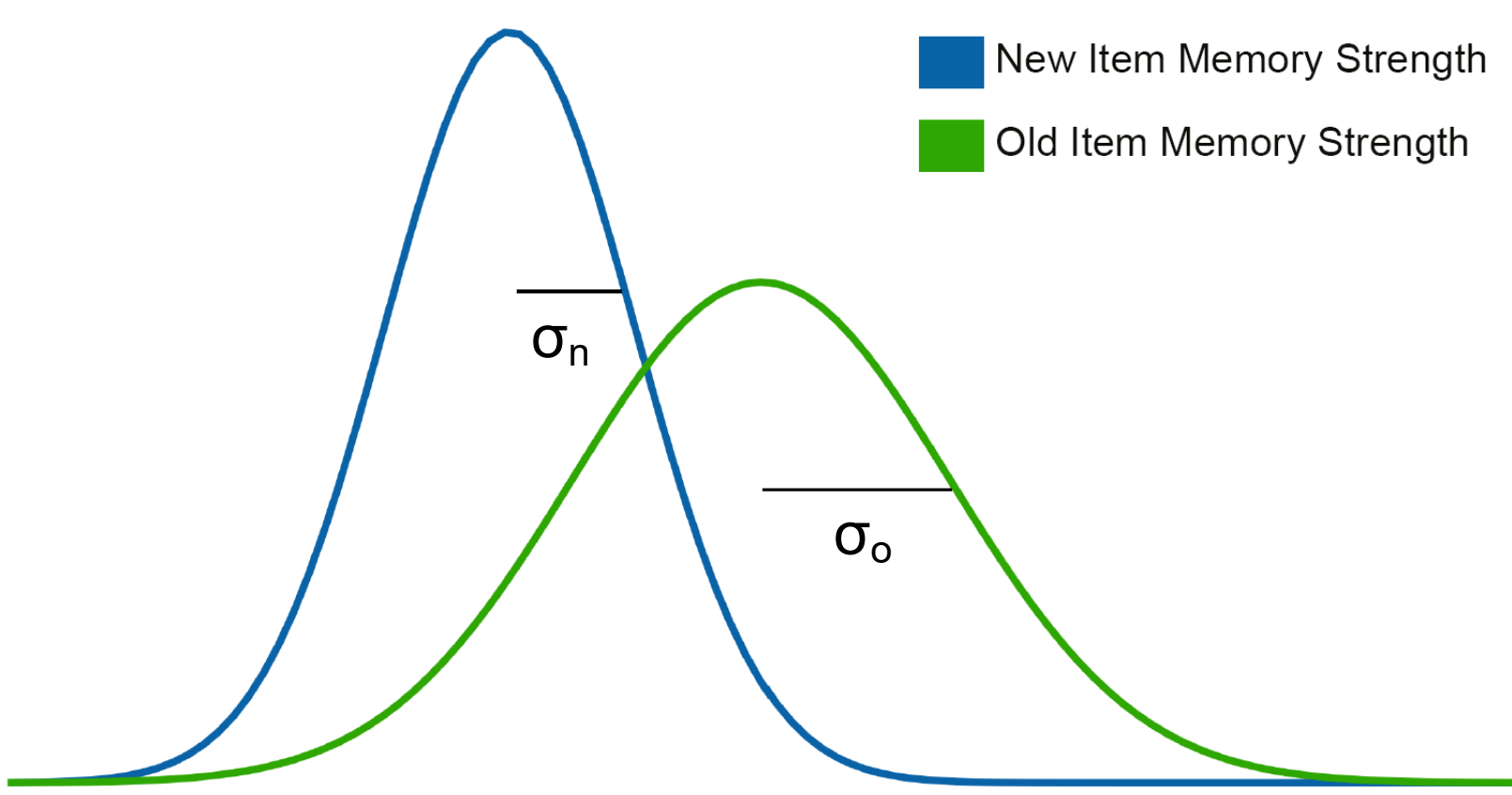
The Unequal Variance Signal-Detection Theory of Recognition Memory: Tests of the Encoding Variability Hypothesis

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Introduction



The unequal variance signal-detection (UVSD) model of recognition memory is well established, though the psychological explanation for unequal variances ($\sigma_o > \sigma_n$) is unclear.

The encoding variability hypothesis explains this as:

$$O = B + Y$$

Where B and Y are Gaussian variables, representing baseline memory strength, and added strength as a result of factors at encoding, respectively. O is the resulting old item strength distribution.

No previous research has found evidence of encoding variability during a study phase.
So, can evidence for the encoding variability hypothesis be found using new methods?

Experiment 1 Method

A Given Study Phase Trial:

Stimulus (word)	Inter-Trial-Interval (ITI)	Fixation ("+")
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Fixed condition: 3000 ms 1000 ms 500 ms
Variable condition: duration sampled from a normal distribution with constraints

Test Phase:

130 old + 130 new items presented:
participants make recognition memory judgements

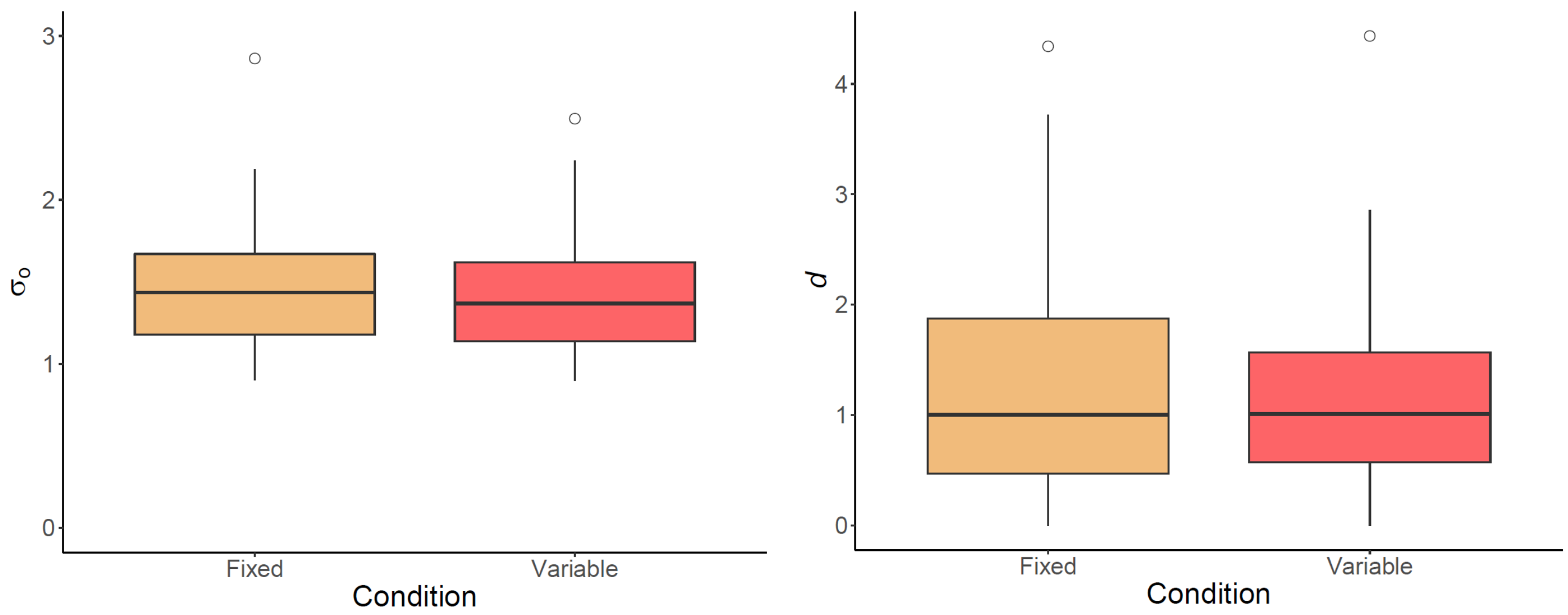
Note: N = 40 (also in Experiment 2)

Prediction:

Old item strength variance will be greater in Variable Condition, due to variation in exposure duration

Experiment 1 Results

Q: Is old item strength variance greater because of added encoding variability?



No difference in UVSD estimates of σ_o (old item variance) between conditions

No difference in UVSD estimates of d (memory strength) between conditions

- Dual process (DPSD) and mixture signal-detection (MSD) model fits also showed no differences in old item variance or strength.
- Study duration very weakly (but significantly) correlated with recognition performance

A: No evidence for encoding variability through a study duration manipulation.

Can a different manipulation (of trial to trial attention) demonstrate an effect predicted by the encoding variability hypothesis?

Experiment 2 Method

Study Phase: Participants viewed stimuli and completed a simultaneous one-back task.



Fixed Condition: inter-digit interval is 3500 ms (synchronised with image presentation)

Variable Condition: inter-digit intervals are sampled from a normal distribution with constraints (digits are asynchronous with image presentation)

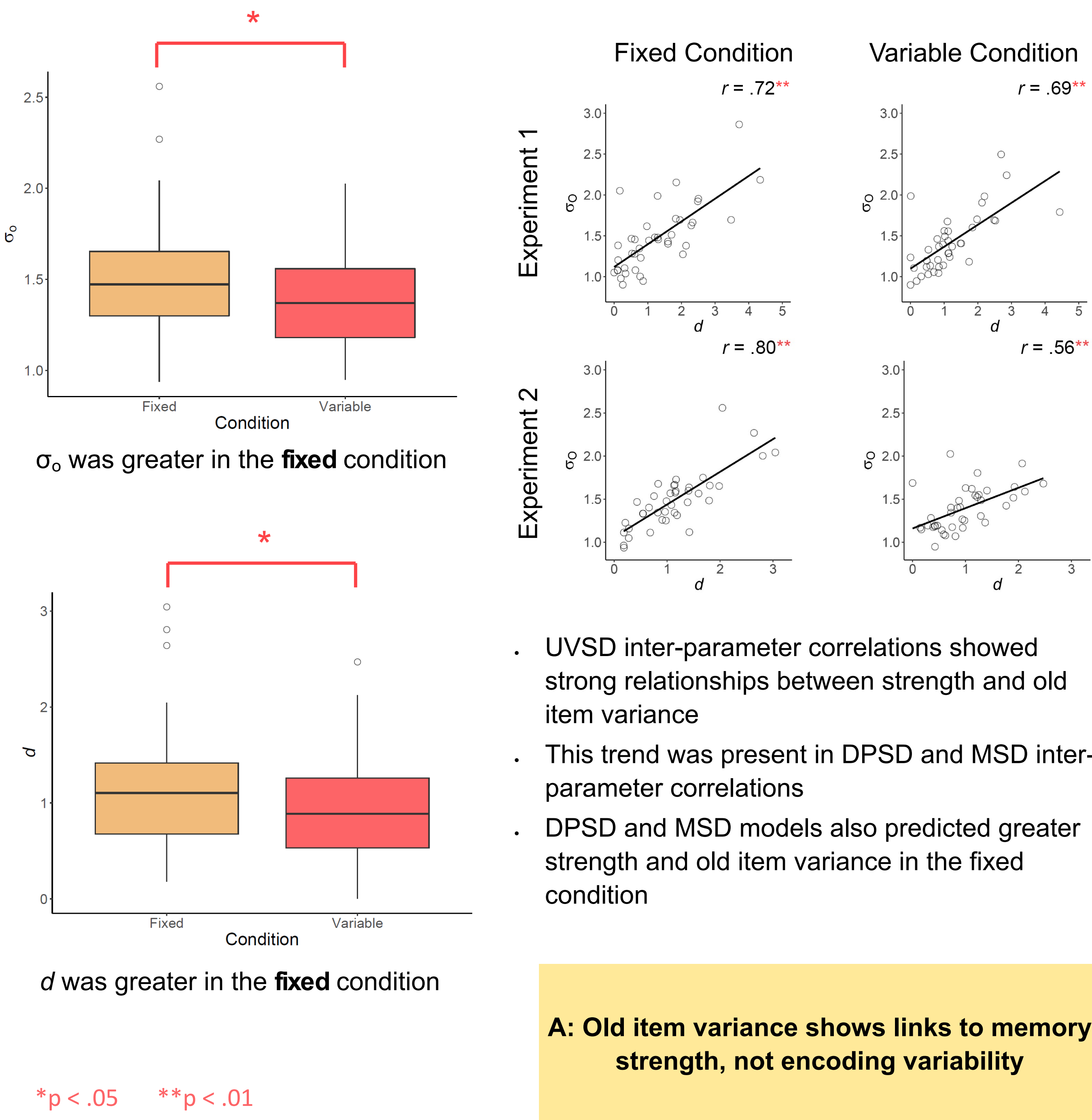
Test Phase: The same as in Experiment 1.

Prediction:

Old item strength variance will be greater in the Variable Condition, due to fluctuations in attention to visual stimuli caused by variation in one-back task digit intervals.

Experiment 2 Results

Q: Is old item strength variance greater because of added encoding variability?



- UVSD inter-parameter correlations showed strong relationships between strength and old item variance
- This trend was present in DPSD and MSD inter-parameter correlations
- DPSD and MSD models also predicted greater strength and old item variance in the fixed condition

A: Old item variance shows links to memory strength, not encoding variability

Conclusions

No evidence was found for the encoding variability hypothesis as it is currently conceptualised.

- Each considered model predicted simultaneous increases in strength and old item variance in Experiment 2
- Inter-parameter correlations from both experiments also provide evidence for a relationship between strength and old item variance
- The UVSD model's validity is not tied to the encoding variability hypothesis; however, a valid (potentially new) account of old item variance should be sought