# Supplemental Materials for Contiguity in Episodic Memory

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The lag-CRP analyses presented in the figures in the main text were conducted using the standard algorithm for computing lag-CRPs. In computing the number of times transitions of various lags were possible, this algorithm assumes any transition to an as yet unrecalled list item were possible. As pointed out by Hintzman (2016), this assumption introduces a confound with variations in recall probability across items (e.g., the serial position effect makes transitions to primacy and recency items more likely). See the main text for a more detailed discussion of this issue. To control for such variations in item availability, we can consider transitions to a given item as possible only if that item was successfully recalled *at some point in the recall sequence*. See the main text for full details on this adjustment.

Figure 4 in main text shows this adjustment applied to the data from PEERS Experiment 4, but all other figures in the main text show lag-CRPs computed in the standard way, without the adjustment. Here, we present alternative versions of key figures using the availability adjustment.

Although the availability adjustment provides an important demonstration that autocorrelation in goodness of encoding does not account for the contiguity effect, we argue against making the adjustment standard practice when computing lag-CRPs. The assumption that only items that are actually recalled are available is, of course, unrealistic (Tulving & Pearlstone, 1966). Ignoring many transitions that were indeed possible is likely to reduce the reliability of the denominator in the CRP computation, artificially increasing variance (compare the error bars between the figures with and without the adjustment).

Moreover, caution should be exercised when making comparisons between conditions, especially when the conditions differ in overall recall level. The availability adjustment changes the scale of the effect by making the denominator of the lag-CRP calculation negatively correlated with the number of items recalled. As a consequence, the curves of conditions with lower recall probabilities (e.g., older adults) will be raised relative to curves

of conditions with higher recall probabilities (e.g., younger adults), potentially disguising the fact that the contiguity effect is shallower in one condition.

In practice, a better approach may be to use a reshuffling procedure to estimate the size of the contiguity effect expected by chance. See Figure 7 of the main text for an example of this approach.

**Main text Figure 1.** An adjusted version of Figure 1 from the main text is shown in Figure 4 in the main text.

**Main text Figure 2.** An adjusted version of Figure 2 is shown in Figure S1. Again, caution must be exercised when comparing conditions because the adjustment places conditions with different recall levels on different scales. For example, in Figure S1A the CRP for $lag + 1$ is the same for participants in both extremes of the contiguity distribution, even though the contiguity effect (i.e., the ratio of CRPs for near lags versus far lags) is much smaller for those in the lower distribution.

**Main Text Figure 3.** An adjusted version is shown in FigureS2.

**Main Text Figure 4.** Already applies the adjustment.

**Main Text Figure 5.** The shuffling procedure used to generate this figure already corrects for availability.

## References

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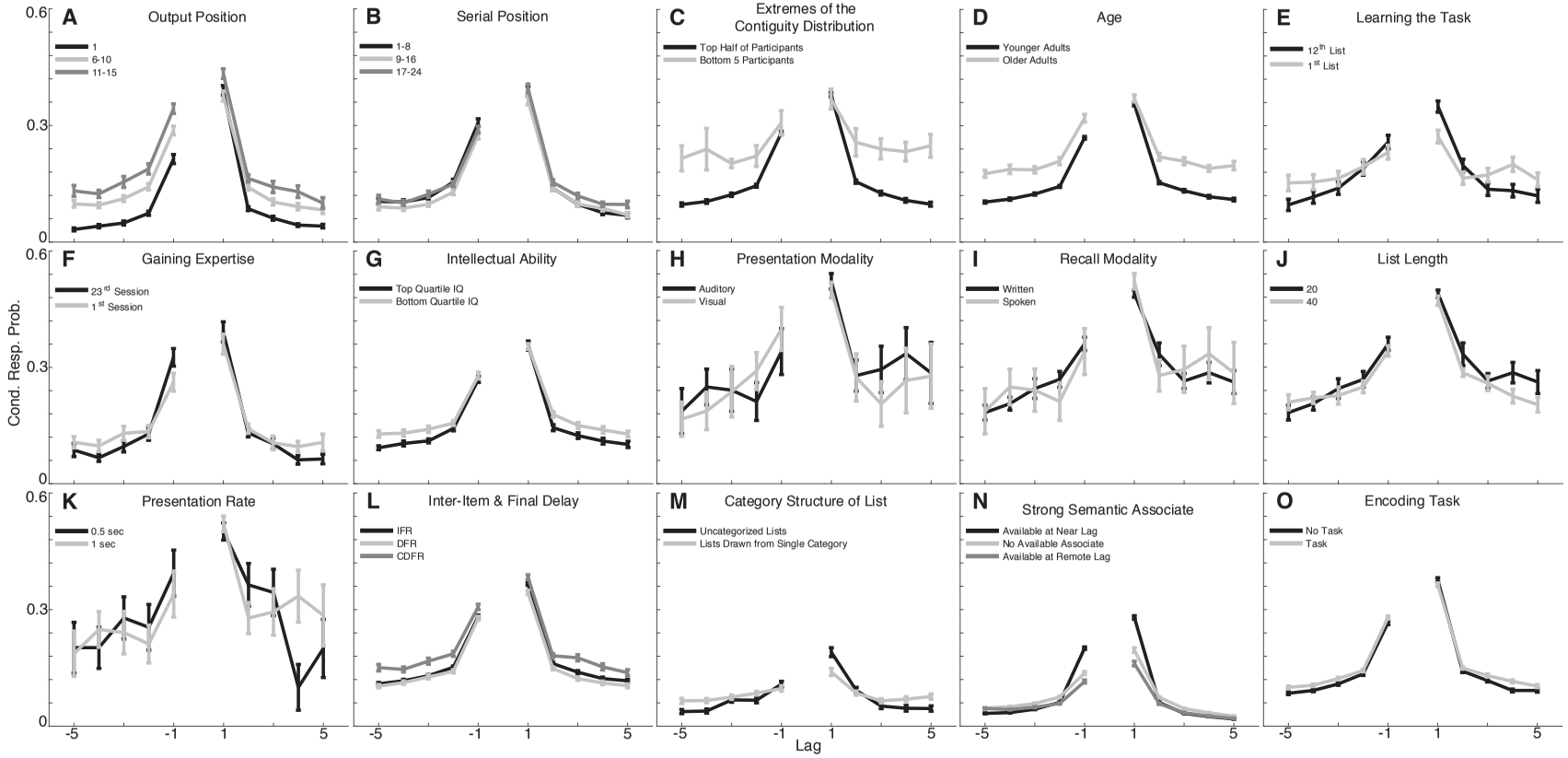


*Figure S1*. A version of Figure 2 from the main text produced using the availability adjustment. Many variables modulate, but do not eliminate, the contiguity effect. (A) Output position 1 vs. output positions 6–10 and 11–15 from PEERS Experiment 4. (B) Transitions originating from serial positions 1–8, 9–16, and 17–24 from PEERS Experiment 4. (C) Subjects with the temporal factor scores in the top half of the distribution vs. subjects with the 5 lowest scores across both age groups in PEERS Experiment 1. (D) Younger vs. older adults in PEERS Experiment 1. (E) First vs. last ($12^{th}$) list in the screening session of PEERS. (F) Naïve subjects' first vs. $23^{th}$ session in PEERS Experiment 4. (G) Top vs. bottom quartile of the younger adult IQ distribution in PEERS Experiment 1. (H) Auditory vs. visual presentation in the 1 sec presentation rate condition in Experiment 1 of Murdock and Walker (1969). (I) Written vs. spoken recall in Murdock and Walker (1969) and Murdock (1962) respectively (20-item lists presented auditorily for 1 sec/item in both cases). (J) List length 20 vs. 40 in Murdock (1962, 1 sec presentation rate). (K) Presentation rates of 0.5 sec vs. 1 sec in Experiment 1 of Murdock and Walker (1969). (L) Immediate, delayed, and continual distractor recall conditions from PEERS Experiments 1–3. (M) Uncategorized lists vs. lists drawn from a single category in McCluey, Burke, and Polyn (2018). (N) Transitions originating from items that had a strong associate (WAS $cos(\theta) > .7$) available only at $lags > 5$ vs. items that had a strong associate available at $lags \leq 2$ vs. items that had no strong associates available. (O) Lists with vs. without an encoding task in Immediate free recall lists of PEERS Experiments 1–3.

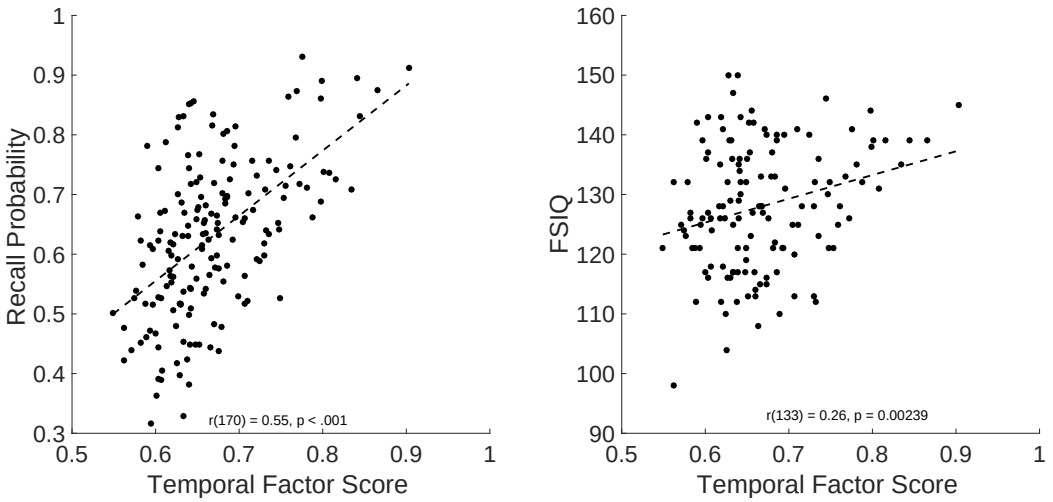


*Figure S2*. A version of Figure 3 from the main text produced using the availability adjustment. Individual differences in contiguity predict memory performance and IQ (A) The correlation between temporal factor scores and overall recall probability. Temporal factor scores give the average percentile ranking the temporal lag of each actual transition with respect to the lags of all transitions that were possible at that time. (B) The correlation between temporal factor scores and full-scale Wechsler Adult Intelligence Scale IV IQ. Computed using all immediate free recall trials from younger adults in Experiments 1–3 of the Penn Electrophysiology of Encoding and Retrieval Study (PEERS). In each session, subjects studied lists of 16 words for immediate free recall.