V35

Incongruent visual animations make unrelated narratives more memorable by driving stronger brain responses

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Introduction

• How does visual context effect the memory of an auditory narrative?

• Does the neural reliability of electroencephalography (EEG) predict memory accuracy?

Rationale

• How do people select what to encode into memory?
  • Do multisensory cues aid in this process?

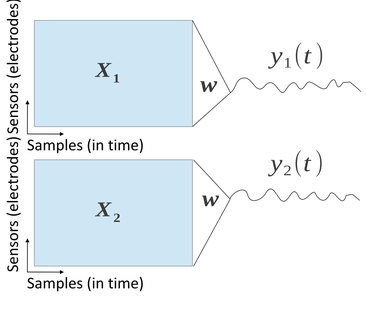
• Goal: Investigate incidental learning in the context of naturalistic stimuli

• Measure a neural signal of encoding

Methods

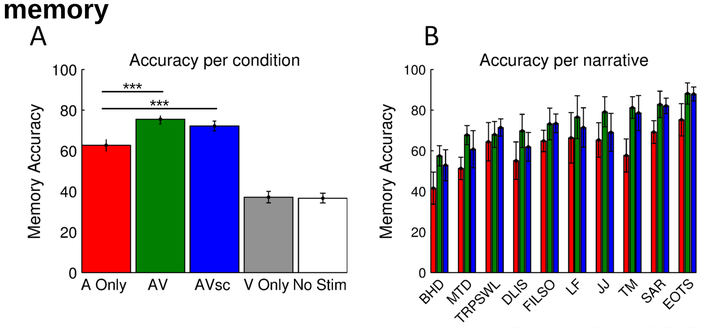
Information presented within continuous “life-like” scenario:
10 animated stories (StoryCorps, NYT Modern Love)

3 conditions:
- Auditory Only (A-Only) n = 17
- Auditory + Visuals (AV) n = 22
- Auditory + Visuals, scrambled (AVsc) n = 18



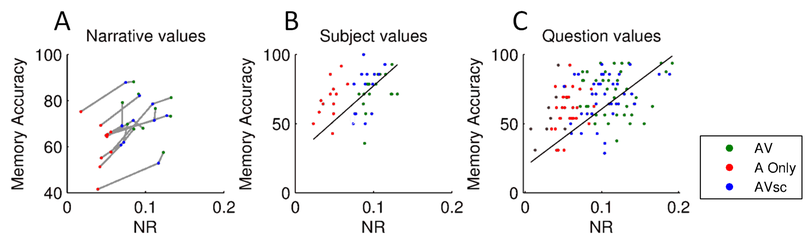
Results

Multisensory presentations enhance incidental episodic memory



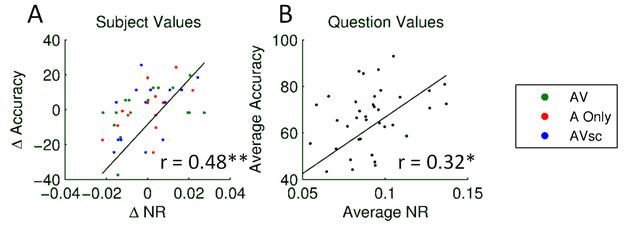
Memory performance for different stimulus modalities (A) and different narratives (B, Broken Heart Doctor” (BHD), “Don't Let it Snow” (DLIS), “Falling in Love at 71” (FILSO), “Lost and Found” (LF), and “The Matchmaker” (TM) and 5 from StoryCorps' animated shorts, “Eyes on the Stars” (EOTS), “John and Joe” (JJ), “Marking the Distance” (MTD), “Sundays at Rocco's” (SAR) , and “To R.P. Salazar with Love” (TRPSWL)). “No Stim” indicates the chance level of performance on the memory questions given no information (n = 9). Note that exposure to just the visual stimuli (V Only, n = 14) yields performance no better than chance. Error bars indicate standard deviations across subjects, *P<0.05, **P<0.01, ***P<0.001.

Neural reliability and memory accuracy are correlated across narratives, subjects, and questions



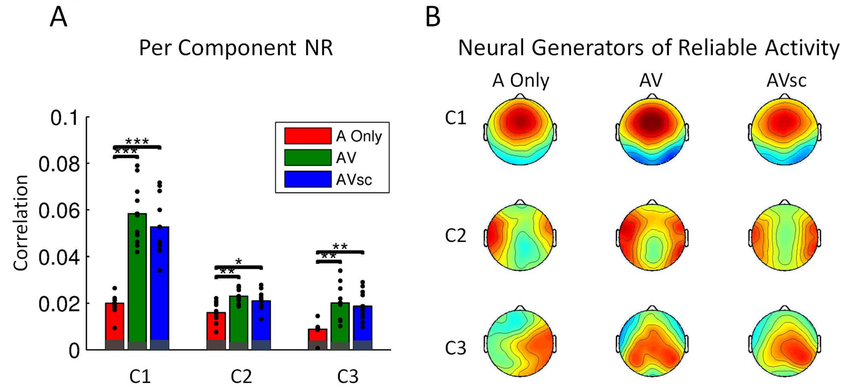
Memory accuracy increases with neural reliability (NR).
A (Narrative values): NR and memory accuracy levels for all 10 stories presented either solely auditorily (A Only, red), with accompanying animations (AV, green), or with animations scrambled in time (AVsc, blue). Each story is represented by a line connecting all three conditions associated with it. NR (calculated using the sum of the three largest correlated components) elicited by the presentation of the narrative condition is on the horizontal axis, and the degree of accurate recognition of story elements across all subjects who experienced that presentation is on the vertical axis.
B (Subject values): NR and memory accuracy for each subject (43 total). Each subject experienced only one of the three conditions. The linear model estimate for the relationship between NR and memory accuracy is plotted with the dashed line. It is of note that the neural reliability evoked by each narrative, and induced in each subject is above chance level (all p's < 0.01).
C (Question values): The NR value plotted against the memory accuracy value for each question asked of subjects who experienced the A Only (red), AV(green), or AVsc (blue) conditions. NR was measured in the 20 seconds preceding and including the window in which the information relevant for the memory question was revealed. Darker gray points indicate the NR values were not significant at a level of P < 0.01.

Correlation between neural reliability and memory accuracy is independent of modality



The relationship between neural reliability (NR) and memory accuracy is preserved within modality.
A: The mean NR and memory recognition level for each stimulus condition was subtracted from each individual who experienced that stimulus to control for the strong modality effect in both measures.
B: NR and accuracy was averaged across modality for each question encoded within a discrete time period.
*P < 0.05, **P < 0.01, ***P < 0.001.

Multisensory presentations increase reliability of neural responses &
Spatial distribution of reliable neural response are preserved across modalities



A: The neural reliability across subjects (NR) for the three strongest components of the EEG (“C1”, “C2” and “C3”) for auditory (A Only, red), audio-visual (AV, green), and audio with scrambled visuals (AVsc, blue) stimuli. Circles indicate the level of NR elicited for each narrative in each presentation modality. Darker gray shade indicates the chance level of correlation for each modality and component. Error bars represent standard error of the mean, *P < 0.05, **P < 0.01, ***P < 0.001.
B: Scalp projections of the three most reliable components of neural activity. Each column represents the projection obtained via a different stimulus presentation (A Only, left, AV, middle, AVsc, right). Each row represents a different component in descending order from most reliable (top) to least reliable (bottom). Color indicates the correlation of each scalp electrode with the component.

Conclusions

Visuals aid in recognition regardless of congruency

ISC correlates with recognition accuracy

Location of components appears consistent across modalities

References

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