

Rapid memory replay of life-like episodic sequence of events precedes their verbal recall from long term memory

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Memories of past experiences (episodic memories) are thought to be organized in a manner that preserves the temporal structure of the experience. It is unclear, however, whether their recollection involves replay of the specific sequence of events in temporal order and whether this precedes their verbal recall. In real life, events occur in a temporal succession and it has been revealed that brain can segment the information in different timescales depending of the brain regions involved [1]. The event boundaries generated by long-timescale cortical regions are triggering hippocampal activity in order to encode information about the just-concluded event into episodic memory. Moreover, semantic congruence has already been related with an enhancement of episodic memory association and the acceleration of the onset signals of those items successfully encoded in memory [2]. In the current study, we recorded electrophysiological (EEG) activity while participants encoded life-like sequences of pictures into an episodic narrative, and in a subsequent memory test, asked them to verbally recall each sequence upon presentation of a cue (the first picture of the sequence). We have tested congruent and incongruent series of information in order to further study the impact of this conditioning factor in neural similarity and also in the event boundary formation. Behaviourally, we found that participants' verbal recall preserved the temporal order of the encoded sequence but accuracy decreased as a function of the picture's temporal distance from the cue. Neural similarity analysis on spatio-temporal EEG patterns elicited during picture encoding and by the memory cue revealed an increase in similarity at fronto-central scalp regions within 600-1000 ms of cue onset, thereby suggesting the existence of a rapid memory replay of the encoded picture sequence triggered by the memory cue. In addition, the degree of neural similarity associated with each picture within the sequence decreased linearly, was correlated with sequence recall accuracy across participants, and varied according to whether specific items from the episodic sequence would be later recalled at the within-subject level. These findings indicate the existence of a very rapid replay of event sequences upon presentation of a memory cue preceding, and therefore possibly determining, their later verbal recall from long-term memory.

This is a joint work with Iria Rodríguez, Ignasi Sols-Balcells, Aya Ben-Yakov, and Lluís Fuentemilla.

REFERENCES

- [1] C. Baldassano, J. Chen, A. Zadbood, J.W. Pillow, U. Hasson, and K.A. Norman, Discovering event structure in continuous narrative perception and memory. Biorxiv (2016), doi.org/10.1101/081018.

- [2] P.A. Packard, A. Rodríguez-Fornells, N. Bunzeck, B. Nicolás, R. de Diego-Balaguer, L. Fuentemilla, 2017. Semantic Congruence Accelerates the Onset of the Neural Signals of Successful Memory Encoding. *J Neurosci.* 37(2017), no. 2, 291–301