Role of schema-based knowledge in reconstructing real-life event sequences

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Background

- Retrieving temporal order of events could be supported by multiple strategies (Friedman, 1993; DuBrow & Davachi, 2017).
- Humans are able to reconstruct/infer past event-sequences making use of schemas or causality.
- The hippocampus is known to support recall of specific event sequences (Lehn et al., 2009).
- The posteromedial (PM) network is proposed to represent abstract knowledge about sequences (Cohn-Sheehy & Ranganath, 2017) and real-world event schemas during narrative perception (Baldassano, Hasson, & Norman, 2018).

- We previously demonstrated that narrated order and chronological order of narrative events are dissociable behaviorally using non-linear narratives (Xu & Kwok, 2018).

➢ Judging narrated order of events depends on relative memory strength.

➢ Judging chronological order of events is based on prior knowledge and inferences.

Hypotheses

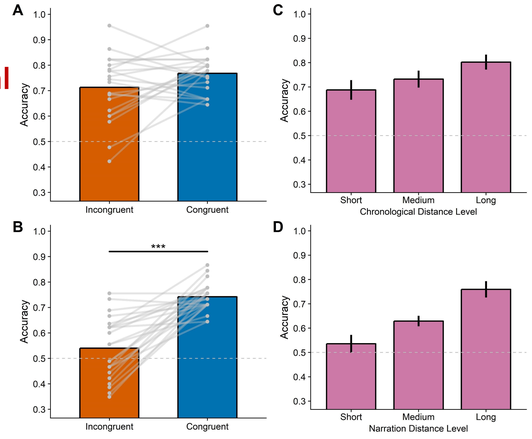
- Humans can preserve both the narrated order and chronological order of narrative events.
- PM regions support reconstructing event sequences with schema-based knowledge (during chronological order judgment).
- There are common cortical network supporting both orders.

Behavioral results

- Performance was high in both chronological order task (mean=73%) and narrated order task (mean=64%).
- Chronological order judgments were not biased by narrated order, but narrated order judgments were biased by the chronological order, suggesting that participants regard what happened chronologically earlier as also narrated earlier.

Chronological Order Judgment

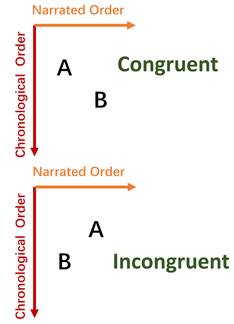
Narrated Order Judgment



Methods

A. Encoding (95min)

C. Conditions



B. Test (~1h later)

Chronological Order Judgment
Narrated Order Judgment
Valence Comparison
(6.5s)

How confident?
1 2 3 4

Confidence Rating
(2.5s)

>

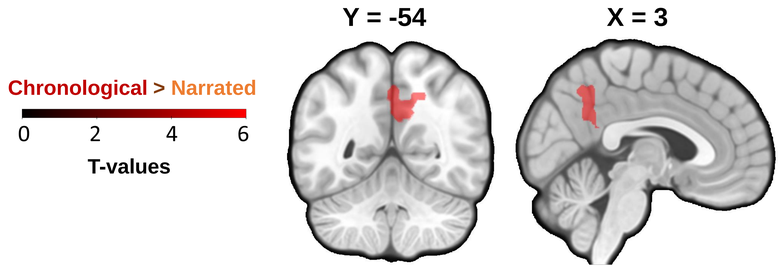
Active ITI
(0-6s)

+
(0.5s)

Participants (n=24) watched a non-linearly narrated film with chronological order and narrated order of events dissociated. They were tested on two order-judgment tasks using fMRI ~1 hour later: judging either the chronological order or the narrated order of a pair of frames extracted from the film. In both tasks, half of the trials contained a congruent narrated/chronological order of the two frames whereas the other half did not. The two tasks were performed in separate blocks within which a valence comparison task was embedded as control task.

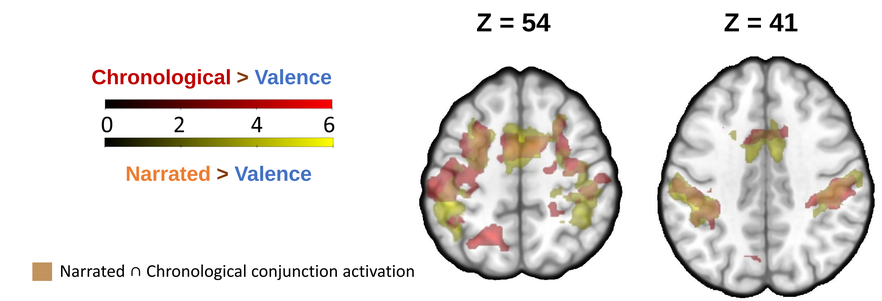
fMRI results

Cluster thresholded as $p_{unc} = .005$,
significance reported as $p_{(FWE)} < .05$ (cluster level).

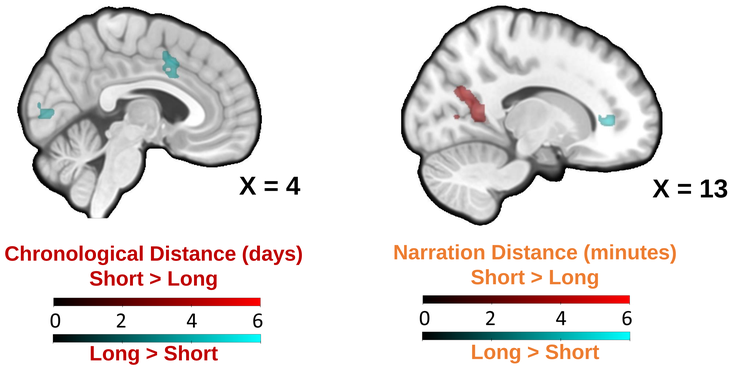


- Precuneus were preferentially engaged by (schema-based) chronological order judgments.
- Narrated > Chronological contrast did not reveal significant clusters.

fMRI results (continued)



Parametric modulation



Discussion & Conclusion

- Prior/schematic knowledge plays a mediating role in event sequences reconstruction.
- Precuneus supports retrieval of real-life event sequences with schema-based knowledge.
- A parietofrontal network showed overlapped activation in both temporal order tasks.
- Parametric distance effects for the two tasks manifest differently in two different sets of brain regions.
- How are temporal positions and distances (narrated and chronological) of events coded in the brain?

References

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