

Neural Correlates of Discourse-level Comprehension for Different Text Types

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Introduction

Default mode network (DMN) involved in discourse-level comprehension. Two hypotheses regarding its involvement (Jacoby & Fedorenko, 2018):

- Content-Dependent Hypothesis: DMN involved due to situation model construction (Zwaan & Radvansky, 1998), specially for narratives, etc.
- Content-Independent Hypothesis: DMN involved due to long-temporal-window information integration (Hasson et al., 2015), for all text types.

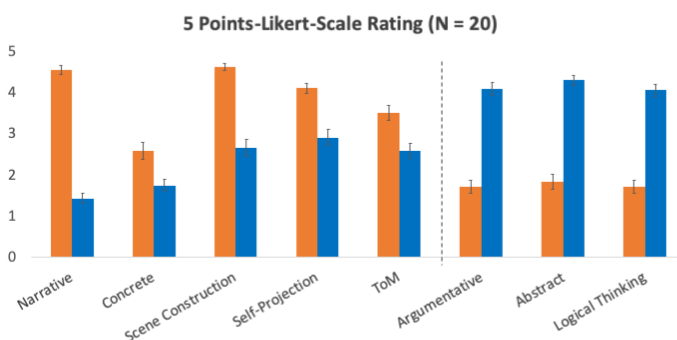
To distinguish between these hypotheses, in this fMRI experiment, we employed inter-subject correlation (ISC; Hasson et al., 2009) analyses to investigate whether DMN is involved in the discourse-level comprehension of argumentative texts, which demand for long-temporal-window information integration but not situation model construction.

Design

2 Types (Narrative vs. Argumentative) × 2 Versions (Intact vs. Sentence-Scrambled) × 2 Texts

Texts were read by a professional voice actors with the same speed, voice, and tone.

	Narrative Texts		Argumentative Texts		
Cited from Book	Marcovaldo	Il bar sotto il mare	Sapiens	The Language Instinct	
Author	Italo Calvino	Stefano Benni	Yuval Noah Harari	Steven Pinker	
Whole Text	N. Words	1335	1158	1283	1183
	Duration (s)	458	402	464	431
Segments	N. Segments	58	50	54	52
	N. Words	23 ± 12	23 ± 10	24 ± 12	23 ± 11
	Duration (s)	7.9 ± 4.1	8.0 ± 3.4	8.6 ± 4.3	8.3 ± 4.1



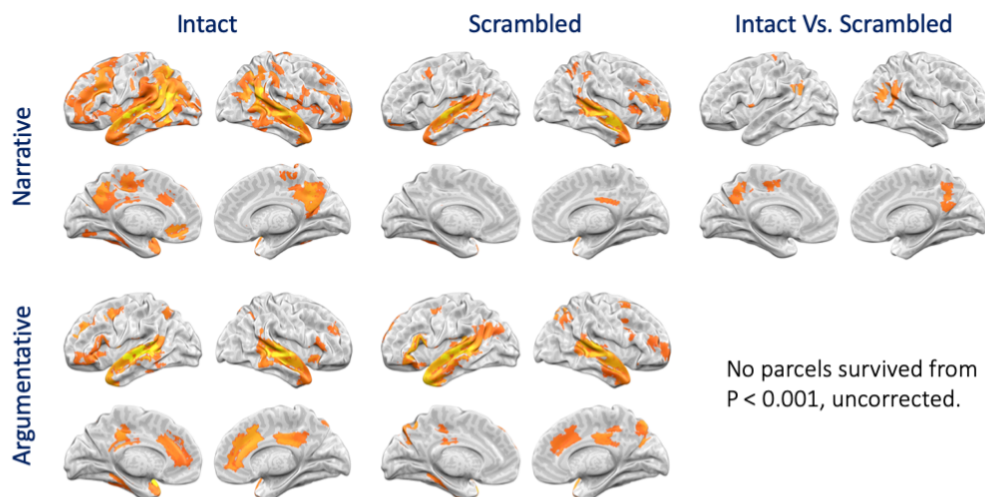
Result

Seventeen participants listened to the all the types and versions of texts (scrambled first)

ISC implemented on the brain template including 400 brain parcels by Schaefer et al. (2018)

Five-thousand surrogate time series with the similar amplitude distribution and identical auto-correlation function were generated for each subject, each condition, and each brain parcel

Statistically inferred with the null-distribution of 100,000 permutations of the surrogate data, FWE Corrected $P < 0.05$



Discussion

The time-locked cross-subject synchronization in the DMN underlying discourse-level comprehension is content-specific. It might result from the engagement of particular cognitive processes (e.g., situation model construction) in a time-locked fashion.

The absent finding of any time-locked cross-subject neural synchronization for argumentative texts might reflect one critical difference between the neural processes underlying narrative and argumentative comprehension. The narrative comprehension relies on online situation modeling, in which situations must be constructed and updated in real time; the argumentative comprehension relies on offline argument evaluation, in which arguments can be held up and evaluated later based on each participant's own pace.

Reference

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