

Neural correlates of context transitions in continuous internal thoughts

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Disclosures

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Abstract

Continuous narratives can be organized into discrete events as they unfold over time. Prior research has shown that the boundaries of these events, which represent transitions in narrative context, elicit neural responses in the default mode network (DMN) and hippocampus (HC) during movie watching or story listening. However, it remains unclear how the brain organizes internally produced continuous thoughts in the absence of external input. To investigate how internally generated thoughts are represented as discrete structures, we conducted an fMRI study where participants freely spoke their thoughts. In the scanner, independent groups of participants engaged in three tasks: recalling a previously watched movie (movie-recall), sharing their opinions on given topics (topic), and speaking about their spontaneous thoughts (think-aloud). After scanning, participants' speech transcriptions were segmented into coherent chunks, corresponding to events in the movie for movie-recall and aligning with context transitions for the topic and think-aloud tasks. We found increased neural responses in subregions of the DMN, including the retrosplenial cortex (RSC) and posterior cingulate cortex (PCC), at transition points between events or context, regardless of the speech type. However, neural responses in the angular gyrus (AG) and HC showed no significant changes at context transitions during topic and think-aloud tasks but exhibited increased responses at event boundaries during movie recall. These results indicated that the RSC and PCC play a crucial role in transitioning between different situational contexts, consistent across all three speech tasks, while the AG and HC may be more involved in demarcating event boundaries within a clear narrative structure. Furthermore, when participants listened to audio clips of actors performing the topic and think-aloud tasks, we observed similar increases in neural responses in the RSC and PCC at context transitions, albeit with a delayed peak compared to speech tasks. In conclusion, our findings suggest the distinct functional roles of the DMN and HC in structuring continuous experiences: the medial posterior DMN regions track changes in

both external and internal situational context, while the HC and AG are more likely to be engaged in processing narratives, whether by observing existing narratives or self-generating them, which involves memory retrieval and integration.

Keywords: context transition, event boundary, fMRI, internal thought, speech

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