Space, Time and Causality: Some Neural Observations

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Abstract: Knowledge of events involves understanding the way that objects occupy space, exist in time, and relate to each other. I will consider behavioral, fMRI and lesion studies that explore how space, time and causality are structured and interact in our brains. Tentatively, I propose the following. 1) The perception and conception of space has a parallel organizational structure. Evidence for this claim comes from the finding that the distinction between path and manner of motion as expressed linguistically is also processed with an analogous dorsal ventral neural organization. 2) Perception of space and time can be tightly linked. Behavioral data show that we are spatial-temporal synaesthetes. The perception of spatial distance and the perception of temporal duration interact highly. 3) The right hemisphere is biased to process space and the left to process time despite bilateral overlap in neural underpinnings of these processes. This assertion is based on data from size discrimination and temporal order judgment tasks, which we regard as markers of space and time granularity. The hypothesis also bears out in data examining the contributions of space and time to perceptual causality. 4) Time, compared to space, has a privileged relationship to causality. In making judgments about perceptual causality, people are more sensitive to temporal offsets than to spatial deviations. When listening to short narratives with sequential events, the neural circuits engaged by causality subsumes neural circuits engaged by time much more so than the neural circuits engaged by space.

Investigating interactions between space, time, and causality can reveal the rich texture of events.