Probing the Foundations of Inner Experience: Neuroimaging and Behavioral Evidence for the Role of the Brain's Default Network in Internal Mentation

Abstract

Converging research has identified a set of brain regions, collectively known as the "default network," that exhibit greater activity during passive states compared to active, task oriented states. One possible explanation - referred to as the "internal mentation hypothesis" – is that the default network supports internally-directed thought processes including mental simulations of past, present, and future scenarios. An alternate possibility - referred to as the "sentinel hypothesis" - is that the default network supports broad, exploratory monitoring of the external environment. The present study aimed to test these competing hypotheses. We developed a series of behavioral conditions that modulated the scope of external attention as well as spontaneous internal mentation. A behavioral thought probe experiment that measured the frequency of participants' spontaneous thoughts was first conducted in a group of 30 young adults to verify that conditions successfully modulated internal mentation. We then used functional magnetic resonance imaging (fMRI) to image an additional group of 30 young adults while performing the identical experiment. Regions-of-interest analyses showed that activity in the default network was strongly sensitive to spontaneous internal mentation and minimally to broad attention. While exploratory analyses contrasting broad and focal activity only exhibited activations in the precuneus, striate and extrastriate visual cortical regions, contrasts of passive and focal activity found robust default network activations. These results provide further evidence that the default network supports internal mentation and may contribute toward our understanding of its role in human cognition and disease.