

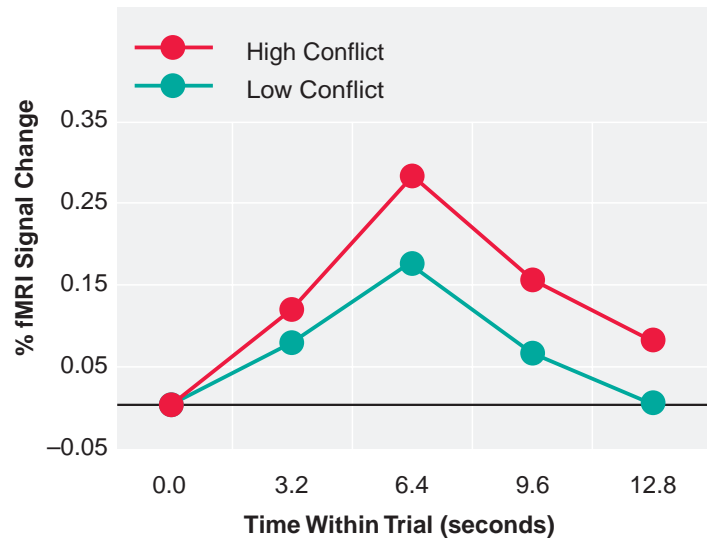
Images in Neuroscience

Carol A. Tamminga, M.D., Editor

Cognition



Z = +30 mm



The transverse functional brain image on the left was acquired by using functional magnetic resonance imaging (fMRI) and represents the area of anterior cingulate cortex that is active when individuals experience conflict among alternative responses. The Z-axis label at the bottom reflects the distance the section falls above a plane intersecting the anterior and posterior commissures. The graph on the right shows the time course of activity in this brain region during task trials in which there is either high or low conflict between responses.

The Anterior Cingulate and Response Conflict

Humans are often confronted with situations in which there are several possible behavioral responses. In some situations, one of the responses may be more practiced or “automatic” than the other responses. When the more practiced or automatic response is the correct one, it is relatively easy to execute the behavior. However, at other times, the less practiced or less automatic response may be the correct one. This situation can lead to competition between the different response possibilities, a situation typically referred to as “response conflict.” Then, additional cerebral input may be needed to select the correct response and prevent the incorrect, but potentially more practiced, response from interrupting behavior.

A number of studies have shown that a particular area of the brain, a region of anterior cingulate cortex, typically posterior to the genu and superior to the corpus callosum, may serve to monitor situations of response conflict (see figure). In particular, this region of the brain becomes active when subjects must produce an infrequent or less practiced response that conflicts with a more practiced response. The anterior cingulate cortex also becomes active when volunteers must choose among several different equally practiced responses, but only when the situational context lacks strong constraints on response choice. Further, this same region of the anterior cingulate cortex becomes active when people make errors, particularly when the errors occur in task situations that produce conflict among alternative responses. What does activity in the anterior cingulate cortex in response-conflict situations do? It may be that activity in the anterior cingulate cortex provides a signal that serves to recruit the dorsolateral prefrontal cortex to play a more central role in complex task performance.

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