# In pursuit of domain-general working memory regions: Is Parietal cortex’s involvement in working memory function more than just visual processing?

The involvement of the parietal cortex in working memory is exaggerated. It is often described as part of the prefrontal-parietal network. This network performs attentional selection that aids in maintenance of relevant items during working memory function (Eriksson et al. 2015). Could the recurring presence of parietal cortex in most working memory research simply be due to the visual nature of most working memory tasks?

## Working memory function is subserved by several cortical and sub-cortical regions

To start, while most research hint at working-memory-specific stores in cortex, it is more likely that activation and maintenance of items is distributed across the cortex and the basal ganglia. For example, verbal and phonlogical items during working memory function are represented in temporal language areas (Osaka et al. 2003;). Similarly, visual items are represented in temporo-parietal regions, along the dorsal and ventral visual pathways, depending on the quality of the stimulus (Eriksson et al. 2015).

Additionally, working memory function is generated up by the concerted effort of the prefrontal and subcortical regions. For instance, McNab and Klingberg (2008) have shown that the basal ganglia gates access of new information to working memory. The prefrontal cortex, they report, is responsible for goal maintenance and selection of goal-relevant stimulus features via attentional resources. The parietal cortex is often thought of as aiding in sustained attention, and its activity seems to be sensitive to size of the load in working memory (Eriksson et al. 2015). But the parietal’s involvement in working memory function is likely overblown.

## The parietal cortex is usually a visuospatial processor

The parietal cortex is implicated in spatial, visual processing and visual attention selection (Corbetta and Shulman, 2002). Lesions in this region, particularly in the right hemisphere, have resulted in deficits in spatial working memory tasks. There is also some evidence of lateralization, where the left parietal cortex is known to aid in language processing, lesioning of which causes deficits in verbal working memory (see Eriksson et al., 2015, for a review; Jonides et al. 1998).

I argue that the parietal cortex, while vital for visual working memory function, is most likely not a domain-general seat of attentional control. The region might be implicated very often because an overwhelming number of studies conduct visual working memory experiments.

## Most working memory studies are vision biased

Most of what we understand about working memory and attention results from vision research. Baddeley’s multi-component working memory model, an influential model in the field, isolates verbal and phonlogical processing or ’stores’ from visual and spatial processing, but he does not make major claims about where they are represented in the brain (Baddeley, 2012). Neuropsychology labs, on the other hand, often draw a multi-region picture of working memory function that includes the parietal cortex as a domain-general attentional processor. But these studies heavily use visuospatial tasks for their working memory experiments.

Examine works by the Vogel group, a prominent contributor to the field, for instance. They use multi-dimensional visual tasks that have colors, shapes, and spatial orientation as relevant dimensions in their imaging studies (Vogel and Machizawa, 2004; Drew et al., 2011). Additionally, a verbal working memory study by Jonides et al. (1998), which reported parietal cortex as being necessary for verbal working memory also used words presented visually. Therefore, these studies are bound to find high involvement of parietal cortex as a core component of working memory function in their experiments.

In contrast to this, Osaka et al. (2003) did not report a parietal cortex involvement in their imaging study where they used a listening span task. The experiment sought to characterize the neural bases of individual differences in verbal working memory. They found that the temporal, prefrontal, and anterior cingulate cortex were most involved in the listening span task.[[1]](#footnote-1)

The listening span task is a language task, so, activity in the temporal cortex is understandable. The prefrontal cortex, however, is present in all working memory tasks and is an undisputed domain-general component of working memory function (among many others). But we cannot ascribe that quality to the parietal cortex with certainty.

1. However, one of their functional imaging figures showed activity in the parietal cortex but it was not discussed by the authors (Osaka et al. 2003). [↑](#footnote-ref-1)