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Integrated intelligence from distributed brain activity

Abstract: Human fMRI studies show a tightly-localised set of “multiple-demand” or MD regions, involved in solution of many different cognitive challenges, widely separated yet strongly functionally connected, and linked to standard measures of fluid intelligence. Multiple-demand regions are generally associated with “cognitive control”, but how should control be conceived? Using data from behavioural, imaging and single unit studies, I argue that the core role of MD regions is to solve complex problems in an integrated structure of simpler, more solvable, focused parts. With wide distribution in the brain, strong functional connectivity, modest relative specializations, and strong conjunctive coding, MD regions are well placed to act as the integrating core of complex thought and behaviour.

Bio: Educated at the University of Oxford (1970-1976), John Duncan spent two years at the University of Oregon working with Professor Michael Posner before taking up a research position with the Medical Research Council. He now holds positions as Programme Leader at the MRC Cognition and Brain Sciences Unit in Cambridge, and Professorial Research Fellow in the Department of Experimental Psychology, University of Oxford. Integrating across cognitive theory, neuropsychology, neuroimaging, and single cell physiology in the behaving monkey, his research addresses problems of attention, intelligence and cognitive control. For 20 years, he has managed a large patient resource for lesion-function mapping in the Cambridge community, addressing problems of recruitment, lesion definition, brain normalization and brain-behaviour correlation. He is a Fellow of the Royal Society and the British Academy, and winner of the 2012 Heineken Prize in cognitive science.