A TMS "ping" during fMRI
reveals physiological consequences of functional connectivity and dissociates multivariate from univariate maps of working memory storage

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We used transcranial magnetic stimulation (TMS) to evaluate causally a verbal storage network identified by a constrained principal components analysis (cPCA) of working memory data. The logic was that **a physiological consequence of functional connectivity should be reflected in the manner in which a TMS-triggered impulse propagates through the putative functional network.**

Methods

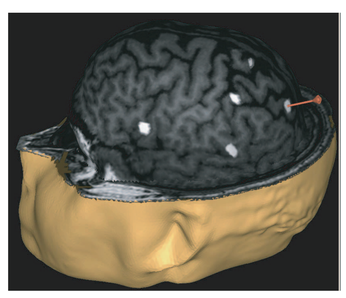
Overview

Session 1 : fMRI
(*May 2006 for this n = 1*)

fMRI of delayed letter recognition with ***load 5*** vs ***load 2***

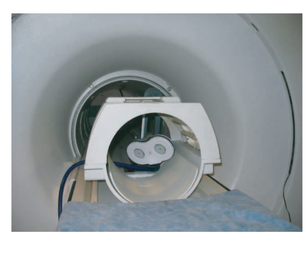
cPCA identifies ***load-sensitive functionally connected*** network (A.k.a. "verbal storage network")

Session 2: rTMS (*May 2006*)



rTMS of a node in cPCA-identified verbal storage network (purpose: demonstrate necessity)

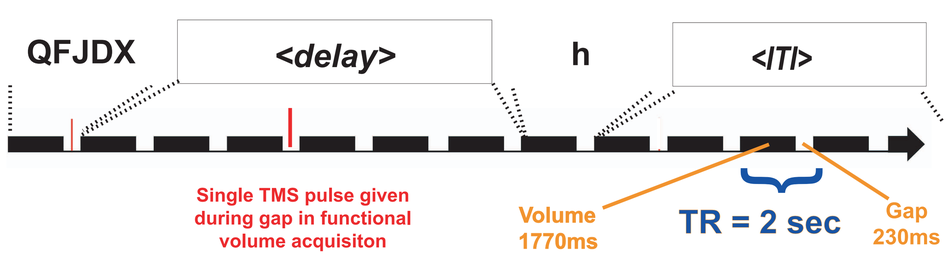
Session 3: TMS Ping (*Nov. 2007*)



TMS of a node in verbal storage network during fMRI

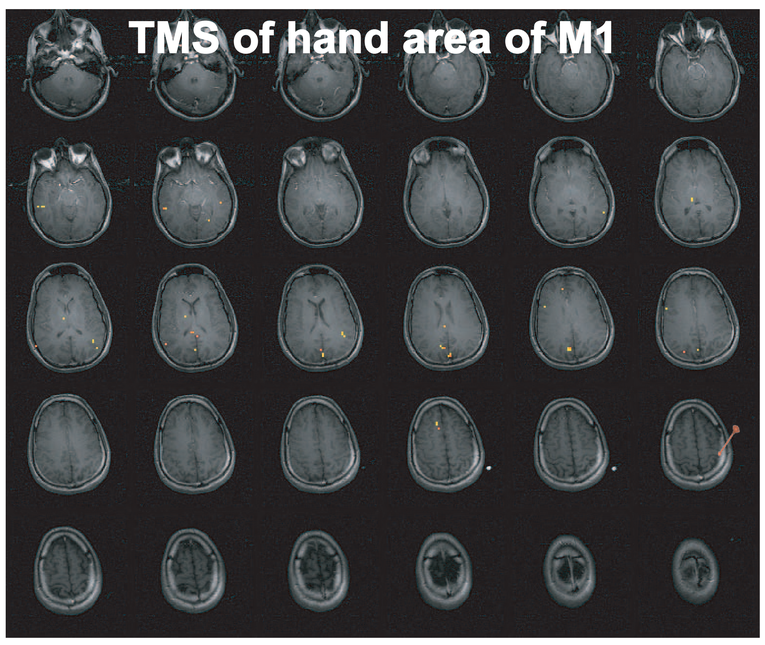
Constrained Principal Component Analysis (cPCA): **Method for structural analysis of multivariate data (Hunter & Takane, 2002). Applied to fMRI data, cPCA can identify components directly relevant to experimental conditions of interest by intergrating this information prior to computation of components.**

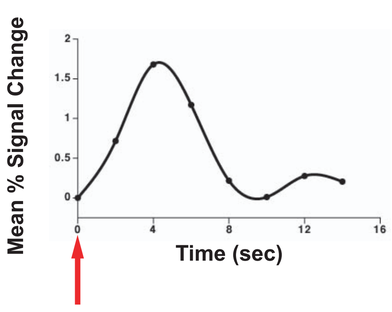
Session 3
2 x 2 design:
***task* (letter, location)**
***TMS* (present, absent)**

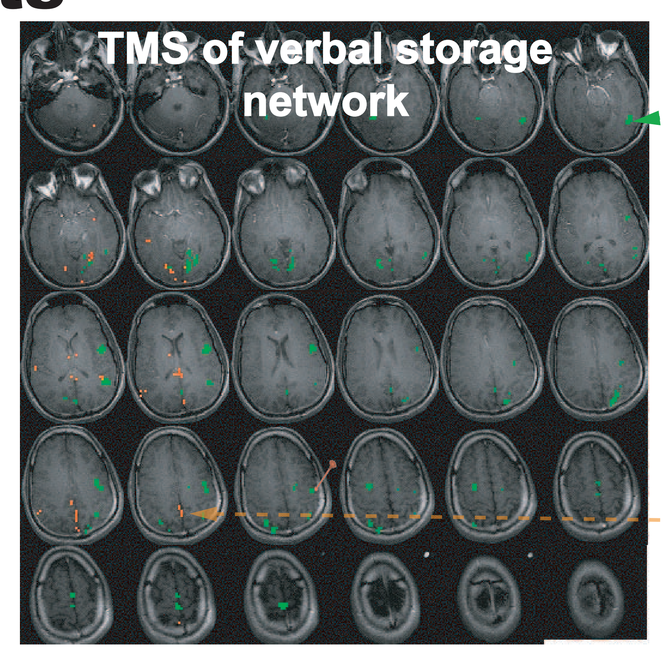


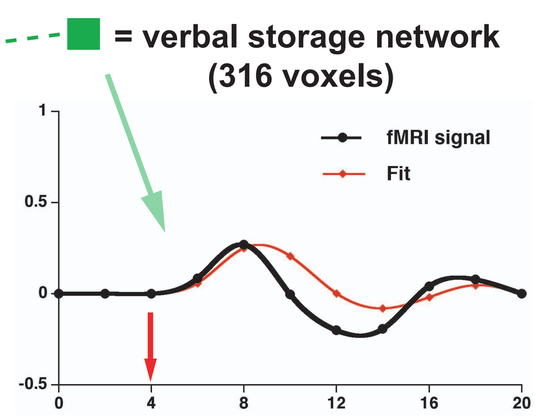
More methodological details of TMS/fMRI procedure were presented by Feredoes et al., HBM 2008 poster # 417 M-AM

Results



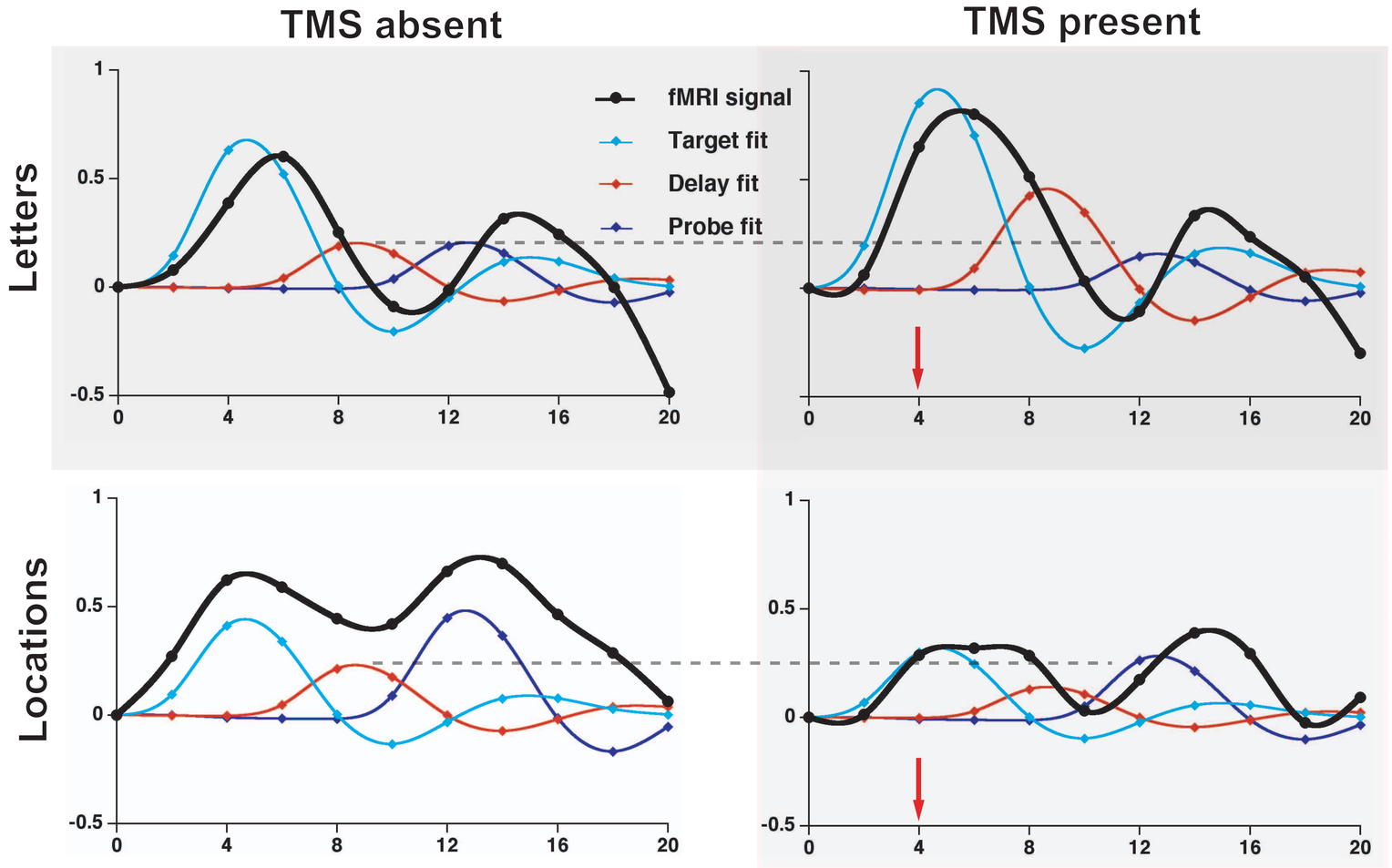


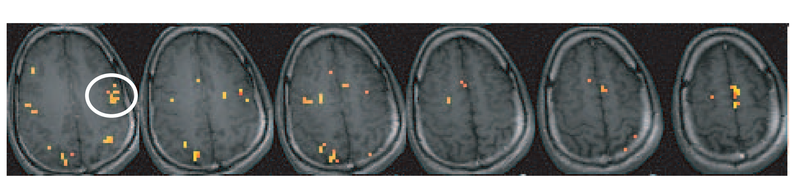


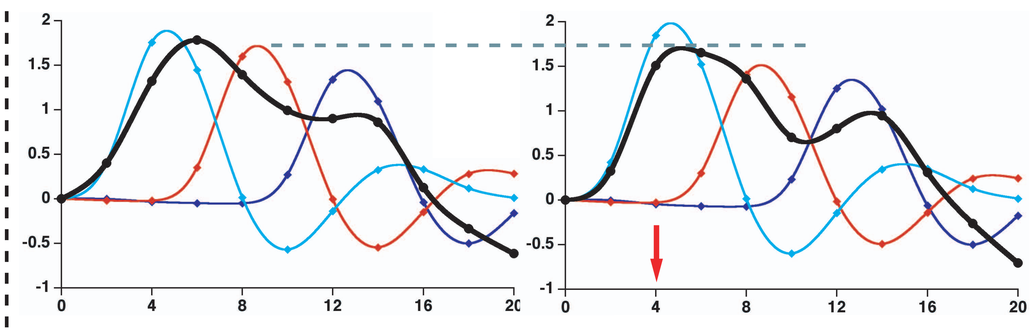


TMS ping of verbal storage network during delayed-recognition performance

Within verbal storage network | **Within GLM-defined dlPFC**







Discussion

These results suggest that a physiological consequence of functional connectivity is facilitation of synaptic transmission between nodes in the network. They also provide a stark demonstration that delay-period activity revealed by univariate analyses cannot be assumed a priori to correspond to the short-term storage of information.