Comparison of Default Mode A (DMA) vs B (DMB): Detectable by Task-based fMRI

Solana Redway[1], Jennifer Tsang[1] & Todd S. Woodward[1]

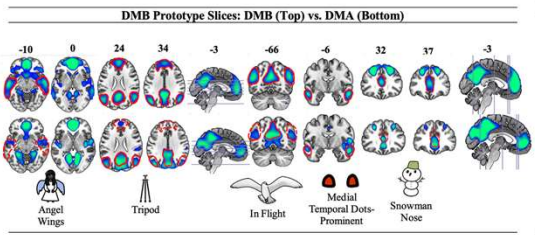
[1]Department of Psychiatry, University of British Columbia

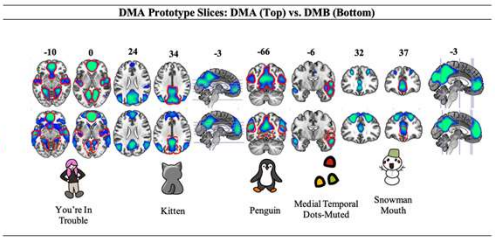
Introduction

- The **Default Mode (DM)** is commonly associated with self-reflective and internally directed thought processes.
- Previous research has shown that the **DM can be reliably divided into two anatomically distinct modes: DMA and DMB** *(Braga & Buckner, 2017; DiNicola & Buckner, 2021)*.
- Task-based functional magnetic resonance imaging (**fMRI**) detects network-level configurations of blood-oxygen-level-dependent (**BOLD**) signalling, allowing us to **anatomically and temporally differentiate between these two modes during tasks.**

Methods

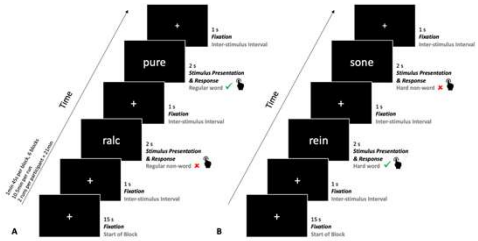
This study compares DMA and DMB using a **set of specific anatomical patterns extracted from multiple functional brain cognitive modes** through our lab's statistical method, fMRI-CPCA *(Chinchani et al., 2025)*.



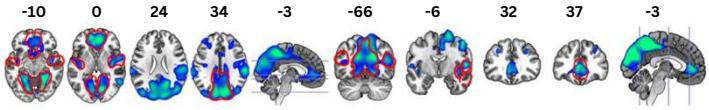


Lexical Decision Task (LDT)

- As an example of mode comparison, we extracted significant cognitive modes that appeared in the LDT *(Wong et al., 2020)*.
- Participants were shown strings of letters **(Easy-Nonword, Hard-Nonword, Easy-Word and Hard-Word conditions)** and were required to make a response.

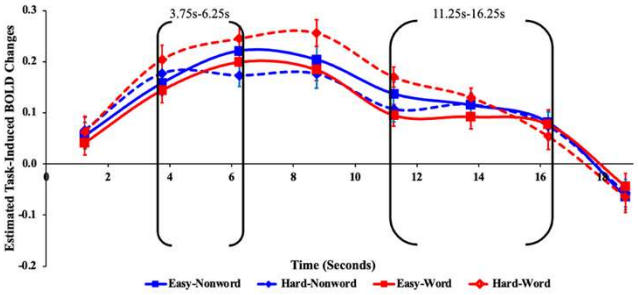


Results



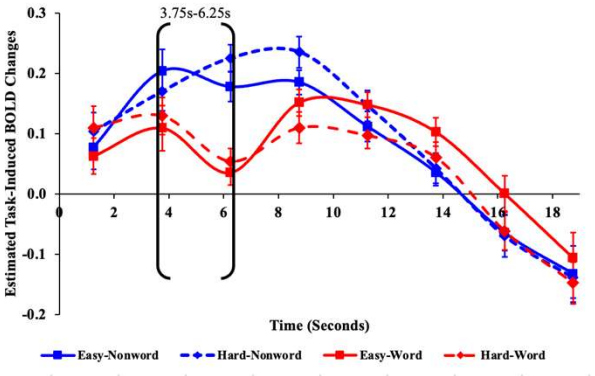
- **DMA** activity was found to be **inversely related to language processing**.
- **Lowest deactivation** was observed in the most resource demanding condition: **wordlike (hard) nonwords**, which required suppression in order to complete the task.

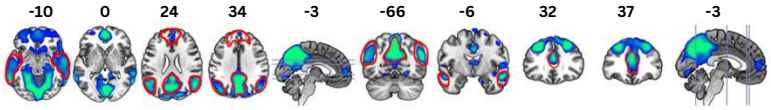
DMA Deactivation in the LDT Task



Brackets indicate the task-induced BOLD changes dominating the interaction

DMB Deactivation in the LDT Task





- **DMB** deactivation was **dependent on cognitive load**, with increased task demands leading to stronger deactivation.
- More difficult letter strings, such as those in the **hard (wordlike) nonword condition**, required a higher cognitive load, resulting in the most **intense DMB deactivation.**

Discussion

- Comparing the anatomical patterns, **DMA includes the ventral posterior cingulate cortex (PCC), precuneus, cuneal cortex, and lingual gyrus**, while the **DMB involves regions such as the superior frontal gyrus and lateral occipital cortex**.
- **DMB showed increased deactivation as attentional demands increased**, whereas **DMA was inversely related to language processing** such that tasks that required greater language processing exhibited greater DMA deactivation.

Reference

- Braga, R. M., & Buckner, R. L. (2017). Parallel Interdigitated Distributed Networks within the Individual Estimated by Intrinsic Functional Connectivity. *Neuron*, *95*(2), 457-471 e455. https://doi.org/10.1016/j.neuron.2017.06.038
- Chinchani, A. M., Feredoes, E., & Woodward, T. S. (2025). Don't hide the good stuff: Scientific advancement in task-based fMRI is slowed by not showing event-related BOLD (erBOLD) changes alongside anatomical patterns. In *JoCN Forum* (pp. doi.org/10.21428/21428e21426ba21428ef.21755bdc21421d).
- DiNicola, L. M., & Buckner, R. L. (2021). Precision Estimates of Parallel Distributed Association Networks: Evidence for Domain Specialization and Implications for Evolution and Development. *Curr Opin Behav Sci*, *40*, 120-129. https://doi.org/10.1016/j.cobeha.2021.03.029
- Wong, S. T. S., Goghari, V. M., Sanford, N., Lim, R., Clark, C., Metzak, P. D., Rossell, S. L., Menon, M., & Woodward, T. S. (2020). Functional Brain Networks Involved in Lexical Decision. *Brain and Cognition*, *138*.

Brain Dynamics Lab

BC Children's Hospital

BC MENTAL HEALTH & SUBSTANCE USE SERVICES