MAPPING HUMAN CORTEX

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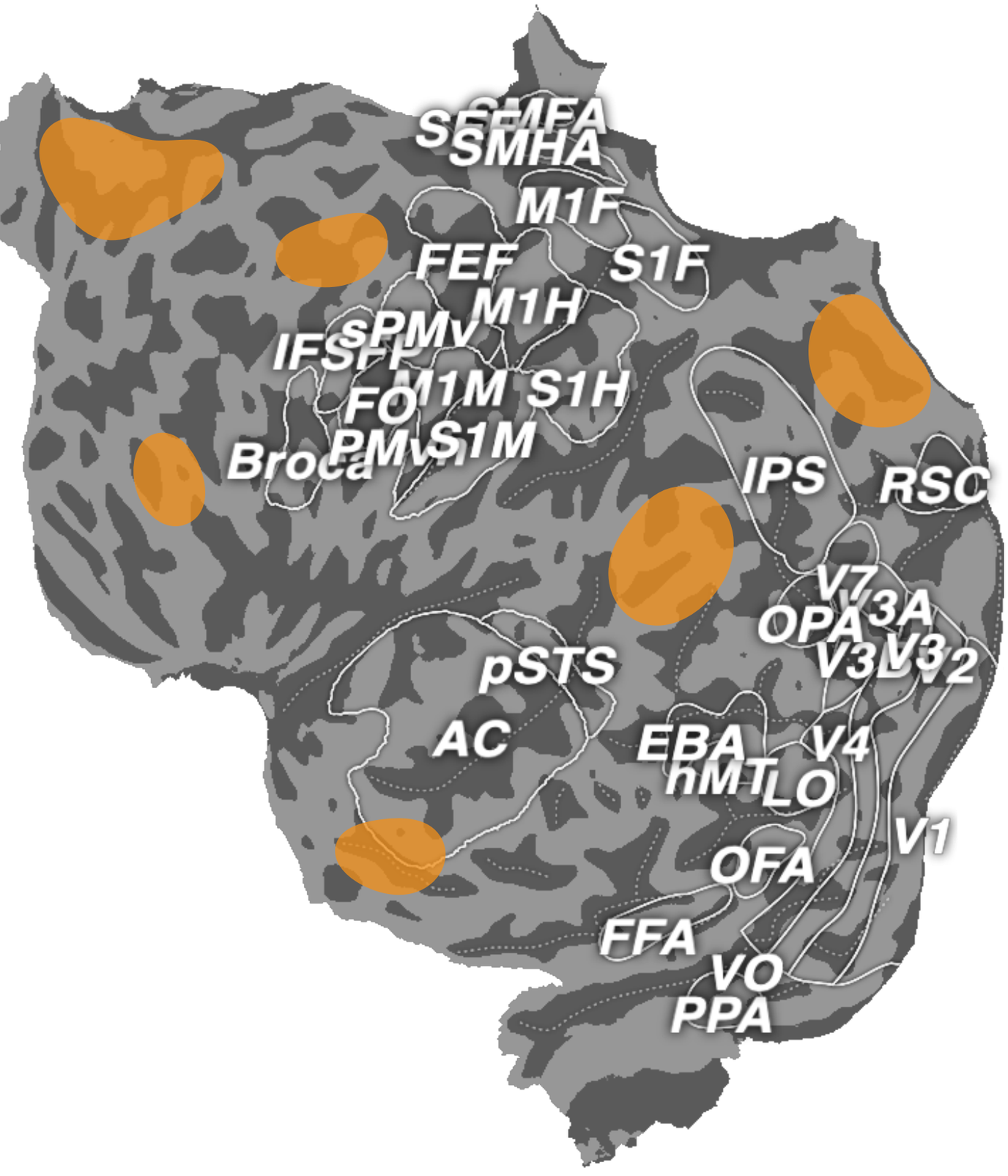
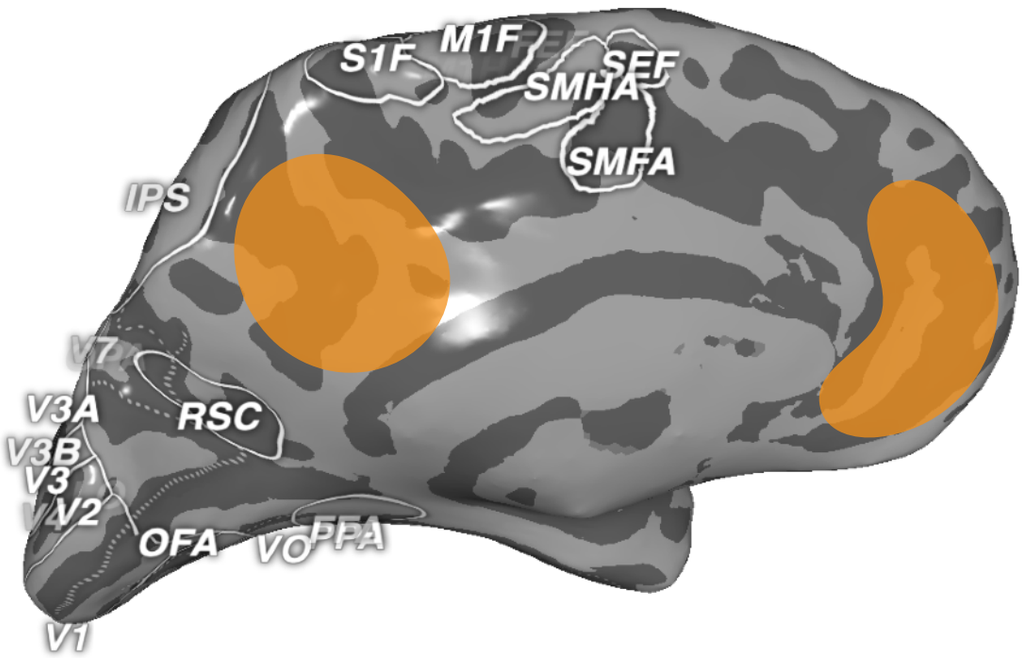
11.19.2020

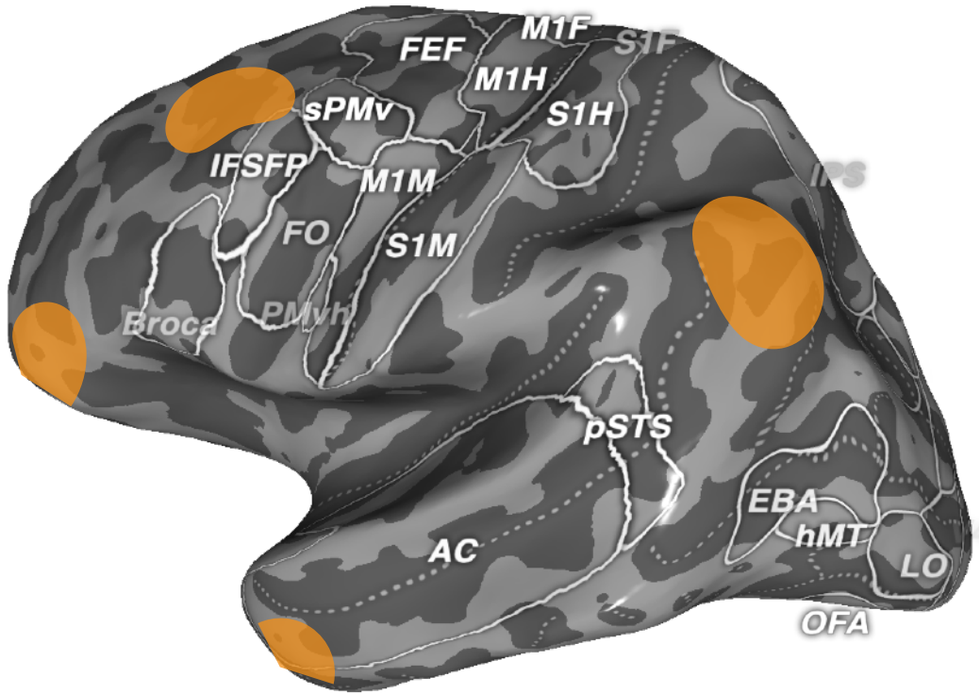
HOMEWORKS

* **Homework 4** (somato+motor cortex) is assigned!

DEFAULT MODE NETWORK



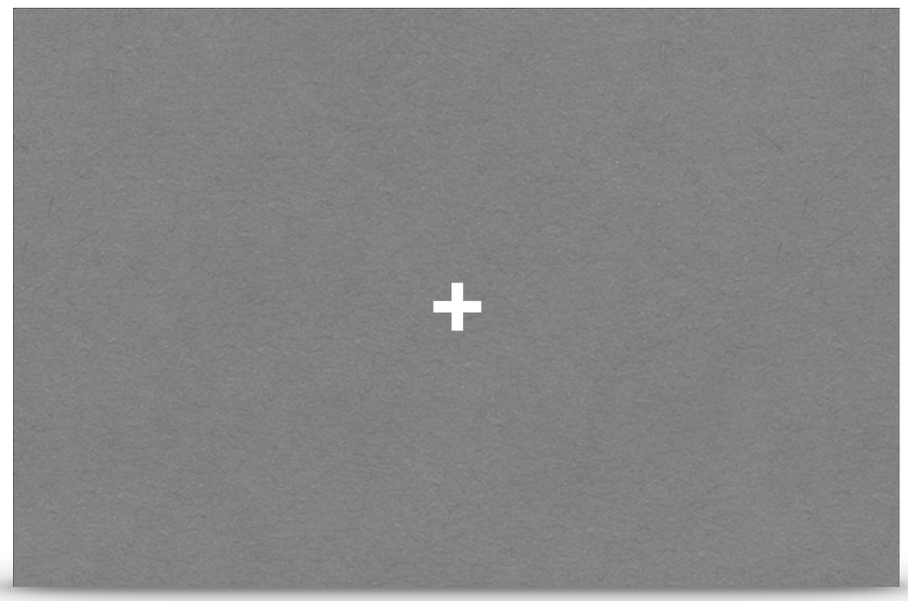




BASELINE

* Many neuroimaging studies compare brain activation to **baseline:** how much activity there is when the subject *"does nothing"*

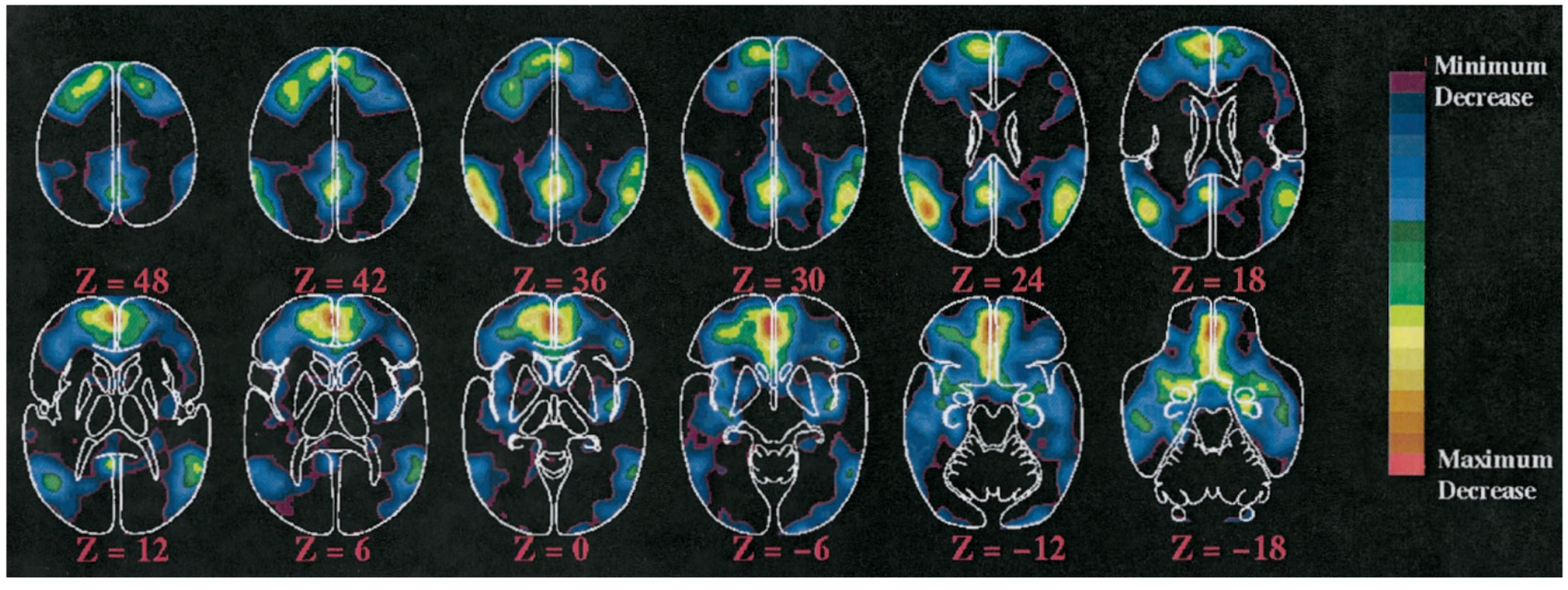
* … but can your brain ever really *"do nothing"* while you're awake?



"TASK-NEGATIVE"

* But there's something weird: some brain areas become **more active** at "baseline"

* These areas become called the **task-negative network** or **default mode network**



Raichle et al., 2001

WHAT DOES IT DO?

* It becomes more active during **mind-wandering** (Christoff et al., 2009)

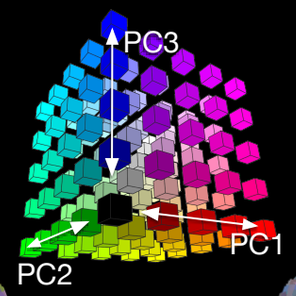
* It becomes more active (particularly TPJ) when thinking about other peoples' thoughts, aka "**theory of mind**" (Saxe & Kanwisher, 2003)

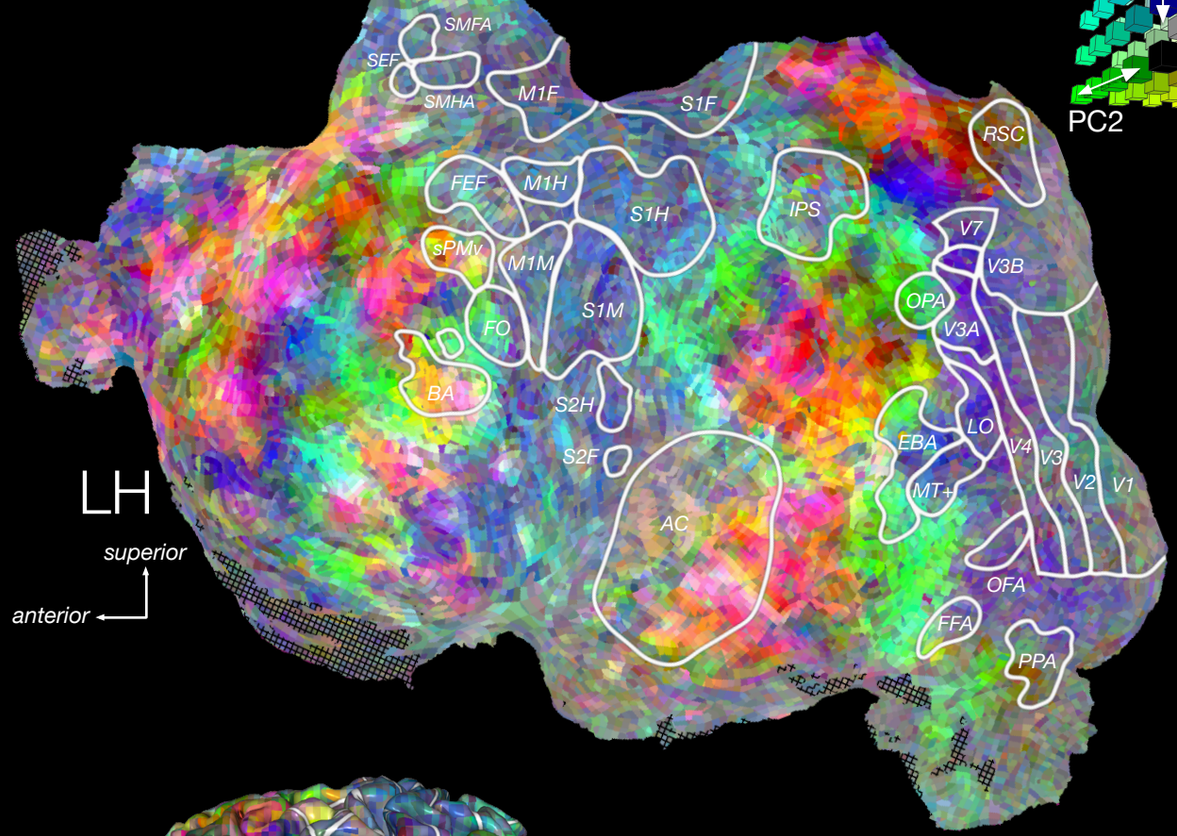
* It becomes more active when retrieving **autobiographical memories** (Svoboda et al., 2006)

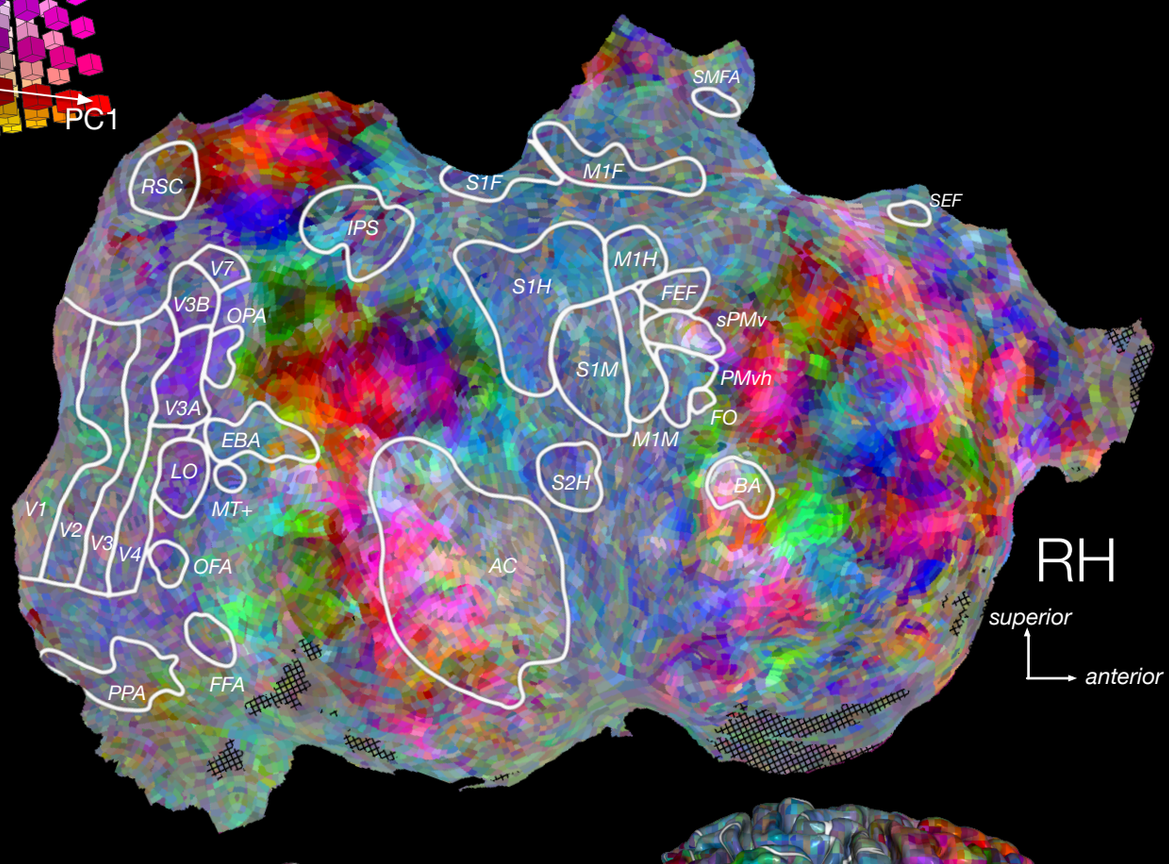
* It responds *a lot* when **listening to narrative stories** (Huth et al., 2016)

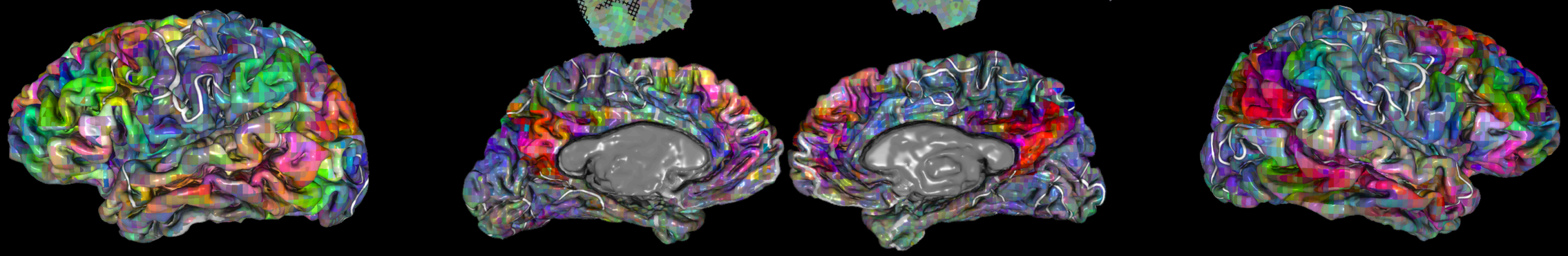
MODEL INTERPRETATION

visual
tactile
abstract
numeric
violent
locational
communal
emotional
social
temporal
professional
mental
PC2
PC1







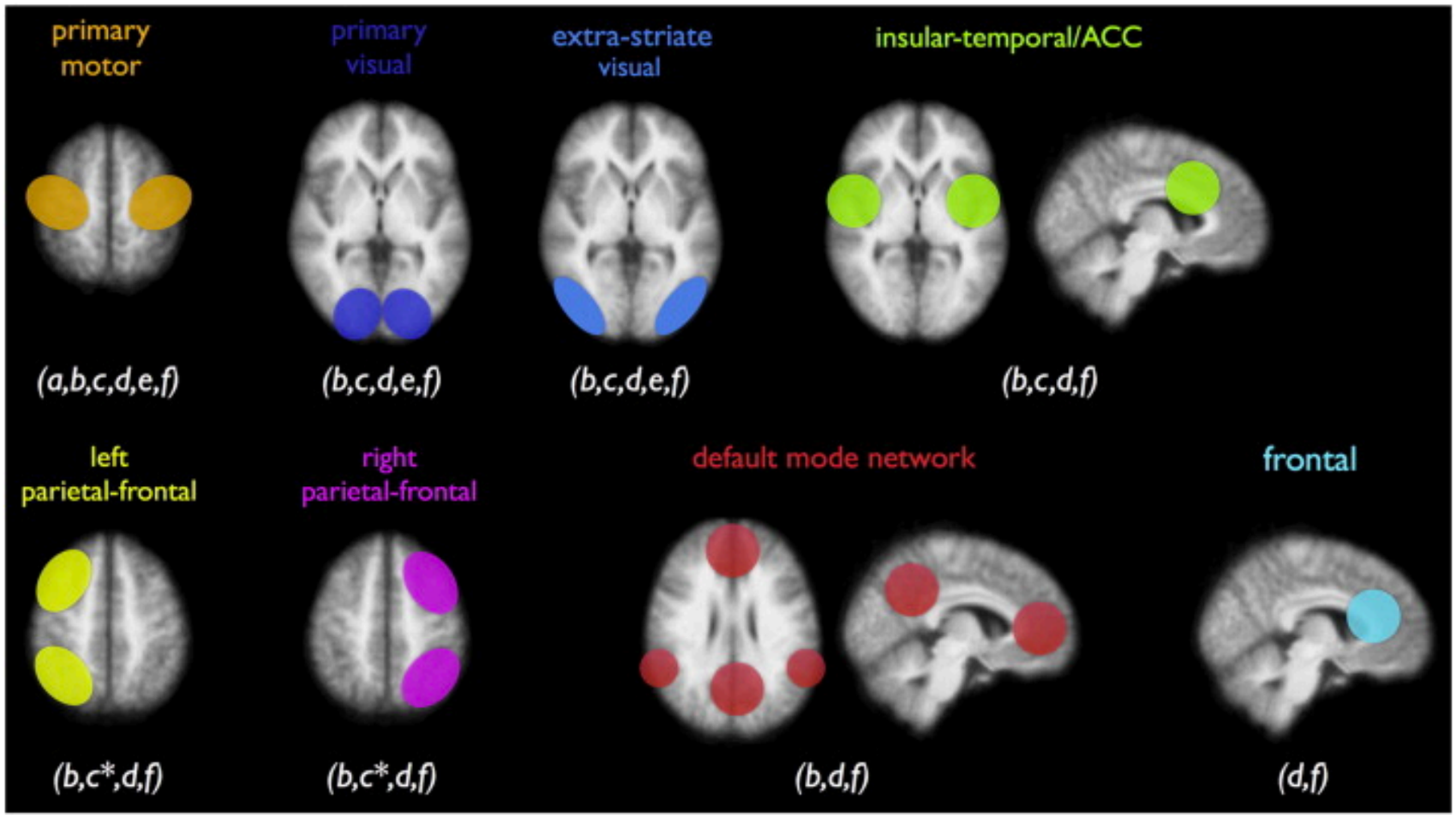


Huth, de Heer, Griffiths, Theunissen, & Gallant, *Nature* (2016)

RESTING STATE

* Nowadays, the DMN is identified using **resting-state fMRI**:
    * Subjects stare at a dot for 5-10 minutes
    * Researchers use **independent components analysis (ICA)** to deconstruct the brain responses into components
    * There are ~8 components that show up pretty consistently

RESTING STATE



van den Heuvel & Hulshoff Pol, 2010

WHY THERE?

PRINCIPAL GRADIENTS

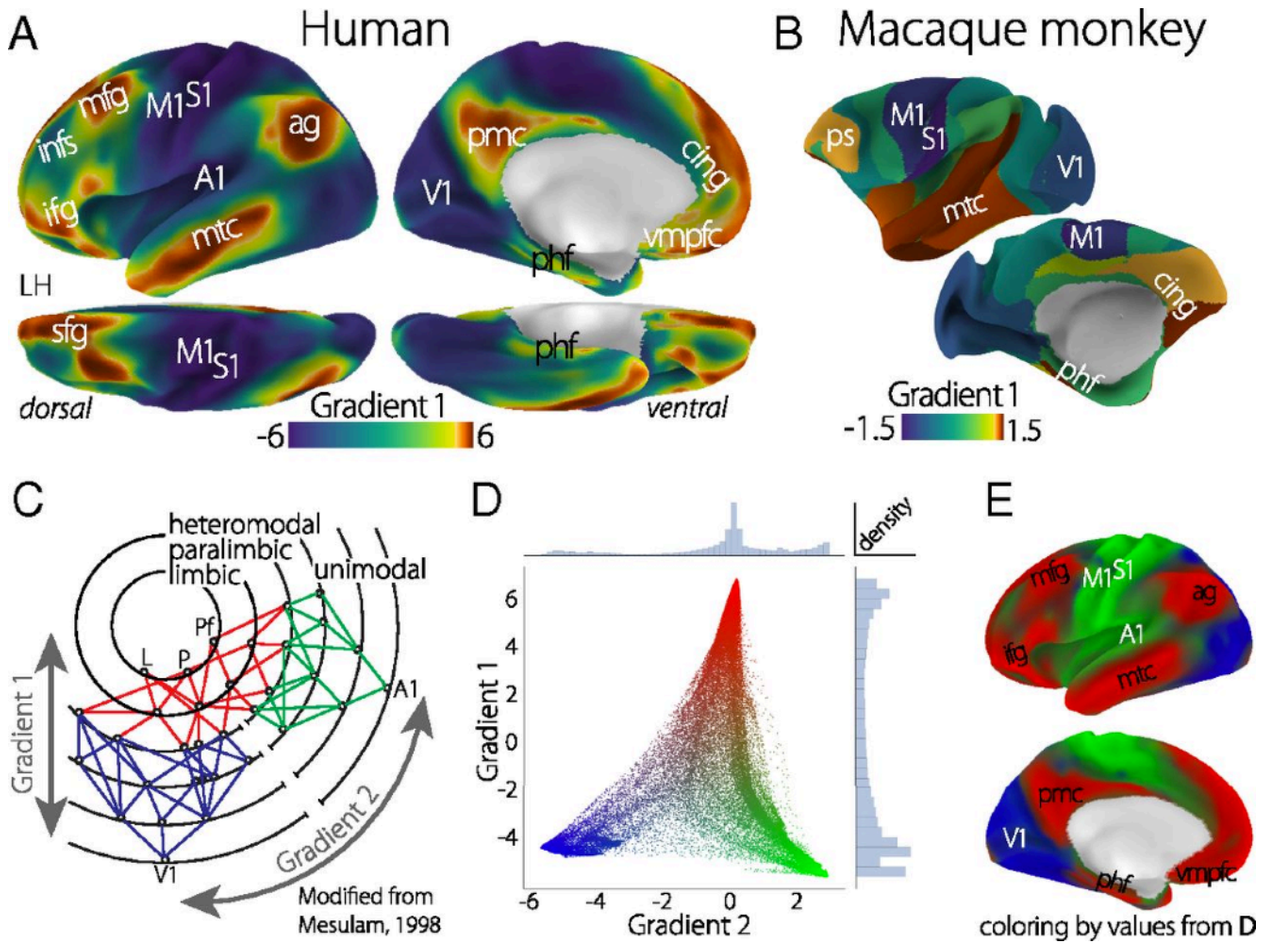
Situating the default-mode network along a principal gradient of macroscale cortical organization

Daniel S. Margulies, Satrajit S. Ghosh, Alexandros Goulas, Marcel Falkiewicz, Julia M. Huntenburg, Georg Langs, Gleb Bezgin, Simon B. Eickhoff, F. Xavier Castellanos, Michael Petrides, Elizabeth Jefferies, and Jonathan Smallwood

PNAS November 1, 2016 113 (44) 12574-12579; first published October 18, 2016;
https://doi.org/10.1073/pnas.1608282113

PRINCIPAL GRADIENTS

* Used **diffusion embedding** (different dimensionality reduction method) on resting state fMRI

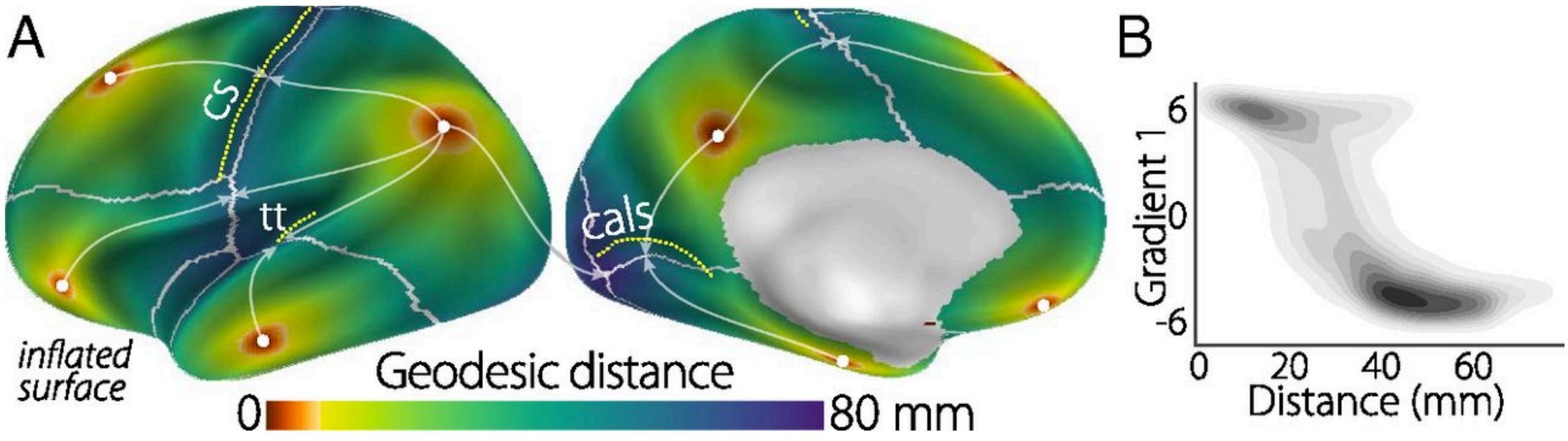


Margulies et al., 2016

PRINCIPAL GRADIENTS

* **Why** are the DMN areas where they are?

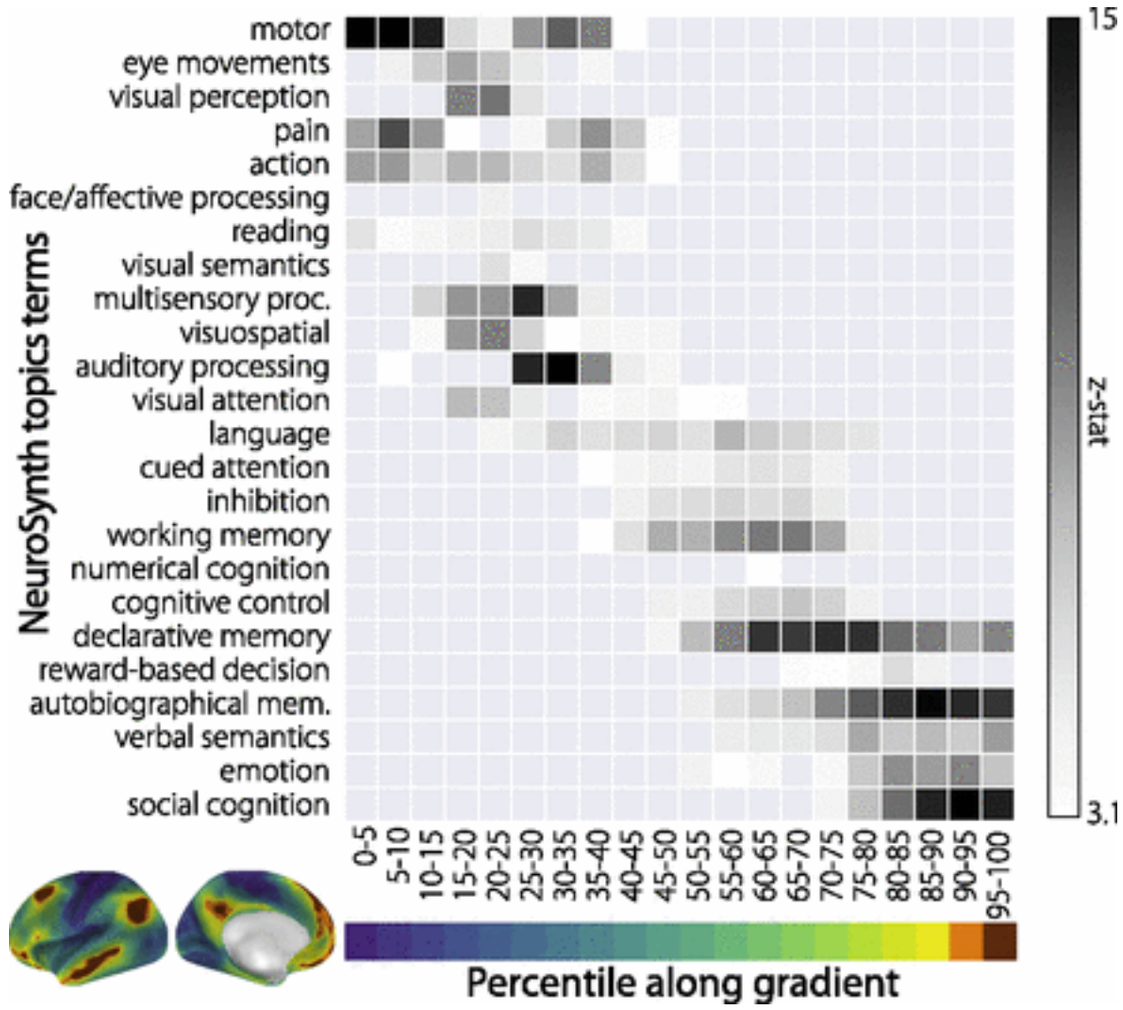
* Proposed answer: because primary sensory/motor areas are **as far away as possible** from the DMN areas



Margulies et al., 2016

PRINCIPAL GRADIENTS

* This suggests a specific gradient of **large-scale organization** across all of cortex



Margulies et al., 2016

UNTIL NEXT TIME