

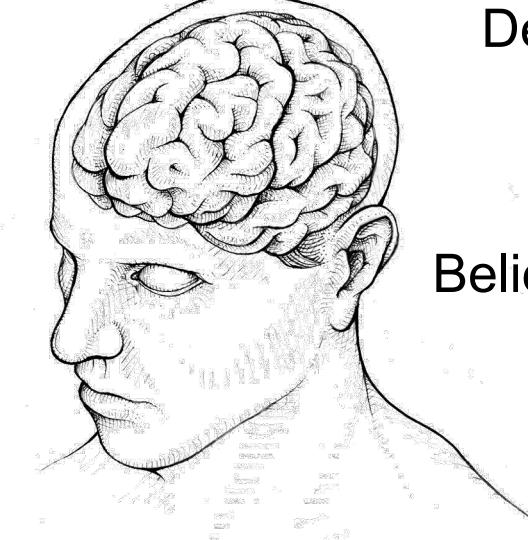
Motivation and Cognition Neuroscience Lab

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<https://mcnlab.uchicago.edu/>

How do our **goals**, **emotions**, and **beliefs** influence how we perceive and respond to our physical and social environment?



Goals

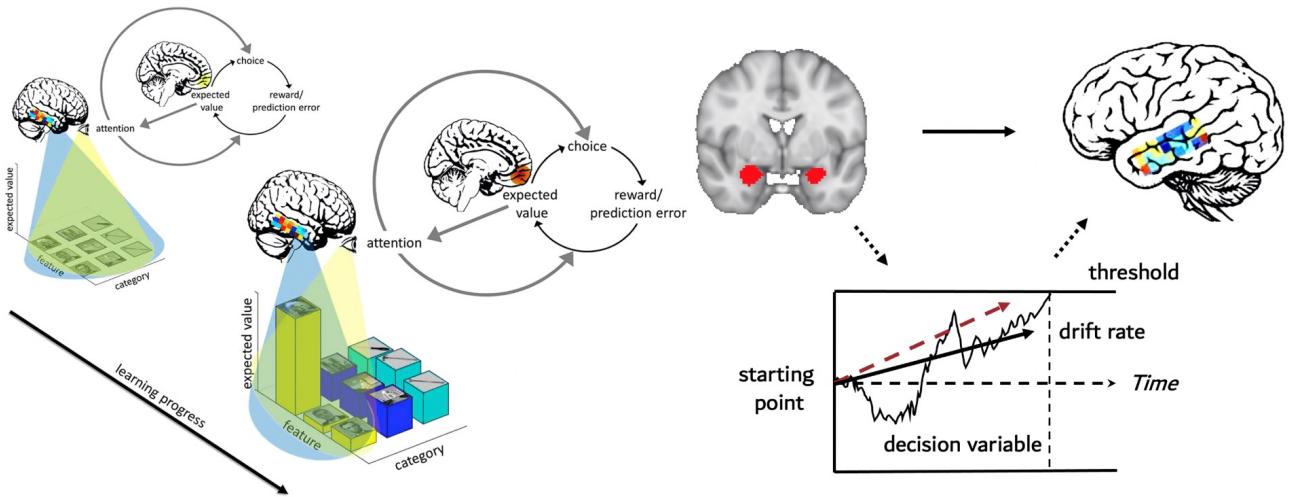
Desires

Fears

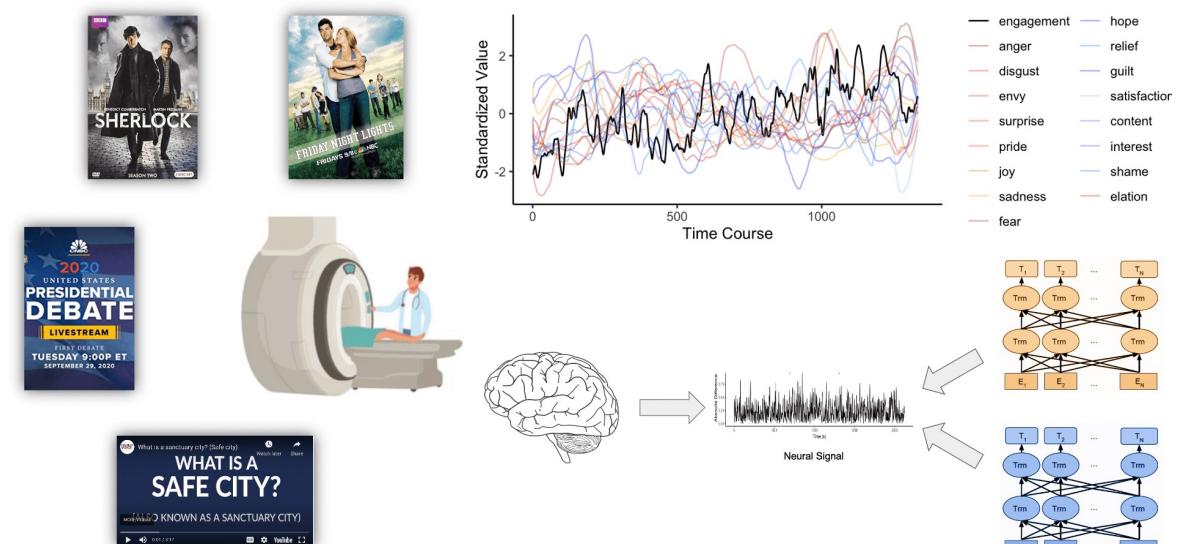
Beliefs

topics

Affective Influences on Perception and Decision-Making



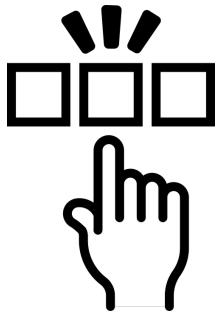
Neuroscience of Narratives



methods



fMRI



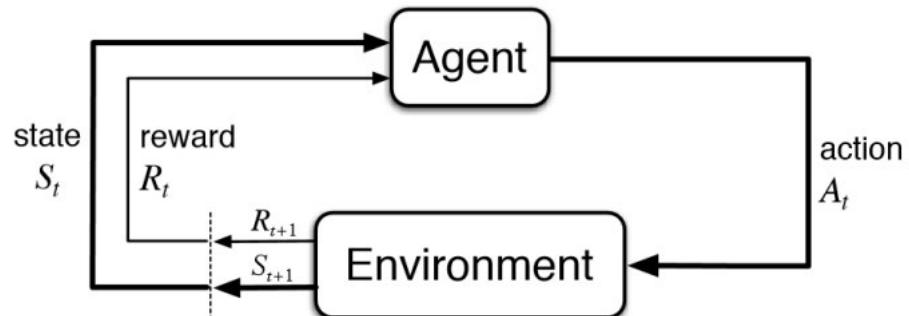
behavior



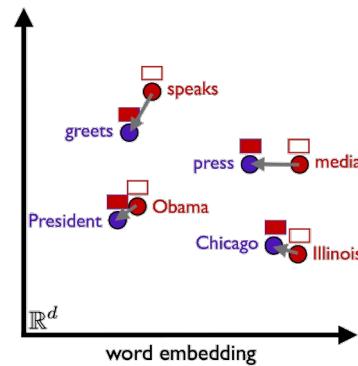
eye-tracking &
pupillometry



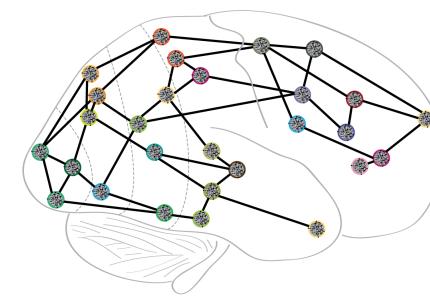
fNIRS



computational
models

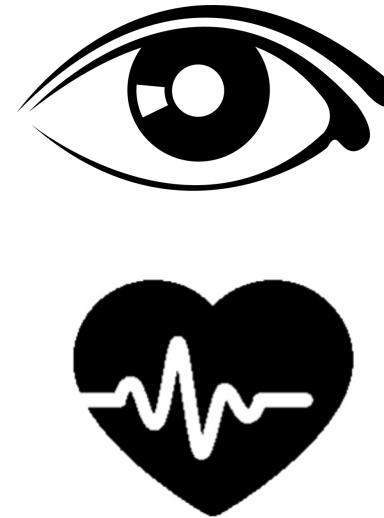
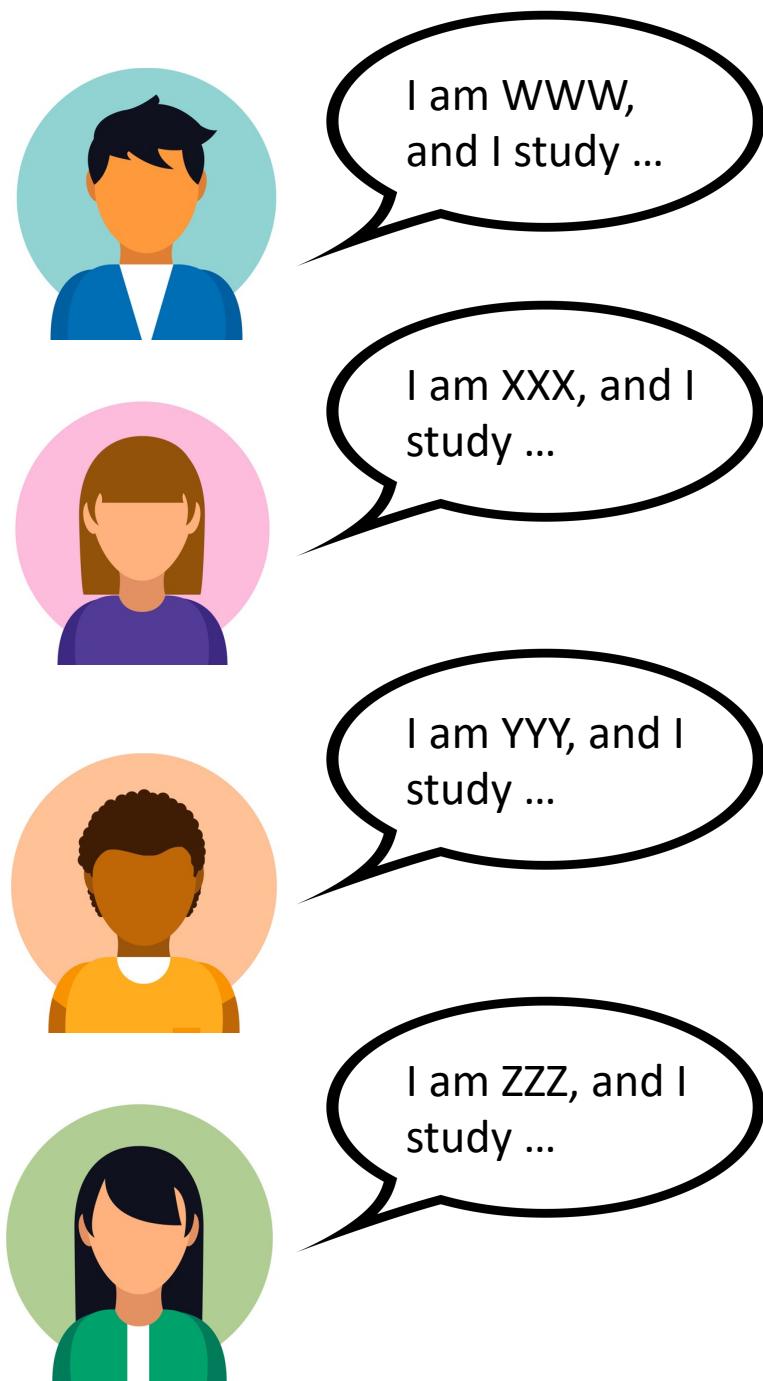


natural language
processing

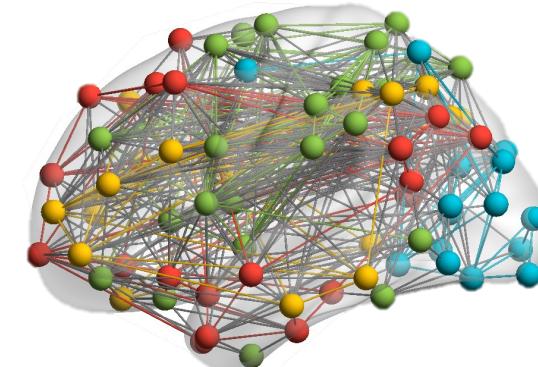


graph theory

Functional network integration mediates arousal effects on naturalistic recall



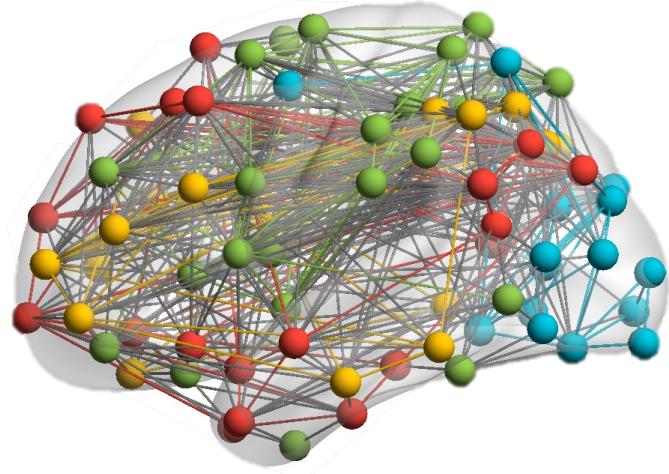
arousal



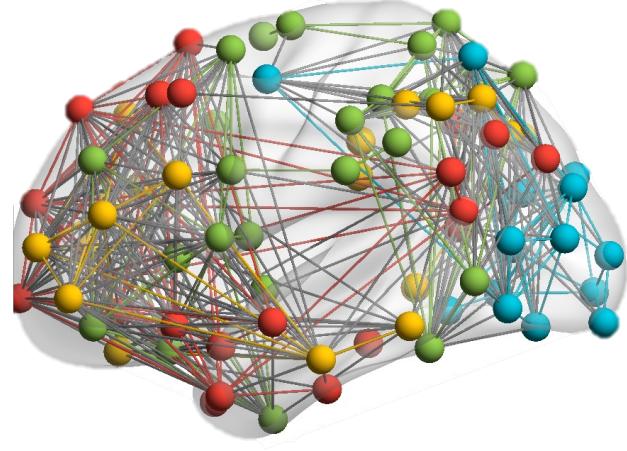
brain state dynamics



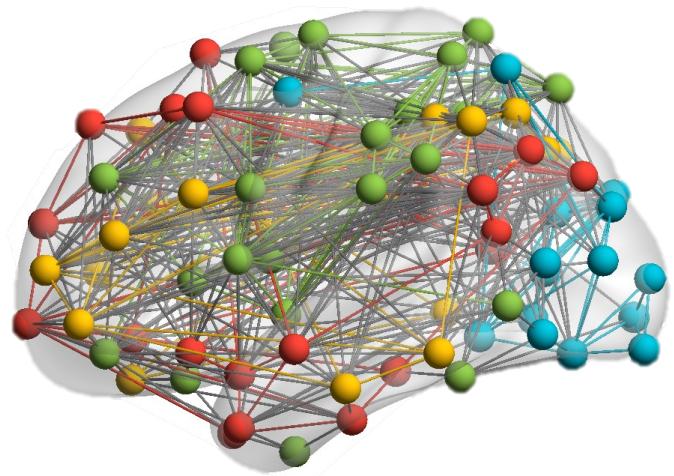
Jadyn Park



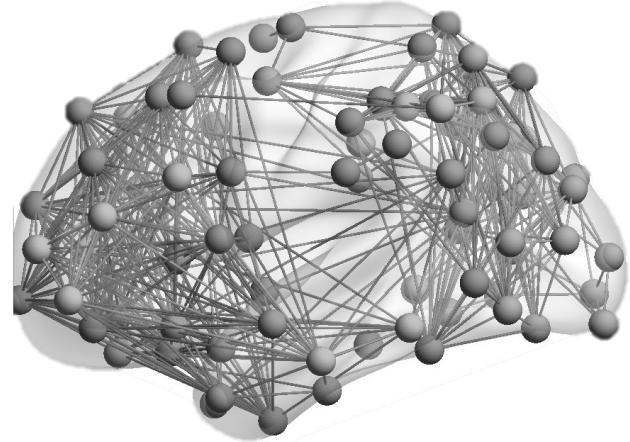
Integration



Segregation

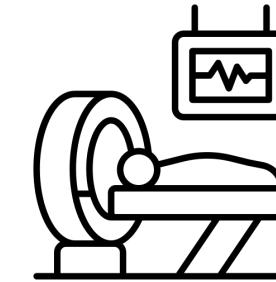


Integration



Segregation

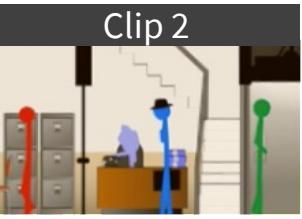
Sherlock (48-min episode)



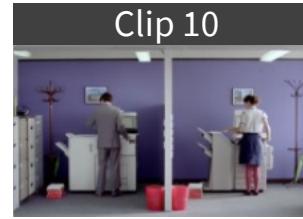
“..Next Watson goes to a warehouse where he meets a man that says he is the closest thing to a friend that Sherlock has. This man says, ...”

Chen, Leong, et al., 2017

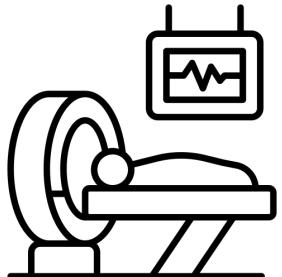
FilmFest (10 x ~5min movie clips)



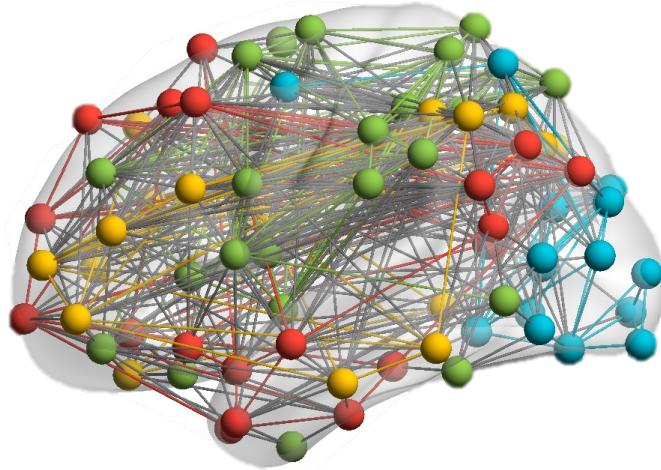
...



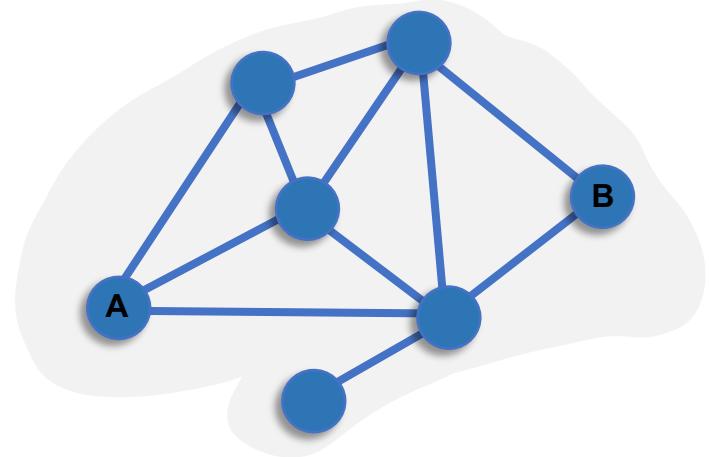
“..It starts out with these three guys on that old game show, To Tell the Truth... ..There's these two people that work in this office...”



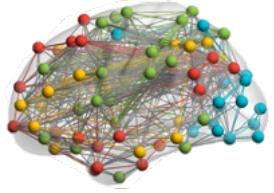
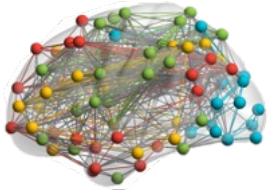
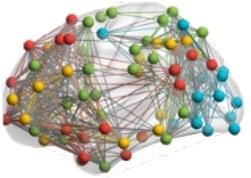
Lee & Chen, 2023



=



- We computed “global efficiency” as a measure of **network integration**
- Average of the inverse of the **shortest path length** between all pairs of nodes

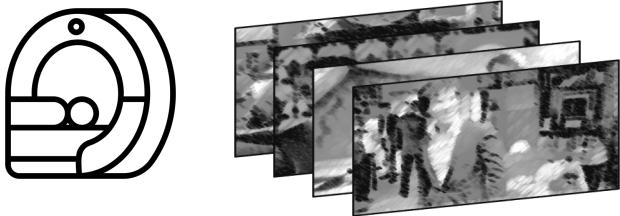


“And then it switches to Watson arriving at 221B street, and it cuts to a scene as Watson walks up, and he’s like, ‘oh, it’s just about to enter’, and Watson’s like...”

“But they walk into this, it’s very old, derelict—it’s pretty dilapidated. No painting on the walls, wooden, well the painting is peeling...”

“It then switches to a morgue. So either that scene happened before this or after. But basically, there is a body of this woman...”

Movie Watching



Encode scene annotations using
Universal Sentence Encoder

event	annotations	embeddings
1	...A soldier runs across the battlefield. Cut to another soldier standing and...	-0.060, 0.049, 0.063, 0.034, ...
...		
22	Sherlock... You wouldn't have come...if there wasn't something different...	0.055, 0.055, 0.047, -0.036, ...
...		

Spoken Recall



“... Next Watson goes to a warehouse where he meets a man that says he is the closest thing to a friend ...”

Encode recall transcripts using
Universal Sentence Encoder

event	transcript	embeddings
1	...There's a lot of guys in army gear shooting. It's very chaotic, can't...	0.002, 0.059, 0.040, 0.019, -0.054, ...
...		
22	Sherlock says well if there wasn't anything different you wouldn't have...	0.044, 0.017, -0.011, 0.031, 0.077, ...
...		

recall accuracy

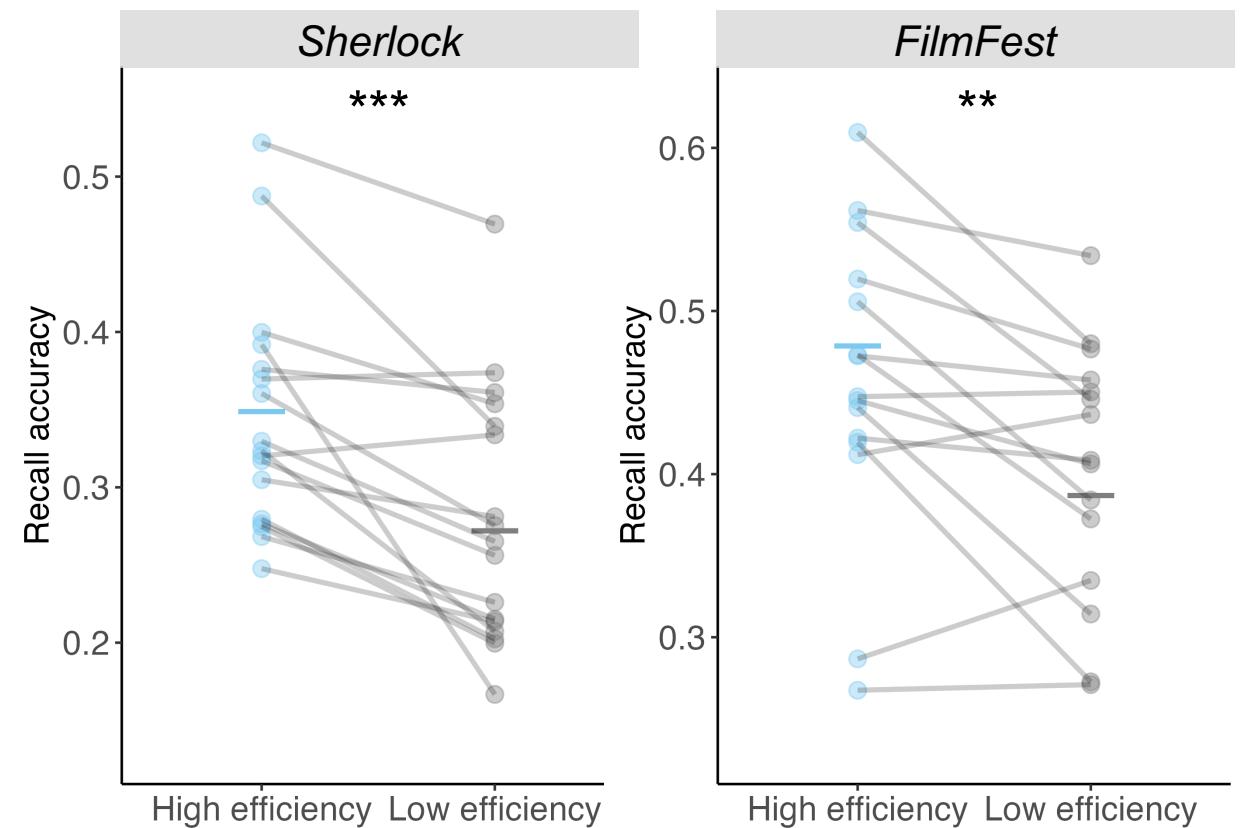
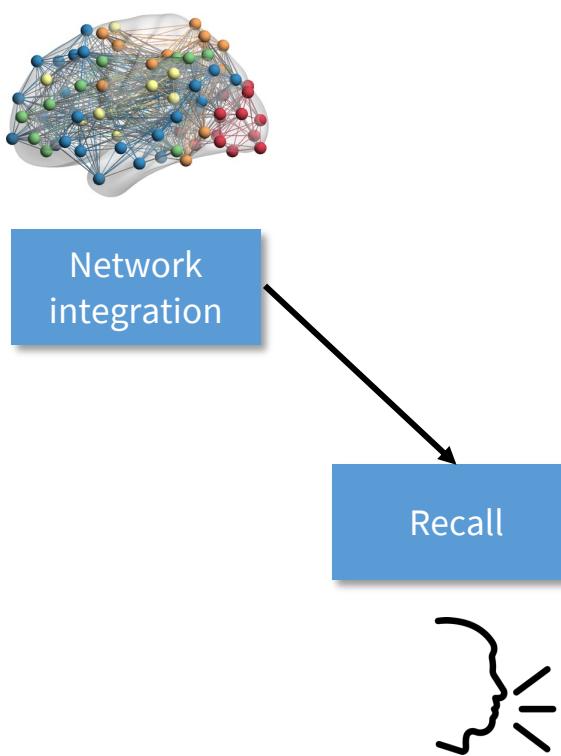
cosine similarity



cosine similarity

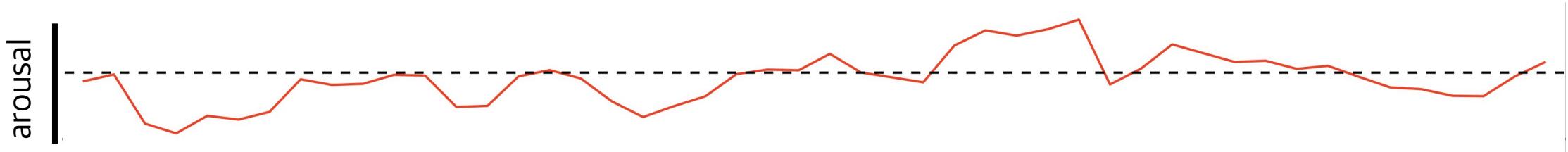


Does network integration predict recall?

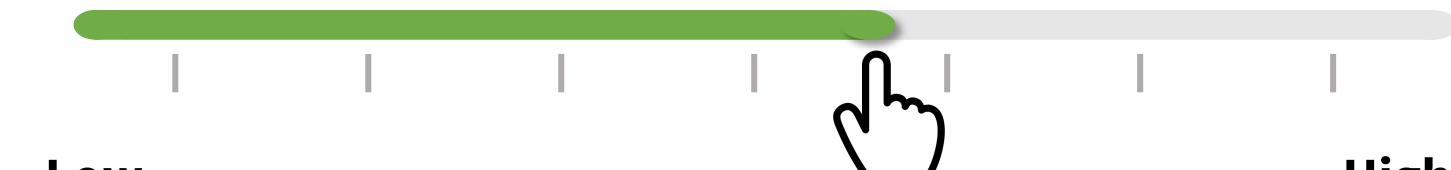


*** $p<.001$, ** $p<.01$

Arousal measure 1: Continuous Ratings



$n=30, r=0.313$



**Low
Aroused**

**Highly
Aroused**



Jin Ke

Arousal measure 2: Large Language Models

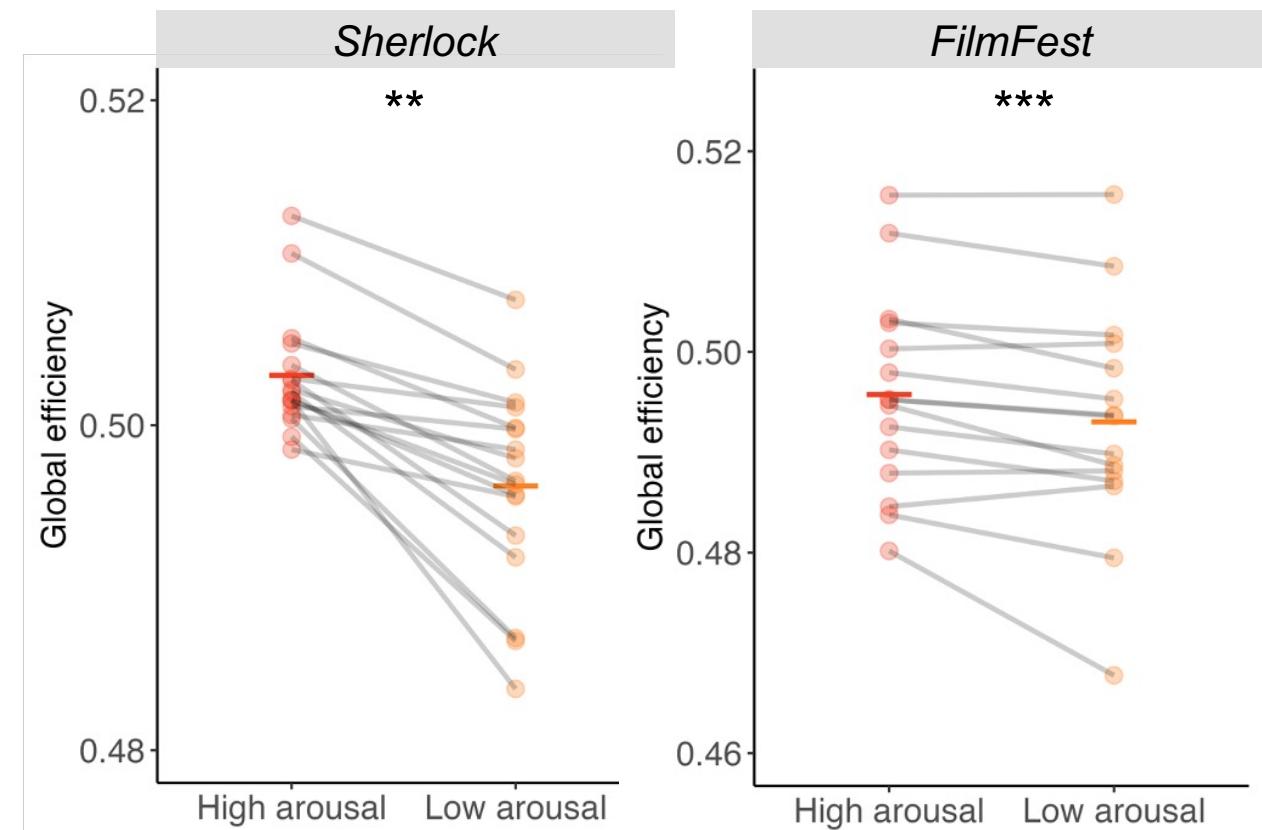
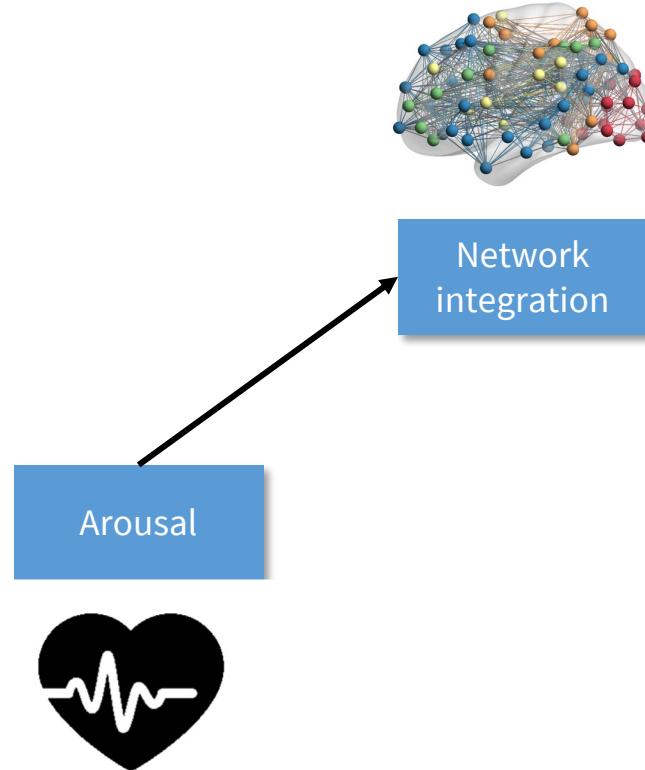


StableBeluga-13B



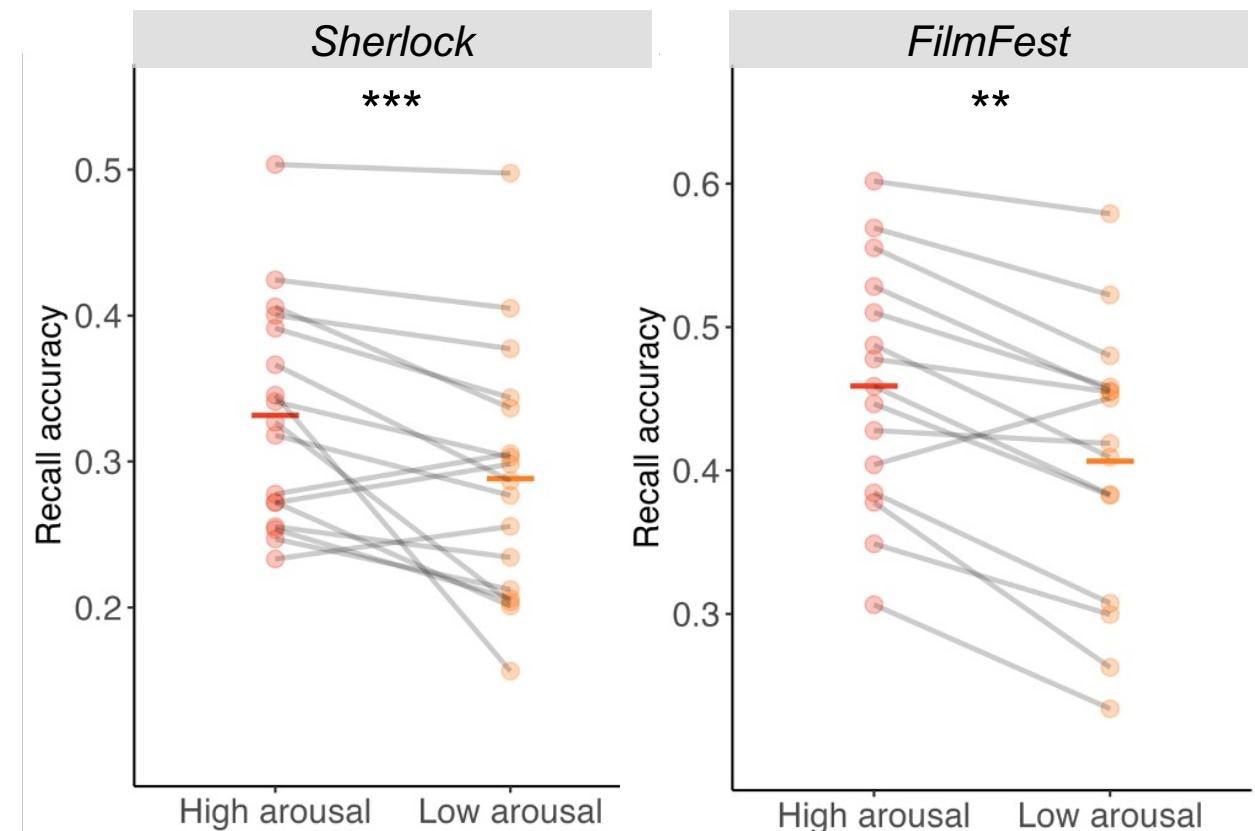
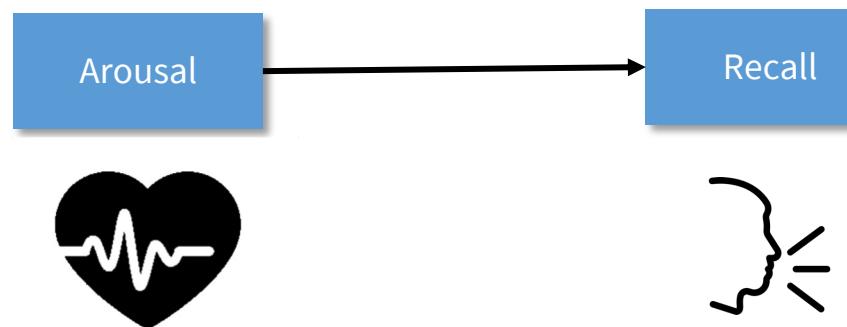
Kruthi Gollapudi

Arousal is associated with functional network integration



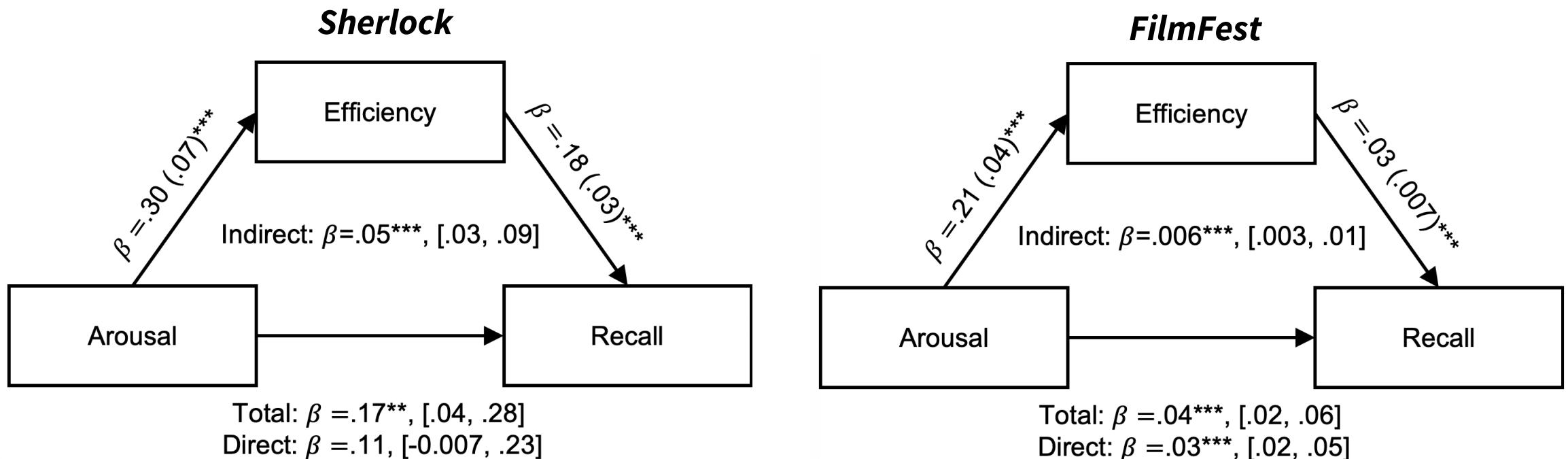
*** $p<.001$, ** $p<.01$

Arousal is associated with recall accuracy



*** $p < .001$, ** $p < .01$

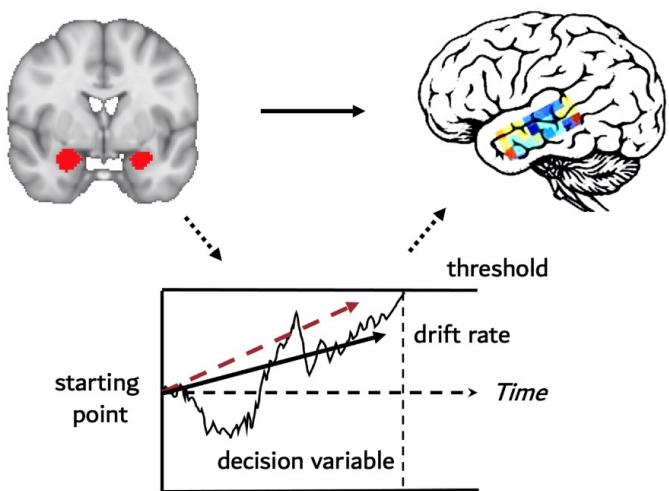
Network integration mediates arousal-driven memory enhancements



Summary

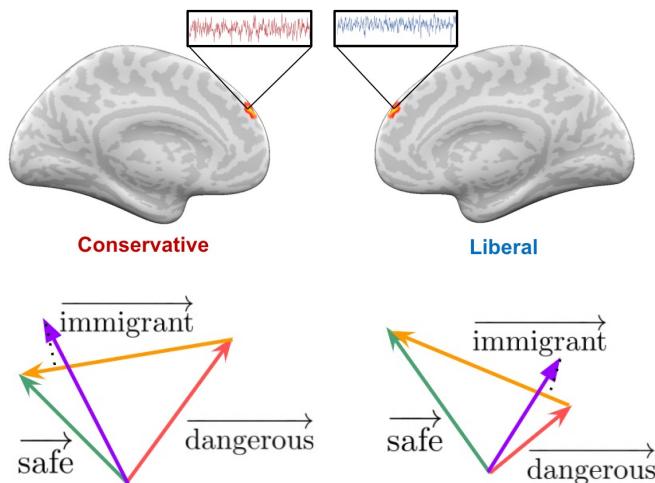
- **Arousing scenes** were more likely to be **remembered**, and participants brains were also in a **more integrated** state while watching these scenes
- Functional brain network integration partially **mediated** the effects of arousal on memory recall
- An integrative approach that ties together **affective states, brain dynamics** and **human cognition**

Motivational influences on visual perception



Calabro, Lyu, Leong, Cereb. Cortex. 2023
Leong et al., Psych. Sci., 2021
Leong et al., Nat. Hum. Behav., 2019

Divergent neural and semantic representations of political content



Leong, Chen, Willer, Zaki, PNAS, 2023
Rim, Berman, Leong (in prep)

Neural correlates of hostile attribution bias



Lyu, Su et al., bioRxiv, 2023

Acknowledgments

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