

Graded questions

1. Suddenly it comes to you in the middle of the night: you've figured out how memory works! You furiously scribble down as many details as you can, before the thoughts are lost forever. You have created...*the SHAM model*.

The next morning, you look back at your scribbles, and you realize that the SHAM model is actually very similar to another model you've studied in PSYC 51.09– the SAM model. In fact, it's identical in every way, except for one “small” detail. In the SAM model, the associations between items that occupy the short term memory store at the same time are strengthened. But in the SHAM model, the opposite happens. Specifically, items that occupy the short term memory store at the same time become *less strongly associated*. (Similarly, items in the short term memory store become *less associated* with context, according to the SHAM model.)

With a sinking feeling, you realize that the SHAM model is going to make some pretty strange predictions about people's free recall behaviors.

- (a) What would the SHAM model predict the *serial position curves* (recall probability by presentation position) will look like for immediate free recall and delayed free recall? Draw two curves (and label which is which). Explain (in 1 paragraph) why you drew the curves the way you did.
(b) What does the SHAM model predict people's temporal clustering patterns (Fig. 7.4) will look like (for immediate free recall)? Draw a curve analogous to Fig. 7.4, and explain (in 1 paragraph) why you drew the curve the way you did.
2. Since graduating from Dartmouth last year, *future you* has been pouring all of your energy into a new tech startup you founded with some of your Dartmouth classmates. You've created a new search engine, *SHAM2* (no relation to that strange model you thought up back when you were an undergrad) that uses the Temporal Context Model to more effectively help people to retrieve personal files on their computer.

For example, suppose you're listening to a song while working on a problem set for PSYC 51.09. Those two co-active events will become linked in a “context database” so that, later, when you search for the song it will also bring up the document, or when you search for the problem set (or its contents) it will bring up the song.

You've been pitching your search engine to a friend-of-a-friend who knows a group of investors who might be interested. Your contact arranges a meeting, but the investors make it clear that they are going to be deciding between backing your TCM-based search engine, or another search engine that has no contextual awareness but is slightly faster than the one you've been working on.

You need to make your case: why should they back your company? Explain to the investors why they should care about context-aware search and invest their millions (billions?) in your company instead of your competition. **(2-3 paragraphs)**

Graded questions

In answering the questions below, consider this week's material in the context of the other material we've learned throughout the course.

1. How do our brains organize and spontaneously retrieve memories? Use an example if it helps, or you can give a general answer. **(2-3 paragraphs)**
2. In your view, what is the single greatest challenge to our understanding of human memory? For example, where is our knowledge of "how memory works" weakest? Or, what sorts of questions about memory are the most difficult to study? Why? **(2-3 paragraphs)**
3. What would need to happen in order to overcome (solve) the challenge(s) you identified above? Do you think it's possible and/or will ever be possible to address that challenge or are we doomed to always have an incomplete understanding of memory? Why? **(2-3 paragraphs)**

Final exam logistics

- Review session: Friday, June 4
- Exam due June 8 (noon)
- Open book, similar format to midterm
- Cumulative

Recap

- Ratio rule
- Long-range recency
- Long-range contiguity
- Single store models (TCM)

Context reinstatement and advanced topics

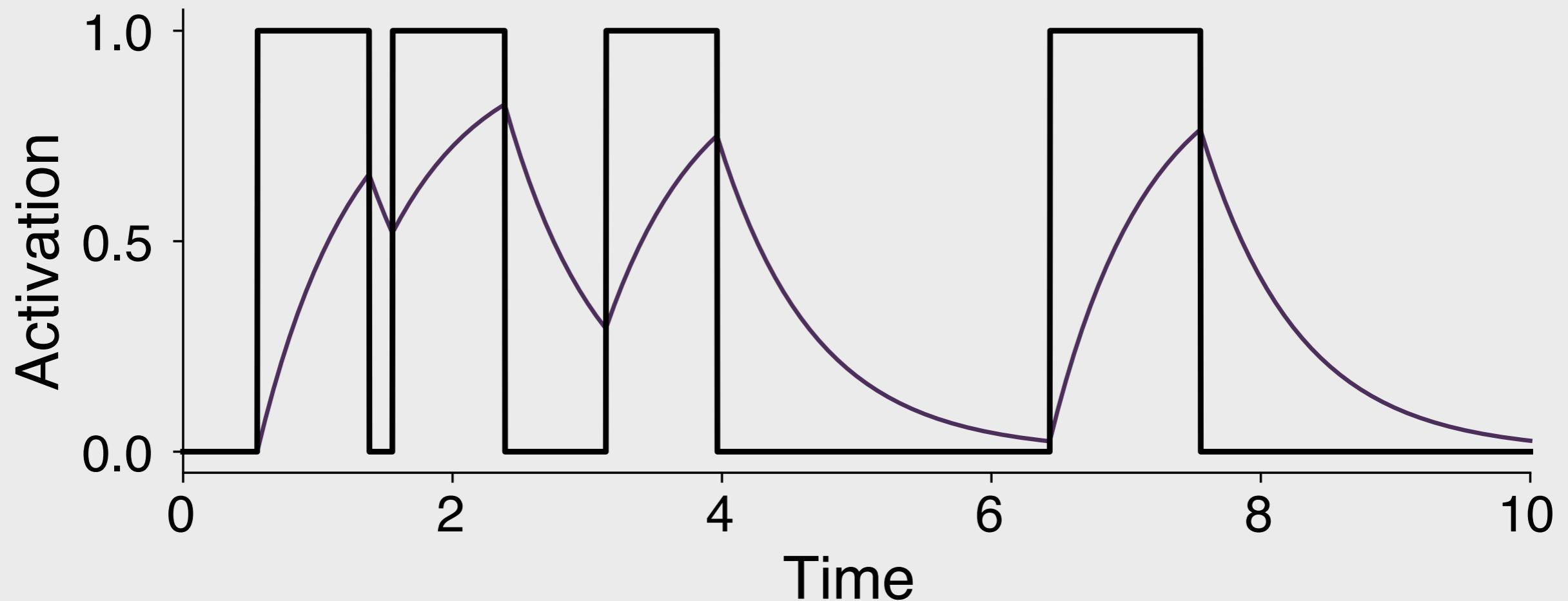
PSYC 51.09: Human Memory
Spring 2022

Jeremy Manning
jeremy@dartmouth.edu

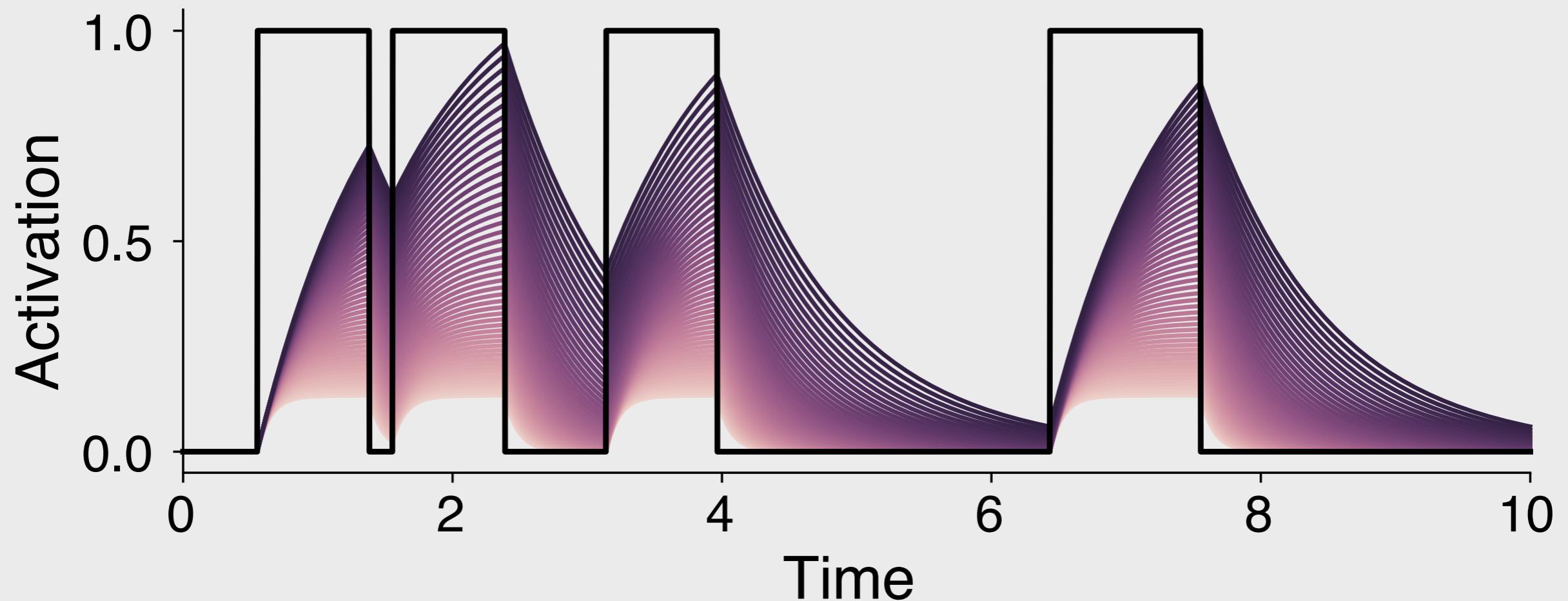
How fast do our thoughts drift?

- TCM says that our thoughts drift at 2 timescales: “fast” (item representation) and “slow” (context representation)
- This is a useful simplification, but how do we know which drift rates to use?

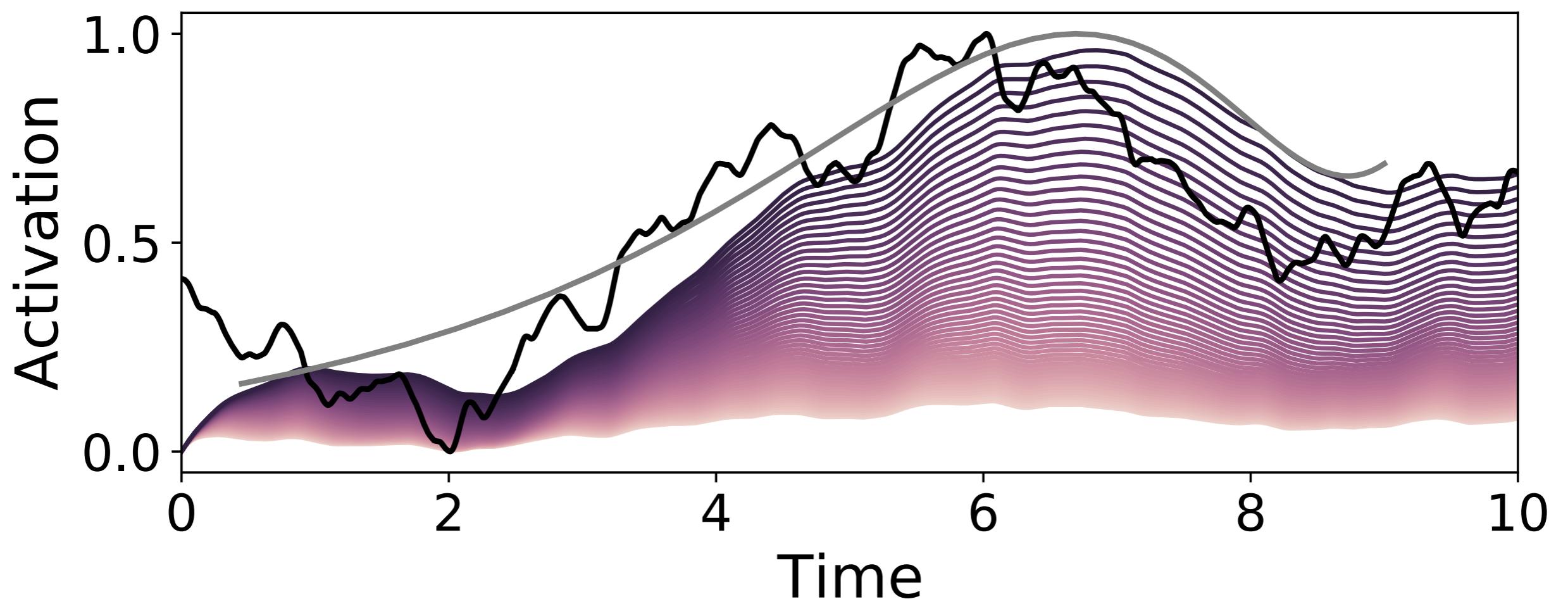
Integrators and drift



Integrators and drift



Thoughts at many timescales



Shankar and Howard, 2012

testing room

hungry

itchy

exams

weather

NOTEBOOK

SKULL

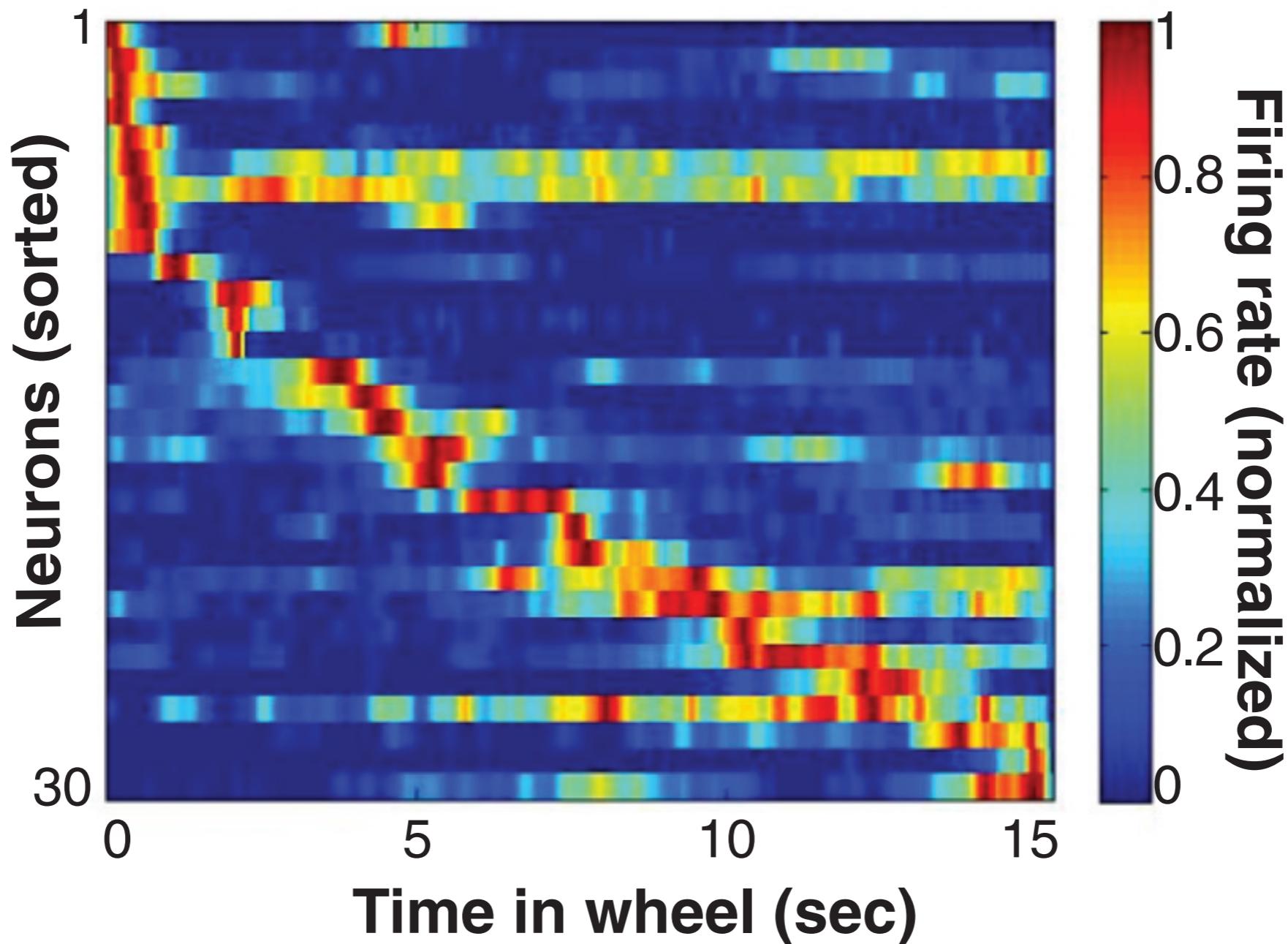
LEAF

BANANA

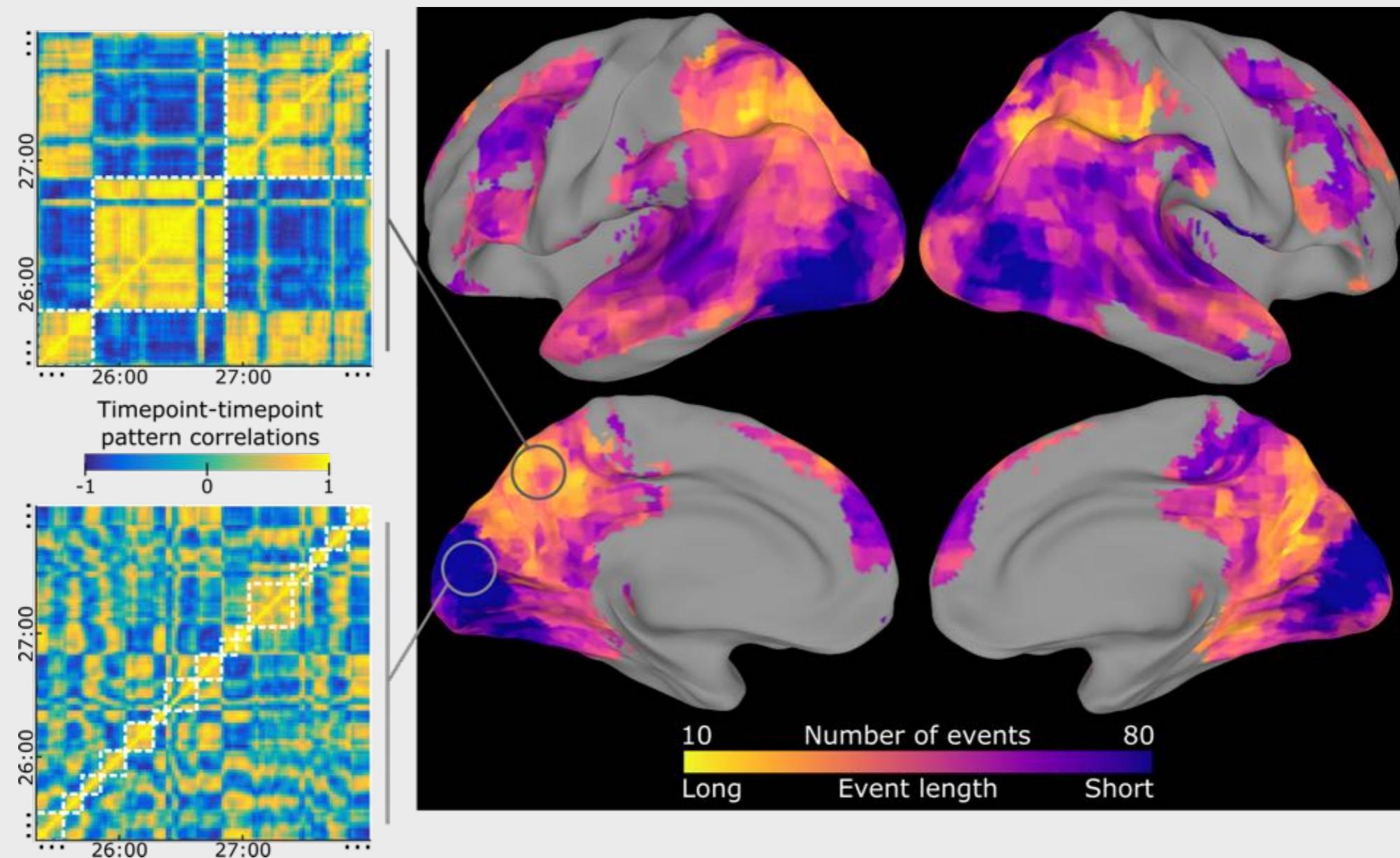
SHARK



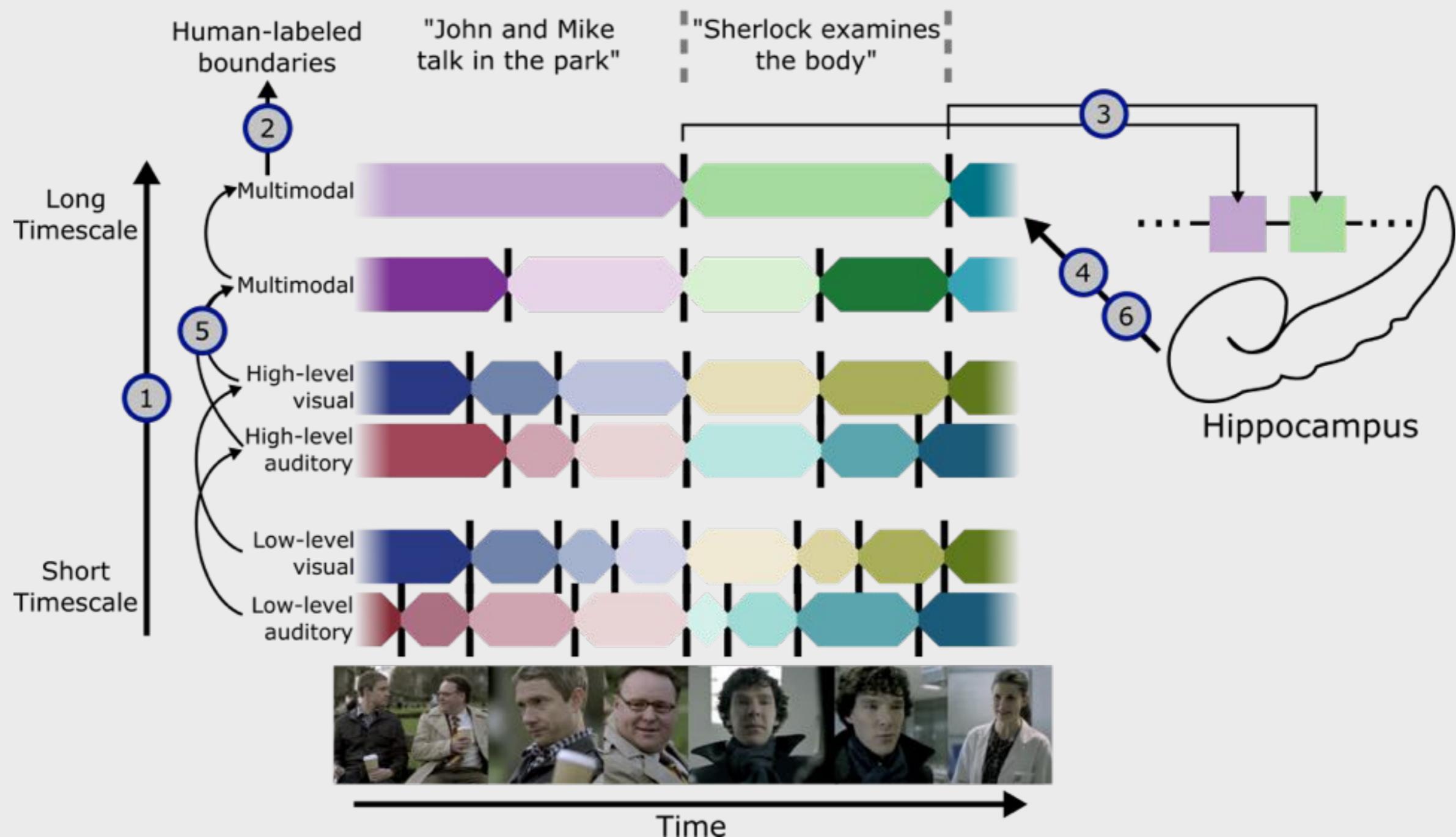
Time cells (Pastalkova et al., 2008)

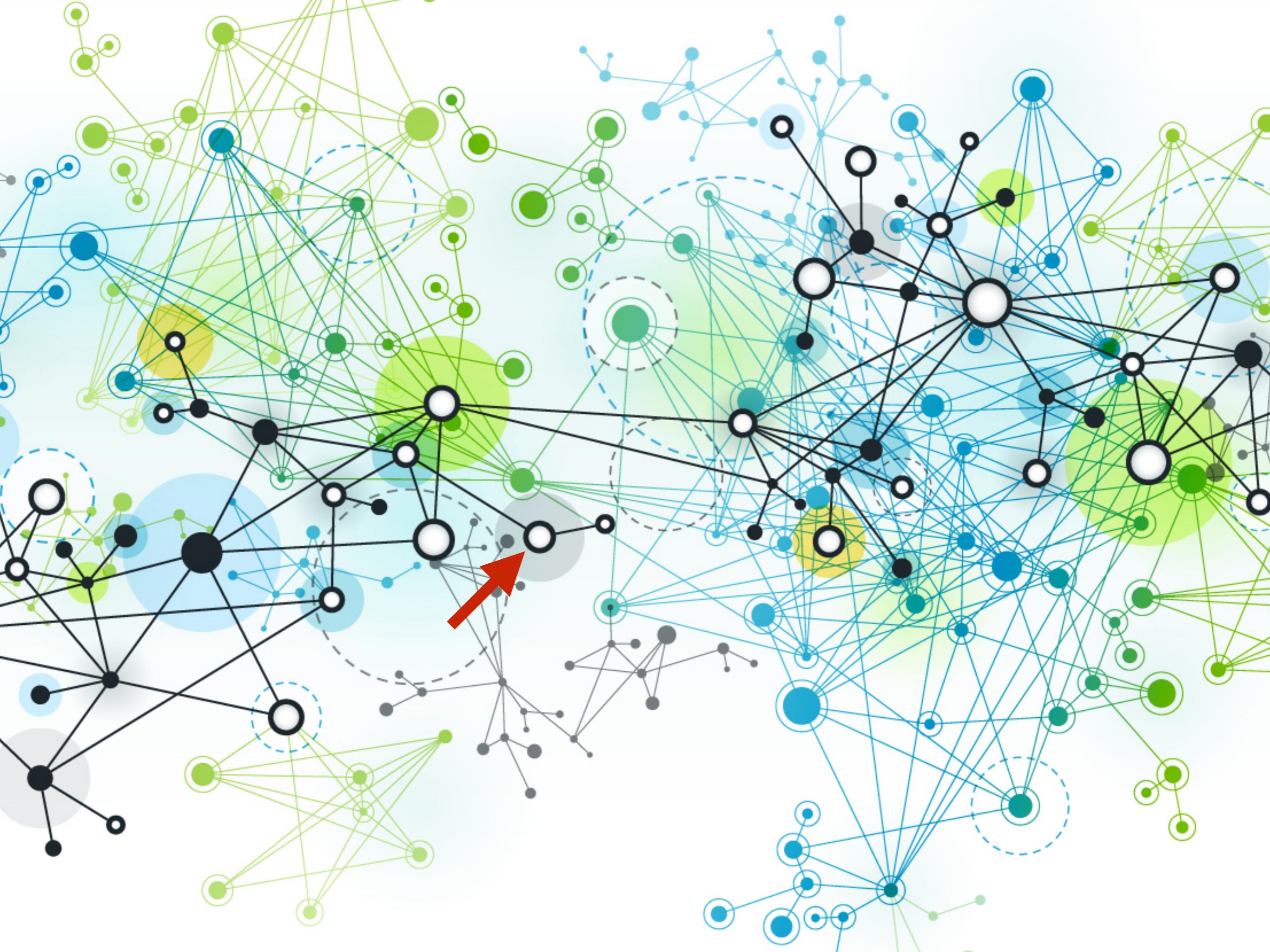


Our brains are sensitive to structure at a wide range of timescales

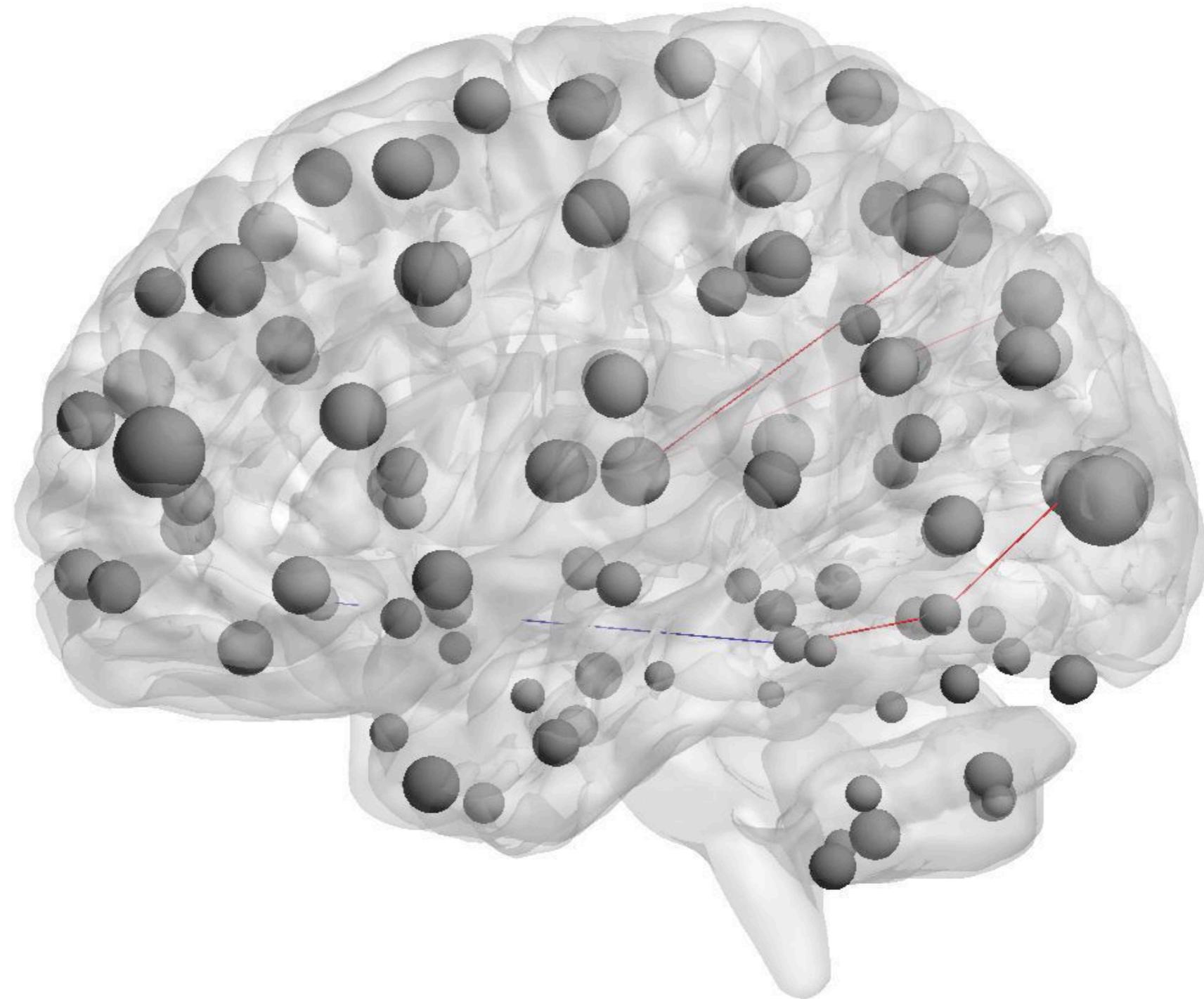


Forming multi-scale associations



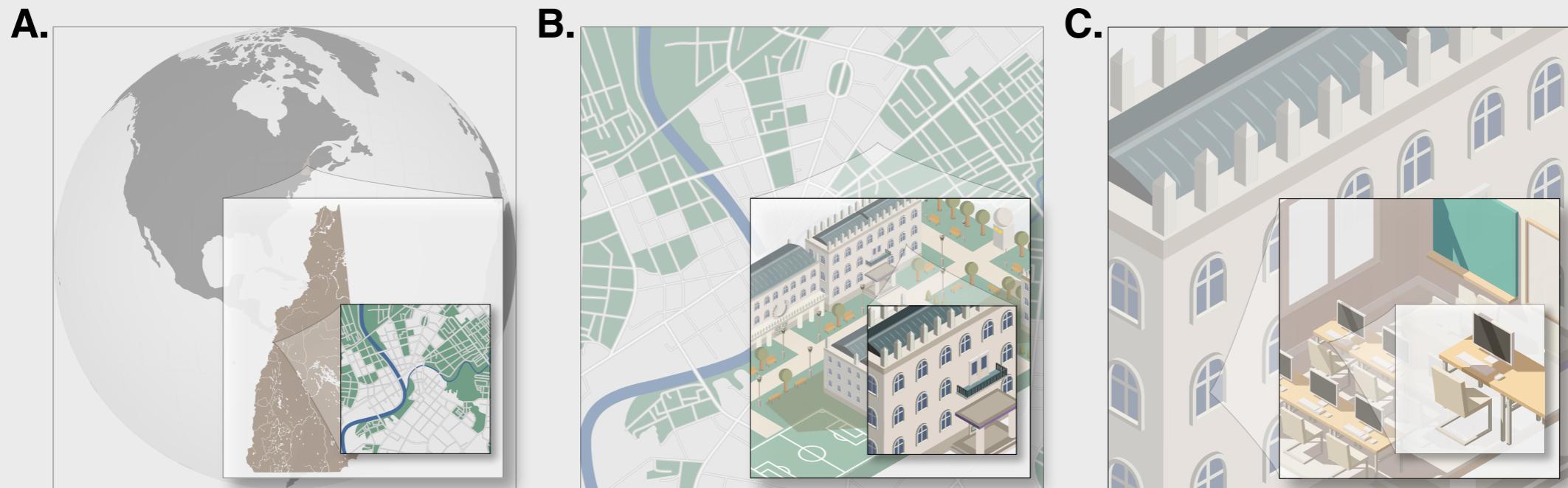


Brain network dynamics

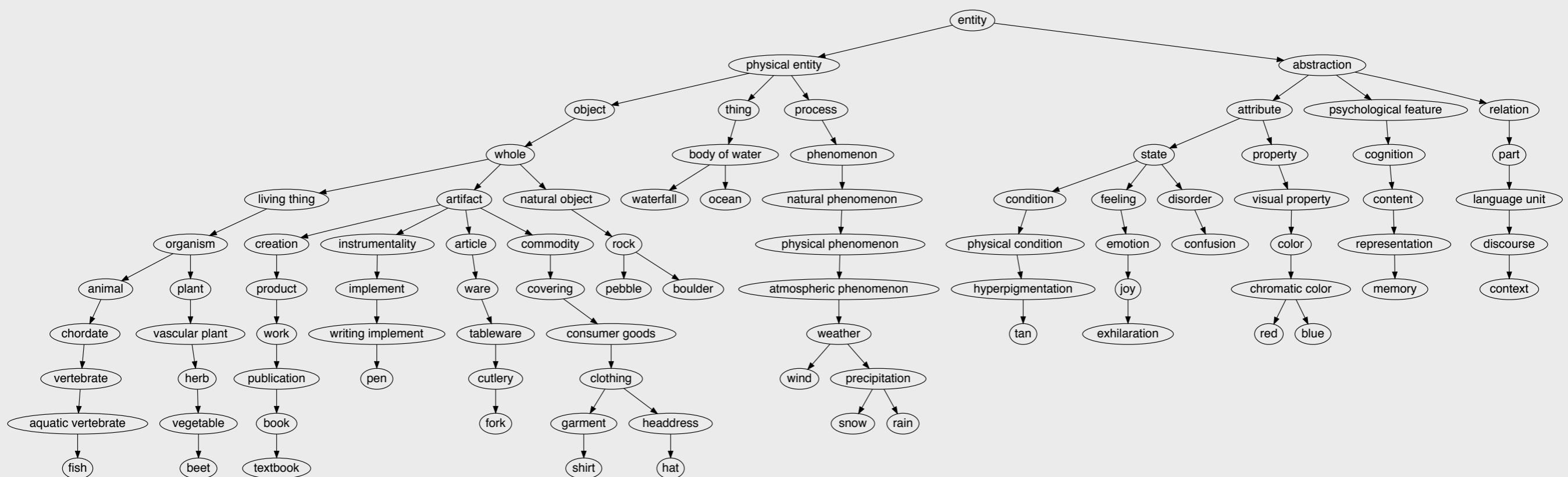


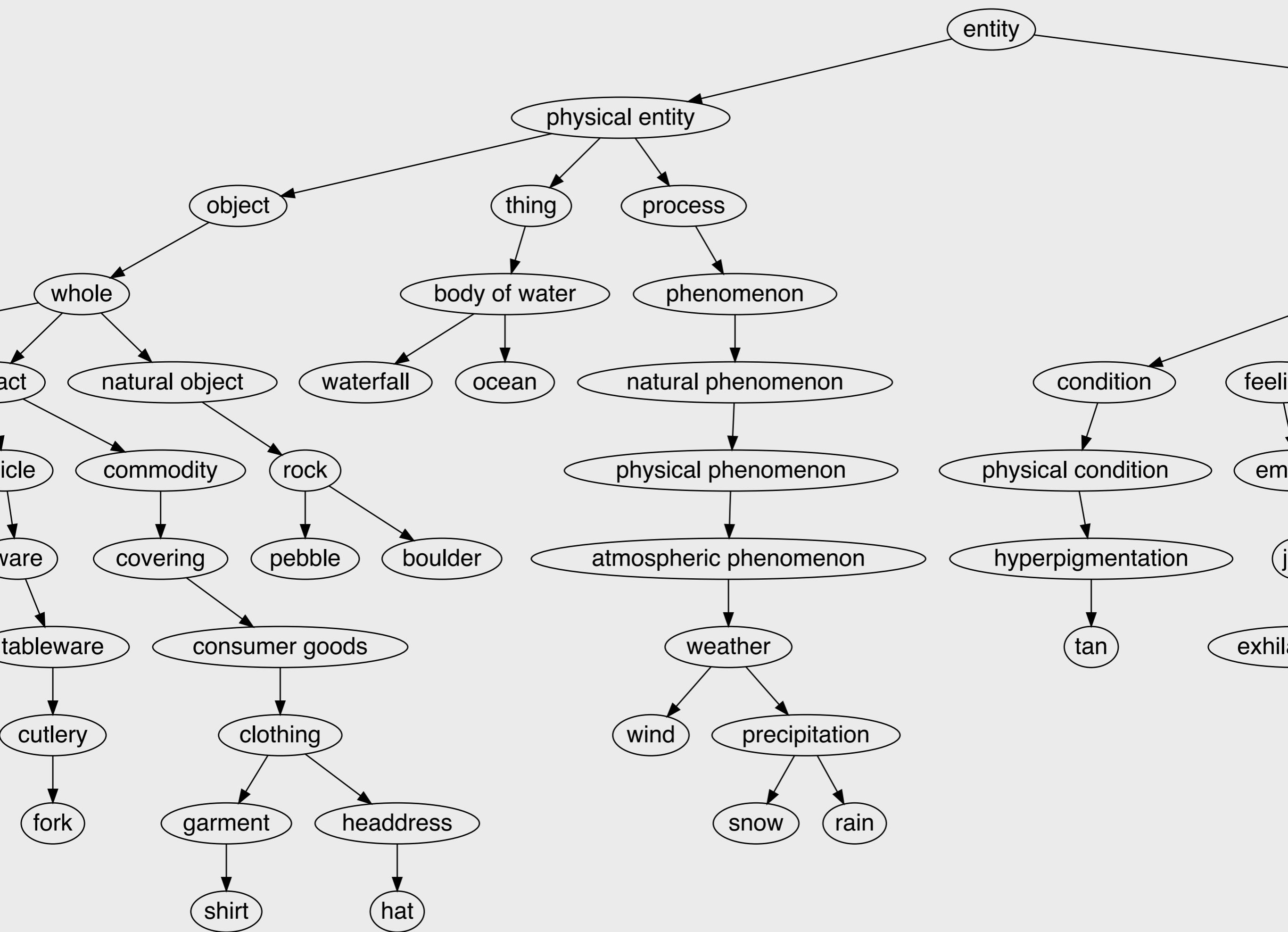
Manning et al., 2018

Scale invariance is a universal organizing principle



Scale invariance is a universal organizing principle





Scale invariance is a universal organizing principle

- More specific experiences (and thoughts) are **contextualized** by more general experiences and thoughts
- More specific also implies smaller scale (temporally, spatially, conceptually, emotionally, situationally, socially, etc.)

Closing thoughts

- We've gone through over 100 years of memory models and experimental results
- Some key organizing principles have survived: scale invariance, context
 - Predict new results **and** explain old results, causal manipulations and brain hacks
 - Connections to brain
 - Naturalistic stimuli, real-world experiences
- **Poke at these ideas, sit with what's unsatisfying or incomplete, ask questions, and make new discoveries!**