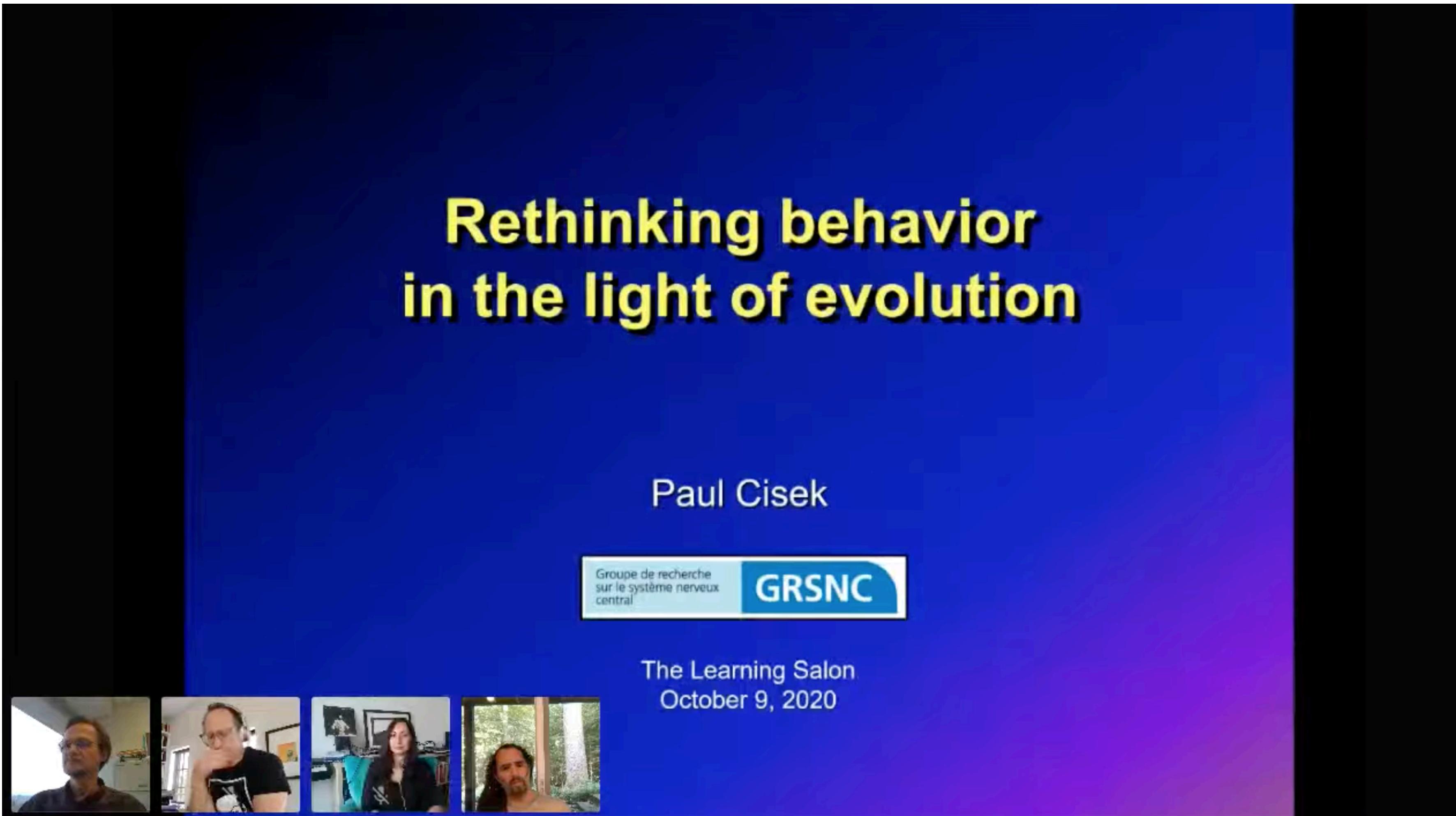


How & why does the brain evolve?

Readings for today

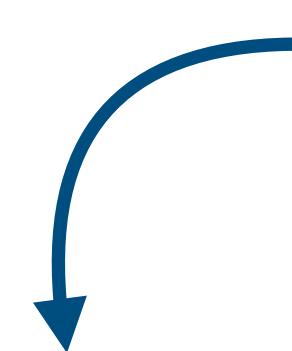
- Cisek, P. (2019). Resynthesizing behavior through phylogenetic refinement. *Attention, Perception, & Psychophysics*, 81(7), 2265-2287.

Cisek in his own words



Phylogenetic refinement

Definition: Progressively refine theories of behavior, whereby each hypothetical mechanism is conceived as an extension of an ancestral one, and whenever possible, each extension is guided by data on the actual phylogenetic history.

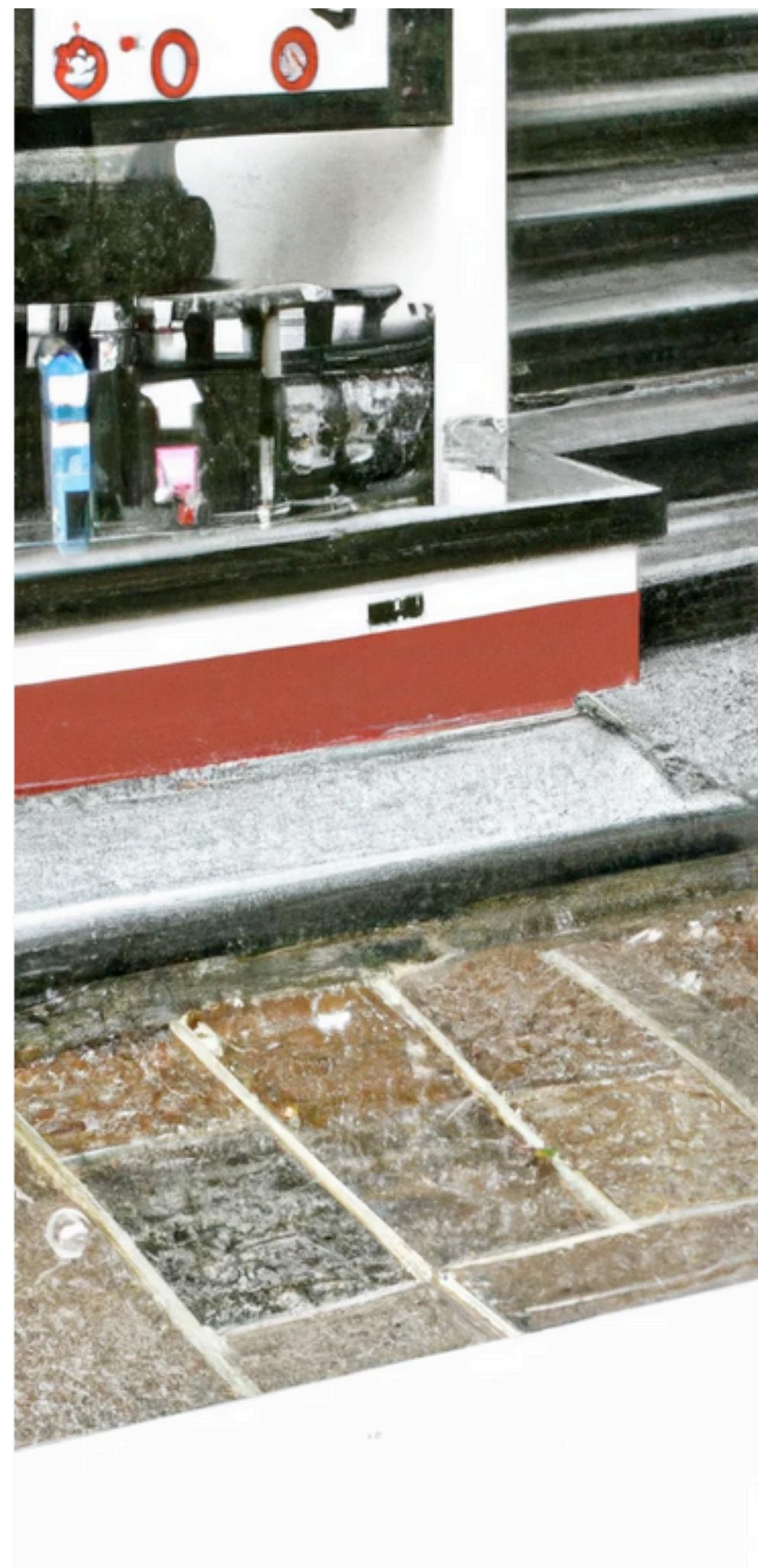


Relating to the evolutionary development and diversification of a species or group of organisms, or of a particular feature of an organism.



(YouTube: Brick Experiment Channel)

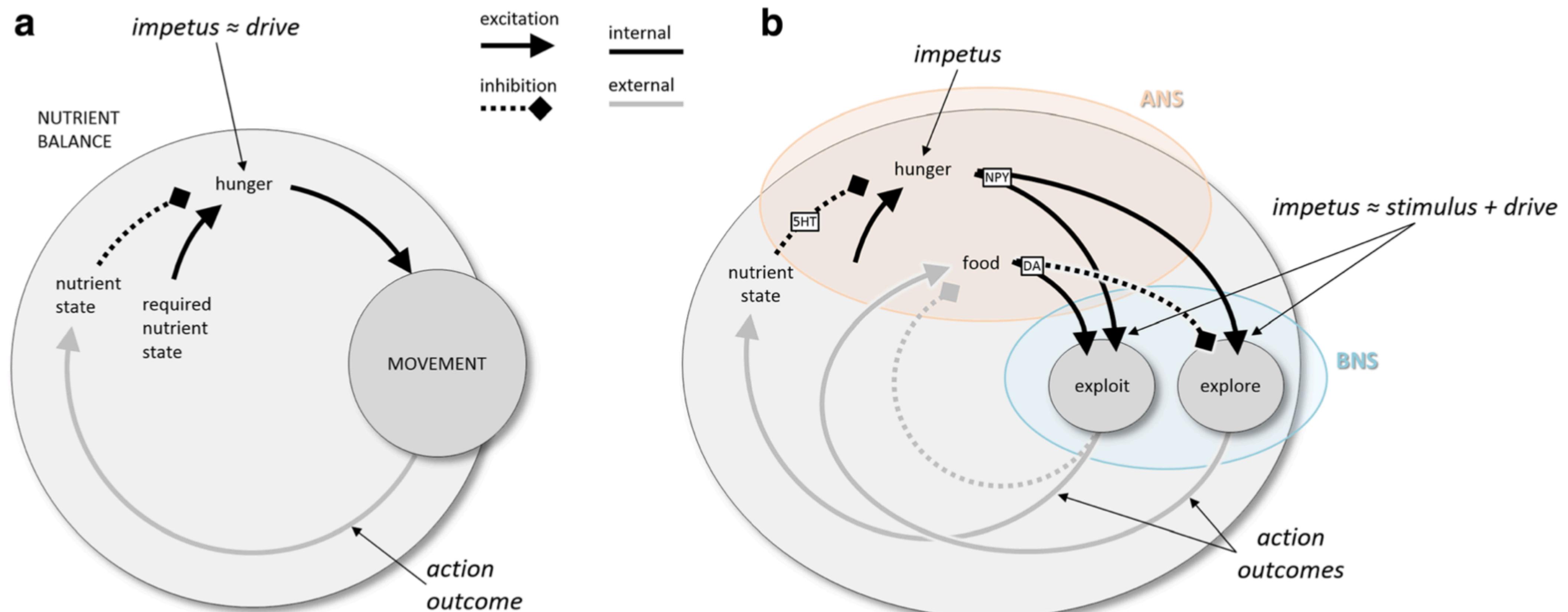
Gibson's affordances



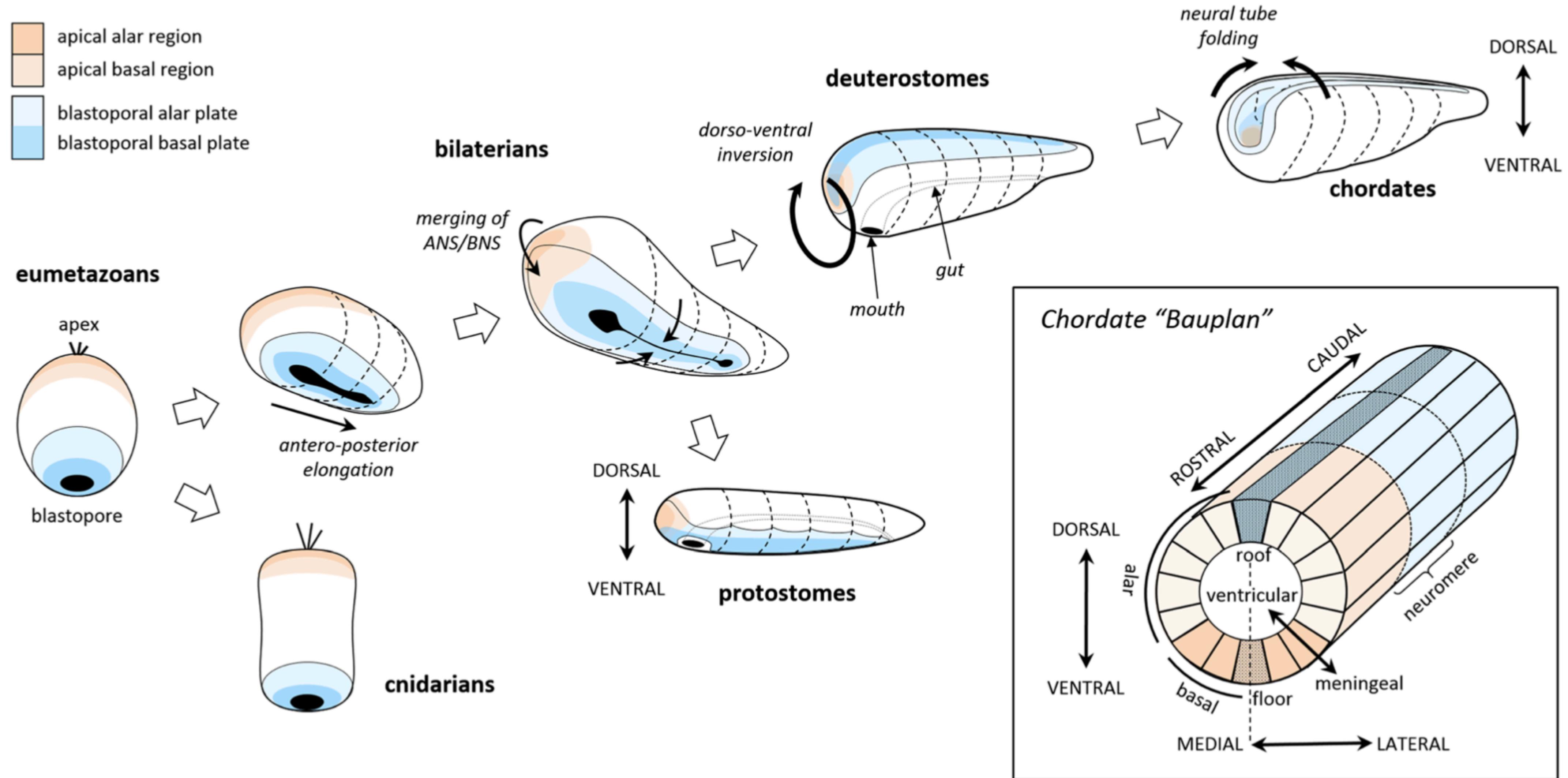
The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill. The verb to afford is found in the dictionary, the noun affordance is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment.

— Gibson (1979, p. 127)

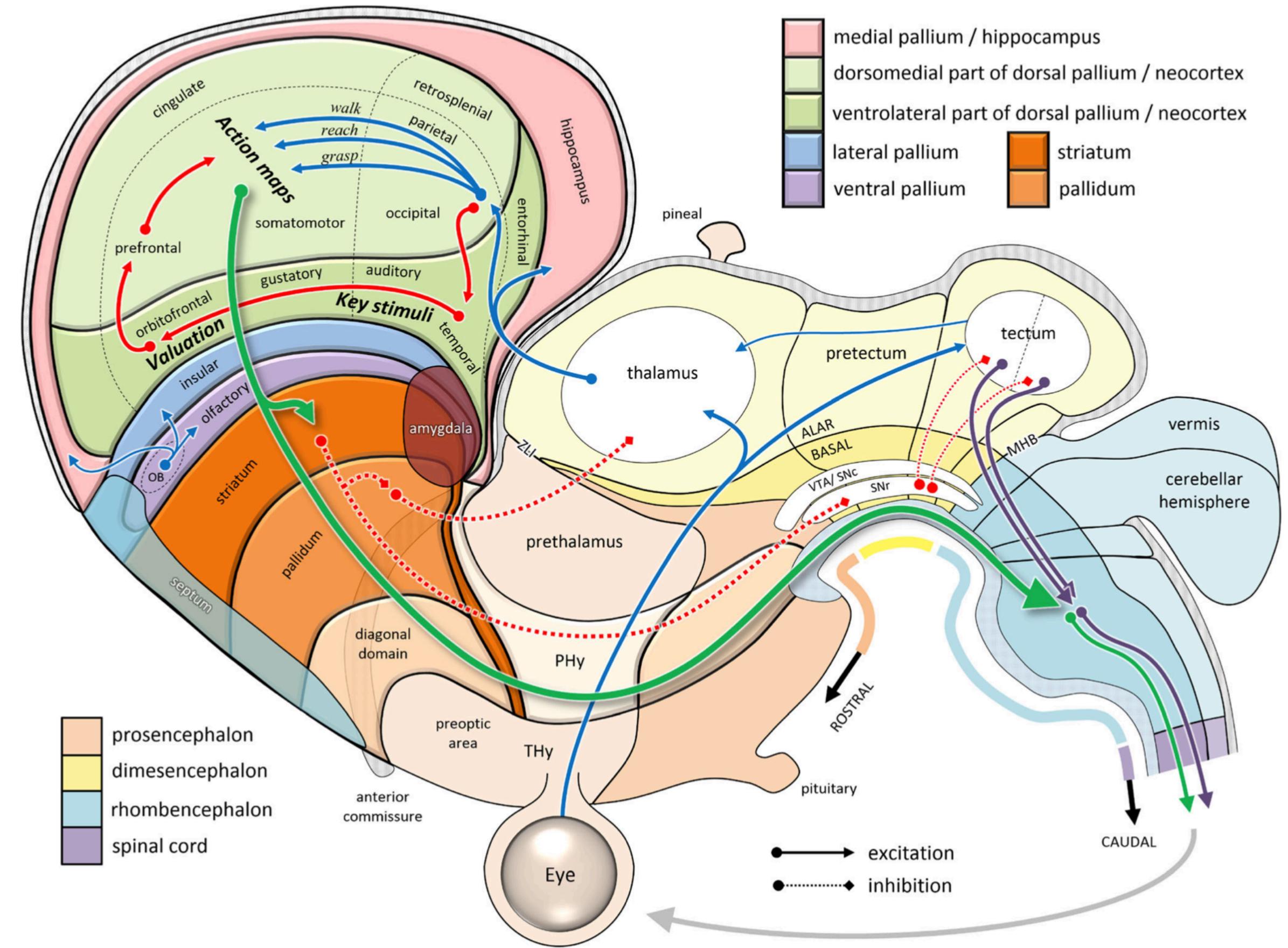
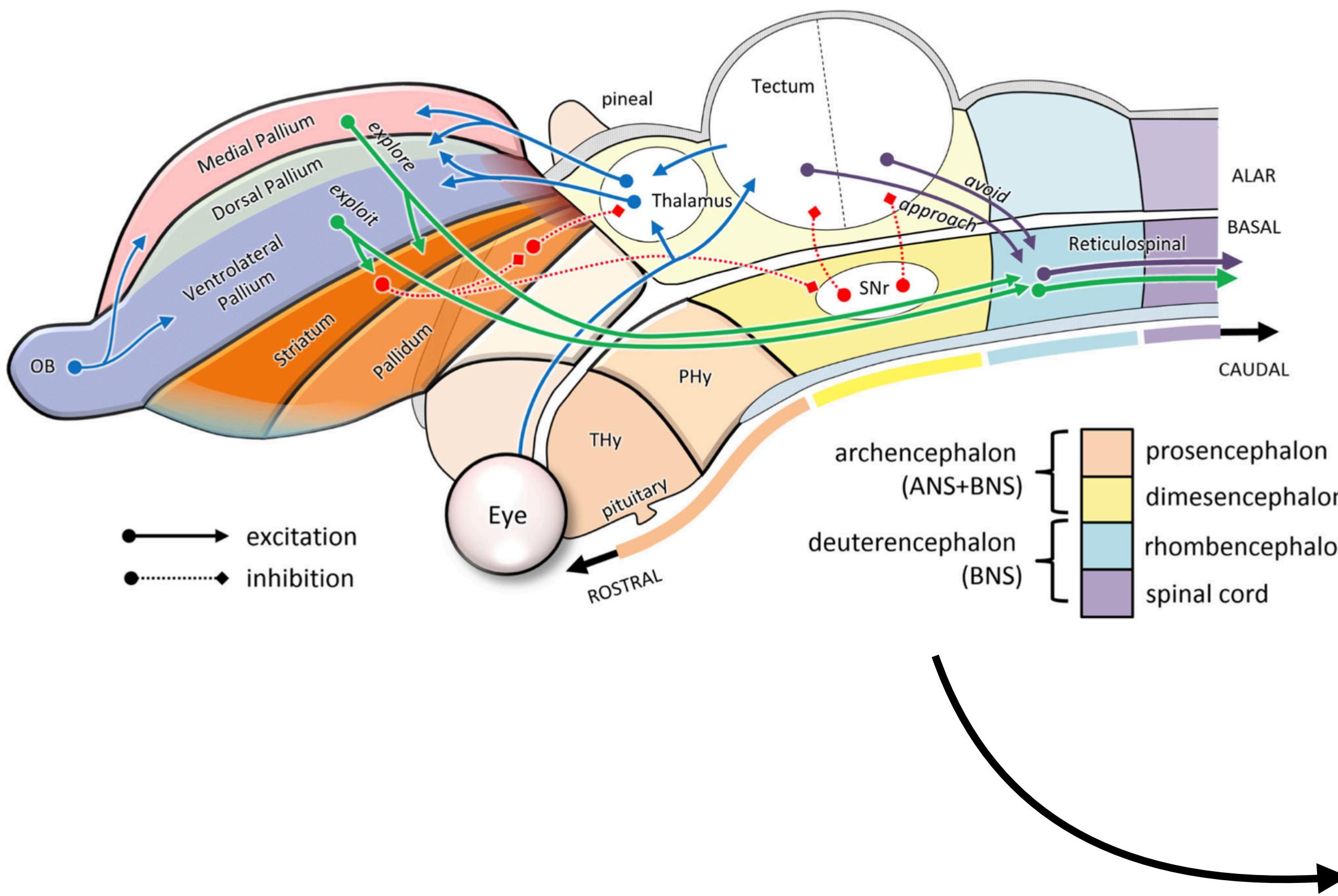
Start simple...



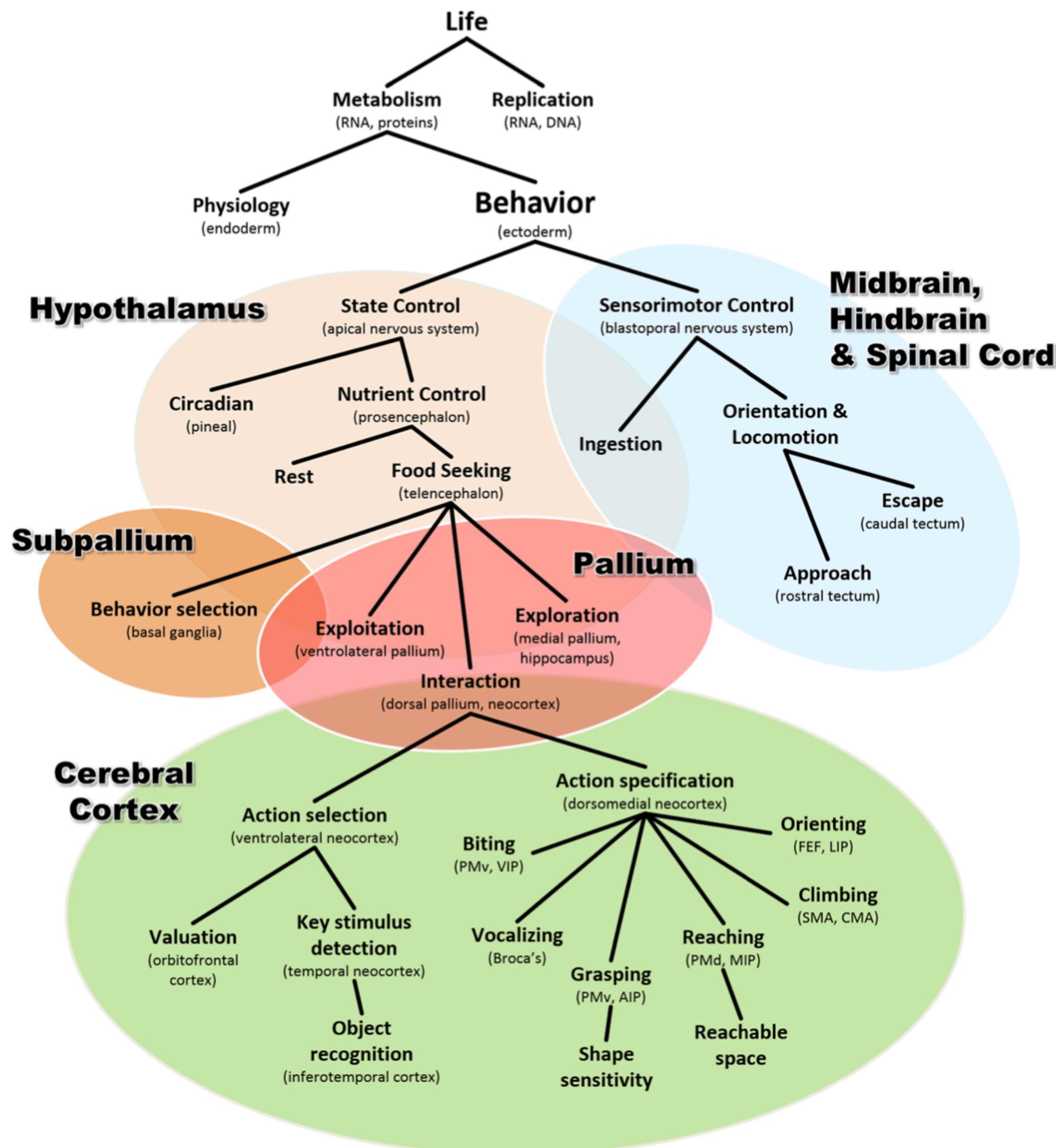
... increase complexity to maximize fitness...



... building on what was done before.



Revised taxonomy via phylogenetic refinement



Here, the hierarchy of functional categories is constructed by progressive differentiation that follows, along each branch, the putative sequence of specializations that occurred over evolutionary time. Thus, behavior is a specialization of metabolism, object recognition is a specialization of action selection, and so forth. I would argue that these are not simply semantic exercises, but useful constraints that can reveal similarities of the underlying mechanisms.

-Cisek, 2019

Take home message

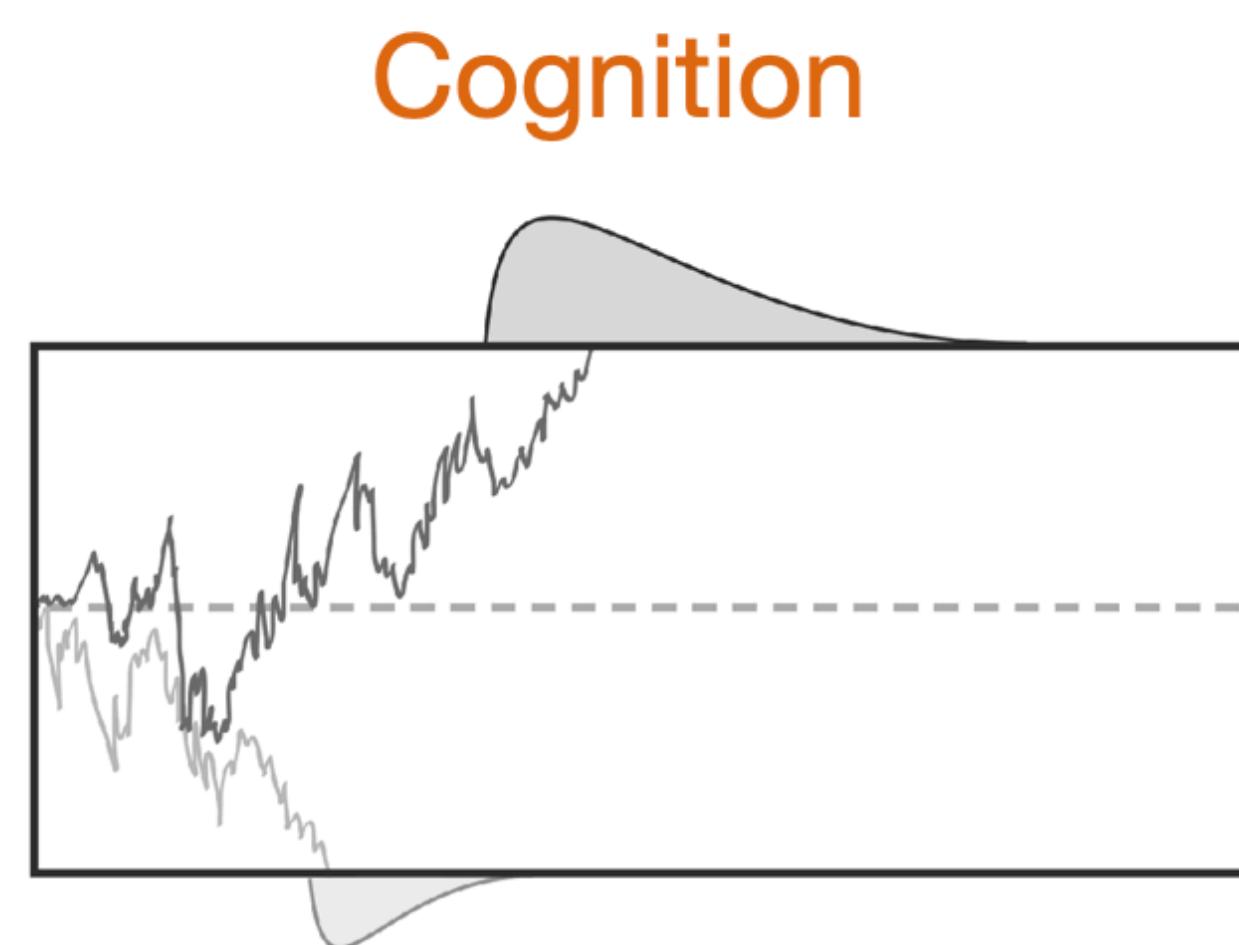
- “Nothing in biology makes sense except in the light of evolution.” - Dobzhansky
- The abilities that we want to study reflect a refinement based on past abilities and a continuous restructuring to meet local environmental demands.

Break out group discussions

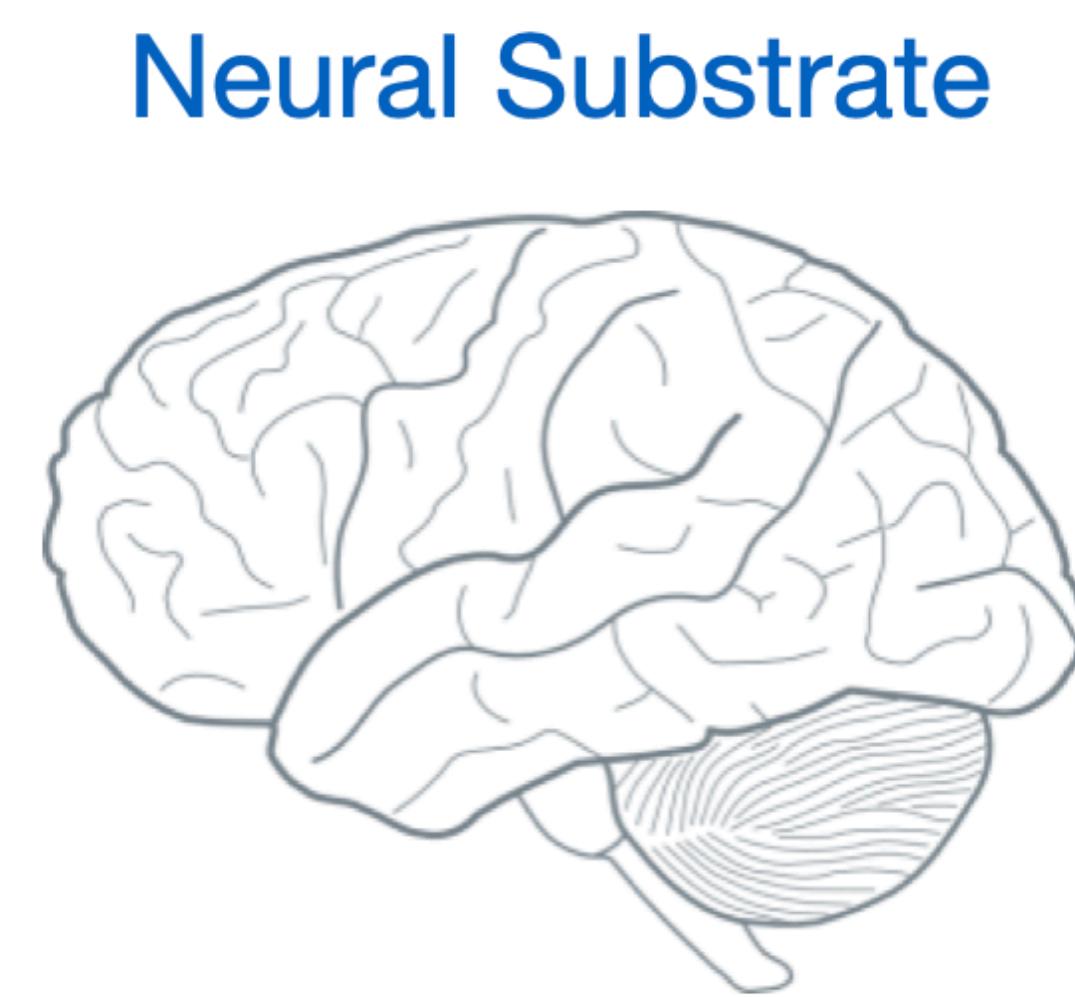
Task: Where do algorithmic Darwinism (Valiant 2009) and phylogenetic refinement (Cisek 2019) theories sit within Marr's levels of analysis? How do they work together to help us understand intelligent behavior?



Computation 1



Algorithm 2



Implementation 3