A program for finding forgetting

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the problem for psychology

declarative forgetting: The inability to recall information that could previously be recalled—or, at least, could be stated at the time that the information was encountered.

1. We know that some memories are stored in long-term memory, but, at some particular time, they can’t be retrieved.
2. It’s also possible that, in some cases, a memory can’t be retrieved because it no longer exists.

One can never tell if anything is ever completely forgotten, only that it is forgotten with the effectiveness of the cues at hand, and this effectiveness can change with time and the state of the individual.

Rubin (2007, p. 328)

a dilemma for psychologists

1. There are memories, in LTM, that cannot be retrieved.
2. Behaviorally, *un-retrievable* (but stored in LTM) and *gone* are the same.

In searching for the answer to the question of why forgetting occurs, it seems best to avoid spending too much time on issues that are inherently untestable and which quickly devolve into the realm of philosophy. . . .

Wixted (2007, pp. 332 – 333)

. . . It would be difficult to establish the complete absence of a trace because it is always possible that an as yet untried retrieval cue would show that some remnant of the trace is still available. Thus, focusing too much time on this definition of forgetting does not seem to be a fruitful course of action.

Wixted (2007, pp. 332 – 333)

In principle, neurobiological investigations could determine if memories are ever completely gone.

The problem is that the only way to determine definitely if a memory is forgotten because of a total erasure of the original memory substrate is to examine an extremely simple neural circuit which can reveal all of the cellular and molecular events that occur when a memory is formed and then to show that all of these events have gone back to their original state at the time when the memory is not retrieved.

(Davis 2007, p. 317)

Davis sets the bar too high.

How should we investigate the strong form of forgetting neurobiologically?

investigating forgetting

1. Establish where memory traces are stored in the brain.
2. Establish that there can be hidden memories stored in that location.
3. Track the presence and absence of the hidden memory traces under different conditions and time frames.

classical conditioning

classical conditioning

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unconditioned stimulus (US)

shocks

+

conditioned stimulus (CS)

odor

learning


conditioned
stimulus (CS)
odor
unconditioned
response (CR)
retreat

a test of memory: Does the odor cause retreating 2 days later? 6 days later? 10 days later?

1. Determine where the memory trace is stored in the brain.

block neural activity in specific brain areas

brain area 1 ⟹ retreating

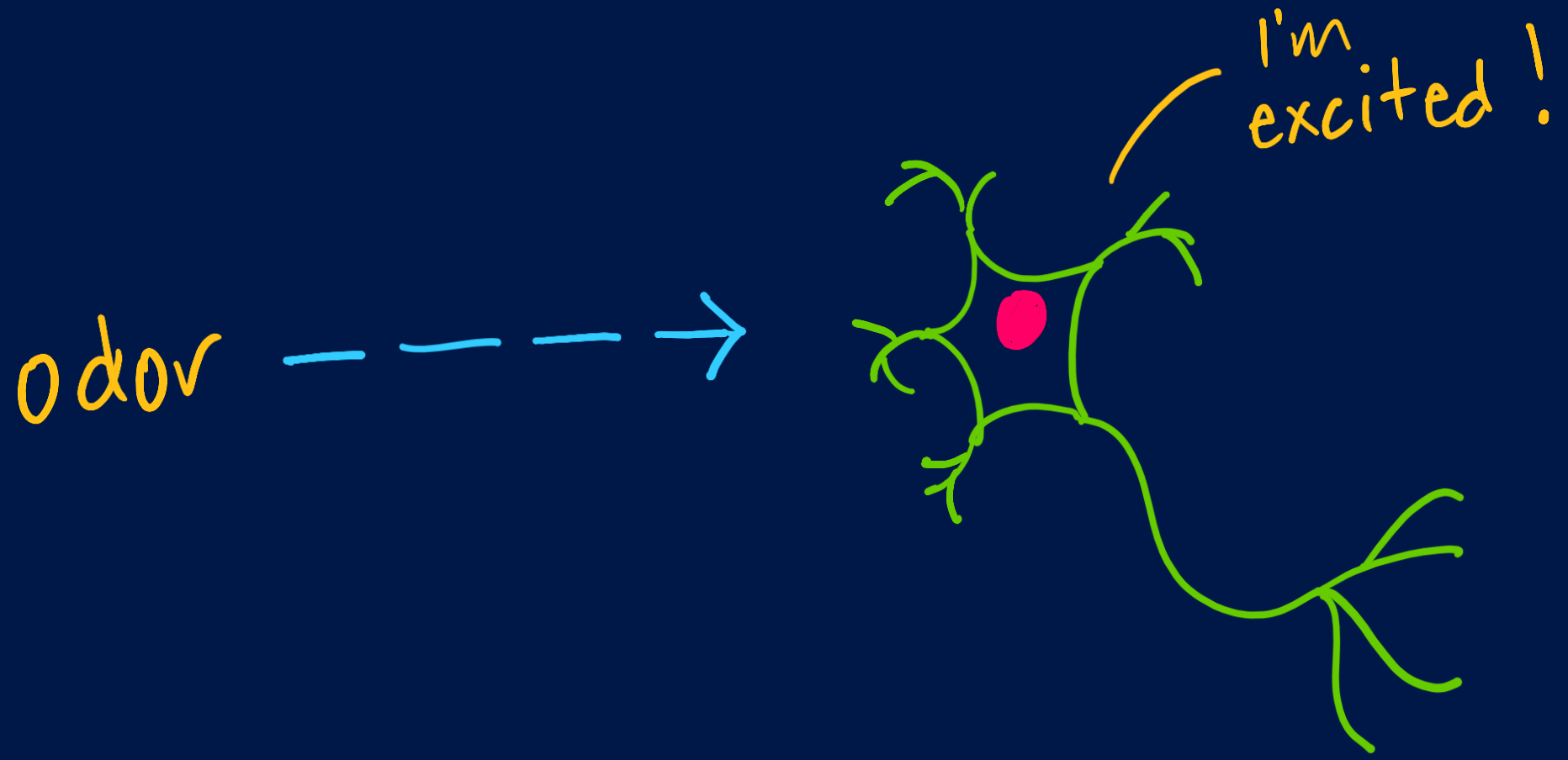

odor
brain area 2
retreating


odor
brain area 3
retreating

If blocking activity in a certain area prevents recall, then we've found where the memory is stored in the brain.

2. Develop a method for establishing that “hidden” memories exist.

then neurobiology of a hidden memory



Exposure to the odor excites the neurons encoding the memory, but this doesn't cause recall behavior (i.e., retreating).

3. Track the presentation of the CS (the odor) and the activity of the neurons encoding the hidden memory.

with, e.g., calcium imaging

t_1: exposure to the odor excites the neurons encoding the hidden memory

t_1: exposure to the odor excites the neurons encoding the hidden memory

t_2: exposure to the odor ***doesn't*** excite the neurons encoding the hidden memory

t_1: exposure to the odor excites the neurons encoding the hidden memory

t_2: exposure to the odor ***doesn't*** excite the neurons encoding the hidden memory

The memory trace no longer exists.

a tentative conclusion: While forgetting is a process that cognitive psychology cannot investigate, it can be investigated neurobiologically.

philosophical issues

Is cognitive psychology autonomous vis-à-vis neurobiology?

de facto autonomy (Richardson,1979)

Cognitive psychology's descriptions or explanations must not not include concepts or features taken from neurobiology.

This case might not challenge the *de facto* autonomy of cognitive psychology.

If it turns out that memories are sometimes completely lost, the explanation of forgetting might still be purely functional.

If it turns out that memories aren’t ever lost, then nothing has to change for explanations in cognitive psychology.

Is cognitive psychology investigatively independent vis-à-vis neurobiology?

Investigative independence

Cognitive psychology must be able to investigate psychological processes.

One qualification: Information from one science can impose constrains on the explanations in another science.

“The only constraint on psychological laws is that they not demand more complexity than the organism supposedly realizing those laws manifests.” (Richardson, 1979, p. 557)

Such a constraint does *not* violate investigative independence.

Investigative independence

Cognitive psychology must be able to investigate psychological processes.

Conclusion: Cognitive psychology is ***not*** investigatively independent.


THANKS!