# Strange Brain Case Studies

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# Brain is Really Good at Adapting

- A disorder that affects one part of the brain… how is its effects amplified in the entire brain and patients' lives?
- Impairment in one structure of the brain → impact on brain's localized/wider network of functions?
- So mysterious…

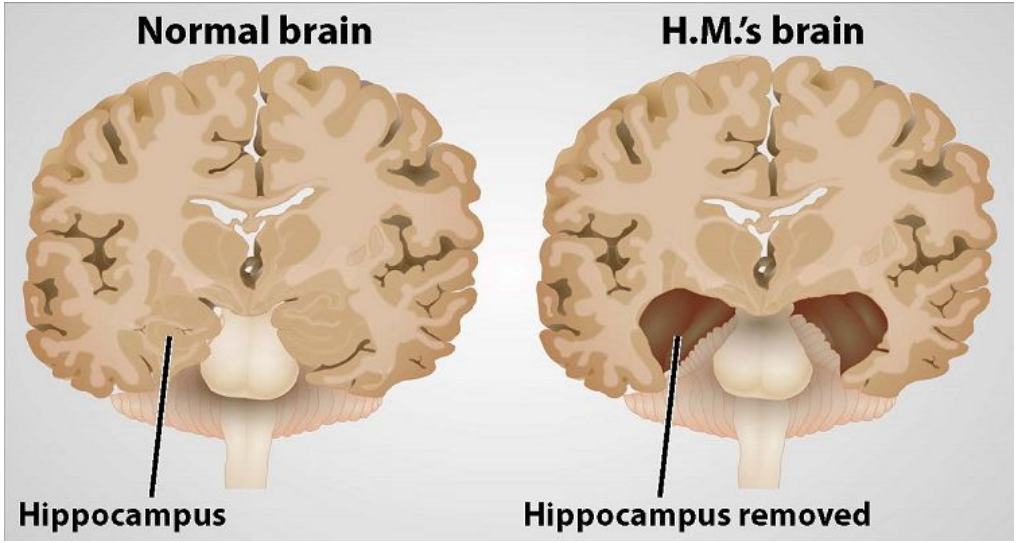
A. Memory
   Hippocampus and medial temporal lobe

# 1. **Anterograde amnesia**

## Case Study: Patient H.M.

What happened?

At 27 in 1953, Henry Molaison had parts of both temporal lobes (anterior two-thirds of his hippocampi, the amygdala, and the entorhinal cortex) removed to treat severe epilepsy. The seizures eased, but he could no longer form new long-term memories and was left with permanent amnesia.



# 1. Case Study: Patient H.M.

What was kept?

Some facts about parents, scenes from childhood memories, historical facts, personality, intellect, etc., from before the surgery. He could hold a conversation, but forgot it minutes later. On the contrary, he could learn and acquire new motor skills.

Why it matters!

The hippocampus is needed to make new memories, not to store old ones. Memory isn’t made and stored in one system, shown by how he could still learn new skills.

# Activity

Pull out your phone and I'll give you a piece of paper.

Look only at the drawing in your phone's reflection (NOT the drawing itself) as you draw 3 stars, 3 houses.

Do your drawings look better the more you attempt it?

H.M. showed similar progression; his motor ability to trace drawings seen in the mirror improved over time, despite him not remembering that he tried drawing them before.

Episodic(events in time and place) and semantic memory(facts and knowledge) vs procedural memory (drawing stars)

# B. Recognition
# Temporal lobe and fusiform face area

# Prosopagnosia (Face Blindness)

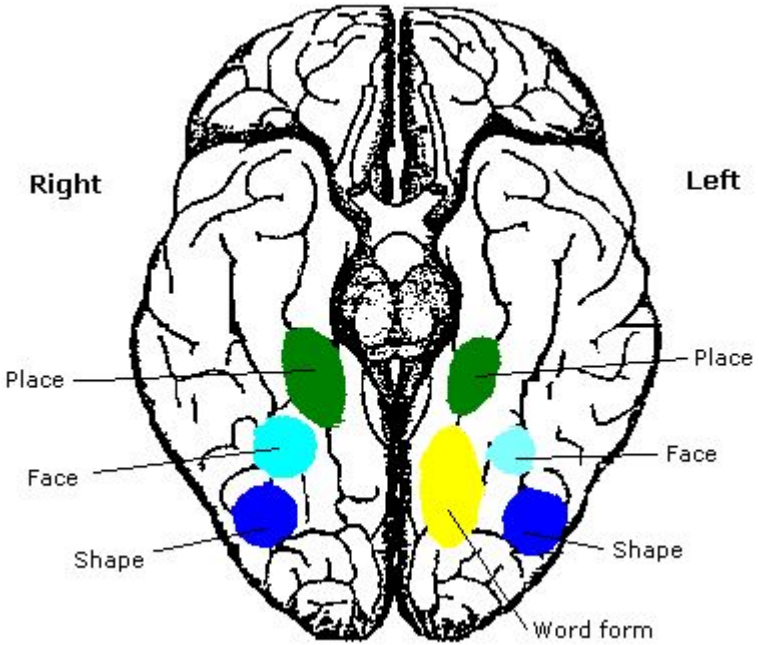
What it is
Not recognizing faces, even close family or your own reflection, while recognizing objects normally. People get by using voices, hair, clothes or the way someone walks.

Where it happens

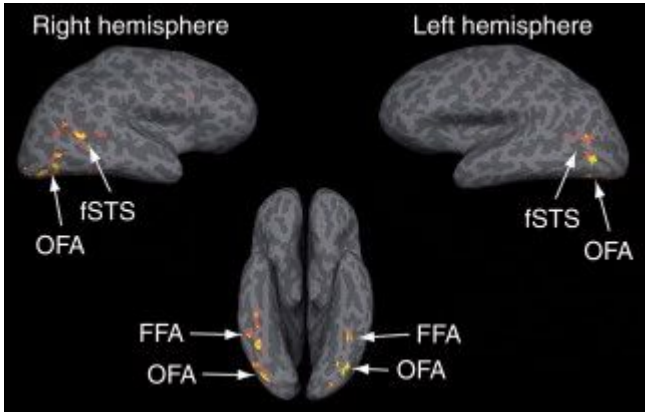
Often in the fusiform face area, a patch of the temporal lobe (especially on the right) that specializes in faces. It can be damaged by stroke or injury, or develop differently from birth.

Fun Fact

~2% of people might have some degree of face blindness without knowing that they have it



# Case Studies




Patient J: born with it (developmental)

- A 30-year-old woman who had been face blind her whole life
- Couldn’t recognize her parents, her husband, or her own reflection
- Didn’t realize she had a condition; assumed everyone recognized people by hair, voice and clothes
- Could still read facial expressions, emotions and attractiveness, and recognized objects normally
- Her brain responded to faces in typical ways, so the problem was specifically matching a face to who it is

Patient P.S.: lost it suddenly (acquired)

- Pierrette Sapey lost face recognition as an adult after a severe brain injury in 1992
- Can’t recognize faces she knew before, and can’t learn new ones
- Damage centered on the right hemisphere’s occipital face area (OFA) (structure that works closely with FFA)
- Object recognition stayed completely intact
- Identifies people by body shape, the way they walk, their voice and their gender

Takeaway: Knowing who a face belongs to is a separate skill from reading what the face shows.










SCHOOL BUS
STOP
222
222

Bruh.

Much

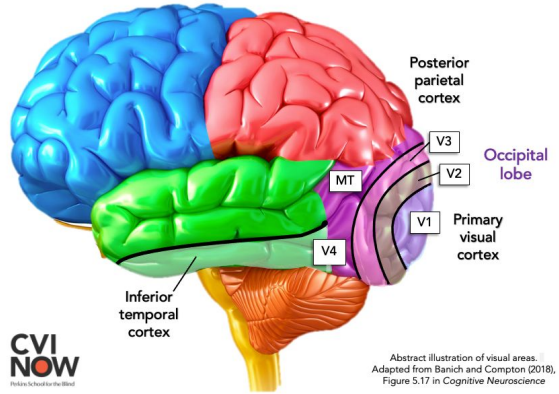
Easier,

Right?



# C. Vision
# Occipital Lobe and Visual Cortex

# Blindsight
# Case Study: Patient T.N.




- A former doctor, blinded by two occipital strokes a month apart
- Both sides of his visual cortex (V1) were destroyed, though his eyes work fine
- He reports seeing nothing, and scans show no activity in his visual cortex
- Yet he could:
  - Tell which way a rod was tilted with 100% accuracy
  - React to emotional faces (his amygdala lit up)
  - Walk a hallway full of boxes and bins without touching any of them (2008)

Takeaway: Seeing and knowing what you see are different processes.



# Vision and Brain Parts

Old route: still used as main source of vision by reptiles, fish, birds, etc.

Mammals use both new and old routes for vision,

| Feature | New route | Old route |
|---|---|---|
| Path | Eye → thalamus → V1 | Eye → superior colliculus → pulvinar and amygdala |
| Share of fibers | About 90% | About 10% |
| Speed and detail | Detailed, slower | Fast, crude |
| Job | The conscious picture: "I see a box" | Steering and reacting: "Something's there, move!" |
| In patient T.N. | Destroyed | Still working |

# D. Body and Space
# Parietal Lobe

# 4. Hemispatial Neglect



What it is

Disorder often due to damage in right parietal lobe.

Patients ignore one side of space, usually the left. They eat from half the plate, shave half their face and draw clocks with all 12 numbers crammed on the right.

Not a vision problem

Eyes work fine, but attention is affected. In a famous 1978 study, patients imagined Milan’s cathedral square and described only the buildings on its right side.

Why the left?

The right hemisphere watches both sides of space, while the left mostly watches the right. Losing the right hemisphere makes so the left side cannot be processed.

# 5. Phantom limb syndrome

1. The face takes over the hand

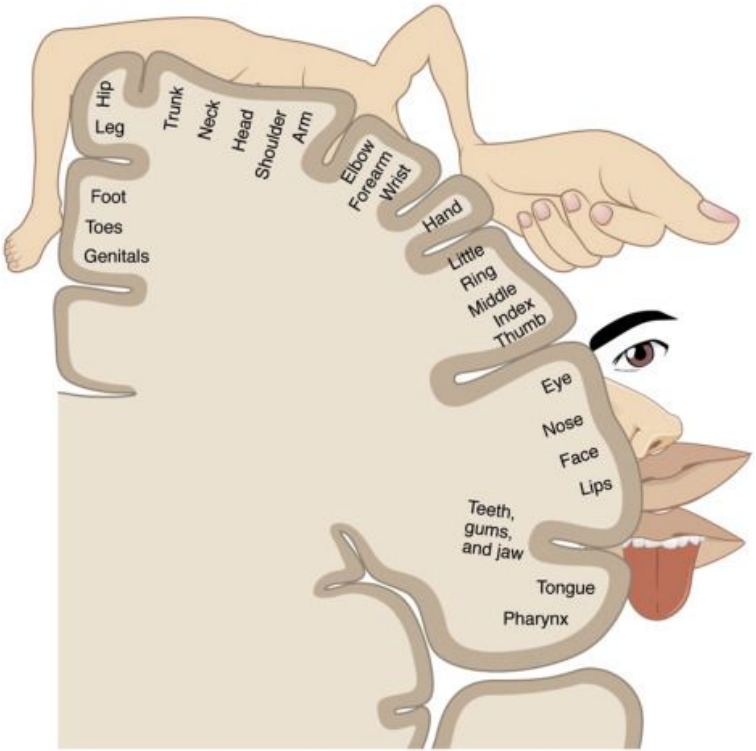
- On the brain's body map (somatosensory cortex), the face area sits right next to the hand area
- After an amputation, the hand area stops getting signals, so the face area moves into the empty space
- Ramachandran's patient Derek: touching specific spots on his face made him feel touches on his missing fingers

2. The fist that won't open

- Many amputees feel their missing hand painfully clenched into a fist
- The brain sends "open your hand" but gets no feedback that it worked, so the command keeps repeating and the cramp never releases

3. Feeling someone else's touch

- Ramachandran and David Brang found that some amputees felt touch in their phantom hand just from watching someone else's hand being touched
- Normally, signals from your real hand tell your brain that it's not one's own hand. Without the hand, nothing stops the mirror neuron system, so they feel another person's touch as their own



# The Mirror Box Treatment

- A mirror stands upright on a table. The healthy hand goes on one side; the stump is hidden on the other.
- The patient watches the reflection of the healthy hand, which looks exactly like the missing hand is back.
- When the patient opens the healthy hand, the brain *sees* the phantom open. The “open” command finally gets visual confirmation, and for many patients the painful clenching releases.

Sense of body is a map that your brain builds and develops throughout time, and the map can outlast the body itself.

# E. Language and Sound
# Broca’s Area, Wernicke’s Area

## Broca's aphasia

Left frontal lobe · 1861

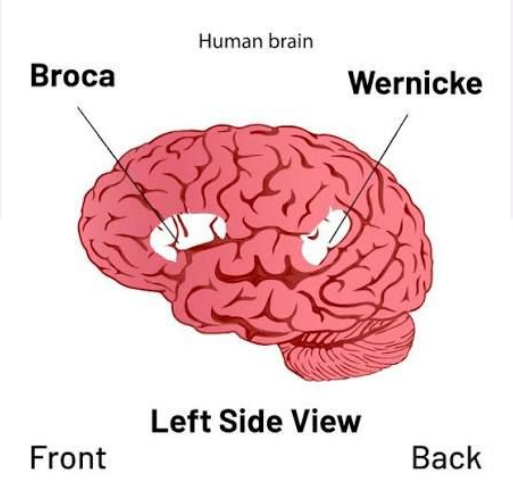
- Understands most speech
- Speech is slow, effortful and missing small words: 'trees… children… run'
- Patients know and are frustrated
- Broca's patient could only say 'tan'

## Wernicke's aphasia

Left temporal lobe · 1874

- Struggles to understand speech
- Speech flows fluently but makes little sense, with made-up words ('word salad')
- Patients often don't notice
- Described by Carl Wernicke

Left Frontal Lobe




Left temporal lobe

Guess the condition and region!

1 She eats only the right half of her plate and doesn’t notice the rest.
2 She can’t learn your name, but her tennis serve keeps improving.
3 He speaks fluently, but nothing he says makes sense.

1. **Hemispatial neglect at the** right parietal lobe.
2. **Anterograde amnesia** (like patient H.M.). At hippocampus, in the medial temporal lobe.
3. **Wernicke's aphasia at** left temporal lobe (Wernicke's area).