

Consciousness

Gleitman *et al.* (2011), Chapter 6, Part 1

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Psych 9A / Psy Beh 11A

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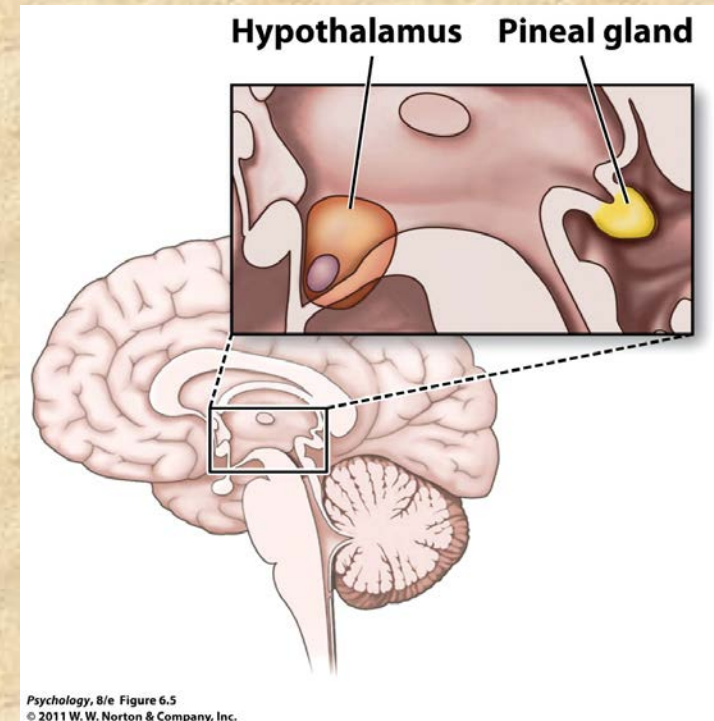
Consciousness

- “Moment-by-moment awareness of ourselves, our thoughts, and our environment”
 - There are present-day robots that are conscious by this definition (<http://www.youtube.com/watch?v=TR8BMZj-Udc>)
 - VSlam: the robot keeps track of how it is moving (self awareness), keeps track of how it is processing visual and odometric information at any one moment (awareness of thought), and situates itself within the environment insofar as it knows its location and can build a map of its environment (awareness of environment).
- Has been an important topic in the study of *philosophy* for millenia.
- Psychology: can provide facts that guide its further study.

Mind-Body Problem

- The conscious mind seems completely different from the physical body.
- How can mental events influence physical / biological ones?
- How can physical / biological events influence mental ones?
- There are many different philosophical angles on the problem. Mind and body are aspects of the same thing. Both are mental. Both are physical. Mind and body are different.

<http://www.youtube.com/watch?v=XLS6qoT0l0o>



Descartes: Pineal gland?

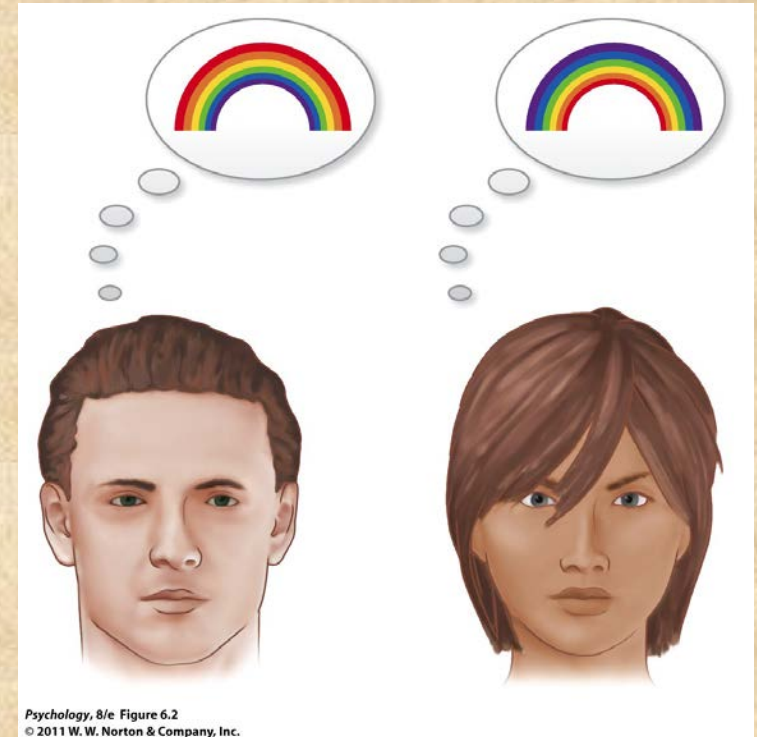


Introspection

- One direct way to study *consciousness* is to have people look within themselves, or introspect.
- *Introspection* is a powerful research tool—but it is limited.
 - People often lack words or other ways to convey their experiences.
 - Different individuals may use the same words or messages to describe different experiences.
 - One cannot experience someone else's consciousness.

Inverted Spectrum Problem

- Two people look at the same light. They both use the same hue word to describe that light. Repeat for a variety of lights. Objective behavior matches.
- Does this mean that the color seen by one person in response to a light is identical to the color seen by the other in response to the same light? There may be a difference in subjective, mental experience that cannot be revealed by measurements of objective behavior.





Cognitive Unconscious

- Introspection is also limited due to the *cognitive unconscious*.
 - Much of what goes on in our minds happens outside awareness.
 - Helmholtz' unconscious inference.
 - Many mental processes occur without conscious awareness.
 - We can be aware of the results of such processes but not the processes themselves.
 - This notion differs from the Freudian notion of the unconscious.



Unconscious Functioning

- The scope of the cognitive unconscious is evident in cases of brain damage.
 - We remember without being aware.
 - We perceive without being aware.
 - Unconscious attribution
 - the ability to evaluate and interpret evidence while being unaware of the process
- Anterograde amnesia; blindsight

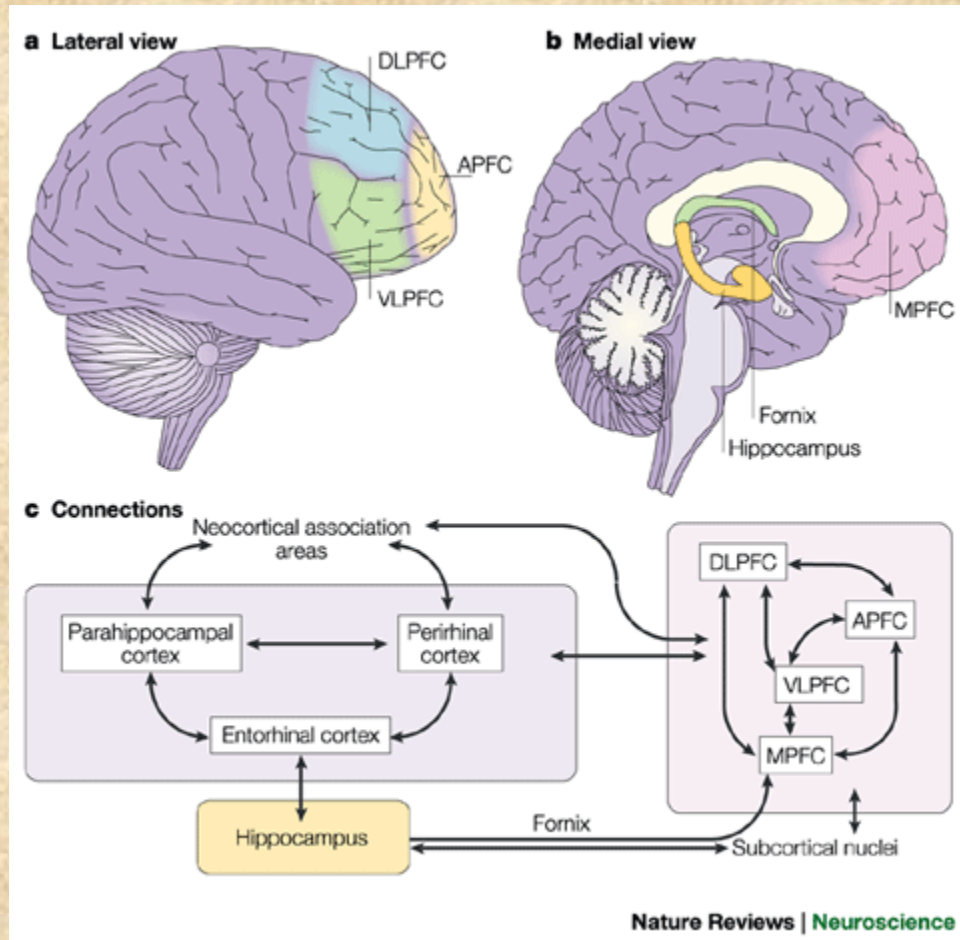
Brain areas of importance to memory processing.

prefrontal cortex:

- anterior
- dorsolateral
- ventrolateral
- medial

medial temporal lobe:

- hippocampus
- amygdala
- entorhinal cortex
- perirhinal cortex
- perihippocampal cortex



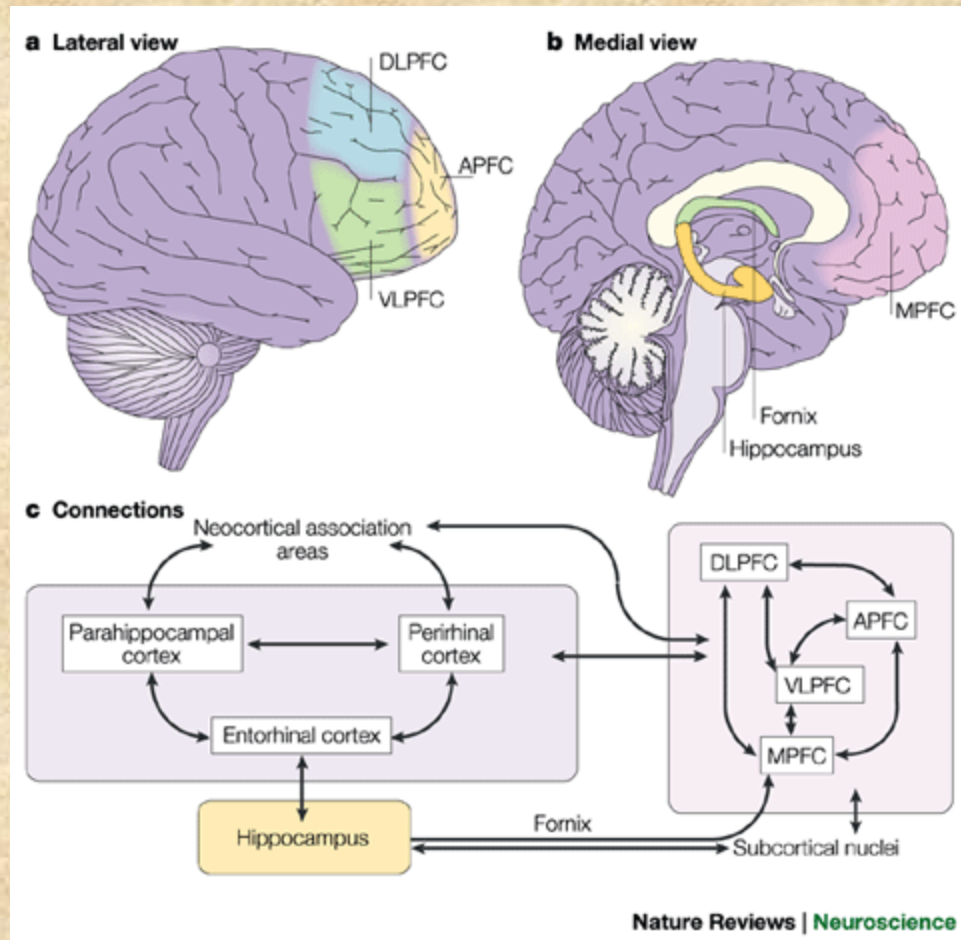
Prefrontal areas are responsible for working memory and memory creation.

Lateralization of memory function in prefrontal cortex:

study of verbal material tends to involve mostly the left hemisphere

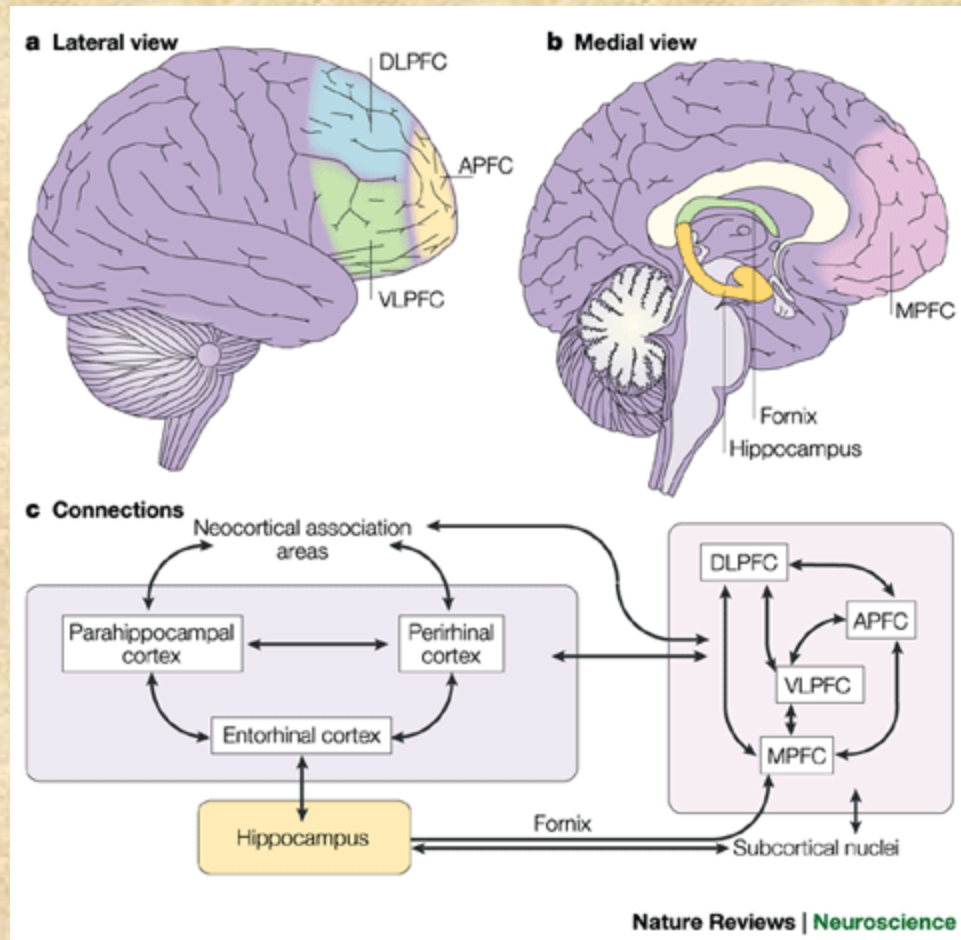
study of pictorial material tends to involve sometimes the right hemisphere and sometimes both

study of pictorial material linked to verbal knowledge (name of a pictured celebrity) leads to left hemisphere activity



The hippocampus and surrounding structures in the temporal cortex are responsible for the permanent storage & retrieval of these memories.

Strong evidence for this comes from study of individuals with anterograde amnesia.



Amnesia comes in two forms

Retrograde

- inability to remember events or facts
relating to some period of time in the past
- caused by blow to the head (often short-term)
or by brain tumor, disease, stroke (often longer-term)

Amnesia comes in two forms

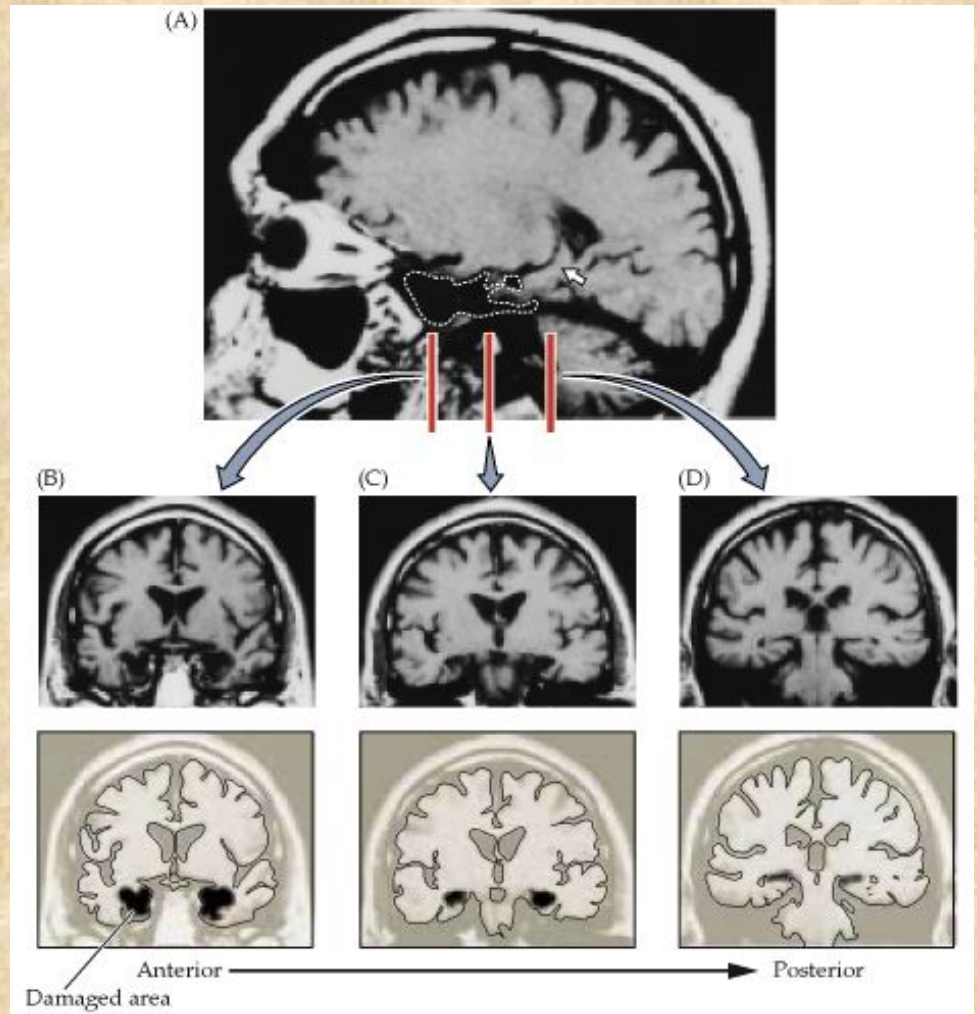
Retrograde

- inability to remember events or facts relating to some period of time in the past
- caused by blow to the head (often short-term) or by brain tumor, disease, stroke (often longer-term)

Anterograde

- inability to form new memories
- typically a permanent condition
- caused by damage to hippocampal system (hippocampus and amygdala) and/or midline diencephalic region, for instance by stroke, physical trauma, or Korsakoff's syndrome

brain scan showing damage to hippocampus and neighbor structures in a patient suffering from anterograde amnesia



Anterograde Amnesia

Patient H.M.

- underwent surgery to treat epilepsy
- normal information capacity of working memory
- can speak, read and write intelligently
- remembers no events that occurred after surgery
- unable to recognize people first met after surgery

Unable to form new long-term memories

However, anterograde amnesiacs can learn new skills.

- trace path through maze, get faster with each try
- learn a new piece on the piano (although claiming never to have played it before!)
- learn to read mirror-reversed print

These are tests of *implicit* or *procedural* memory

Anterograde Amnesia

Implicit Memory Function

- Present patient a list of words
- A few minutes later, ask patient to recall the words with helpful hints, such as *Was there a word on the earlier list that began with CLA__?*
- Patients failed to remember that the word *clasp* was on the earlier list.
 - No evidence of explicit memory for the word.
- Present patient a list of words
- Ask patient to come up with words in response to cues like *Can you think of any word that begins with CLA__?*
- Only those patients who had recently seen *clasp* on their list offered this word in response to the cue.
 - Memory without conscious awareness.

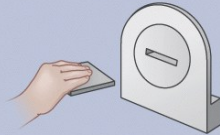
Blindsight

6.3 SCIENTIFIC METHOD: Can a patient with blindsight accurately interact with objects that she doesn't consciously perceive?

Method

1. The patient was asked to position her hand so that the angle of the card she was holding matched the slot.

Matching, slot at 0°



2. She was also asked to put the card in the slot, as if she were mailing a letter.

Mailing, slot at 0°



3. The researchers compared the patient's performance with that of two sighted control participants. All participants were tested with the slot at six different angles ranging from 0° to 150°.

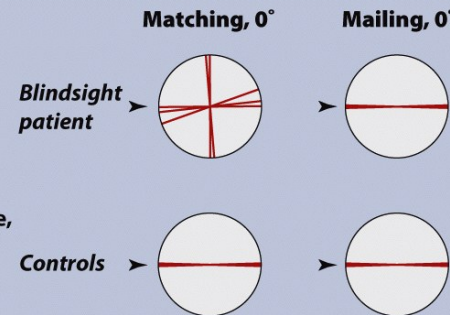
Results

The circles-with-lines show how the blindsight patient fared at the matching and mailing tasks compared to a sighted control patient.

The blindsight patient's performance on the matching task was highly variable and included larger errors. But on the mailing task she performed as well as the controls.

CONCLUSION: People with blindsight may be able to make accurate, goal-directed movements to a target object, despite being unable to consciously perceive the target's orientation or dimensions.

SOURCE STUDY: Goodale, Milner, Jakobson, & Carey, 1991



Psychology, 8/e Figure 6.3
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Blindness caused by damage to the geniculostriate system (e.g. damage to V1) need not mean that other parts of the visual system (retina / superior colliculus / pulvinar) are not functional.

Unconscious Attributions

- Nisbett & Schachter (1966)
- Use increasingly-strong electric shocks to determine how much shock a person will endure voluntarily.
- Some participants were given a pill and were told that it had several side effects: shaky hands, irregular breathing, butterflies in the stomach, etc. These are all effects of being shocked.
- The pill was a placebo and had no such effects.
- These participants endured 4x stronger shocks than the others.
- These participants did *not* report the pill as having an influence on their ability to endure electric shock.
- The influence of the pill was largely via *unconscious* attribution of shock effects to the pill.

Mistaken Introspections

- Introspections are also sometimes mistaken.
 - People don't realize what factor influenced their thoughts or behavior.
 - Or they insist a factor influenced them even though it did not.
 - These cases suggest introspection often is people's best after-the-fact estimation of why they acted or felt the way they did.
 - Post hoc rationalization. Do something (often driven unconsciously). Come up with a reason for why you did it *afterwards*.

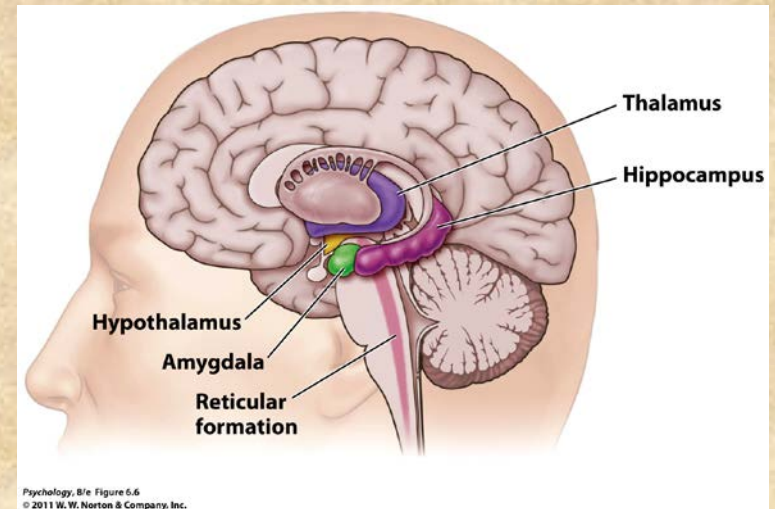


Function of Consciousness

- The cognitive unconscious allows processes that are fast, effortless, and automatic.
- Consciousness may be needed when we wish to rise above habit or resist the temptation of the moment: exercise *executive control*.
- But isn't it possible to exercise executive control without consciousness? Could a robot exercise executive control?

Neural Loci of Consciousness

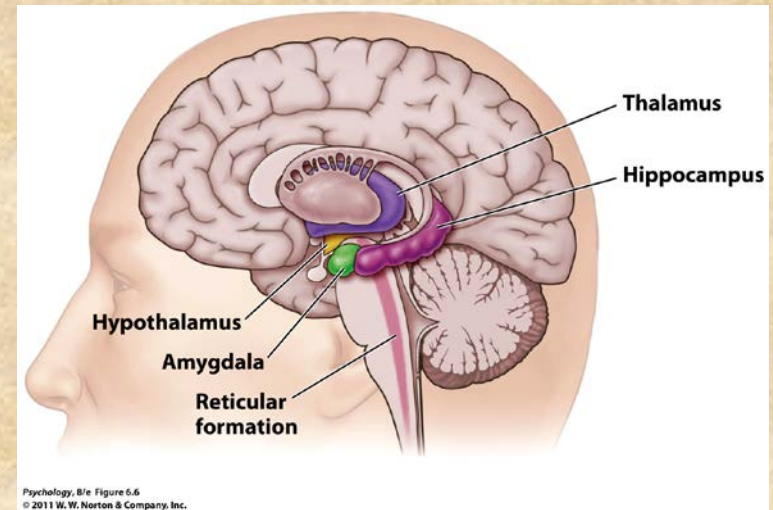
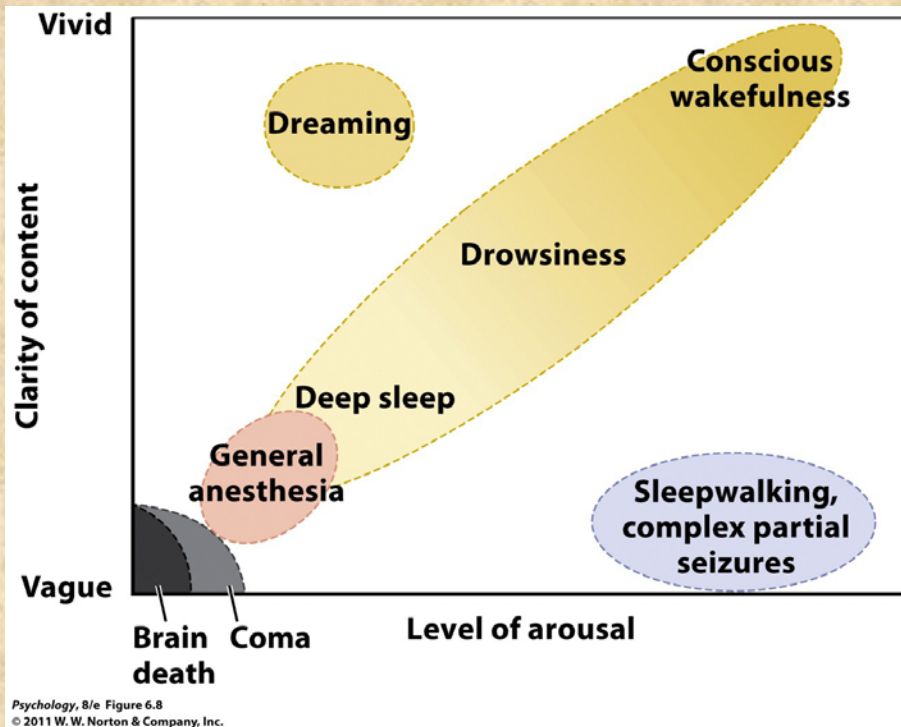
- Many brain areas are needed for consciousness.
 - these include areas that govern people's overall level of arousal and alertness:
 - thalamus and reticular activating system
- The exact content of consciousness depends on diverse brain sites and what a person is conscious *of*.



reticular activating system projects via the thalamus to cortex

Neural Loci of Consciousness

- Some people suggest that consciousness has two separable aspects: arousal/alertness and the clarity/specificity of content



reticular activating system projects via the thalamus to cortex

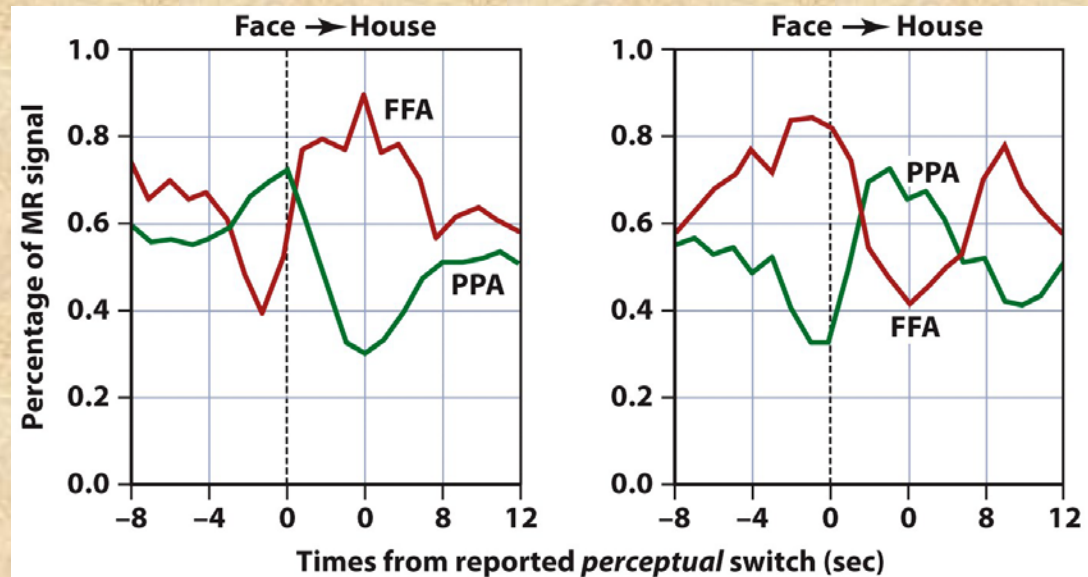
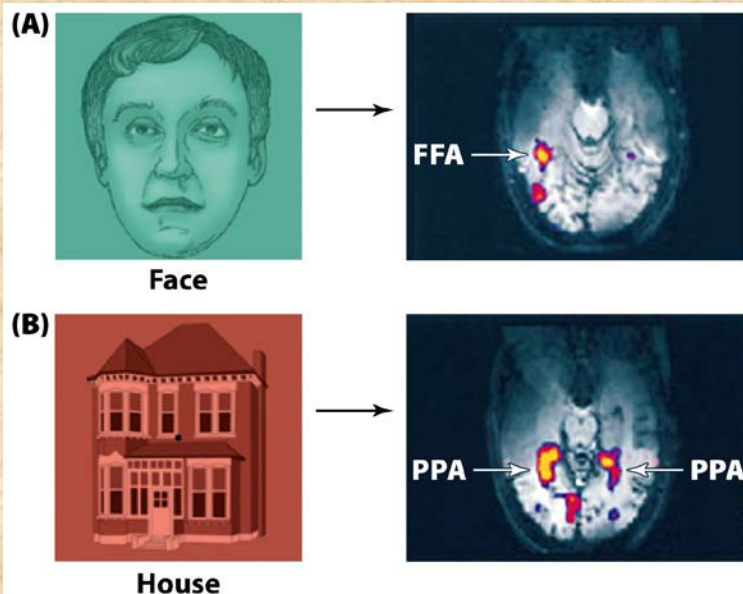


Neural Correlates

- Many studies have examined the *neural correlates of consciousness*.
 - Binocular rivalry: http://www.youtube.com/watch?v=q_xv062VW5c

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 - Binocular rivalry (Tong and colleagues): FFA activity seems to indicate that the participants is aware of seeing a face; for the PPA, aware of seeing a house.



Psychology, 8/e Figure 6.9ab
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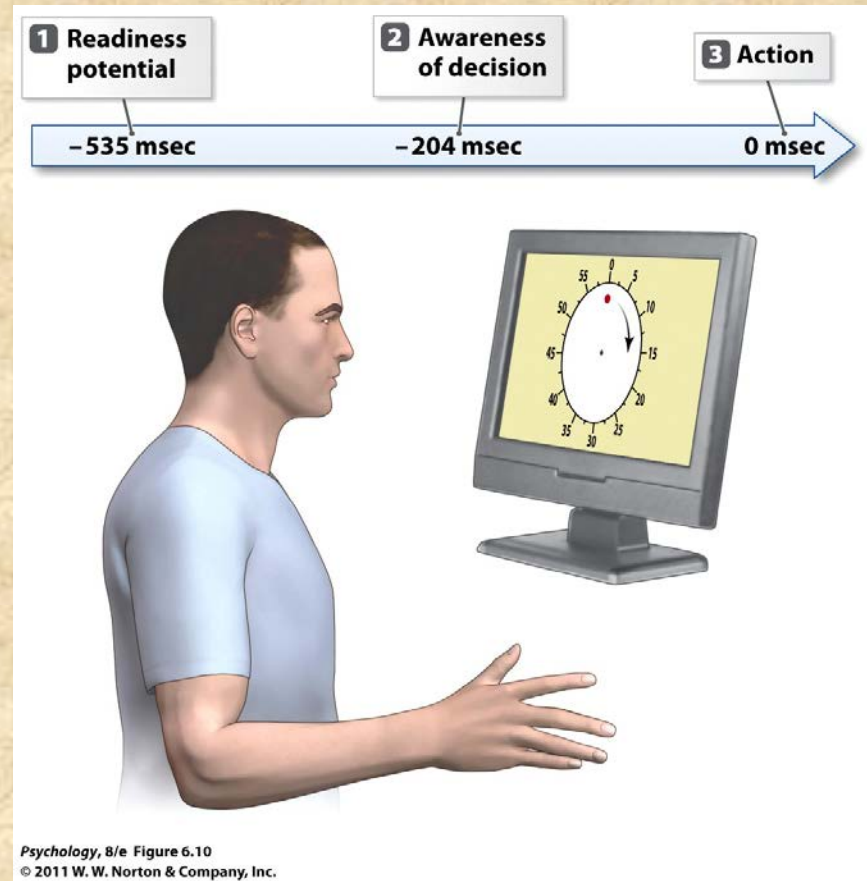
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 - These studies show that the activity of certain brain sites depends on visual stimuli.
 - Other studies have examined “free will” and identified patterns of brain activity that may cause this conscious sensation.

- Watch dot moving around the clock face.
- Occasionally move one's hand.
- When choosing to move the hand, note the dot position.
- This lets the experimenters know when the choice to move was made.
- EEG was recorded.
- “Bereitschaftspotenzial” – readiness potential occurs several hundred msec earlier than the time at awareness of the choice was felt.





Global workspace hypothesis

- Consciousness is made possible by a pattern of integrated neural activity. There is no single seat of consciousness.
- Integrated neural activity is made possible by connections provided by “workspace” neurons.
- Integrated neural activity controlled by processes of attention.
- Integrated neural activity states can be maintained actively for extended periods of time so that they may be made available to thought processes, working memory, etc.
- This is evidently not a theory of consciousness but an account of neural signal integration...