Lecture 16 (Nov 21st): Emotional Behaviors

Lecture Outline

1) Emotion & Emotional Behaviors
2) The Limbic System
3) Positively Reinforced Behaviors
4) Connections of the Amygdala and Response Properties
5) The Amygdala & Fear (not Anxiety, which is next lecture)
6) The Amygdala & Aggression
7) Hormonal Control of Aggression

YOU CAN SKIP:
  - Anxiety-Reducing Drugs, Panic Disorder
Psych 106, 2017: TOP SEVEN GRADES..... It’s dinner time!

3rd place: 100.00%
Rachel Heutz
Betina Karshaleva
Rebecca Yamamoto
Feng Zhu

2nd place: 100.97%
Allison Slater
Emron Wali

1st place: 101.94%
Tianhao Qiu
Emotion & Emotional Behaviors

10 emotions:
- distress, anger, disgust, contempt, fear, shame, guilt, interest, happiness, surprise

Emotional Behaviors:
- Aggression (resulting from anger)
- Avoidance (resulting from fear)
- Reinforced Behavior (in order to get happiness)
LIMBIC SYSTEM

Papez (1937)

Frontal Cortex Control of Limbic Activity

Phineas Gage (1848)
Subsystems of the Limbic System

1) Septum, Cingulate Gyrus, Nucleus Accumbens:
   - reinforced behaviors, rewards
   (more in the “Learning and Memory” lecture)
   - happiness?
“Happiness” is… 
…what *usually* results from a positively reinforced behavior

Reinforcer: INCREASES likelihood of behavior
…*usually* because the reinforcer makes you HAPPY

A hungry rat will be made “happy” by eating food. In a Skinner box, the rat presses a lever to get food. Thus, food is a reinforcement for pressing the lever
RESULT ➔ The rat continues to press the lever
Fear & Anger …… not Anxiety

Fear and Anger = short-term, immediate (emotions)
Anxiety ("Stress") = long-term (not an emotion) → next lecture

The Amygdala
  Emotions: Fear / Anger (in animals, must be inferred from behavior)
  Behaviors: Avoidance / Aggression
Also, amygdala involved in Emotional Memories (don’t focus on your fears!)

Input to Amygdala
  - Visual and Auditory Cortex
  - Thalamus

What kind of stimuli does the amygdala respond to?
  Facial Expressions of Emotion
  Vocal Emotions
  Responds to subliminal stimuli
Output of Amygdala

Hypothalamus

Sympathetic Autonomic Response $\rightarrow$

increased heart rate,

blood pressure, breathing

(remember from 1st third of course?)

(Next Lecture: More on how it’s really bad to have this system active for LONG-TERM!)

Midbrain $\rightarrow$ Pons (Hindbrain): flinching, freezing, startle response

there is also a direct pathway from the Ears $\rightarrow$ Pons $\rightarrow$ Muscles

(startle response to loud noise), which does not involve the Amygdala

(this is relevant later)
Subsystems of the Limbic System

1) Septum, Cingulate Gyrus, Nucleus Accumbens:
   - reinforced behaviors, rewards
   - happiness?

* Skinner Box: Rats will press lever to self-stimulate these brain areas
* Monkeys will do this 8000x/hour
* Rats choose brain stimulation over food and pups

2) Amygdala: fear and anger
   (more next slide)
The Amygdala and Fear/Avoidance (Animals)

Emotion = FEAR, Behavior = AVOIDANCE

The Amygdala involved in learning (i.e., making memories) NEW fears e.g., a robot that, when touched, shocks you

What happens if LESION the Amygdala (animals)?

1) Cannot learn new fear associations
2) Lose old learned fear associations

A BUNCH OF FURTHER QUESTIONS TO ASK!!

(1 and 2) Can animal see and discriminate the stimulus? YES
(1) Is it possible that they simply cannot learn anything new? NO
(1 and 2) Can the animal show any fear at all? YES

… still show a startle response to a loud noise (which is an innate reflex, see next slide)

The topic of innate fears is very complicated
Stephan Anagnostaras: book may be wrong
A Good Example:
Amygdala Lesions in Rats -> Inability to Learn New Fear Association

First, *Intact-AMYGDALA animals*:

1) Measure startle response (muscle tensing) to loud NOISE alone
   \[ \text{NOISE} \rightarrow \text{Startle} \]

2) Make the rat “afraid” of a harmless stimulus (e.g., LIGHT) … by pairing that harmless LIGHT stimulus with a SHOCK (animal should learn to fear light)

3) Measure startle response when LIGHT (but NO SHOCK) presented right before loud NOISE
   \[ \text{LIGHT} \text{ (yikes!)}, \text{ then present NOISE} \rightarrow \text{Startle} \]

Subtract: 3 - 1 = *enhancement of startle response* (due to the “fear” induced by the LIGHT): 3 – 1, should be > 0.

In a separate “control” group -> NO Step #2:
   So, 3 - 1, should = 0

*Note: Fear of loud noise is innate -> startle reflex
*Note: Onset of light is NOT innately startling/scary.
The Amygdala and Anger/Aggression (Animals)

Emotion = ANGER, Behavior = AGGRESSION

What happens if LESION the Amygdala (cats and monkeys)?
   - Excessively tame, lack of aggression

What happens if STIMULATE the Amygdala (cats)?
   - “affective” attack (shrieks, hiss, hunch back)

Aggressive Behaviors vs. Amygdala activity
   - Defensive/aggressive behavior in cats presented with threatening stimuli (dog)
**Correlational Evidence from Humans: Be cautious!**

1) Men are more aggressive than women (??)
   Coincidental correlation? → Maybe some other factor in men

2) Body Builders using Steroids (which mimics the effects of TTT on muscle) are more aggressive than Body Builders who don’t use steroids
   But maybe ….

3) Inmate Violence vs. TTT Levels (Men & Women)

And…. maybe the more aggressive body builders are the ones who choose to take steroids?
Now, *Lesion-AMYGDALA animals*:

1) Measure **startle response** (muscle tensing) to loud NOISE alone  
   \[ \text{Noise} \rightarrow \text{Startle} \]

2) Make the rat “afraid” of a harmless stimulus (e.g., LIGHT)  
   ……by pairing that harmless LIGHT stimulus with a SHOCK  
   (animal should learn to fear light)

3) Measure startle response when LIGHT (but NO SHOCK)  
   presented right before loud NOISE  
   \[ \text{LIGHT (yikes!), then present NOISE} \rightarrow \text{Startle} \]

Subtract: \[ 3 - 1 = \text{enhancement of startle response} \]

If amygdala needed to learn new fear, then Step #2 should not work!  
So, 3 -1 should = ??

- But, remember, these animals are still startled by NOISE itself,  
  which is an innate fear!! (last 2 slides)
Hormonal Control of Aggression: *Testosterone* (*TTT*)

**Necessary and Causal Evidence from Animals:**

1) *Castrated male rats:*
   - Less aggressive than other rats
   - Become more aggressive when given TTT

2) *Female rats:*
   - Become aggressive when given TTT
   Also…. Become *less* aggressive when given Estradiol!

..........How does this relate to the menstrual cycle in **human females**?

Is there a relationship between Estradiol and PMS?
Actually… many women report that they experience euphoria
So, maybe PMS is about being emotionally LABILE!