

First: what are the main points of the Siegel et al. (2018) and Kragel et al. (2016) papers? If you had to summarize the papers in one bullet, what would you write?

- Kragel: you can localize particular emotions to certain parts of the brain; at least *basic* emotions seem to have neural *biomarkers*
- Siegel: you are perceiving what you are feeling; neutral faces are perceived as more smiling when paired with unconsciously perceived positive stimuli (relative to neutral and unconsciously perceived negative stimuli, i.e., scowling).

According to Lisa Feldman Barrett (All in the Mind podcast), what are the classic views of emotion? And what does she view as wrong with these perspectives?

- Emotion circuits are buried deep in the brain (e.g., fear circuits)
- We share these circuits with all animals (like rats)
  - There is no characteristic pattern to a particular emotion; the brain constructs emotions all the time
  - The same networks that process emotion also process other components of cognition; hence the comment of ‘networks in different recipes’
  - Emotions are *learned* concepts
- Facial expressions can be universal and characteristic of particular emotions
  - Culture shapes how people express their emotions, so this cannot be universal, and we can make guesses about how other people feel but are never certain
    - Because of our cultural norms, we are more accurate about our guesses
- Characteristic actions are associated with particular emotions
  - People have different ways of expressing their emotions (smile when sad, cry when angry) – no set expressions associated with specific emotion

According to the podcast and the papers, how might researchers study emotion?

- Kragel: experience sampling (asking how people feel on a moment-by-moment basis; see Expt 2), emotion induction (Expt 1; watching films and listening to music clips that were rated as being consistent with particular emotional categories), self-report (not in their expt), fMRI (like they do – but then localize emotional states for treatment)
- Siegel: affect induction via different facial expressions to test how emotion & perception interact on ‘neutral faces’
- Lisa: going to tribes that have no familiarity with Western culture, testing whether they recognize our emotional expressions as belonging to our particular categories (i.e., Paul Ekman: basic universal emotions – disgust, anger, fear, sadness, happiness, surprise). Show them different facial expressions, sounds associated with emotions.
  - Do their categories match ours?
- Not covered by either article & extra material: looking at hormonal actions (e.g., stress responses); how much your fingers sweat (*skin conductance response* – sympathetic arousal); startle reflexes; eye blinks and pupil dilation; annoying but not painful shocks

Extra material (but good to apply your Perception background): What does it mean to have a *predictive coding* framework (Siegel article, Barrett podcast)? This goes back to what you learned on perception. How might that change the way you view the Kragel paper?

- Recall from our discussion on perception:
  - The image on our retina is ambiguous, so Helmholtz suggests we solve this ambiguity with the likelihood principle: we perceive the object mostly likely to have caused the pattern of stimuli we have received
    - *Unconscious inference*: our perceptions are the result of unconscious assumptions or inferences that we make about the environment (process seems “automatic” but is actually complicated)
  - Bayesian inference: probability of an outcome is determined by the ‘prior

probability’ or prior, i.e., our initial belief about the probability and the extent to which evidence is consistent with the outcome (likelihood). We update our prior with the more evidence we gather.

- You can imagine that a predictive coding framework takes these views on perception to their extreme. Specifically, it suggests that we’re constantly predicting the world around us from the sensory input that we receive
  - If we’re incorrect about what we perceive, like with ‘priors’, we update our initial beliefs with the new evidence we gather. This is us using past experience to inform our current reality.
- The fact that the Kragel paper shows that basic emotions can be localized to different areas in the brain isn’t necessarily a function of an innate biomarker, but is a learned concept that is likely in part due to a homogenous sample with similar cultural norms
  - They are also doing this analysis at a group-level. How does the localization of these emotions change on an individual level? Does each individual show the same set of differences in localizing emotions?
- This is why the Siegel paper takes a perspective of what you feel (via suppressed affective images, i.e., sensory input) will influence what you perceive.
- Predictive coding is considered a “big” theory about how all of cognition works, and this is why Perception is typically covered first – it impacts everything

What are some limitations or critiques of either perspective or paper?

- Kragel & Seigel: what does it really mean to have a neutral emotion or neutral expression? Barrett seems to critique emotional expressions as culturally based but also uses them in her research.
- Kragel: in their experience sampling method, the negative emotions are not experienced at high frequency, which limits their ability to match what they found in e1
- Siegel: they replicated experiment 1 with experiment 2, but the effect becomes much smaller; they wave that away by saying it was a replication nonetheless.
- Barrett: can you ever definitely prove that the brain is predictive, not reactive, especially if we are the ones studying ourselves?

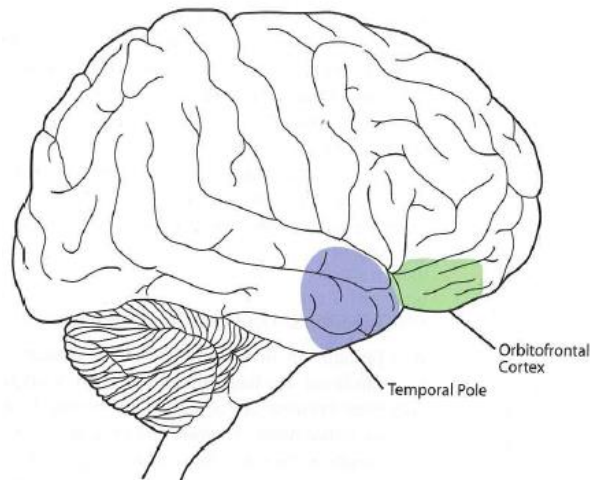
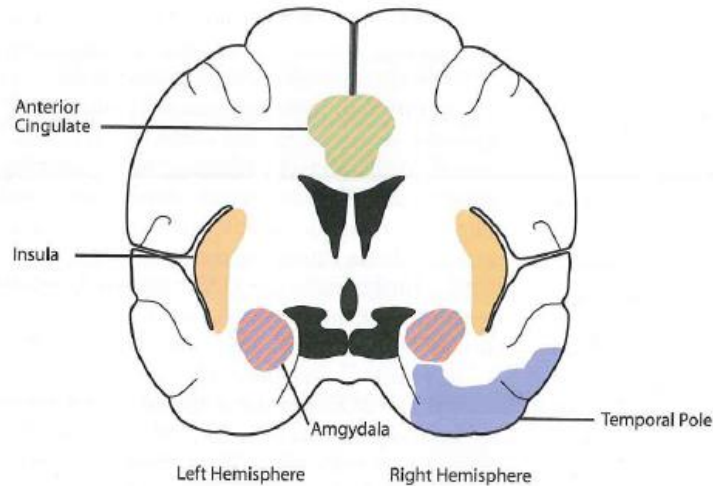
So, both the Kragel reading and the Lisa Feldman Barrett podcast (and reading) mostly discussed emotional *concepts* or *categories*. What would a dimensional view of emotion look like?

- If emotions fall on a continuum, they could fall on two orthogonal axes: valence (hedonic quality: pleasant to unpleasant) and arousal (sense of physical activation: excited/active/jittery vs. calm/relaxed/disengaged)
- What would this look like? Try to map out where different emotions would fall on these axes, assuming that similar emotions will be closer together.

(B) Circumplex model



- If a scientist approached research with a dimensional vs. categorical view of emotion, how do you think their research goals would change?
  - Dimensional theorists are interested in uncovering neural correlates of valence and arousal, whereas categorical theorists might look for discrete neural correlates associated with each basic emotion.
- Extra (optional material, for those interested in neural mechanisms): like suggested in the Kragel paper, do you think that there are unique brain regions associated with particular emotions? If so, what would they be?
  - There might be some regions uniquely associated with some emotion (cc: Kragel paper), but different emotions share common components. For example:
  - The *amygdala* is often associated with fear, assuming that the functional role is *learning* and *avoidance* behaviors.
  - The *orbitofrontal cortex* and *anterior cingulate cortex* are often associated with anger, assuming the functional role is to indicate social violations
  - The *amygdala* and *right temporal pole* are often associated with sadness, assuming the functional role is to indicate withdrawal
  - The *anterior insula* and *anterior cingulate cortex* are often associated with disgust, assuming the functional role is to indicate avoidance behaviors



- Can you think of other theories of emotion? The generation of an emotion can be broken down into 3 stages or components:
  - 1- The *evaluation* of sensory input (“Is this a bear running toward me?”)
  - 2- The experience of a *feeling* (Fear)
  - 3- The *expression* of physiological and behavioral responses (high heart rate, running)

away from the bear!)

For example, how might they differ based on which comes first: the experience of the emotion or the physiological pattern? What would it mean if emotion -> physiology or physiology -> emotion? What about non-humans? Do they experience the same emotions as us? What emotions would be basic in them? How does context impact our emotions? I list 2 theories on the first question; 1 on non-humans; 1 on context

- James-Lange theory of emotion:
  - Stimulus perceived
  - Physiological changes occurred
  - Those changes are the emotion
    - “What kind of an emotion of fear would be left, if the feelings neither of quickened heartbeats nor of shallow breathing, nor of trembling lips nor of weakened limbs, neither of goose-flesh nor of visceral stirrings, were present, it is quite impossible to think.” –William James
    - I.e., we are fearful as a consequence of the bodily changes associated with an emotion, not the other way around. The emotion is a result of the brain interpreting the *feedback* from changes in bodily states.
- Panksepp:
  - Seeking, rage, fear, panic, play, mating, and care are the basic emotions in rats (and elsewhere). “Once an electrode is in the correct neuroanatomical location, essentially identical emotional tendencies can be evoked in all mammals, including humans.”
    - This is an example of what Lisa Feldman Barrett refers to as emotions being hard-wired in the brain.
- Cannon-Bard theory:
  - Visceral sensations across emotions are similar
  - Physiological changes and subjective feeling are separate and independent
  - Arousal doesn't have to come before the emotion
  - An emotional stimulus is first processed by the diencephalon (thalamus/hypothalamus/etc.), which then signals to the peripheral autonomic nervous system (eliciting behavior) and to the neocortex (eliciting feelings)
- Schacter & Singer:
  - Physiological arousal makes us have emotion at a given moment
  - Use environmental cues to label it as emotion (appraisal)
  - Physical reactions aren't really as defined as in James-Lange/Panksepp models; it's more about the appraisal process
- There are many, many theories on how arousal impacts emotion generation... James-Lange and Cannon-Bard are covered, because they helped generate more models. Panksepp is extra material. Appraisal/reappraisal will come up tomorrow in theories of emotion regulation.