Notes for Meeting 24
Cognition, Affect, and Emotion

The Pervasiveness of Emotion

There is no question that emotion plays a central role in human lives.

It colors and modulate many of our activities, both physical and mental.

This raises an important and interesting question:

- How is emotion related to cognition?

More broadly, what function does emotion serve in an integrated cognitive system?

Emotion and Rationality

The traditional view is that emotions are an irrational holdover from our evolutionary precursors.

This perspective influenced much of the early AI work, which ignored emotions as being detrimental to intelligent systems.

- Clearly, one can build programs that reason, plan, and communicate, to some extent, without emotional components.

- However, Simon (1967) has argued that affect and emotion play important roles in controlling cognitive attention.

- Damasio (1994) describes brain-damaged humans who have little or no emotion, and who have difficulty making decisions.

This suggests that human-level cognitive systems may require emotions.

Some Distinctions

Both the academic literature and everyday language use a number of terms that we should differentiate:

- Affect. The positive or negative aspect of some experience.

- Mood. A global variant of affect for the entire cognitive system.

- Emotion. An experience associated with some mental structures related to an event, agent, or object.

- Feelings. Affective or hormonal responses associated with an emotion.

A complete account would relate each of these factors to cognition.

Here we will focus on emotions, which are the most complex and interesting from a cognitive perspective.

Examples of Emotions

There are many emotions that we view as important enough to name, including:

Happiness	Sadness	Anger
Fear	Worried	Despair
Love	Pride	Courage
Disappointed	Relieved	Pleasant surprise
Frustration	Satisfaction	Helpless
Annoyed	Irritated	Disgusted
Resentful	Envious	Jealous
Embarrassed	Guilty	Ashamed
Self righteous	Regret	Offended
Pity	Sympathy	Schadenfreude
Amused	Wonder	Awe

Although other mammals have emotions, the human analogs are distinguished by their richness and complexity.

This suggests there is a strong cognitive component to emotion.

Representing Emotions

Before we can discuss emotional processes, we must consider how to represent them.

Marsella, Gratch, and Petta (2011) distinguish three main ways to encode emotional content:

- Dimensional models (emotions as points in N-dimensional space)

- Anatomic models (emotions as activations in neural circuits)

- Appraisal models (emotions as relations among cognitive structures)

These frameworks suggest very different ways to approach explaining emotional processes.

Dimensional Models

Most dimensional models characterize emotions as points in a three-dimensional space:

- pleasure (measure of valence)

- arousal (level of affective activation)

- dominance (measure of control)

Such "PAD" models have been used successfully in a variety of synthetic characters (e.g., Becker-Asano & Wachsmuth, 2008).

However, they cannot handle some clear and important phenomena:

- emotions are ABOUT some event, person, or object;

- one can have MIXED emotions about the same target.

This suggests the need for an account with richer cognitive structures.

Emotions as Cognitive Structures

Appraisal models view emotions as inferred relations among mental structures based on situations.

Ortony et al. (1988) describe 22 such configurations that characterize common emotions organized around events, objects, and other agents.

We can describe elicitation conditions of emotions as relations among:

- an agent’s goals, intentions, expectations, and beliefs

- an agent’s inferences about other agents’ goals, intentions, etc.

This suggests that emotions are abstract and domain independent, much as the inference rules used in dialogue.

Examples of Emotional Structures

We can specify the conditions for eliciting emotions as abstract rules:

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- (disappointed ?agent ?event) <=
     (goal ?agent ?event) (expect ?agent ?event)
     (belief ?agent (not ?event))

- (jealous ?agent ?other ?object) <=
     (goal ?agent (possess ?agent ?object))
     (belief ?agent (not (possess ?agent ?object)))
     (belief ?agent (possess ?other ?object))
```

More complex emotions are specializations of more basic ones in that they involve more conditions.

An agent can use the same rules for inferring another agent’s emotions as for eliciting its own.

Intensity of Emotions

Although emotions have a clear cognitive structure, they also have associated feelings.

One aspect of feelings is their intensity, which typically begin high and gradually decay over time.

Computational models that address intensity usually calculate it with equations based on utilities and probabilities.

Such calculations play more important roles in dimensional models than in ones that incorporate appraisals.

Effects of Emotions

Some accounts of emotion are "open loop", in that they model generation of emotions but not their effects.

More complete accounts are "closed loop", in that they influence either:

- the agent’s physical behavior
  - e.g., crying or punching someone
- the agent’s cognitive processing
  - e.g., changing goal priorities or increasing planning

The latter view follows Simon (1967) in claiming that emotions play a regulatory role in cognition.

When combined with the domain-independent, abstract character of emotions, this suggests:

- The Emotion as Metacognition Hyptothesis: Emotion plays a metacognitive role in determining the course of mental processing.

Again, this suggests that emotion will be a central part of any human-level cognitive system.

Assignments for Meeting 25
Cognition and Personality

Read the article:

* Rizzo, P., Veloso, M., Miceli, M., & Cesta, A. (1997). Personality-driven social behaviors in believable agents. Proceedings of the AAAI Fall Symposium on Socially Intelligent Agents. Cambridge, MA: AAAI Press.

* Rousseau, D., & Hayes-Routh, B. (1996). Personality in synthetic agents (Report No. KSL 96-21). Knowledge Systems Laboratory, Department of Computer Science, Stanford University, Stanford, CA. [optional]