# MODELING AFFECT IN DIALOG

LING 575, Spring 2013

Mike Foster

# Overview

- What is affect and what can we use it for?

# Overview

- What is affect and what can we use it for?
- How is affect modeling applied to dialog systems?

# Overview

- What is affect and what can we use it for?
- How is affect modeling applied to dialog systems?
- Steve and the Mission Rehearsal Exercise.

# Overview

- What is affect and what can we use it for?
- How is affect modeling applied to dialog systems?
- Steve and the Mission Rehearsal Exercise.
- Components of a dialog agent.
  - Task Model
  - Dialog Model
  - Emotion Model

# Overview

- What is affect and what can we use it for?
- How is affect modeling applied to dialog systems?
- Steve and the Mission Rehearsal Exercise.
- Components of a dialog agent.
  - Task Model
  - Dialog Model
  - Emotion Model
- Automatic emotion prediction.

# Overview

- What is affect and what can we use it for?
- How is affect modeling applied to dialog systems?
- Steve and the Mission Rehearsal Exercise (MRE).
- Components of a dialog agent.
  - Task Model
  - Dialog Model
  - Emotion Model
- Automatic emotion prediction.
- Adapting to affective states.

# What is affect and how is it used in dialog systems?

- Definitions:
  - Psychology: Feeling or emotion.
  - Psychiatry: An expressed or observed emotional response.

# What is affect and how is it used in dialog systems?

- Definitions:
  - Psychology: Feeling or emotion.
  - Psychiatry: An expressed or observed emotional response.

- Uses:
  - Virtual human agents (Steve)

# What is affect and how is it used in dialog systems?

- Definitions:
  - Psychology: Feeling or emotion.
  - Psychiatry: An expressed or observed emotional response.

- Uses:
  - Virtual human agents (Steve)
    - Training simulations/Instructional assistants
    - Game characters

# What is affect and how is it used in dialog systems?

- Definitions:
  - Psychology: Feeling or emotion.
  - Psychiatry: An expressed or observed emotional response.

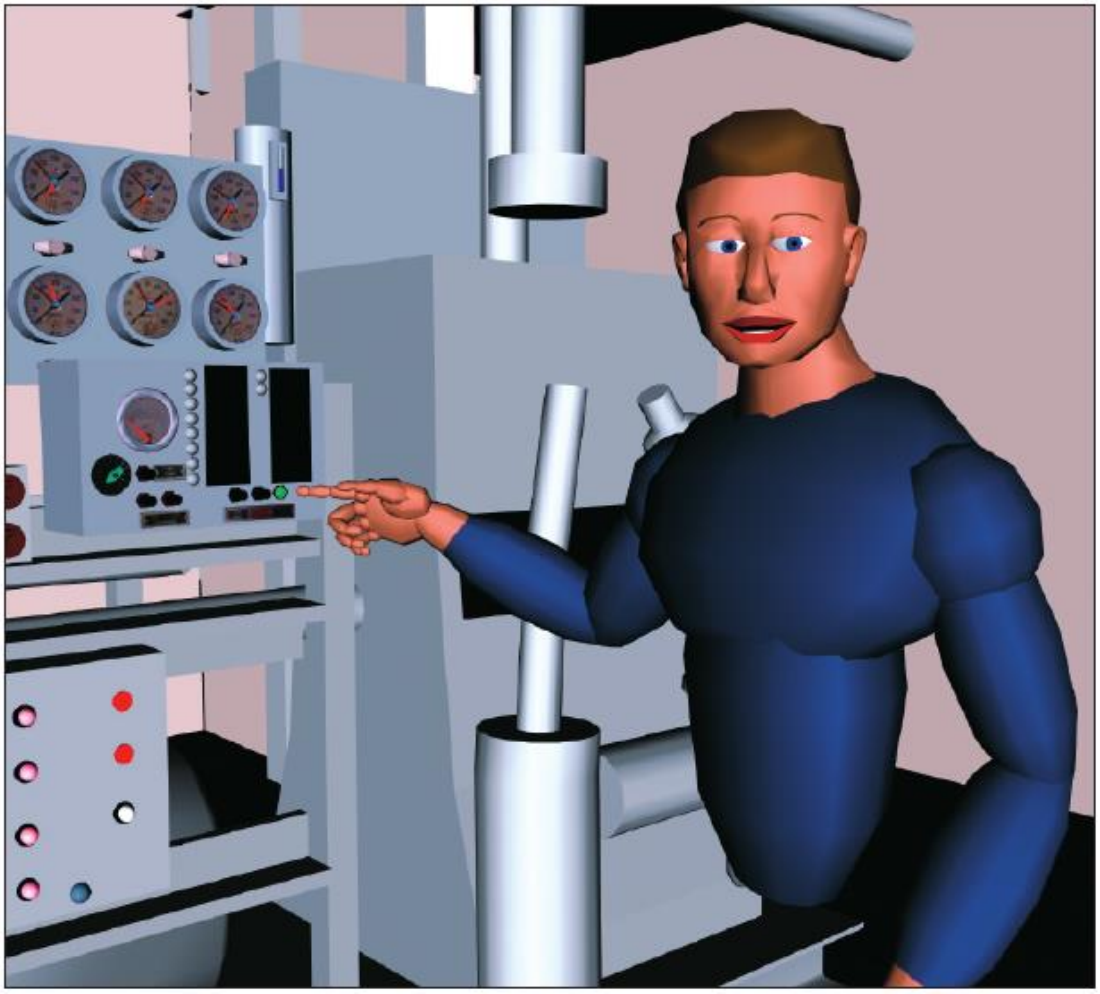
- Uses:
  - Virtual human agents (Steve)
    - Training simulations/Instructional assistants.
    - Game characters.
  - Adaptive tutoring systems

# What is affect and how is it used in dialog systems?

- Definition:
  - Psychology: Feeling or emotion.
  - Psychiatry: An expressed or observed emotional response.

- Uses:
  - Virtual human agents (Steve)
    - Training simulations/Instructional assistants.
    - Game characters.
  - Adaptive tutoring systems
    - Change prompts depending on perceived emotions in the student.
    - Attempt to re-engage disinterested students.
    - Provide more information for students who lack confidence in their answers.

# Steve: A virtual human agent



# Steve: A virtual human agent

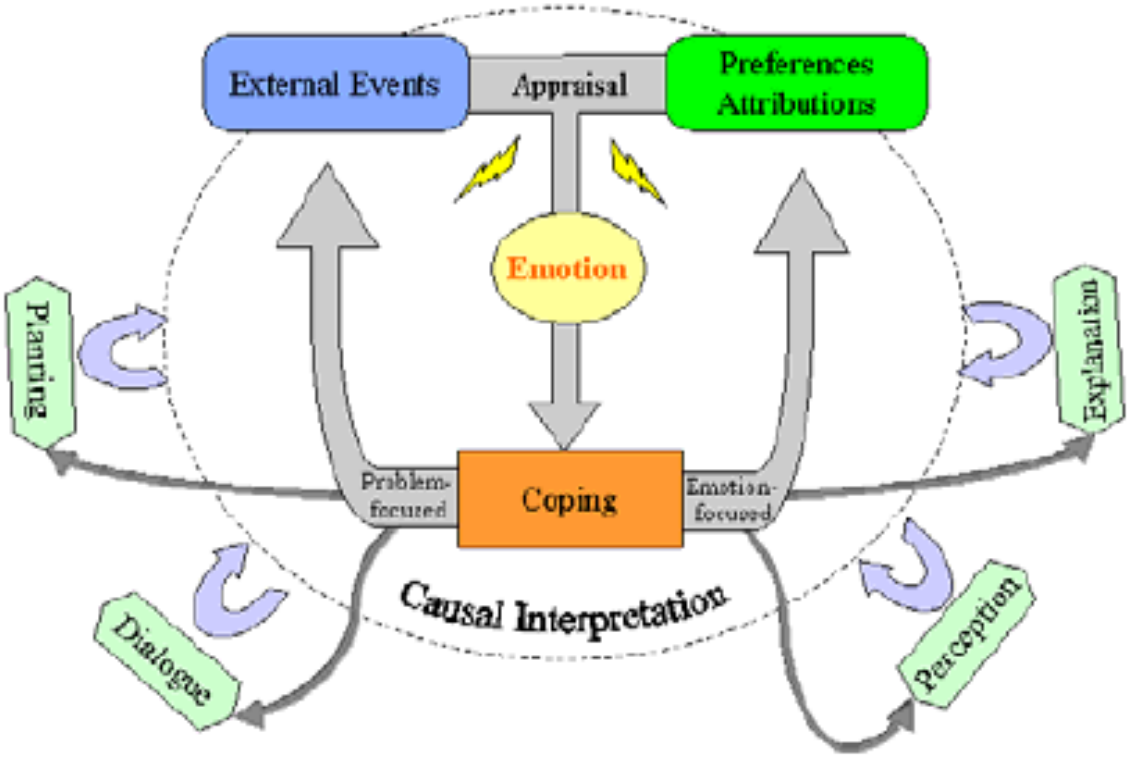
- Has spatial interaction and dialog capabilities.
- Behavior determined by a set of domain independent tasks.
- Must be given knowledge of a domain to be capable of interacting:
  - Objects in the world, their states and their spatial properties.
  - Task knowledge.
- Task knowledge enables Steve to makes plans to complete a task and revise plans as events occur in the world.

# The Mission Rehearsal Exercise (MRE)

# The Mission Rehearsal Exercise (MRE)

- A military training simulation consisting of three Steve agents and scripted characters.
- The human plays the role of a lieutenant in a situation where a military vehicle has collided with a civilian vehicle.
- Time sensitive, high stress situation.
- Steve Agents:
  - Steve 1: Mother of a child who was injured in the collision.
  - Steve 2: Sergeant who must be given orders to resolve conflict.
  - Steve 3: Medic who is attending to the wounds of the child.
- Depending on the lieutenant's decisions, a news story of varying favorability is produced at the end of the simulation.

# Components of a dialog agent




Marsella & Gratch: The emotional octopus

# Components of a dialog agent

- Task Model
  - The common ground of a virtual world and how it can be interacted with.
- Dialog Model
  - What an agent will say and when will it be said.
- Emotion Model
  - What is important to the agent.
  - How do events alter the agent's behavior and plans to achieve goals?

# Task Model

- Encodes task knowledge for a scenario.
- Serves as a **basic source of reasoning** for dialog and emotion.
- Consists of a **hierarchical set of steps** each step being:
  - Primitive action (physical or sensing in the virtual world)
  - Abstract action (another task)
- **Ordering constraints** can apply to the steps.
- **Causal links** connect actions to their outcomes and enforce interdependencies among steps.
- **Threat relations** specify that a step can unachieve a goal.
- As an event unfolds and team members react, an agent uses the task model to revise their plan to achieve a goal.

# Dialog Model

- Supports multiple simultaneous conversations in a virtual world.
- Partitions information state into a set of layers:
  - Contact – Can individuals be accessible for communication?
  - Attention – The object or process that an agent attends to.
  - Conversation – Models dialogs during an interaction.
    - Participants – Any individual involved in the conversation.
    - Turn – Who is has the right to communicate at present?
    - Initiative – The participant who controls the direction of the conversation.
    - Grounding – Tracks how information is added to the common ground.
    - Topic – Governs Relevance.
    - Rhetorical – Connections between content units.
  - Social Commitments – Obligations/restrictions on acting.
  - Negotiation – How agreements are reached among participants.

# Dialog Model

- Assertions:
  - Establish a commitment by the speaker that the state holds or that action did, is, or will take place.
- Info-requests:
  - Questions.
  - Have a *q-slot* indicating what is being asked about.
- Requests:
  - Contains an action with the effect of requiring the request to be addressed.
- Orders:
  - Can only be performed by a superior to a subordinate.
  - The subordinate is obliged to perform an action.
- Suggestions:
  - Focus the topic on an action but do not impose obligations.
- Backwards-looking acts:
  - Relieve obligations of completed tasks, accept/reject requests.

# Emotion Model

- The computational emotion model, EMA (Emotion and Adaptation)
- Informed by *appraisal theory*, a group of psychological theories of emotion.
- Emotion is specific to each individual given their current state in the world. Past events and future prospects influence the current state.
- Maps the processes that influence emotion to a common set of *appraisal variables*.

# Appraisal Variables

- Perspective – Who is judging the event.
- Desirability –The utility of the event from a perspective.
- Likelihood – How probable is the outcome.
- Causal attribution – Who is responsible for the event.
- Temporal status – When in time did the event occur.
- Controllability – Can the agent whose perspective is taken actions alter the outcome.
- Changeability – Can the outcome be altered by another agent?

# Coping Strategies

- Action
- Planning
- Seek instrumental support
- Procrastination
- Positive reinterpretation
- Acceptance
- Denial
- Mental disengagement
- Shift blame
- Seek/suppress information

# Coping strategies

- Coping works in reverse of appraisal, determining how to process the precursors of emotion.
- Change behavior and also lead to variation in the state of the world, leading to re-appraisal.
- Provide the input that determines what actions will be taken by an agent.
- The emotional model, informed by coping strategies puts focus on ideas and actions within an agent.

# Coping and Dialog

- An agent can report on the knowledge that is eliciting the most emotional response at the time, even if there is no prompt from another agent or human.
- Depending on the emotional reasoning of the agent, word selection and prosody can be altered.
- Dialog brings events into focus, forcing appraisal of new information, coping, and altering of emotional state, all of which can cause re-appraisal.
- Participant roles can heavily influence an agent's emotional evaluation of a conversation.

# Predicting affective states

- Affective state can be automatically predicted to a certain extent (positive, negative, neutral)
- This can be done using machine learning algorithms.
- Features:
  - Acoustic-Prosodic information
    - Fundamental frequency features: Max, min, mean, std dev
    - Energy features: Max, min, mean, std dev
    - Temporal features: turn duration pause duration, speaking rate, amount of silence.
  - Non-Acoustic-Prosodic information
    - Lexical items.
    - Turn beginning/end, # words in turn, # syllables in turn
    - False starts, question, grounding

# Adapting to affective state

- Rate of success is not increased.
- Engagement and motivation can be increased.
- Uncertainty can be decreased.

# Questions

# References


- Forbes-Riley, K. and Litman, D. (2004). “Predicting Emotion in Spoken Dialogue from Multiple Knowledge Sources” in *Proceedings of the Human Language Technology Conference of the North American Chapter of the Association for Computational Linguistics: HLT-NAACL 2004*
- Forbes-Riley, K. and Litman, D. (2012). “Adapting to Multiple Affective States in Spoken Dialogue” in *Proceedings of the 13th Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL)*, p. 217-226.
- Marsella, S. and Gratch, J. (2003). “Modeling coping behavior in virtual humans: Don’t worry, be happy.” In *Proceedings of AAMAS 2002: First International Joint Conference on Autonomous Agents and Multi-Agent Systems*.
- Rickel, J., Marsella, S., Gratch, J., Hill, R., Traum, D., and Swartout, W. (2002). “Toward a New Generation of Virtual Humans for Interactive Experiences” in *IEEE Intelligent Systems, 17*.
- Traum, D.R., Marsella, S., Gratch, J. (2010). “Emotion and Dialogue in the MRE Virtual Humans”. In *Proceedings of the Tutorial and Research Workshop on Affective Dialogue Systems*.