ALMA - A Layered Model of Affect

**The Forth International Joint Conference on
Autonomous Agents & Multi Agent Systems
Utrecht, Netherlands, July 25 to 29, 2005**

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Outline

- Classification of Affect
- Exploitation for Virtual Characters
- Computational Model of Affect
- Representation of Mood
- Mood Changes

Affect

- *General term for feelings, emotions, or moods – the conscious subjective aspect of feeling*
- Can be distinguished by*
  - **time** (short-term vs. long-term)
  - **influence** (unnoticed vs. dominant)
  - **cause** (specific vs. diffuse)
- Affect types classified by time
  - short-term: **emotions** (dominant, specific)
  - medium-term: **moods** (unnoticed, diffuse)
  - **and** long-term: **personality** (dominant)

* Krause , Affekt, Emotion, Gefühl, In: Merten W., Wandvogel B. Handbuch psychoanalytischer Grundbegriffe, Kohlhammer, 2000, 73-80

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Exploitation for Virtual Characters

- Enhance non-verbal behavior
  - speech parameters
  - wording in utterances
  - facial expressions
  - conversational gestures
- Tailoring dialog and interaction strategies in script and plan based systems
- **What for?**
  - enhance believability
  - create the illusion of "human-like" abilities

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VirtualHuman

- 3D edutainment environment for real students*

- Autonomous life-size virtual teacher and student

- Lesson's topic: Birth and life of stars

- Personality traits influence dialog contributions

- Multimodal interaction
  - speech
  - gestures
  - multiple-choice menus

* http://www.virtual-human.org

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Affect in VirtualHuman

- **Aim**: Behavior aspects should be controlled by different affect types
  - selection of special topics (student motivation/uncooperative behavior)
  - selection of lession's topic details
  - how emotions impact (re-)actions
- Extended simulation of nonverbal-behavior
  - natural affective complexions

pale head

default

red cheeks

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Motivation

- ## Cognitive processes regulated by mood*
    - making decisions
    - dealing with risks
    - appraising situations

- ## Follows Davidson's thesis: emotion bias action, whereas mood bias cognition

- ## **But:** How to integrate mood, emotion and personality in one operational model?

*Davidson, R.J. On emotion, mood and related affective constructs, In Ekman P. Davidson R.J. The nature of emotions, 1994, 51-55
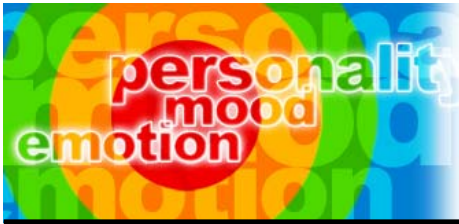   Morris, W.N. The frame of mind, New York, Springer, 1889

Approach

- ## What we have
  - – operational model of appraisal for dialog based environments
  - – operational model of emotions

- ## What is needed
  - – reliable model of mood
  - – characters default mood
  - – method for changing mood

Appraisal

- Act based appraisal according to OCC-Model*

- Acts reflect intention
  - DialogActs for utterance (e.g. Insult, Encourage, …)
  - AffectActs for affect signals (e.g. Blush, Smile, …)

- Mapping on internal OCC-Variables according to
  - role (speaker, addresse, hearer)
  - context

- Simplifies affect generation in script- and plan based application

* Gebhard et al. Adding the Emotional Dimension to Scripting Character Dialogues, Proc. of IVA03, 2003, 48-56
   Gebhard er al. Coloring Multi-Character Conversations through the expression of emotion, Proc. of ADS04, 2004, 128-141

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Emotions

- Appraisal based emotion generation by EmotionEngine in real-time[1]

- OCC-Model of Emotions[2]

- 24 types of emotion

- Complex emotions (i.e. gratification)

- BigFive personality traits for regulating intensity and decay[3]

1   Gebhard et al. Adding the Emotional Dimension to Scripting Character Dialogues, Proc. of IVA03 , 2003, 48-56
    Gebhard er al. Coloring Multi-Character Conversations through the expression of emotion, Proc. of ADS04, 2004, 128-141
2   Orthony A., Clore G.L., and Collins A. The Cognitive Structure of Emotions. Cambridge University Press, Cambridge, MA, 1988
3   Becker P. Structural and Relational Analyses of Emotion and Personality Traits.
          In: Zeitschrift für Differentielle und Diagnostische Psychologie, 22,3, 2001, 155-172

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Mood

- **PAD** space for describing mood[1]
  - mood is described by dimensions **pleasure**, **arousal**, and **dominance**
  - 8 mood types (bored, relaxed, anxious, docile, …)
  - allows representation of emotions[2]
  - allows representation of BigFive personality traits[3]

- Why not a good/bad mood model?
  - only one aspect of mood
  - many "human" mood based phenomena not covered

1 Mehrabian A. Pleasure-arousal-dominance: A general framework for describing and measuring individual differences in temperament
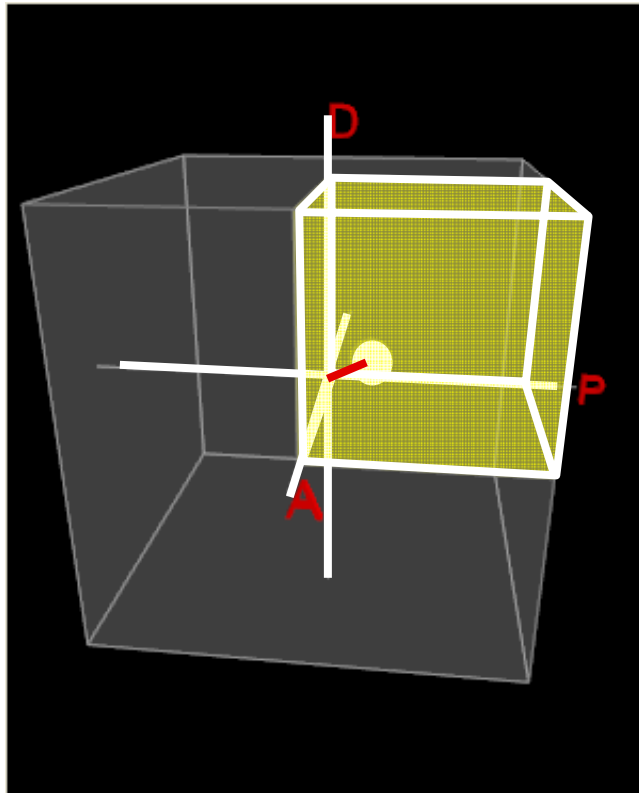   Current Psychology, 14 1996, 261-292
2 Analysis of the Big-Five Personality Factors in Terms of the PAD Temperament Model. Australian Journal of Psychology, 48-2, 1996, 86-92
3 Framework for a Comprehensive Description and Measurement of Emotional states. Genetic, Social, and General Psychology, 22, 1995, 334-361

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PAD mood space

- Each dimension uses values -1.0 to 1.0

- Mood is a point in PAD space

- Octants define discrete mood

+P+A+D	Exuberant	-P-A-D	Bored
+P+A-D	Dependent	-P-A+D	Disdainful
+P-A+D	Relaxed	-P+A-D	Anxious
+P-A-D	Docile	-P+A+D	Hostile

- Mood strength derived by distance to origin

- Default mood derived through correlation of personality traits to PAD values

BigFive defines default mood

- ## Openness[2]
  - related positively to arousal, pleasure, and dominance
- ## Conscientiousness[3] and Extraversion[1]
  - related positively to pleasure and dominance
- ## Agreeableness[1]
  - related positively to pleasure and arousal
  - related negatively to dominance
- ## Emotional Stability[1]
  - related positively to pleasure
  - related negatively to arousal

1: high correlation (~70%), 2: medium correlation (~40%), 3: low correlation (~25%)

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Simulation of mood changes

- **Approach**
  - mood change due to emotional experiences*
  - emotions can change or intensify mood

- Mood change function
  - rely on representation of emotions in PAD space
  - *pull phase*:
    emotions change current mood
  - *push phase*:
    emotions intensify current mood

* Morris, W.N. The frame of mind, New York, Springer, 1889

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PAD space and emotions

- Studies* confirm that the PAD space is well suited to represent emotional states

Emotion	P	A	D	Mood Octant
Admiration	0.5	0.3	-0.2	+P+A-D Dependent
Anger	-0.51	0.59	0.25	-P+A+D Hostile
Disliking	-0.4	0.2	0.1	-P+A+D Hostile
Disappointment	-0.3	0.1	-0.4	-P+A-D Anxious
Distress	-0.4	-0.2	-0.5	-P-A-D Bored
Fear	-0.64	0.60	-0.43	-P+A-D Anxious
FearsConfirmed	-0.5	-0.3	-0.7	-P-A-D Bored
Gloating	0.3	-0.3	-0.1	+P-A-D Docile
Gratification	0.6	0.5	0.4	+P+A+D Exuberant

* Mehrabian 95, Shaver, Schwartz, Kirson, O'Conner 87, Russell 80, Mehrabian, Russell 77
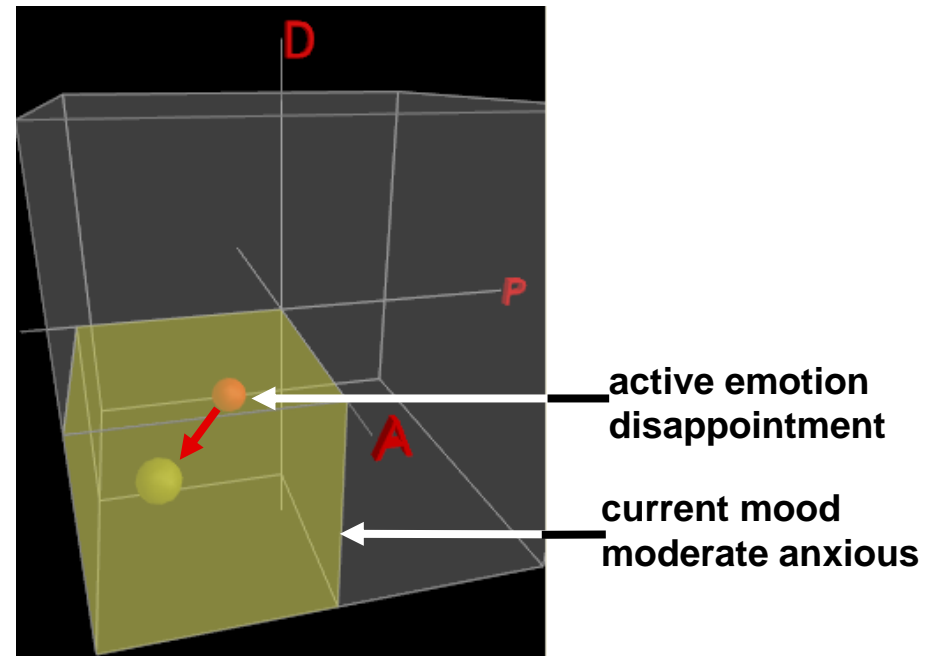
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Mood changes

Pull phase

current mood slightly hostile

active emotion fear
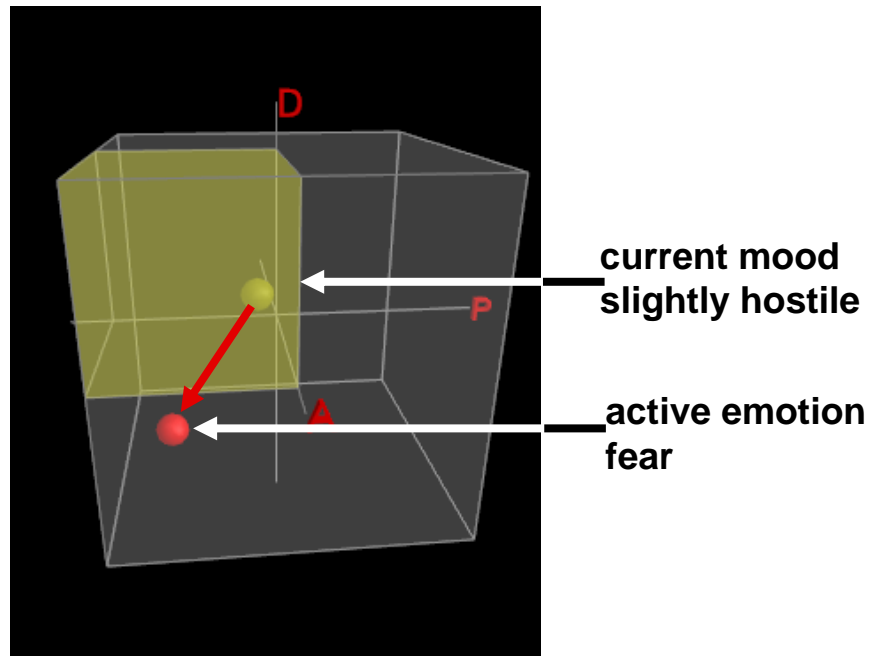
➡️ **mood is pulled toward anxious mood**

Push phase
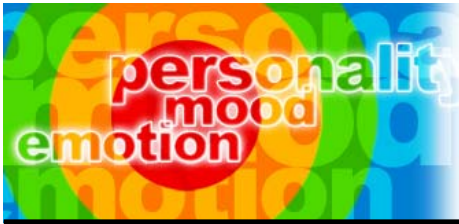

active emotion disappointment

current mood moderate anxious

➡️ **anxious mood is intensified by pushing it away from the origin**

Conclusion

- **Fully operational model of appraisal and affect based on psychological theories**
  - easy appliance in dialog scenarios through act-based appraisal
  - simulation of three affect types for virtual characters
  - mental model of affect for other characters
- **Simulation of different affect types enable**
  - behavior control at different levels body-layer, cognitive-layer
  - transfer of psychological research results on human behavior for controlling virtual character behavior

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