



## **ALMA - A Layered Model of Affect**

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# Outline

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





## Affect

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- *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)

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





# Exploitation for Virtual Characters

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- 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





# 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>





# Affect in VirtualHuman

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





# Motivation

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- 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

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- 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

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- 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, addressee, 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 et al. Coloring Multi-Character Conversations through the expression of emotion, Proc. of ADS04, 2004, 128-141





# Emotions

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- Appraisal based emotion generation by EmotionEngine in real-time<sup>1</sup>
- OCC-Model of Emotions<sup>2</sup>
- 24 types of emotion
- Complex emotions (i.e. gratification)
- BigFive personality traits for regulating intensity and decay<sup>3</sup>

1 Gebhard et al. Adding the Emotional Dimension to Scripting Character Dialogues, Proc. of IVA03 , 2003, 48-56

Gebhard et 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





# Mood

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

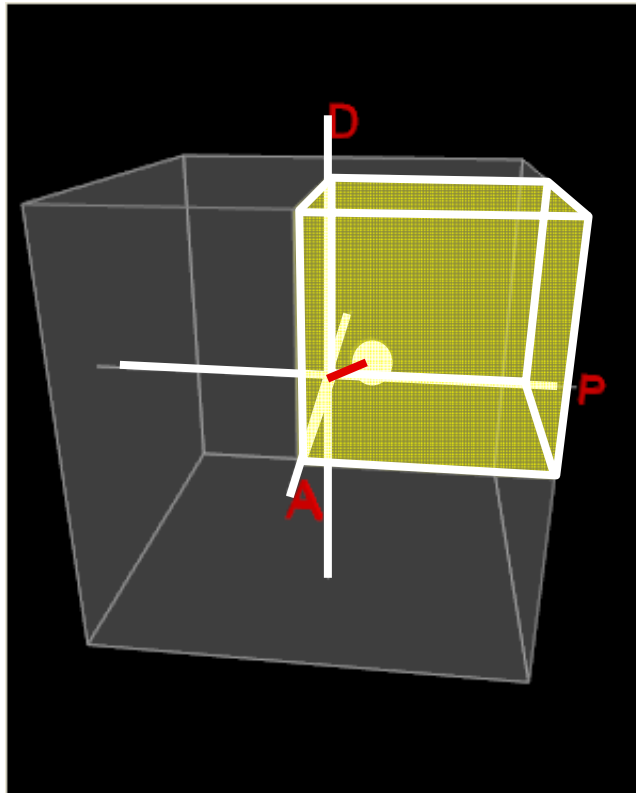
2 Analysis of the Big-Five Personality Factors in Terms of the PAD Temperament Model. Australian Journal of Psychology, 48-2, 1996, 86-92

3 Framework for a Comprehensive Description and Measurement of Emotional states. Genetic, Social, and General Psychology, 22, 1995, 334-361





# 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

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- Openness<sup>2</sup>
  - related positively to arousal, pleasure, and dominance
- Conscientiousness<sup>3</sup> and Extraversion<sup>1</sup>
  - related positively to pleasure and dominance
- Agreeableness<sup>1</sup>
  - related positively to pleasure and arousal
  - related negatively to dominance
- Emotional Stability<sup>1</sup>
  - 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

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- **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





# PAD space and emotions

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

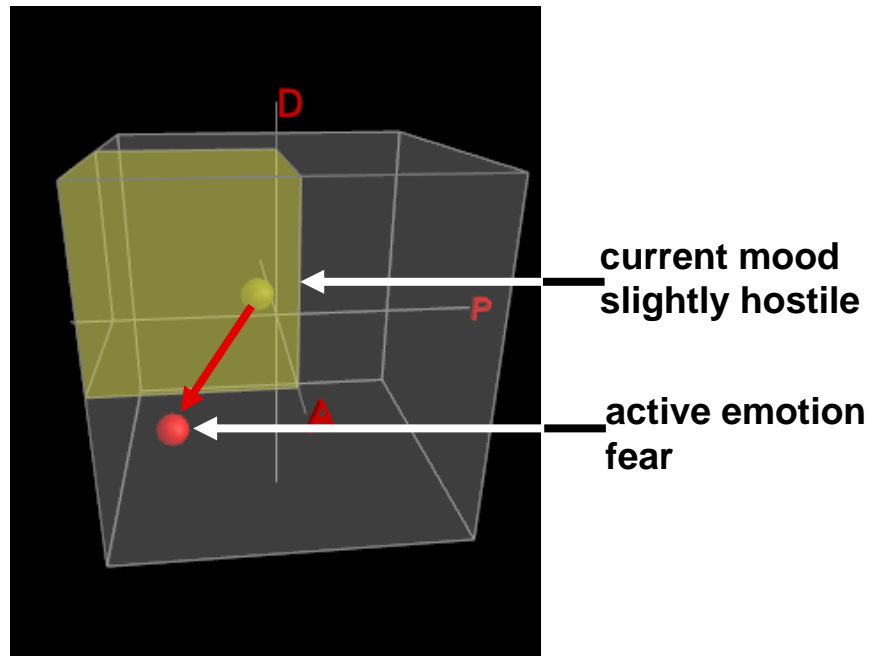
Emotion	P	A	D	Mood Octant
Admiration	0.5	0.3	-0.2	+P+A-D Dependent
Anger	-0.51	0.59	0.25	-P+A+D Hostile
Disliking	-0.4	0.2	0.1	-P+A+D Hostile
Disappointment	-0.3	0.1	-0.4	-P+A-D Anxious
Distress	-0.4	-0.2	-0.5	-P-A-D Bored
Fear	-0.64	0.60	-0.43	-P+A-D Anxious
FearsConfirmed	-0.5	-0.3	-0.7	-P-A-D Bored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



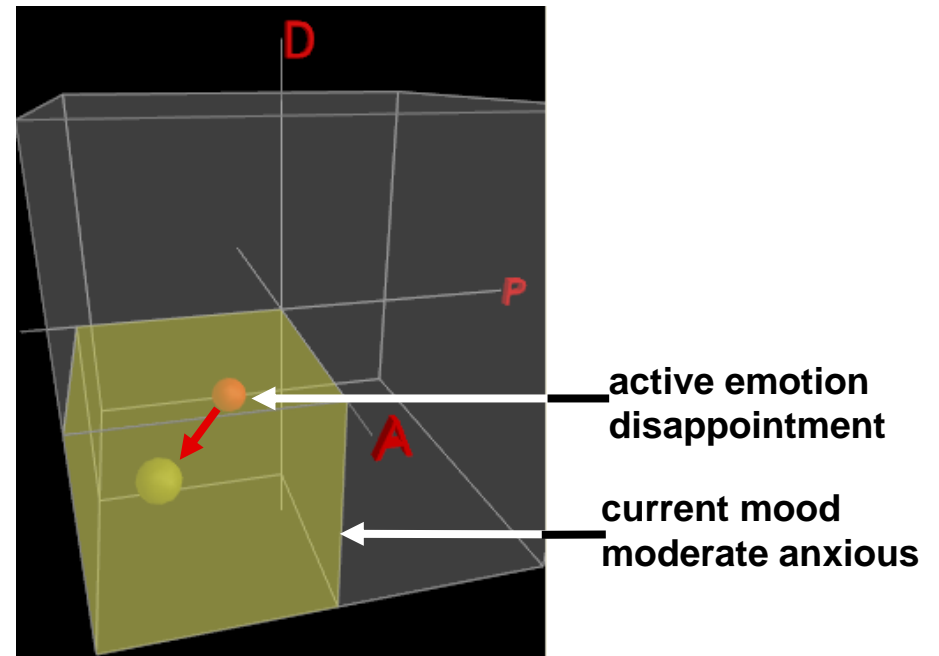
# Mood changes

## Pull phase



→ mood is pulled toward anxious mood

## Push phase



→ anxious mood is intensified by pushing it away from the origin





## Conclusion

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- 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

