Computational modeling of emotions

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Overview

a) Motivation: Why to simulate affect
b) Theoretical background: Emotion psychology
c) Implementation: WASABI & its emotion dynamics

a) Why to simulate affect

Burghouts, op den Akker, Heylen, Poel & Nijholt (2003):

1. The “Believable-agent-motive”:
   “Embodied conversational agents that show emotions in the way they act or behave in environments where they interact with humans [..] are more believable and engaging than similar agents that do not show emotions.”
2. The “Experimental-theoretical-motive”:
   “The system is built and used as an experimental environment to verify or falsify hypotheses based on the theoretical insights expressed in the emotion theory.”

The embodied conversational agent MAX:

1. as an interactive & believable embodied agent
2. as testbed for emotion theory

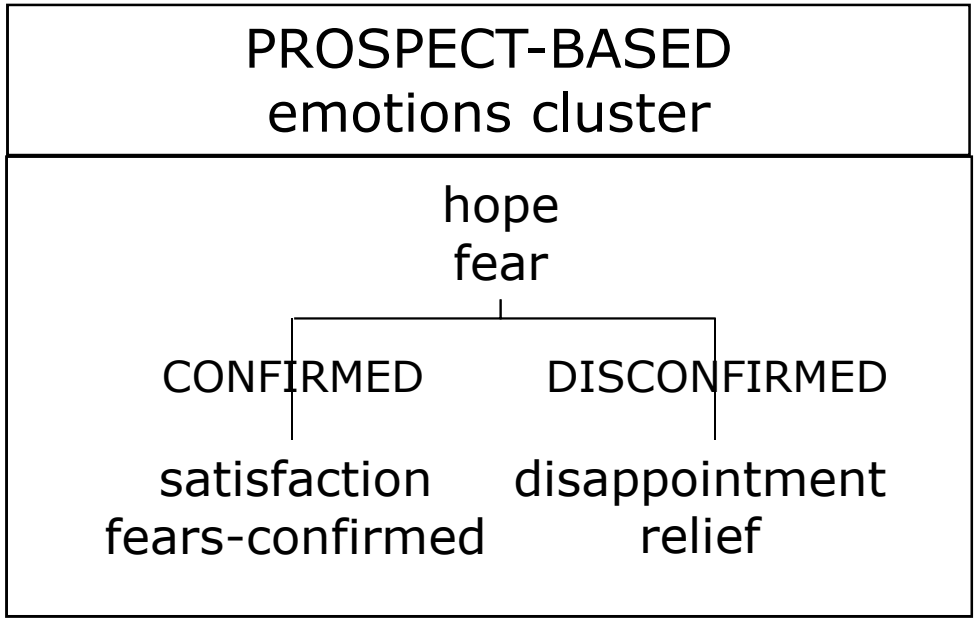
b) Theoretical background

1. Psychological background
   - "OCC-model" of emotions (Ortony, Clore & Collins 1988)
   - "Core Affect" (Russel & Feldmann Barrett 1999)
     & Pleasure-Arousal-Dominance space (Russel & Mehrabian 1977)
2. Neurobiological background (Damasio 1994/2003)
   - Primary emotions
   - Secondary emotions
3. Social / interpersonal emotions
   (Parkinson, Fisher & Manstead 2005)
   - sociomoral emotions: embarrasment, shame & guilt

b) The OCC-model (example)

(Ortony, Clore & Collins 1988)

IF event-has-consequences-for-self AND prospects-relevant
THEN

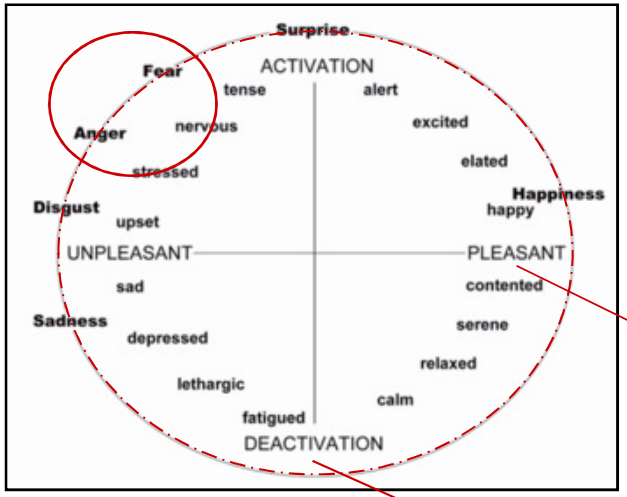


OCC-model best suited to reason about emotions

The non-cognitive emergence of emotions is neglected

(E.g.: The experience of relaxation when sitting in front of a warm oven.)

b) Core affect
(Russel & Feldmann Barrett 1999)



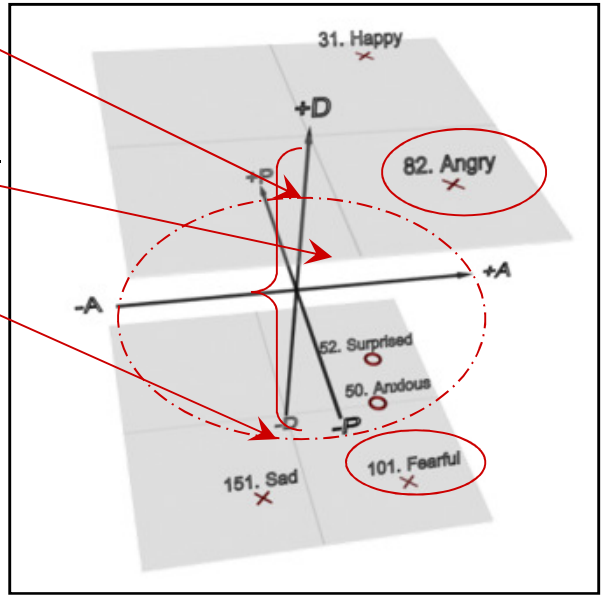
(Russel & Feldmann Barrett 1999)

Assumption for "Core Affect":

→ Emotions not identifiable by distinct categories from the start

→ "Circumplex model of Core Affect" (Pleasentness & Activation)

PAD space



Term	Pleasure		Arousal		**Dominance**	
	Mean	SD	Mean	SD	Mean	SD
31. Happy	.81	.21	.51	.26	.46	.38
50. Anxious	.01*	.45	.59	.31	-.15*	.32
52. Surprised	.40	.30	.67	.27	-.13*	.38
82. **Angry**	-.51	.20	.59	.33	**.25**	.39
101. **Fearful**	-.64	.20	.60	.32	**-.43**	.30
151. Sad	-.63	.23	-.27	.34	-.33	.22

(Russel & Mehrabian 1977)

b) Primary & secondary emotions
(Damasio 1994 / 2000/ 2003)

1. Primary emotions (fear, anger, joy, ...):
   - fast, hard-wired stimulus response patterns
   - trigger fight-or-flight behaviors
   - ontogenetically earlier types of emotion
2. Secondary emotions (e.g., hope, shame):
   - lead to cognitively elaborated, deliberative behaviors
   - are based on memories and expectations
   - "social emotions" developed during infancy
   - "utilize the machinery of primary emotions"

b) Social emotions

- „The final recurrent theme is that emotions are not necessarily defined by the quality of the associated feeling state but may instead derive their identity from the **interpersonal dynamics** that provide the context for their subjective aspects.“
  (Parkinson, Fisher, Manstead, 2005)
- Of particular interest here: „sociomoral emotions“
  - Embarrasment: „[..] an interruption of the orderly performance of social action.“
  - Shame: „[your] failure to live up to central standards of conduct [in the eyes of others].“
  - Guilt: „[..] blameworthy action is the key elicitor.“

Guilt

1. helps to repair relationships
2. encourges actions that maintain relationships
3. guilt induction serves as a way of influencing another‘s conduct from a relatively powerless position

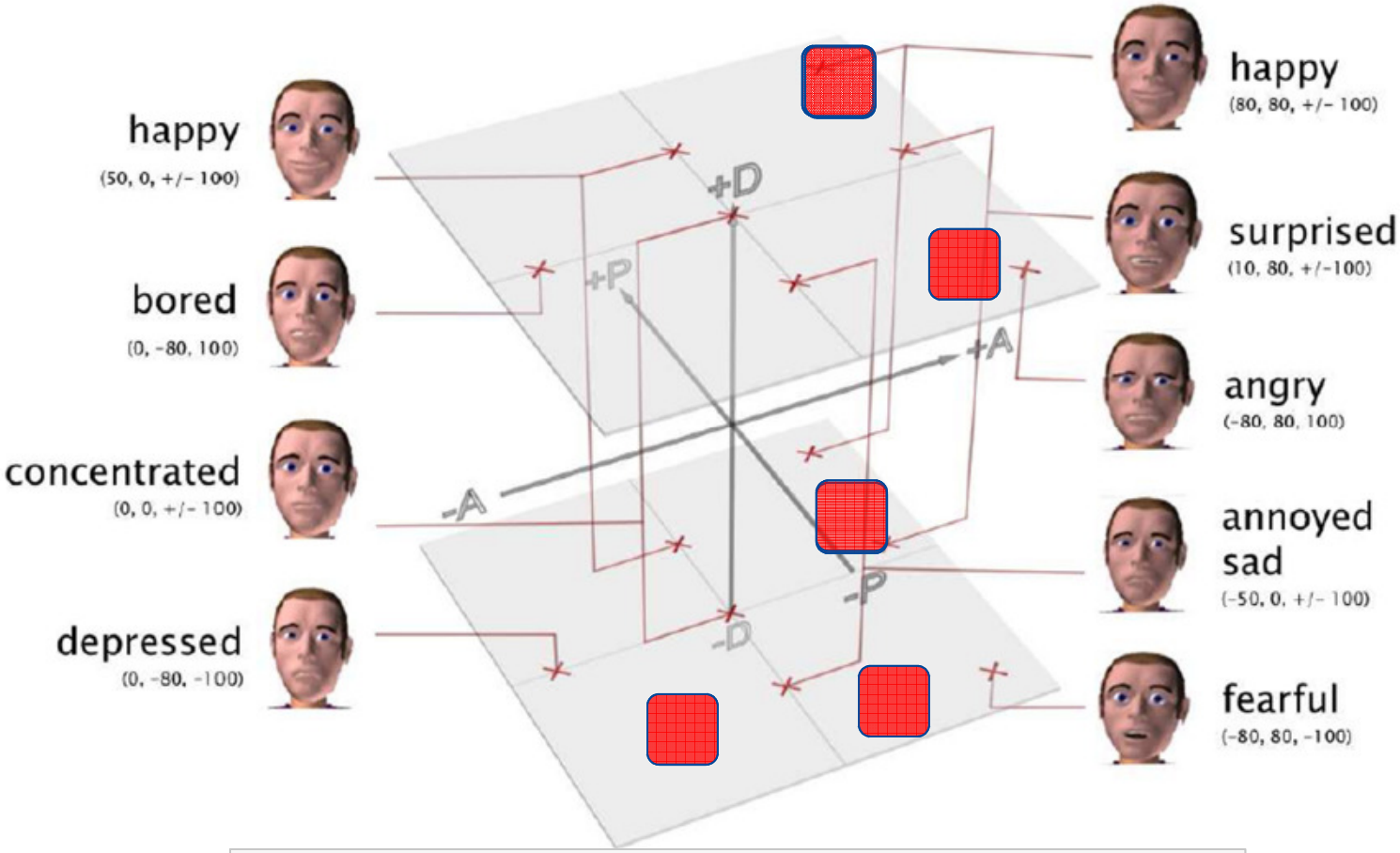
→ Guilt induction strategies:

- If I know
  - that you are present and were able to help
  - that you don‘t know
    - that I am present and need help
    - that you could help
- then I should (at least) make you aware of me.

b) Conclusions

1. Primary emotions:
   - No memory, no expectations, no higher-order cognition
   - Elicitation of primary emotions in PAD space (Russel & Mehrabian)
2. Secondary emotions:
   - product of conscious appraisal based on memory, expectations and goal-conduciveness (Scherer)
3. Social emotions:
   - Rely on ability to reason about others‘ knowledge (Parkinson, Fisher & Manstead)

c) Nine emotions in PAD space



As of 2005 only primary emotions

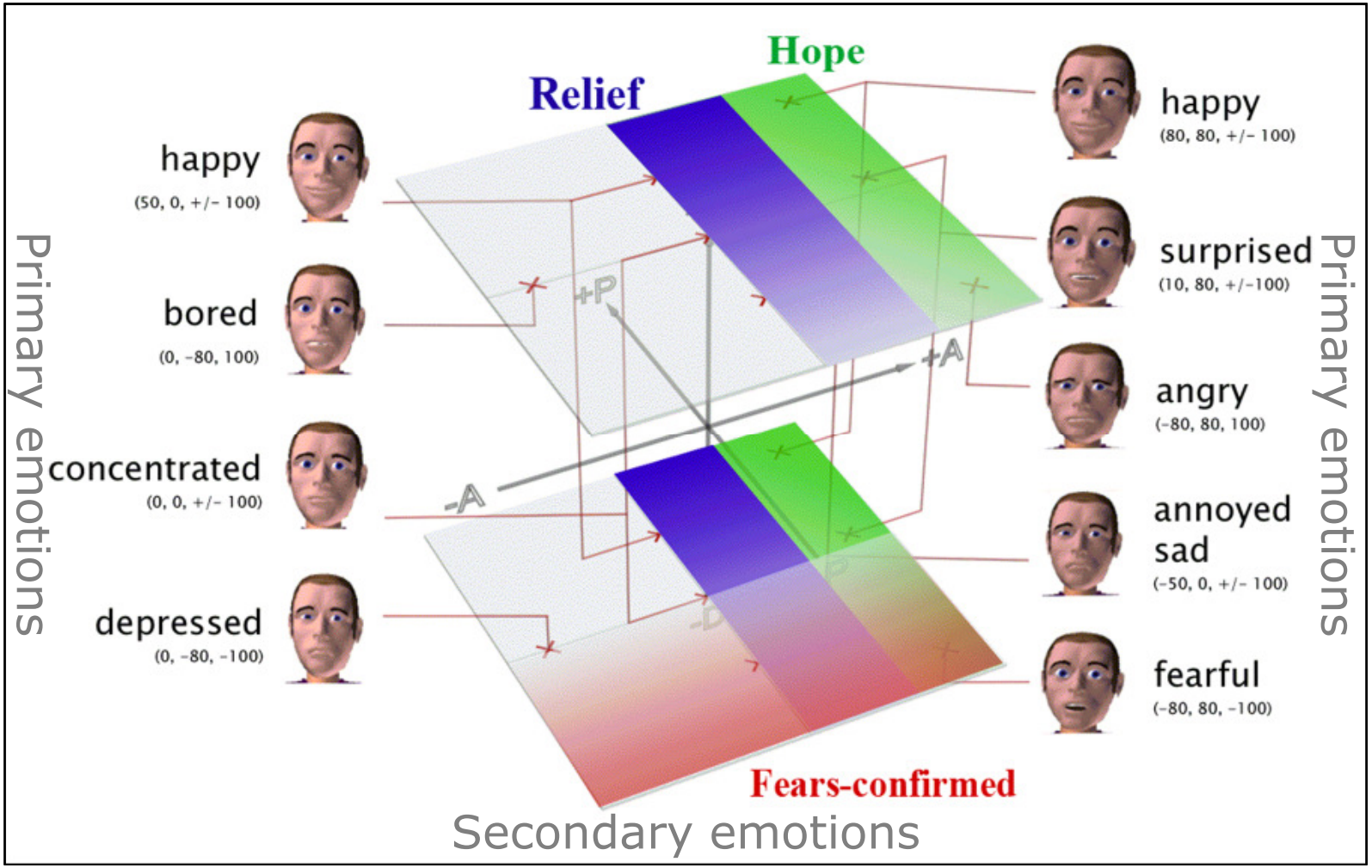
c) Secondary emotions

Three prospect-based emotions as secondary emotions:

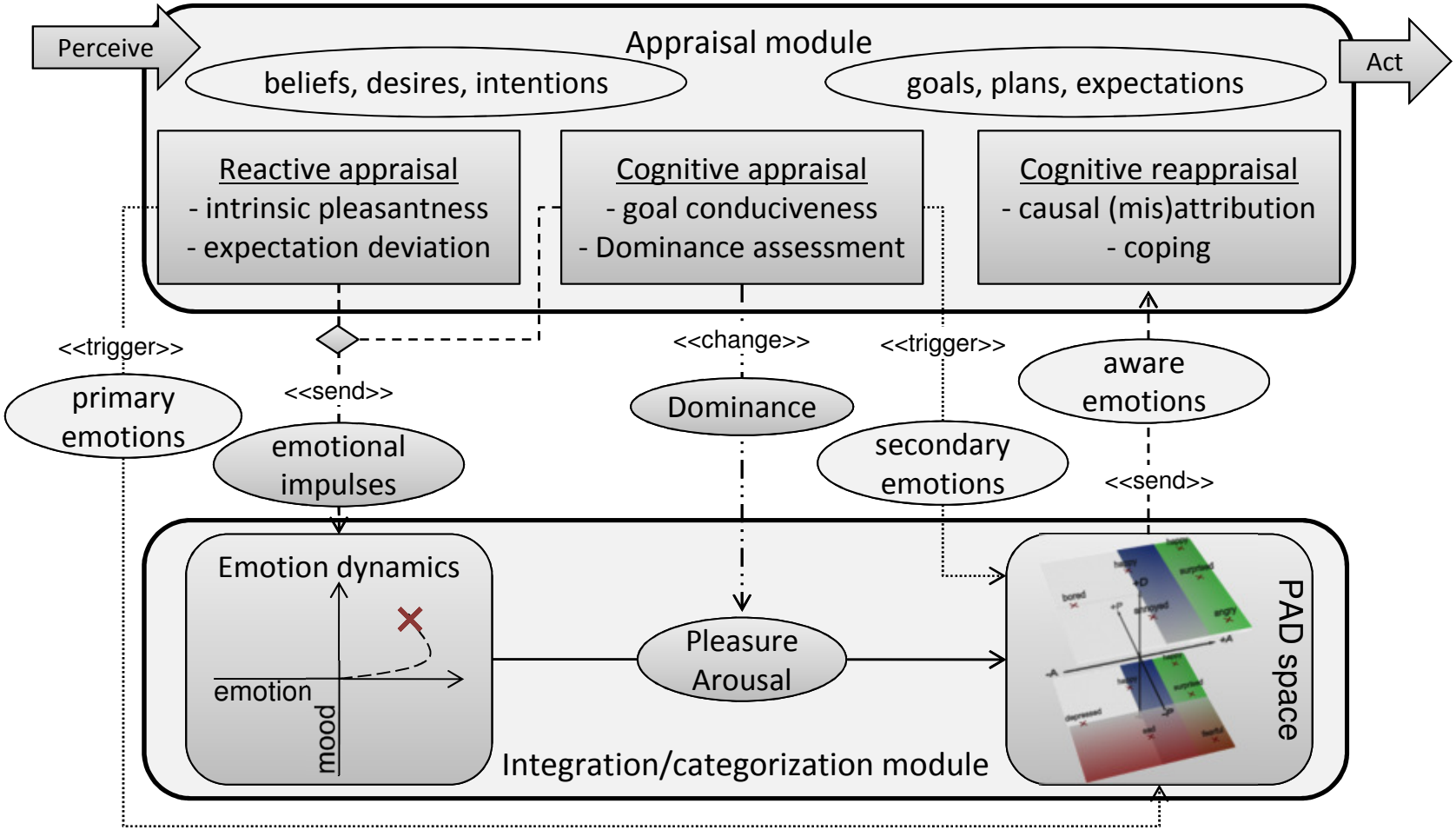
1. HOPE:
   MAX hopes that the human player plays one of her stock cards or her main card, because MAX could play his own main card afterwards.
2. FEARS-CONFIRMED:
   MAX sees his fears confirmed, because the human player played a card that MAX was afraid of before.
3. RELIEF:
   MAX realizes that the human player did NOT play a card that MAX was afraid could have been played.

Aspects of their connotative meaning represented in PAD space
→ ensuring mood-congruent elicitation
→ enables calculation of their awareness likelihood

c) Secondary emotions
in PAD space

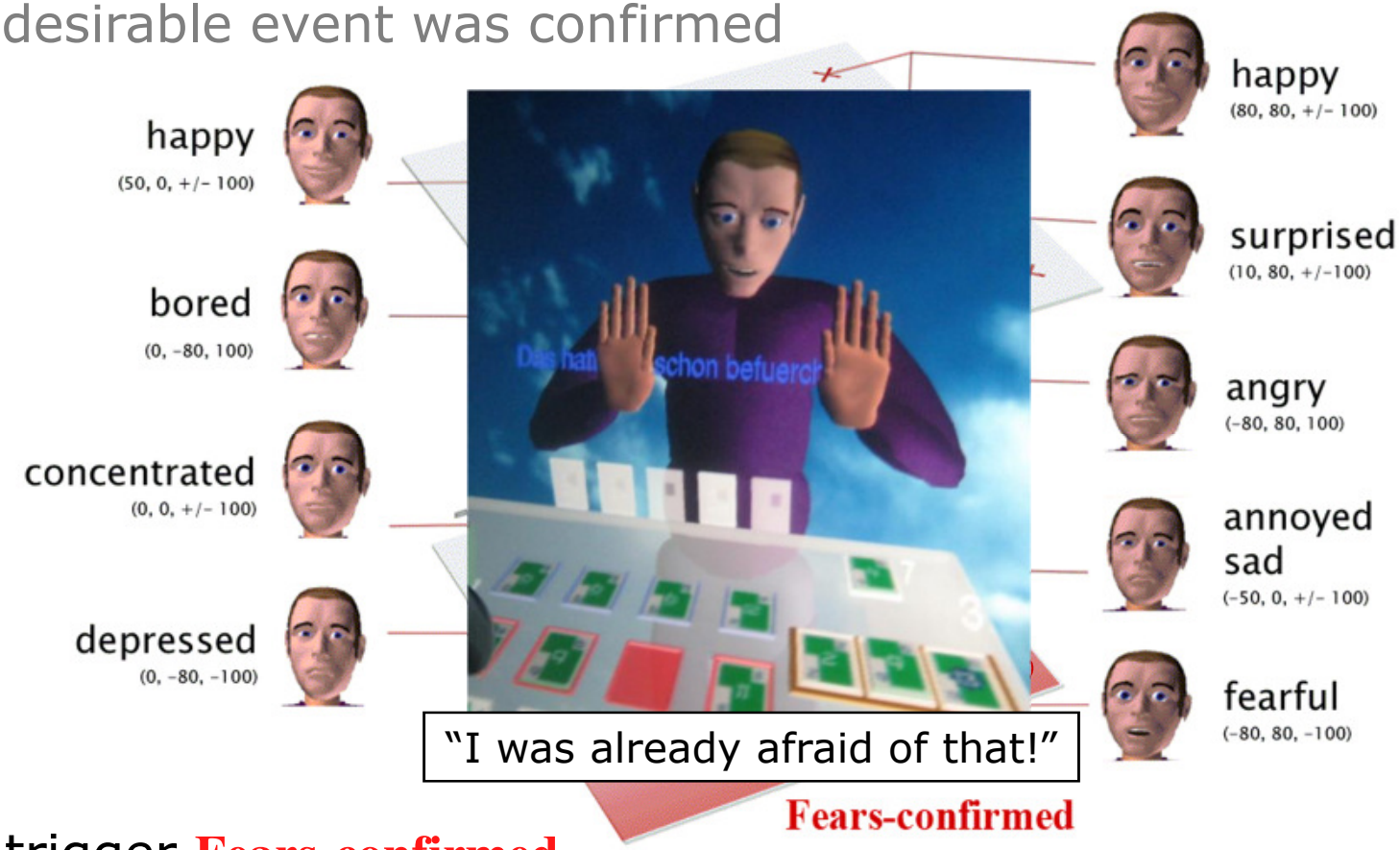


c) The WASABI architecture



c) Secondary emotion
example

Cognition: The prospect of an undesirable event was confirmed



→ trigger **Fears-confirmed**

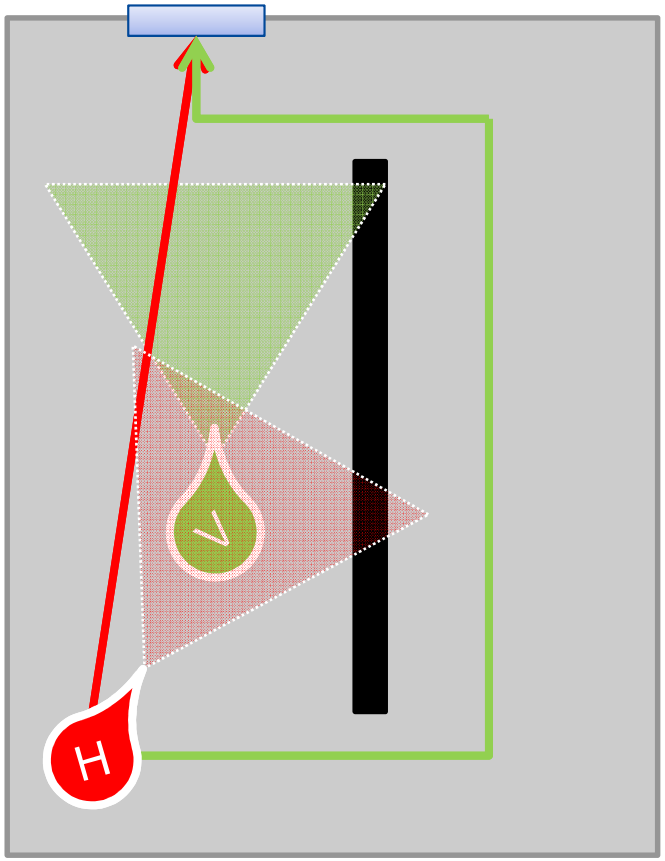
awareness likelihood = (0.3 * fearful, 0.2 * sad, 0.6 * **Fears-confirmed**)

c) Social emotions

- Future work!
- Dynamic epistemic logic approach
- Situation I:
  - V knows that H present
  - V not knows whether or not (H knows that V present)

  → V makes noise to induce guilt!
- Situation II:
  - H knows that V present
  - H not knows whether or not (V knows that H present)

  → H avoids actions that imply (V knows that H present) to avoid feeling guilty



H = Helper, V = Victim

Thank you for your attention