

Affective Computing: agents and emotions

Christian Becker-Asano, Dr. rer. nat.

Albert-Ludwigs-Universität Freiburg

Institut für Informatik

Foundation of Artificial Intelligence

Overview

Three main areas of (emotion) research:

- I. Artificial Intelligence (AI):
Computational Modeling of Emotions
- II. Social Robotics (SR):
interacting with humanoid & android robots
- III. Virtual Reality (VR):
Using VR to elicit emotions and simulate
multi-agent interactions

AI: Why simulating affect?

1. The “Believable-agent-motive”:

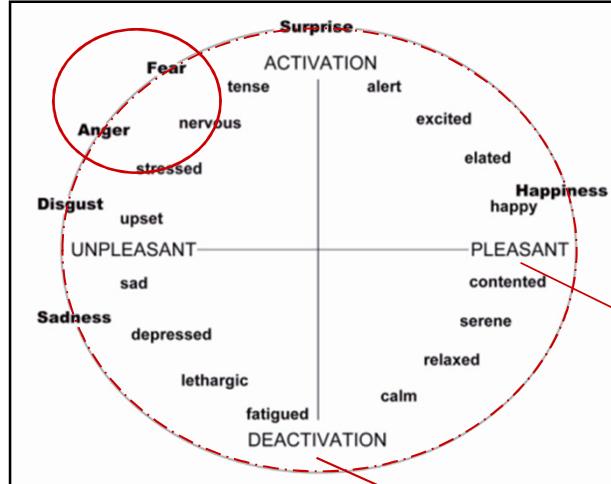
“Embodied conversational agents that show emotions in the way they act or behave in environments where they interact with humans [...] are more believable and engaging than similar agents that do not show emotions.”

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.”

AI & psychology

(Russel & Feldmann Barrett 1999)



(Russel & Feldmann Barrett 1999)

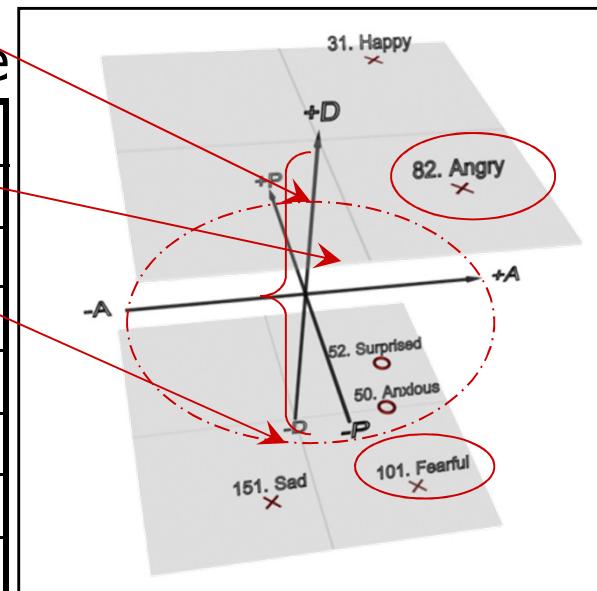
Assumption for “Core Affect”:

- Emotions not identifiable by distinct categories from the start
- “Circumplex model of Core Affect” (Pleasantness & Activation)

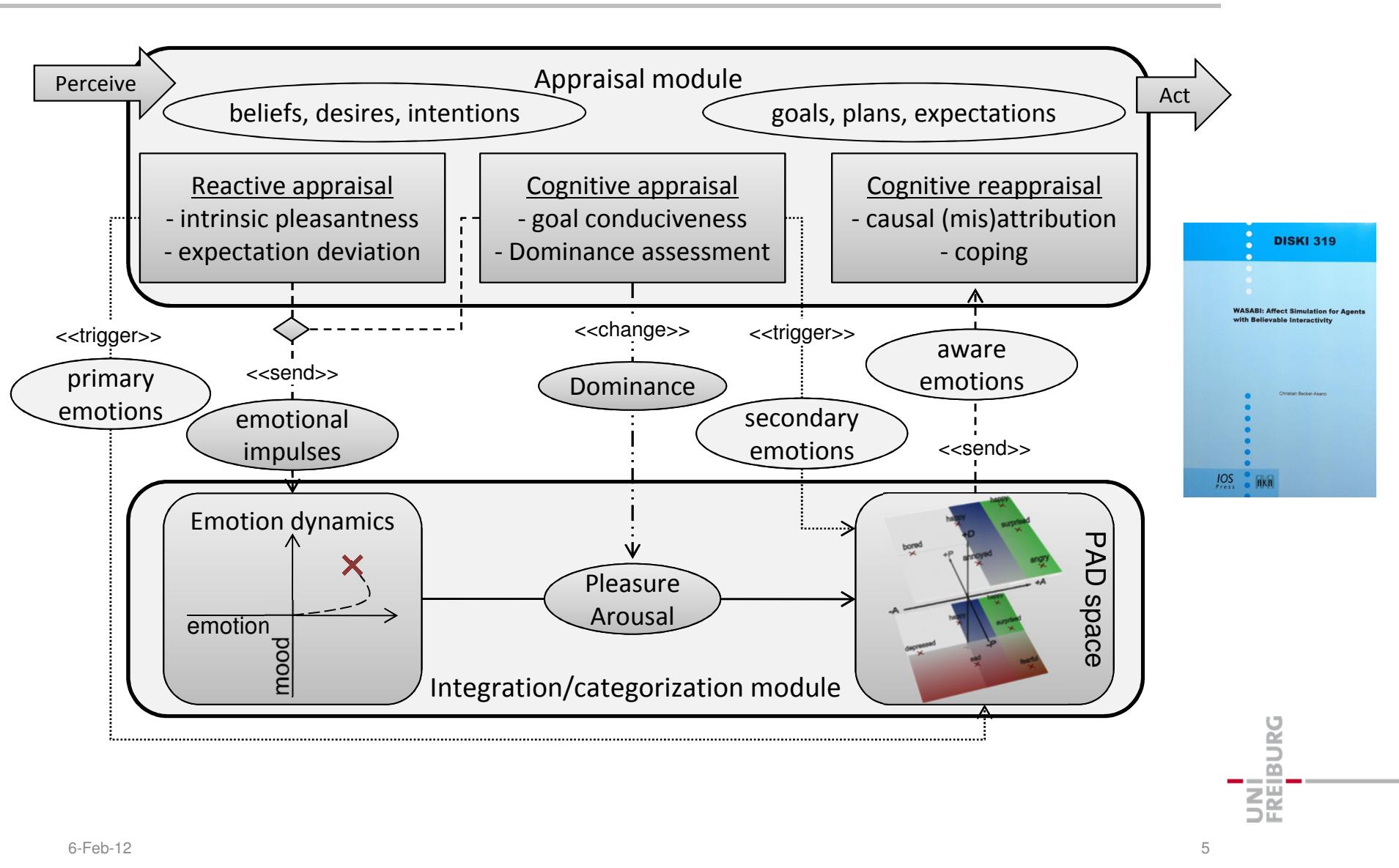
PAD space

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

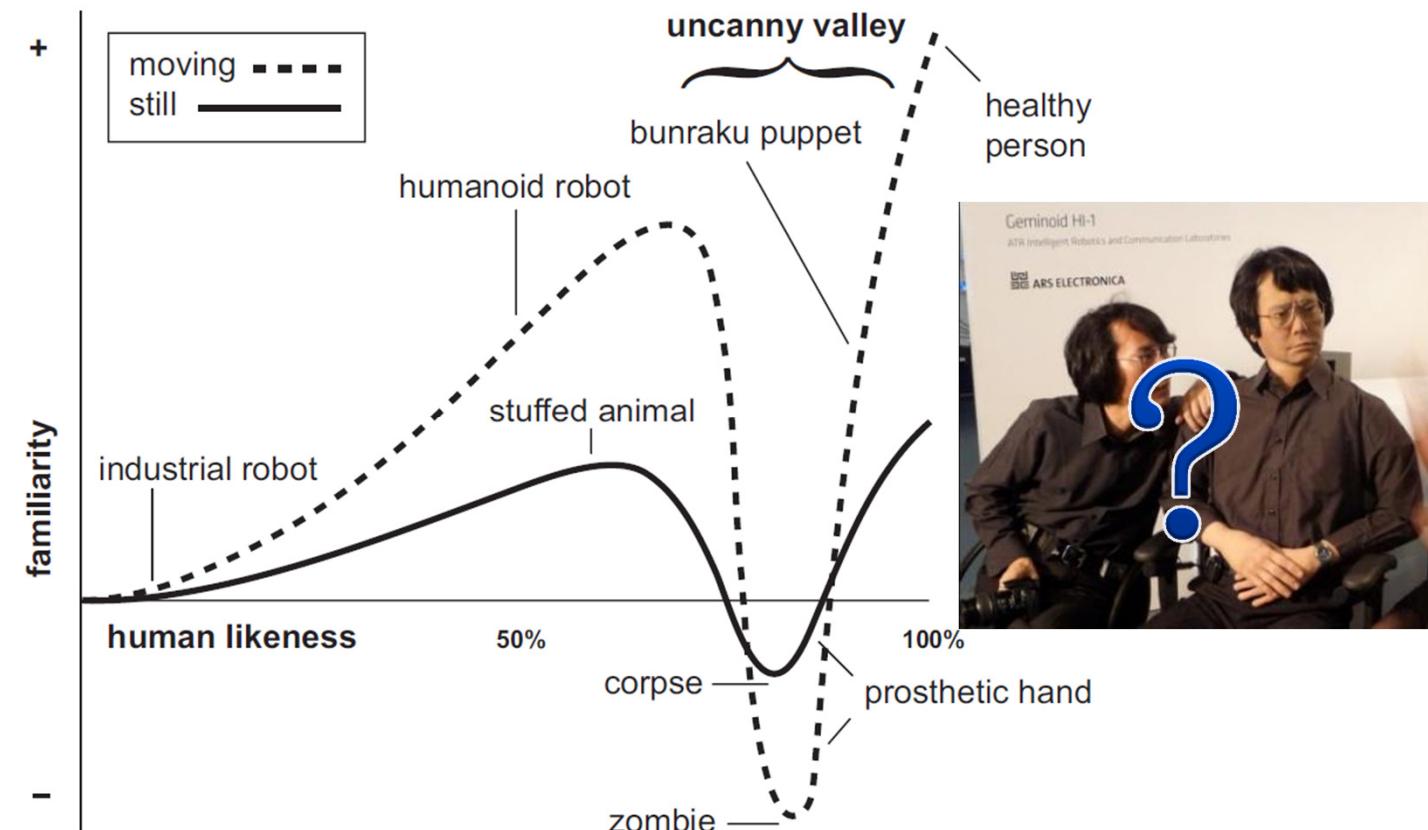
(Russel & Mehrabian 1977)



AI: The WASABI architecture



SR: Uncanny valley hypothesis



The “uncanny valley” hypothesis (Mori, 1970)
(picture taken from MacDorman & Ishiguro, 2006)

SR: Ethnological study: Geminoid HI-1 in a public café



SR: Ethnological study

Questionnaire results

Geminoid HI-1			Hiroshi Ishiguro	
No eye contact	Eye contact	Remote; all with eye contact and speech	Eye contact	No eye contact
N=30	N=45	N=16	N=5	N=2
N=91			N=7	
TOTAL N=98				

Question	Answers		
Noticed the info table?	yes: 61	no: 36	
Geminoid recognized as	human: 18	robot: 50 (1 st mistook: 18)	no comment: 25
uneasy / uncanny feeling	3		

SR: Ethnological study

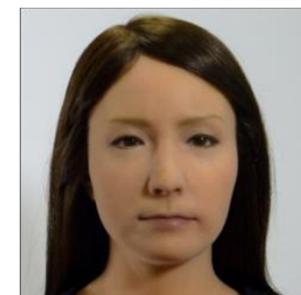
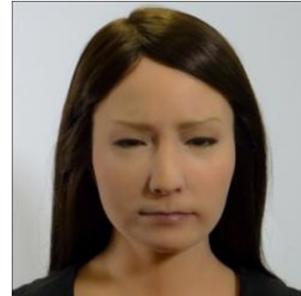
Video analysis



Geminoid HI-1		Visitor
with eye contact	→	longer eye contact (M=3.873 vs. 28.132 secs; p=.001)
with eye contact	→	easier recognize robot (M=1.5 vs. 1.745 times; p=.053)
remote controlled	→	talk to Geminoid HI-1 more often (0% / 11% → 44%)

SR: Geminoid F

facial expressions



SR: Model person results



Geminoid

	angry	fearful	happy	neutral	sad	surprised
angry	54,6%	3,4%	0,4%	5,2%	6,4%	1,4%
fearful	3,0%	10,2%	0,4%	0,6%	4,2%	32,9%
happy	0,2%	15,3%	78,3%	0,0%	0,4%	0,6%
neutral	1,0%	0,0%	15,3%	83,5%	5,8%	0,4%
sad	33,9%	0,6%	0,4%	5,2%	74,9%	0,0%
surprised	0,2%	66,1%	0,4%	0,6%	0,2%	62,7%
none	6,8%	4,2%	4,6%	4,6%	7,8%	1,8%



Model

Picture shown

	angry	fearful	happy	neutral	sad	surprised
angry	89,1%	2,0%	0,8%	3,1%	6,3%	0,8%
fearful	2,3%	61,3%	0,4%	0,8%	1,6%	0,8%
happy	0,0%	0,4%	96,9%	0,4%	0,0%	2,0%
neutral	0,4%	3,5%	0,4%	82,0%	1,2%	0,0%
sad	2,7%	12,5%	0,4%	10,9%	79,3%	0,0%
surprised	0,4%	8,6%	0,0%	0,4%	0,0%	94,1%
none	5,1%	11,7%	1,2%	2,3%	11,7%	2,3%

VR: Technical background

- VR-Technology:
 - Head-mounted display (HMD) with head tracking and headphones
 - Joystick: Moving / interacting with the virtual world
 - Modification of the „Source 2007“ game engine
- Emotion detection:
 - Questionnaires before and after the experiment
 - Physiological data:
 - Skin conductance, heart rate, respiration
 - Marker channel to synchronize with VR

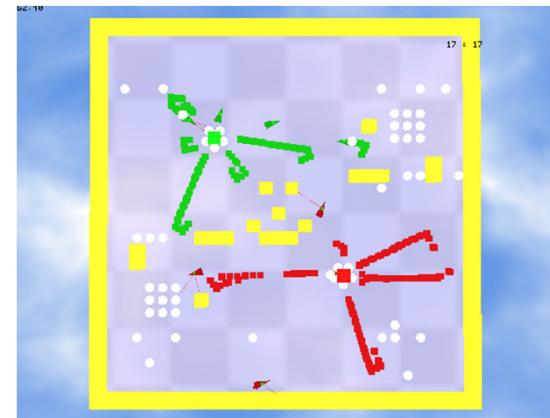


VR: CoVE demo video

Bewältigungsverhalten
in Notfallsituationen
Demo-Video

VR: CoVE increasing complexity

- Challenges for artificial intelligence:
 - Integration of emotions to increase the believability of virtual agents
 - Expression of emotions
 - Simulation of dysfunctional emotions (panic, shock)
 - Goal selection and prioritization based on emotions during behavior planning of virtual agents
 - Social interaction of multiple agents
 - Cooperation between humans and agents
- Behavior planning / decision making and emotion



Thank you for your attention any questions?



Where is Geminoid F? (Photo: S. Nishio, ATR, Japan)