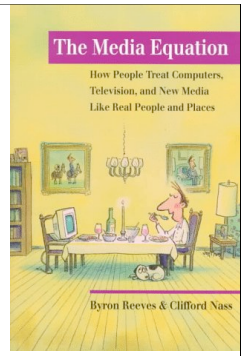
Human-Computer Interaction

Session 12

Social Aspects of HCI

Interacting is social



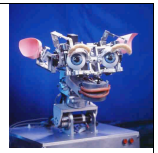
Evidence suggests that computers are liked better when they

- praise the user or other computers
- match the user's personality
- become like the user over time
- they are „teamed" with the user
- use humor
- conduct reciprocal self-disclosure

(Reves & Nass 1996, Moon 1998, Morkes et al. 1998)

„Anthropomorphization":
Humans tend to treat machines as social beings, appraise their behavior as if human

Pay up, you're being watched



VANESSA WOODS

WOULD you donate more to charity if you were being watched, even by a bug-eyed robot called Kismet? Surprisingly perhaps, Kismet's quirky visage is enough to bring out the best in us, a discovery which could help us understand human generosity's roots.

Altruism is a puzzle for Darwinian evolution. How could we have evolved to be selfless when it is clearly a costly business? Many experimental games between volunteers who have to decide how much to donate to other players have shown that people do not behave in their immediate self-interest. We are more generous than necessary and are prepared to punish someone who offers an unfair deal, even if it costs us (*New Scientist*, 12 March, p 33).

To some, this is evidence of "strong reciprocity", which they believe evolved in our prehistoric ancestors because kind groups did better than groups of selfish individuals. But others argue that altruism is an illusion. "It looks like the people in the experiments are trying to be nice, but the niceness is a mirage," says Terry Burnham at Harvard University.

He and Brian Hare pitted 96 volunteers against each other anonymously in games where they donate money or withhold it. Donating into a communal pot would yield the most money, but only if others donated too.

The researchers split the group into two. Half made their choices undisturbed at a computer screen, while the others were faced with a photo of Kismet – ostensibly not part of the experiment. The players who gazed at the cute robot gave 30 per cent more to the pot than the others. Burnham and Hare believe that at some subconscious level they were aware of being watched. Being seen to be generous might mean an increased chance of receiving gifts in future or less chance of punishment, they will report in *Human Nature*.

"The players who had been gazing at the cute robot gave 30 per cent more to the pot than those who hadn't"

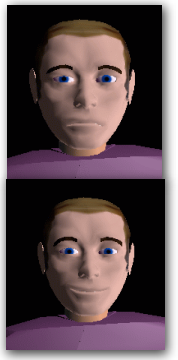
Burnham believes that even though the parts of our brain that carry out decision-making know that the robot image is just that, Kismet's eyes trigger something more deep-seated. We can manipulate altruistic behaviour with a pair of fake eyeballs because ancient parts of our brain fail to recognise them as fake, he says.

He believes that strong reciprocity is an illusion because even though volunteers are told they will never meet the other players again, our brains are not geared up for that degree of anonymity because humans evolved in small groups. Altruism expert Daniel Fessler at the University of California, Los Angeles, agrees. "Our mental architecture is just not used to the modern environment."

Charities and taxmen could even exploit the Kismet effect. Next time you click on a charity's gift page you may just see Kismet's dopey eyes staring back at you as you are overwhelmed by an uncontrollable urge to give.

Embodied agents are social actors

- Draw attention to face, where most socio-communicative cues are delivered *(Dehn & van Mulken, 2000)*
- Interactions tend to be more entertaining *(Koda & Maes, 1996; van Mulken et al., 1998, Krämer et al., 2002)*
- Social dialogue *(Bickmore 2003; Kopp et al., 2005)*
- Impression management and social facilitation/inhibition *(Sproul et al. 1996; Rickenberg & Reeves 2000)*
- Facial mimicry *(Bailenson & Yee 2005; Sommer, Krämer & Kopp, in prep)*
- Motor resonances



Social machines?

(C. Breazeal, MIT)

"Social as relationship"

Interactive Toys

"Social as entertainment"

„Future applications require robots to address

the socio-emotive and psychological aspects of people, in long-term relations"

BANDAI "elder toys"

Professional Service Robots

"Social as interface"

NEC "babysitters"

OMRON "pets"

Social machines?

- Socially evocative - capitalize on feelings evoked when humans nurture, care, or are involved with their "creation"
- Socially situated - perceive and react to a social environment, distinguish between other social agents and objects
- Social interface - employ human-like social cues and modalities.
- Socially receptive - passive but benefit from social interaction, e.g. through learning by imitation
- Socially embedded - socially interact with other agents and humans; at least partially aware of human interactional structures
- Socially intelligent / sociable - aspects of human style social intelligence, pro-actively engage with humans in order to satisfy internal aims based on deep models of human social competence

Sociable Agents

CITEC

„Sociability"

- from Latin *sociabilis* "close, intimate," from *sociare* "to join, unite," from *socius* "companion"
- being intuitive and pleasant to interact with

Sociable agents - **four „crucial co's"**

- conversational
- cooperative, supportive
- companionable, building familiarity & rapport
- convergent, adaptive, learning

Engineering sociability - features

Interactivity & Attentiveness

- be accessible, attentive and respond appropriately as fast as possible

Expressivity & Engagement

- demonstrate intrinsic interest and commitment in the interaction

Empathy & Resonance

- be sensitive to and reinforce the others' states and behavior

Alignment & Convergence

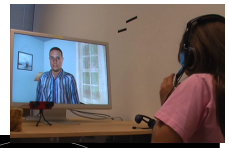
- coordinate and synchronize on behavioral & linguistic levels

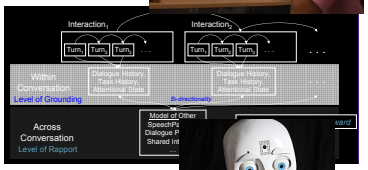
Companionship & Solidarity

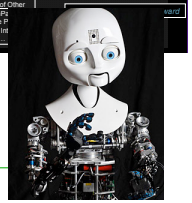
- be a collaborative, positive, and supportive partner

An emerging trend…

- Relational Agents *(Bickmore 2003)*
  - increase trust by building solidarity, familiarity, affect through small talk
- Virtual rapport with silent listener *(Gratch et al. 2006, 2007)*
- Long-term rapport *(Cassell & Tepper 2007)*
- Social robots *(Dautenhahn 1995, 2000; Breazeal 2002, 2003)*







Relational agents

Cooperation and **relationship**

- Cooperative, goal-directed activity is supported by positive relationships among the cooperation partners, e.g., fosters trust (Deutsch, 1973; Marsh, 1994)
- Creating and maintaining a relationship requires successful collaborations

Relational agents (Bickmore 2003)

- Computational artifacts designed to build and maintain long-term, social-emotional relationships with their users

Timothy Bickmore
Northeastern Univ.

Goal: building trust

- **Trust**: generalized expectations about the likelihood of a partner meeting one's (relational) expectations
- How to create machines that know how to win people's trust and go about it using relational conversational strategies?
- Two strategies applied in relational agents:
  - establish and maintain common ground
  - avoid face threads, i.e., all events incompatible with how one wishes others to see oneself, mitigate its effects if unavoidable

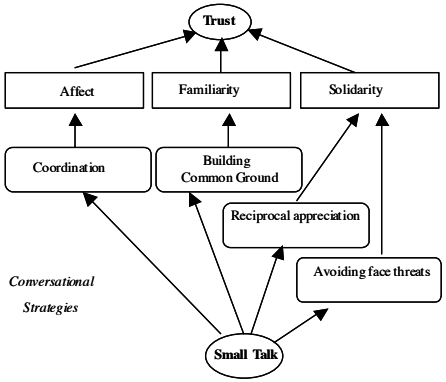
Underlying theory (in a nutshell)

Dimensions of interpersonal relationships:
(Brown & Levinson 1983; Berscheid et al. 1998; Svennevig 1999)

- Familiarity: growth of a relationship can be represented in both the breadth (number of topics) and depth (public to private) of the information disclosed amount and kind of information disclosed
- Power: ability to control the behavior of the other
- Solidarity: „like-mindedness", degree of similar behavior dispositions, low social distance
- Affect: the degree of liking for each other

The benefit of small talk

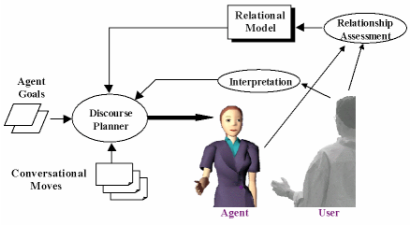
Social dialogue that provides an opportunity for applying conversational strategies for building trust.

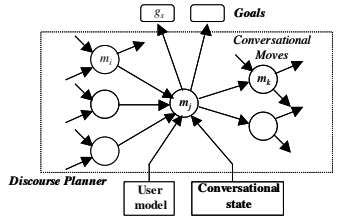


(Bickmore 2003)

The first relational agent

Embodied conversational agent augmented with a discourse planner that dynamically interleaves task moves and relational moves to satisfy task goals given a set of relational constraints.



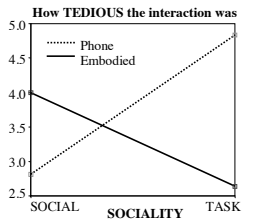


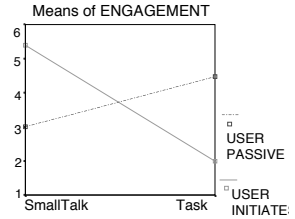
Bickmore & Cassell (CHI 2001)

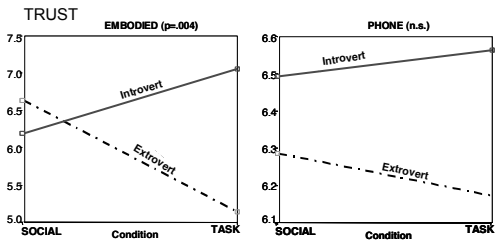
Example

	Move	Fam/D	Fam/B	Solidarity
1.	How about this weather?	0.00	0.00	0.00
2.	I think winters in Boston are awful.			
3.	How do you like Boston?			
4.	I have lived in Boston all my life. Come to think of it, I have lived inside this room all of my life. It is so depressing.			
5.	Boston is certainly more expensive than it used to be.	0.50	0.19	0.17
6.	So, Where would you like to live?			
7.	How many bedrooms do you need?			
8.	Do you need access to the subway?			
9.	Is one bath enough?	0.60	0.29	0.30
10.	You know, I keep showing the researchers here the same houses, over and over again. Maybe one day I will get lucky.			
11.	Have you been in the Media Lab before?			
12.	Do you know that the Media Lab is going to expand into another building. Things are really going well for the researchers here.			
13.	It is pretty cool do you think?			
14.	They are doing some crazy things in here.			
15.	I have shown houses to lots of students and faculty from M I T. But I always enjoy talking to them.	0.70	0.38	0.50
16.	Anyway, What can you afford?			
17.	What kind of down payment can you make?			
18.	Let me see what I have available.	0.90	0.43	0.57

Results







Bickmore's conclusions

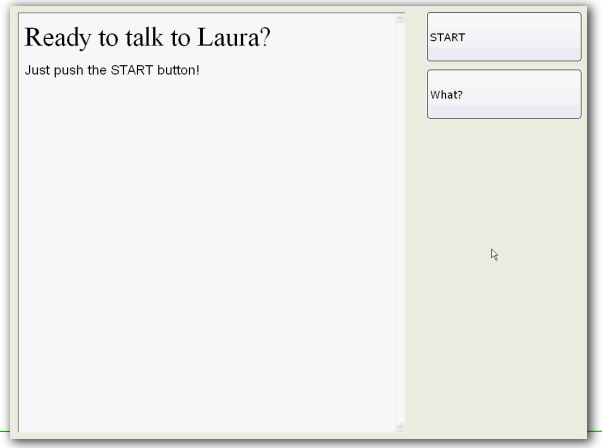
- Care about nonverbal behavior
  - nonverbal behavior is important, but very difficult to get right (here, inappropriate for the social dialogue)
- Consider user personality
  - users who reach out more towards other people are more susceptible to relationship building, and need relational strategies in order to trust the interface
- Increase competence above all
  - No amount of relational behavior can compensate for incompetence and too limited system capabilities.
- Create persistence and common-ground
  - Need long-term interaction, little can be accomplished relationally in a five minute conversation

2nd agent: MIT FitTrack

Laura

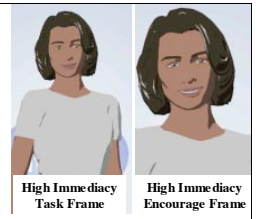
- Task: exercise advisor for students
  - develop persistent relationship with people
  - influence exercise behavior of people
- Richer nonverbal behaviors
  - facial expressions: neutral, warm, concerned, happy
  - head nodding on emphasis
  - eyebrow flashes on emphasis
  - gaze away/towards the user at beginning of the theme/rheme
  - look-away and return to signal turn-taking and turn-holding
  - high/low pitch accents on new objects in rheme/theme
  - posture shifts on topic shifts
  - gestures: beat, contrast, down, up, left, you, me, ok, relax, ready

Example



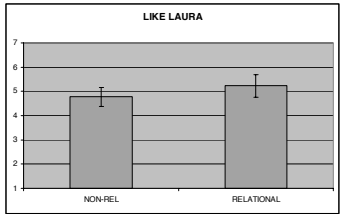
Relational nonverbal behavior

	Relational Stance	
Frame	**High Immediacy (Warm)**	**Low Immediacy (Neutral)**
TASK	Proximity=0.2 Neutral facial expression Less frequent gaze aways	Proximity=0.0 Neutral facial expression Less frequent gestures Less frequent headnods Less frequent brow flashes
SOCIAL	Proximity=0.2 Smiling facial expression Less frequent gaze aways	Proximity=0.0 Smiling facial expression Less frequent gestures Less frequent headnods Less frequent brow flashes
EMPATHY	Proximity=1.0 Concerned facial expression Slower speech rate Less frequent gaze aways	Proximity=0.5 Concerned facial expression Slower speech rate Less frequent gestures Less frequent headnods Less frequent brow flashes
ENCOURAGE	Proximity=0.5 Smiling facial expression Less frequent gaze aways	Proximity=0.1 Smiling facial expression Less frequent gestures Less frequent headnods Less frequent brow flashes



Proximity: 0.0 = full body shot, 1.0 = close up on face
Frequencies relative to baseline.

Results



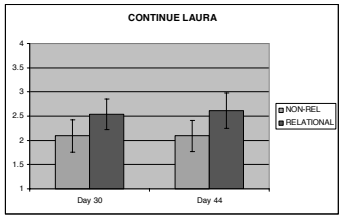
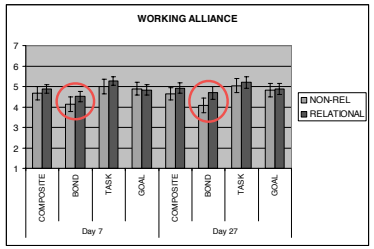
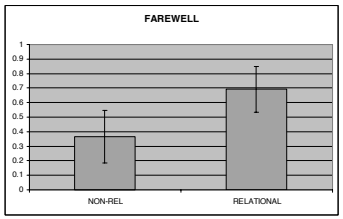


Figure 9-9. Reported Desire to Continuing Working with Laura by All Subjects





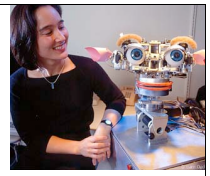
(N=82, 7+30 (interventions)+7 days)

Conclusions

- Carefully and consistently employed, social behavior of an embodied agent can foster human-agent cooperation
  - depends heavily on the task, the user, and the particular application domain.
- Systems can built and maintained a successful working alliance, relational strategies had a significant impact on the bond dimension, on liking, and on the desire to continue interaction

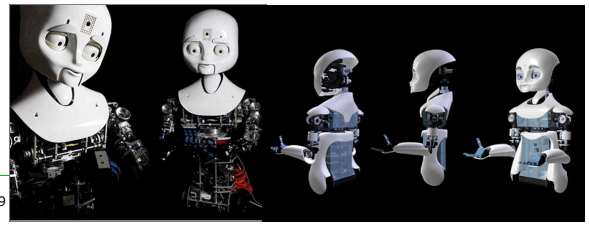
Social robots

Leonardo



Cynthia Breazeal
Robotic Life Group
MIT Media Lab

Nexi / DMS



Example: Leonardo

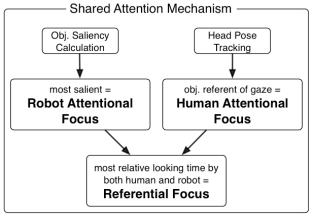
Goal: a robot that can act as a cooperative partner

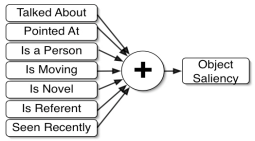
- maintaining mutual understanding of other's internal states
- performing learned tasks collaboratively with a human partner
- social learning of new tasks
- utilizing social cues to demonstrate commitment, manage collaboration, support learning and teaching

Joint attention

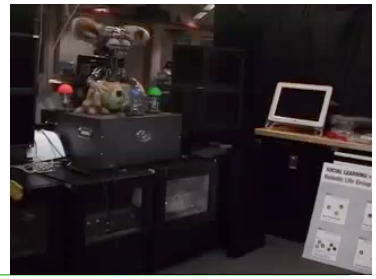
Joint attention as a collaborative process

- Attentional focus vs. referential focus





+ social cues (pointing, gaze)



Learning new motor skills

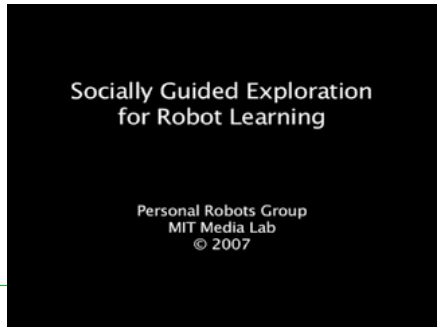
By demonstration

By imitation

Learning by guided exploration

Captures two important abilities of robot learners

- explore on its own to discover new goals and generalized tasks
- leverage a human partner to improve what and how the robot learns through a collaborative process



Understanding others?

Need to infer mental states from people's observable behavior, surrounding context, internal models

- crucial capability for socially intelligent agents

Representing mutual beliefs and intentions

- robot beliefs: dynamic database of belief objects with attributes, formed from percepts
- human beliefs: same model, updated following attential focus
- mutual beliefs marked

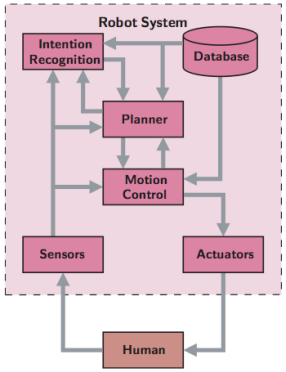
Intention recognition?

- (especially when we don't have a collaborative discourse)

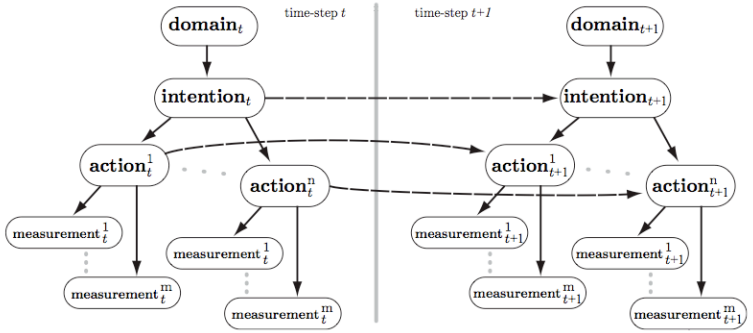
Usually tackled inferentially

- Intention recognition
  - read (non-)verbal cues
  - probabilistic forward model
- Proactive planning & execution
  - actions that support the infered intentions
  - actions that urge the user to unravel her intentions, i.e. decrease robot's uncertainty
- Database
  - model of the environment
  - actions
  - FSMs for certain forms of interaction

„Proactive cooperation"



(Schrempf et al. 2005, Univ. Karlsruhe)



(Schrempf et al. 2005, Univ. Karlsruhe)

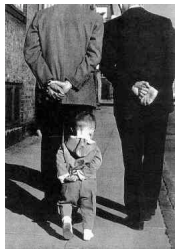
Embodied approach

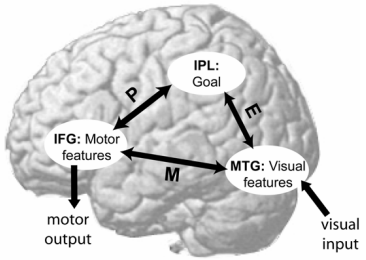
Ability to communicate depends not only on symbolic exchange, but also on basic processes linked to one's body

- constraining not only what one can perceive, feel, and do, but also how we understand and relate to others

Motor resonances / Mirroring
(Sebanz & Knoblich 2008)

- of actions, movements, gestures, emotions, sensations
- necessary (but not sufficient) for numerous social skills
- recruited and controlled by higher cognitive processes for, e.g., intention understanding, mimicry, or imitation





(Hamilton 2008, Emulation and mimicry for social interaction: A theoretical approach to imitation in autism, QJEP)

Pathways of social-motor information processing

- E-route (MTG-IPL): understanding the goal of an action
- P-route (IPL-IFG): action planning
  - EP-route: goal-emulation behaviour

High-level resonance

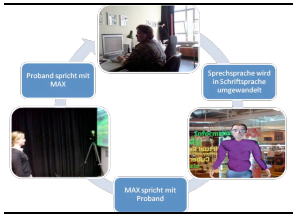
- M-route (MTG-IFG): motor mimicry behaviour

Low-level resonance

Mirroring in HCI

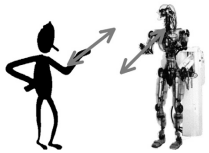
„Digital chameleons"
(Bailenson & Yee 2005)

- mimicking agents are more persuasive and receive more positive ratings than non-mimickers



People mimic EAs
(Sommer, Krämer & Kopp, in prep)

- when talking to *Max*, people mimic the agent's smiling
- not found with self-adaptors or eyebrow movement



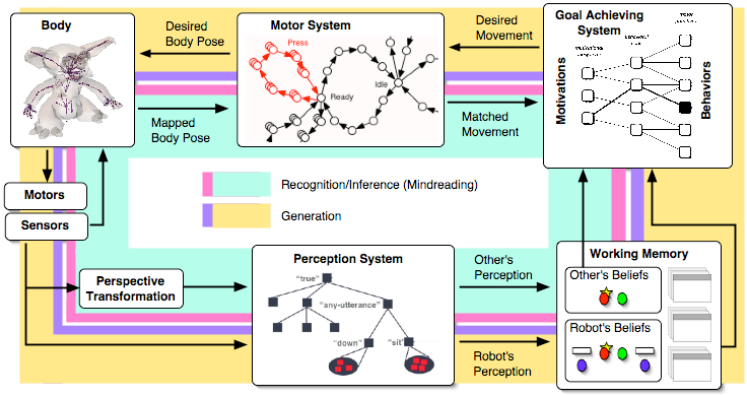
Motor resonances with humanoid robots (behavioral & imaging evidence)

Embodied approach

- Treat the other as being „like me" (Meltzoff 1996)
- Simulation theory (Gordon 1986)
  - our brain employs mirroring & resonances, using own system "off-line" to simulate others
  - cognitive processes are dual-use: generate own actions from mental states, and infer mental states responsible for other's actions by "stepping into their shoes"

➔ Could afford companions with better abilities for

- understanding others & interacting with them
- aligning and coordinating with others
- learning from others
- creating bonds with others



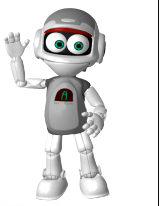
(Breazeal et al. 2007)

Example: mental perspective taking

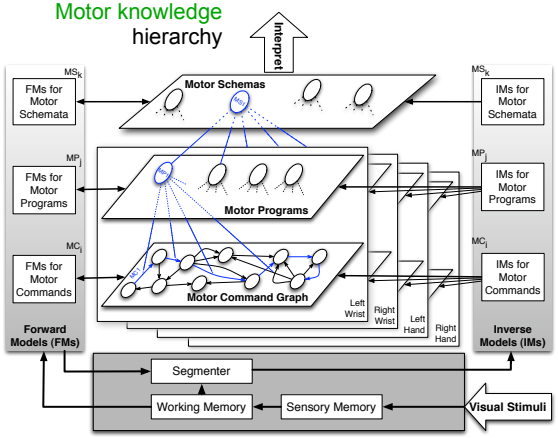
Sociable Agents

Projects in the Sociable Agents Group

- Speech-Gesture Alignment (SFB 673)
- Conceptual Motorics (CoR-Lab)
- Appropriate Dialogue Coordination
- Imitation Mechanisms of Social Resonance
- Familiarity & Compansionship
- Adaptive Embodied Communication
- Routinization - Cognitive building blocks of syntactic structure
- Machine Learning of Interaction Sequences



Motor knowledge hierarchy

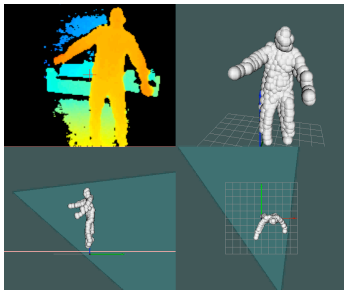


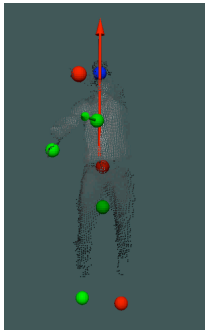
Forward models: predict & evaluate

Inverse models: analyze & learn

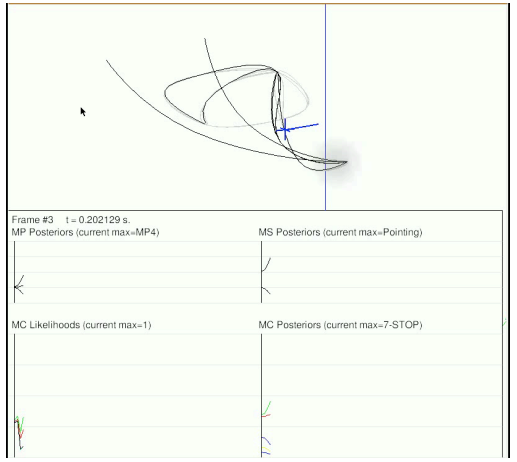
Preprocess: memorize & segment

3D time-of-flight camera (SwissRanger SR3000)





Marker-free tracking software *iisu* (Softkinetic)

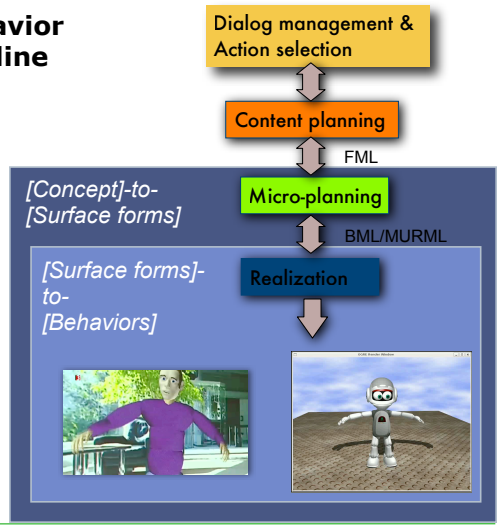


Schemas: {Pointing, Waving, Circle}

Programs: {P1, P2, C1, W1}

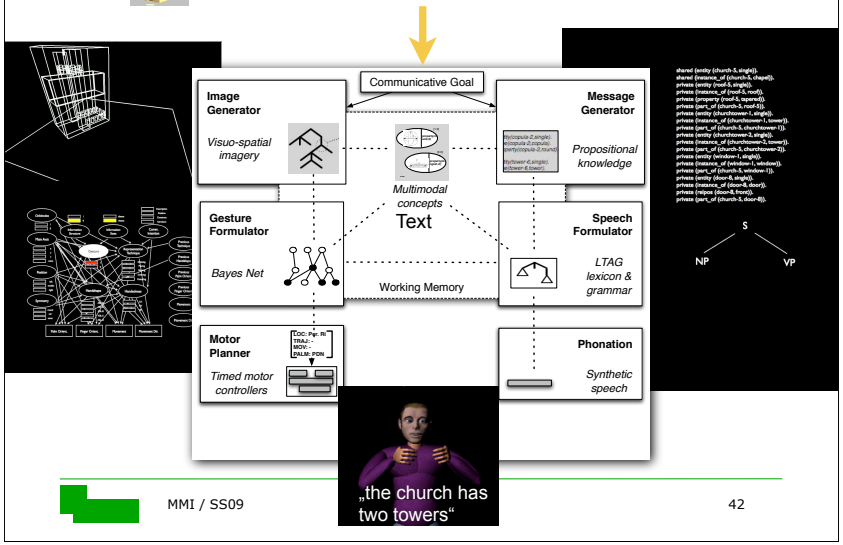
Commands

Interactive behavior generation pipeline



Articulated Communicator Engine (ACE)

Communicative goal:
DescrConstruct (church-5, churchtower1, churchtower-2)



„the church has two towers“

Summary

- HCI has been concerned with usable tools, starting to look into interactive and collaborative systems
- Formal models and systems for framing collaboration as a joint activity are around
- Social and relational behavior can be exploited carefully to foster collaboration
- Embodied companions offer great promise for increasing engagement, coordination, and interaction, and for studying how basic abilities of cooperation can be acquired via social learning

Overall summary

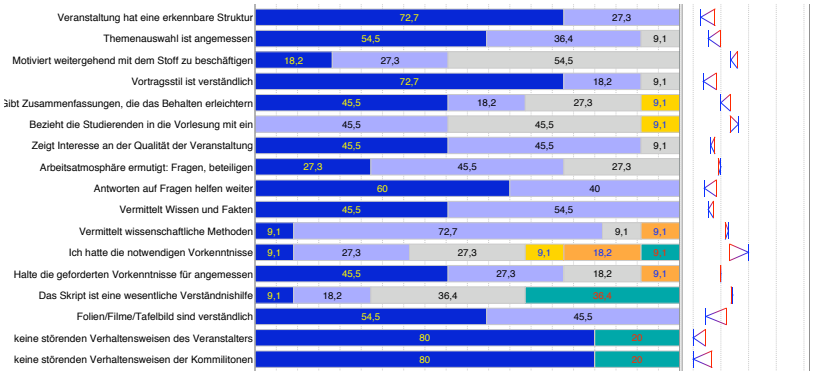
Human-Computer Interaction

- Basic goals, views, history
- Human User: perception, attention, memory, reasoning, action
- Interface styles & technology
- Usability & user-centered design: guidelines, design process, evaluation
- Natural language: recognition, synthesis, understanding, generation
- Dialog: problems, methods, systems
- Multimodal interfaces: multi-modality, fusion, fission
- Agent-based interface: conversational agents, collaborative agents
- Social Aspects: effects, social & relational agents

Evaluation

Was war gut:

- Die interessante Themenauswahl und Vorstellungsweise.
- nicht nur Theorien, sondern auch praxisrelevantes Wissen



Abschlussprüfung

- Mündliches Kolloquium
  - 15-20 Minuten
  - Fragen zur Vorlesung (Folien)
- Datum: 11./12.8., jeweils 9:00-17:00
- Anmeldung bis zum 7.8. bei Petra Udelhoven
  - petra@techfak.uni-bielefeld.de
  - Q1-142
  - 0521/106-12142

Praktikum „Communicative Robots“

4 SWS, 4 LP, Di 16-18 + praktische Arbeit

Sprachliche Kommunikation findet in der Regel in Form von koordinierten Dialogen mit koverbalem Verhalten statt, wie sie auch zunehmend für die Mensch-Maschine- bzw. Mensch-Roboter-Interaktion in den Blick genommen werden. Im Praktikum "Communicative Robots" wird die praktische Modellierung derartiger Interaktionsfähigkeiten auf Robotern thematisiert.
1. Seminarteil: theoretischen Grundlagen
2. Praxisteil: multimodales Sprachdialogsystem für "Tux Droid" implementieren, in einem einfachen Szenario angewenden und evaluieren