Trust in Social HRI

Attributes which influence the trust in a robot

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Outline

Why is this topic relevant?

Motivation

Figure: "Buddy" the companion robot [Blu17]

What is social HRI?

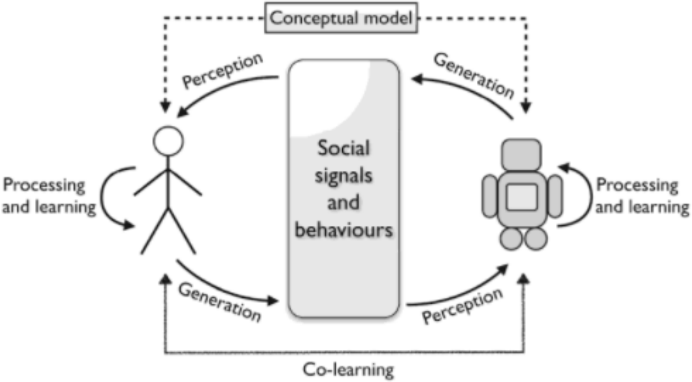

Figure: Human-robot interaction in a social context [SD17]

Why is trust important?

- No trust = robot is not used
- Too much trust = robot is misused

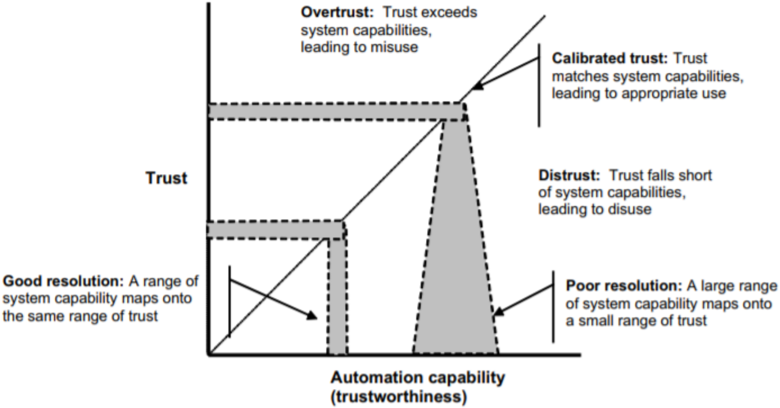

Figure: Relation between Capability and Trust [LS04]

Outline

What influences Human-Robot Trust?

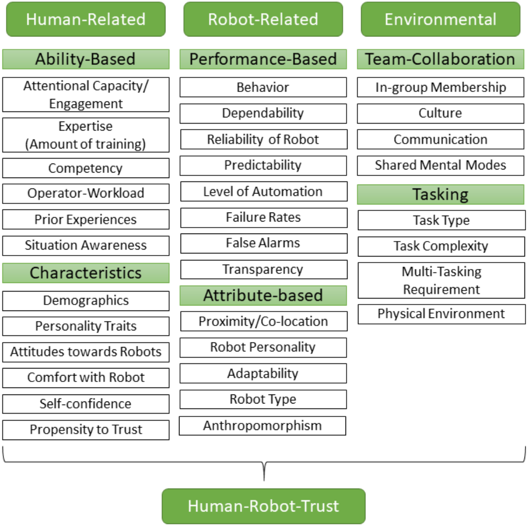

Figure: Factors which influence trust [Sch13]

What influences Human-Robot Trust?

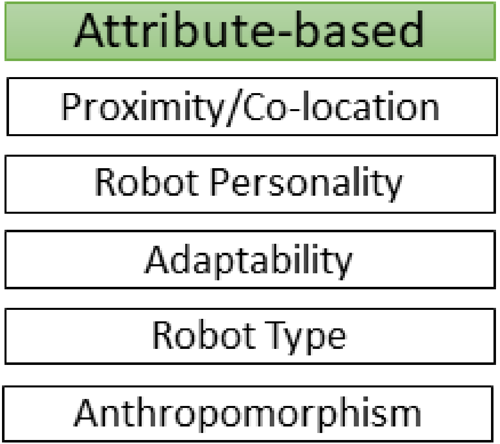

Figure: Factors which influence trust [Sch13]

Outline

Anthropomorphism

- Humans generally prefer familiar objects/shapes/faces
- Humanoid robots are judged as more likeable, intelligent, ...
- BUT:

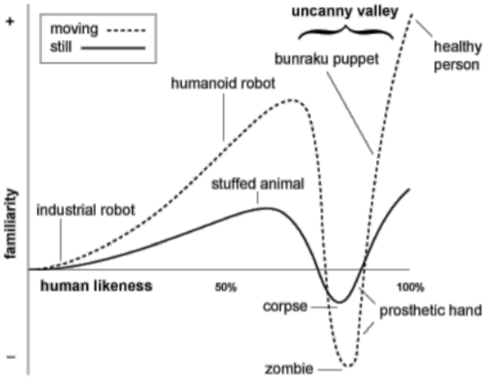

Figure: The uncanny valley [Mor70]

Matching robot behaviour I

- Goetz et al. [GKP03] tested two competing hypotheses
- Natural preference of attractive people with positive attitude ("Positivity hypothesis")
- Appearance and task-type should match ("Matching hypothesis")
- Study compliance to robot regarding robot behaviour:

Types/ Compliance in seconds	Playful robot	Serious robot
Fun task	218	148
Serious task	95	125

Matching robot behaviour II

→ Behaviour and appearance influence willingness to comply

→ **Match robot to task to improve trust**

+ Easy to switch from playful to serious behaviour (e.g. change of words)
– General appearance not so easy to adapt
– Robot has to be able to understand the tone of a task
– Adapting only to the task might not work for all users

Adapting proxemics I

- People adapt distance to interaction partner (0.5 – 3.5m)
- Standing too close to someone makes us uncomfortable

→ Robot should adapt distance to increase trust

- If robot stands too close, cameras can't capture all of the human

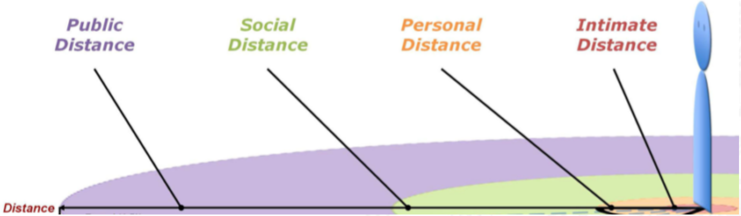

Figure: Distance types of proxemics [MM17]

Adapting proxemics II

- Studies found that people stand closer to robots (0.3 – 1.3m) [HRI16]
- Cues for proxemics subtle (Tone of voice, posture, ..)

+ Important aspect of social interaction
+ Necessary to adapt to increase performance (speech/posture recognition)
– Difficult to find balance between social aspects and functionality
– Reasons for moving might have to be communicated

Vocal cues I

Effects of different voice types (human /robot) and gender studied by [EKHR12]

- People perceived human-like voice as significantly more likeable
- Both genders tend to perceive a voice of their own gender as more likeable
- Males felt significantly closer to a male-voice

→ **Adapt voice type to the user**

Figure: [Pixabay.com]

Vocal cues II

Why do so many computer-assistances have a femal voice?
"It's much easier to find a female voice that everyone likes than a male voice that everyone likes" [Gri11]

+ Human-like voice significantly improves closeness (Trust)
+ Initial positive reaction towards robot apperance reinforced with voice
– Gender of voice has to fit the appearance
  → Design choice, which can't be adapted
– Only relevant if the communication is performed via speech
– Complex speech generation might not sound very human-like yet

Gaze I

- Interaction more fluent, if human can predict what the robot is doing next
- Indicater of intentions = eye gaze
- Gaze also shows attentention / distraction
- Gaze example

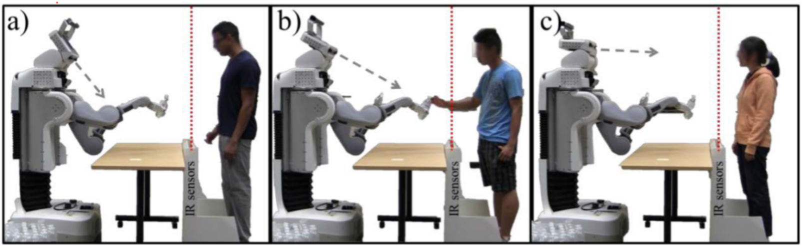

Figure: Reaction to handing over an object [MTG+14]

Gaze II

- High level of mutual gaze = High level of trust
- Too much mutual gaze might make the dialogue partner uncomfortable

+ Robot looks lifeless without gaze
+ Smoother interaction with humans
− Head and eyes have to be turned, even if not necessary for "seeing"
− Level of mutual gaze has to be adapted to user

Gestures I

- Human-like robots are expected to behave human-like
- Gesturing is an essential part of communication
- Gestures can covey information which speech cannot provide
- Study by Salem et. al [SKW+12] to see effects of (in-)congruent gestures accompanying speech

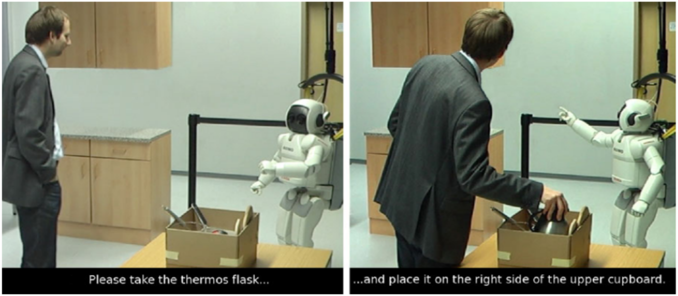

Figure: Asimo instructing a participant [SKW+12]

Gestures II

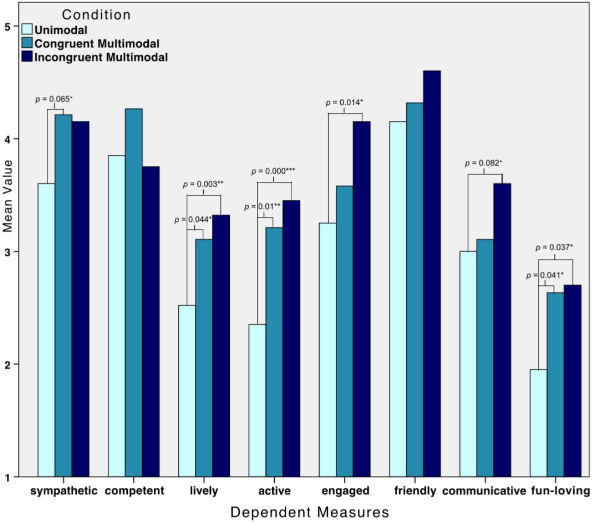

Figure: Results of the study [SKW+12]

Gestures III

- Gesture example
- Even non-perfect gestures add trust
- Some level of information convayable with only gestures

\+ Significantly improves trust
\+ Could be used instead of generating speech
\+ Gestures don't have to be perfect
– Some gestures can't be performed while handling another task
– Adds further problems (e.g. Need for space to perform gestures)
– Different gestures for different types of robots necessary

Example for a gesture generation implementation I

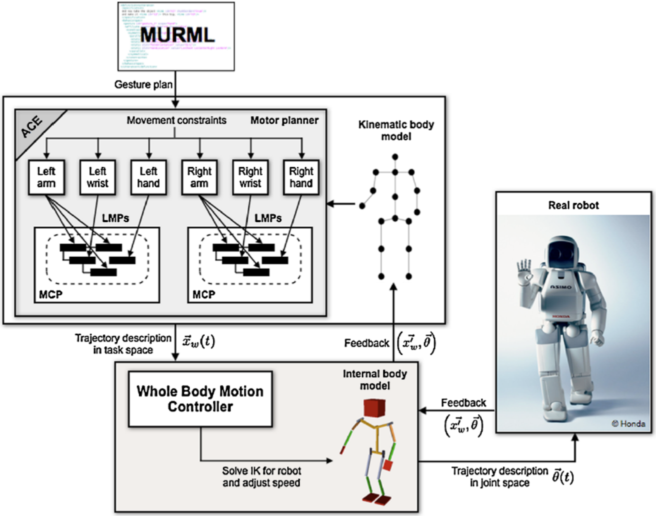

Figure: Generation of gestures [SKW+12]

Example for a gesture generation implementation II

- MURML “provides flexible means of describing gestures [..] and expressing their relations to accompanying speech” [KKW12]
- ACE generates movement according to constraints and the kinematic body model
- Wrist position and orientation are transmitted to the Motion controller (Task space)
- The motion controller solves the IK (Inverser kinematics)
- Information about join positions is handed to the real robot
- Feedback loop updates the internal model

Outline

Summary

- Attributes have to be selected according to area of operation
- Always ask: How social does my robot have to be?
- Don't forget: Performance has higher impact on trust
- Be aware of the uncanny valley effect

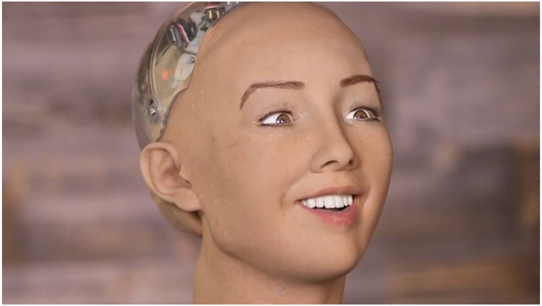

Figure: Sophia [Cam16]

Thank you for listening! Questions?

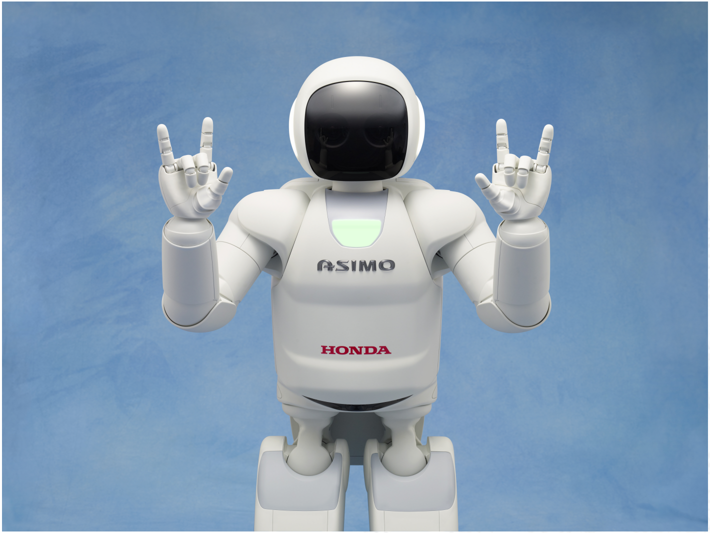

Figure: ASIMO signing "I love you" [Hon17]

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