Seminars in AI & Robotics: Social Robotics

Mary Ellen Foster
MaryEllen.Foster@glasgow.ac.uk

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Exam arrangements

Choose a paper from the proceedings of:

- HRI 2018 http://humanrobotinteraction.org/2018/proceedings/
- ICSR 2017 https://www.springer.com/gp/book/9783319700212
- IEEE RO-MAN 2017 https://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8116593)

Prepare and submit a 3-page report on the paper, including

- Summary of problem addressed and solution
- **Discussion on your opinion of the positive and negative points of the paper!**

If you presented in the HRI elective, **you cannot choose the same paper!**

Watch Moodle site for more details of paper selection and submission process

Today’s topic: social interaction

What is social interaction?

Why do robots need to be social?

- Early discussion (Breazeal, 2004)
- More recent discussion (Breazeal et al., 2016)

Social robotics for children (and adults) with autism

Social robotics “in the wild” – practicalities and challenges

What is social interaction?

“**Social interaction** is the way people talk and act with each other and various structures in society. It may include interactions such as a team, family or bureaucracy that is formed out of the need to create order within the interaction itself.”

Simple English Wikipedia
https://simple.wikipedia.org/wiki/Social_interaction

Why do robots need to be social?

Rayna meets a “robot” – https://youtu.be/h1E-FlguwGw

Social Interactions in HRI: The Robot View (Cynthia Breazeal, 2004)

IEEE Transactions on Systems, Man and Cybernetics, Part C (Applications and Reviews). Volume 34, Number 2, pages 181–186. https://doi.org/10.1109/TSMCC.2004.826268

Interaction paradigms in HRI

1. Robot as tool
2. Robot as cyborg extension
3. Robot avatar
4. Robot as sociable partner

Main distinctions between levels: mental model human has of robot while interacting

Shared challenges across all levels

Shared control between robot and human

1. Self-navigation
2. Basic reflexes; local feedback from synthetic skin
3. Coordination of speech, gesture, gaze, facial expression, and addressee
4. Share control of dialogue and exchange of speaking turns

Understanding intention (internal state) of other

Allows both parties to coordinate and synchronise behaviour

Work as a team, correct misunderstandings, compensate for difficulties

How should people interact with “sociable” robots?

Humans (trained and untrained) will treat computers as they would treat other people, **provided that the technology behaves in a socially competent matter** (Reeves and Nass, *The Media Equation*, 1996)

- Since humans have evolved to be experts in social interaction, a social interface may be a **truly universal interface**

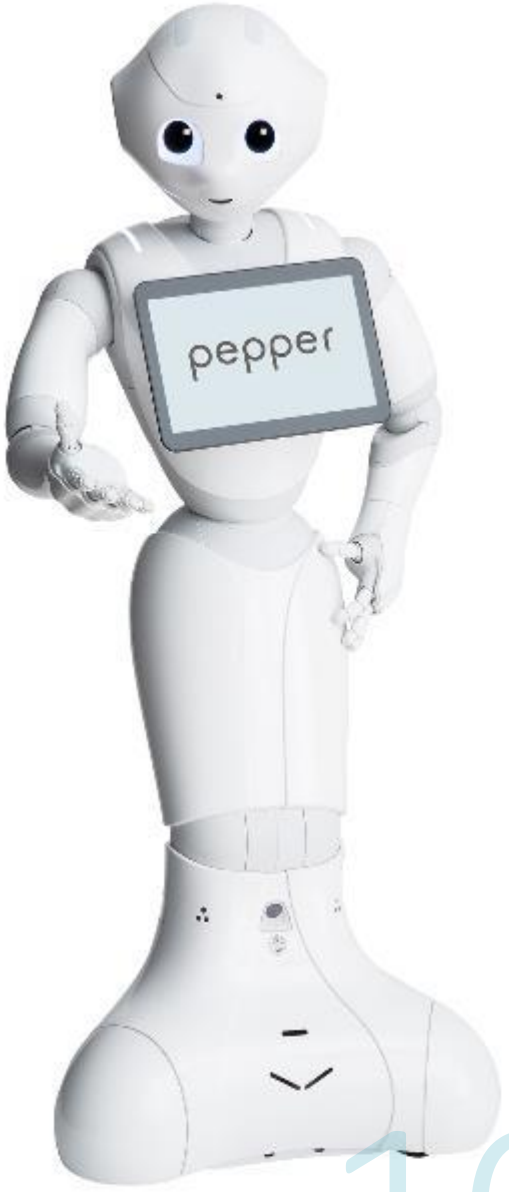
Assumption: humans will accept robots as social partners *if* the robot displays rich social behaviour

Advantages of social robots

People will find working with them more enjoyable – and would feel more competent

Communicating with them will not require any additional training – humans are already experts in social interactions

If robot could engage in social learning (imitation, etc) – would be easier for humans to teach robots new tasks



Suggested study directions in HRI

Comparative media

How does interacting with robotic technologies differ from other interactive media (such as software agents)? In what ways is it similar?

Naturalness

How are people naturally inclined to interact with this sort of technology? In what ways will people try to teach it?

User expectation

What are people's implicit expectations for the robot's capabilities? For instance, do people expect the robot to communicate using natural language?

Suggested study directions (2)

Quality

How does one design robots that are enjoyable, useful, and rewarding for people to interact with? What aspects make the robot more appealing and engaging? What aspects make the robot intimidating or annoying?

Relationship

What should be the nature of the human–robot relationship? What social roles are appropriate for robots?

Teamwork

How can robots serve as effective members of a human–robot teams?

Suggested study directions (3)

Personality

How does the person’s personality impact the design of the robot? Should the robot be designed to convey a personality itself? If so, of what type and how complex?

Culture

How do cultural attitudes impact the design? What kinds of behavior are socially acceptable verses inappropriate for a robot?

Acceptance

How do different underlying views (e.g., based on science fiction) impact the way in which robots are accepted and integrated into human culture?

What makes robots different?

- Long-term interaction
  - Robots share the physical environment – people cannot avoid encountering the robot, and robots can support long-term autonomous interactions
- Survival in the real world
  - Human designers cannot predict all possible circumstances and challenges
  - Robots must support robustness, adaptivity, and uncertainty
- Deeply integrated interface and control
  - It is the observable behavior that allows the robot to negotiate its way about the real world—whether it is physically manipulating objects, socially engaging people, or dealing with self-maintenance functions.

Also …

Interacting with people

Specific characteristics related to having a physical embodiment

Robot can share frame of reference with a human

Robots can manipulate real objects

Robots can locomote in the same physical space as humans and make direct physical contact

"A technology is not so easily dismissed when it has the ability to proactively seek you out and come into immediate contact with you."

Learning in the human environment

"One key challenge is to design robots that are as easy to teach as another person."

Socially guided learning: Key challenges

- Knowing what matters
  - State of learner’s attention must be transparent to robot
- Knowing what action to try
  - Human instructor could demonstrate action, or guide it (e.g., like an animal)
- Knowing when to learn and who to learn from
  - Explore vs. exploit – socio-emotional skills become important (e.g., childlike inquisitiveness)
- Correcting errors and recognising success
  - Human instructor provides feedback through various social channels
- Leverage from provided structure
  - Taking turns – robot’s observable behaviour should provide feedback to the instructor

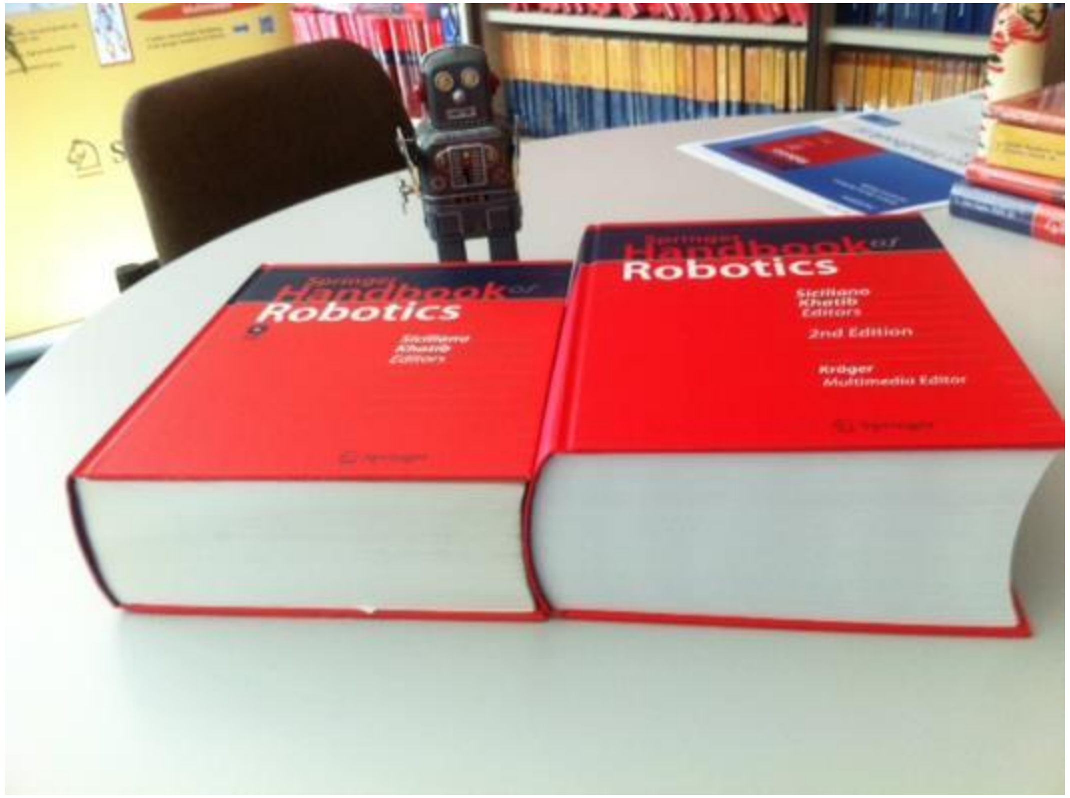
Conclusions (Breazeal, 2004)

- Giving a robot social capabilities has wide benefits
  - Robots can interact with people and use those interactions to perform tasks better and to learn
- Bringing a robot into the social world presents many challenges
  - Humans have evolved significant social and emotional intelligence
  - Robots need similar skills to exist successfully in the world and be accepted
- Developing measures for evaluating robot performance requires input from HCI, robotics, and other communities

More recent survey

Breazeal C., Dautenhahn K., Kanda T. (2016) Social Robotics. In: Siciliano B., Khatib O. (eds) Springer Handbook of Robotics. Springer, Cham. https://doi.org/10.1007/978-3-319-32552-1_72

Also: http://handbookofrobotics.org/ (relevant videos at http://handbookofrobotics.org/view-chapter/videodetails/72)



Design space of social robots

Socially interactive humanoid robots – participate in whole-body interaction with humans (dancing)

Android robots: very human-like appearance

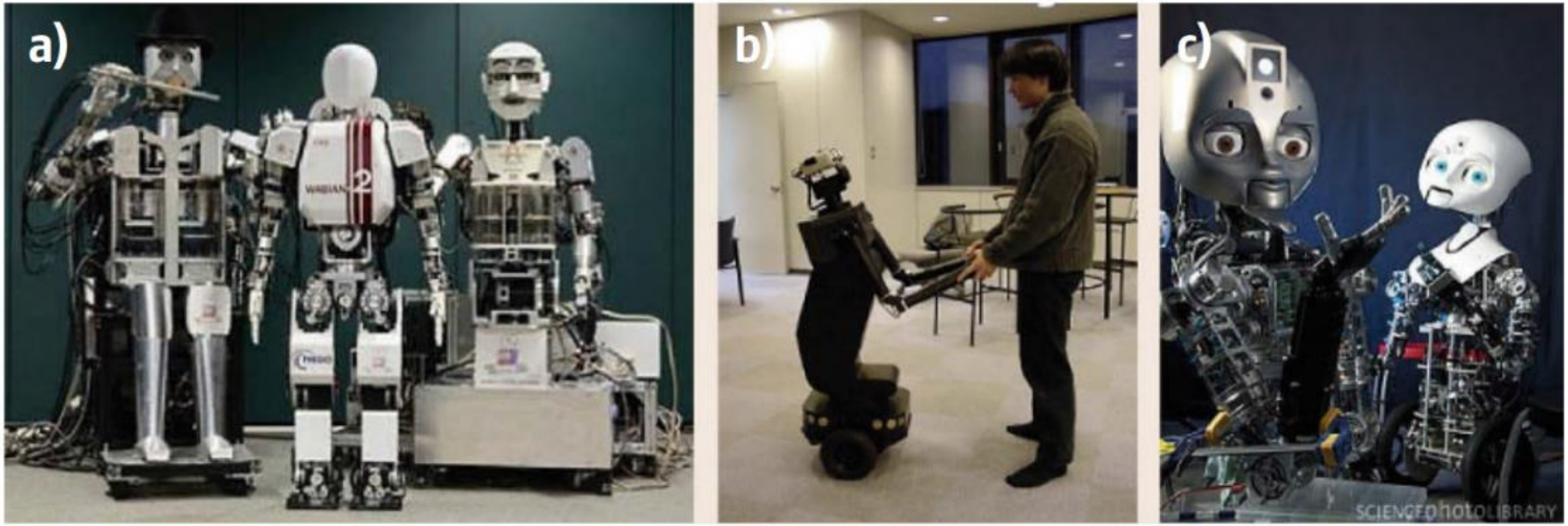
- Danger: "uncanny valley" (very human-like robots can produce unpleasant feelings)
  - *… although there is a lot more to the uncanny valley than that!* *https://www.frontiersin.org/research-topics/2385/the-uncanny-valley-hypothesis-and-beyond*

Creature-like robots – similar to animals (e.g., dogs)

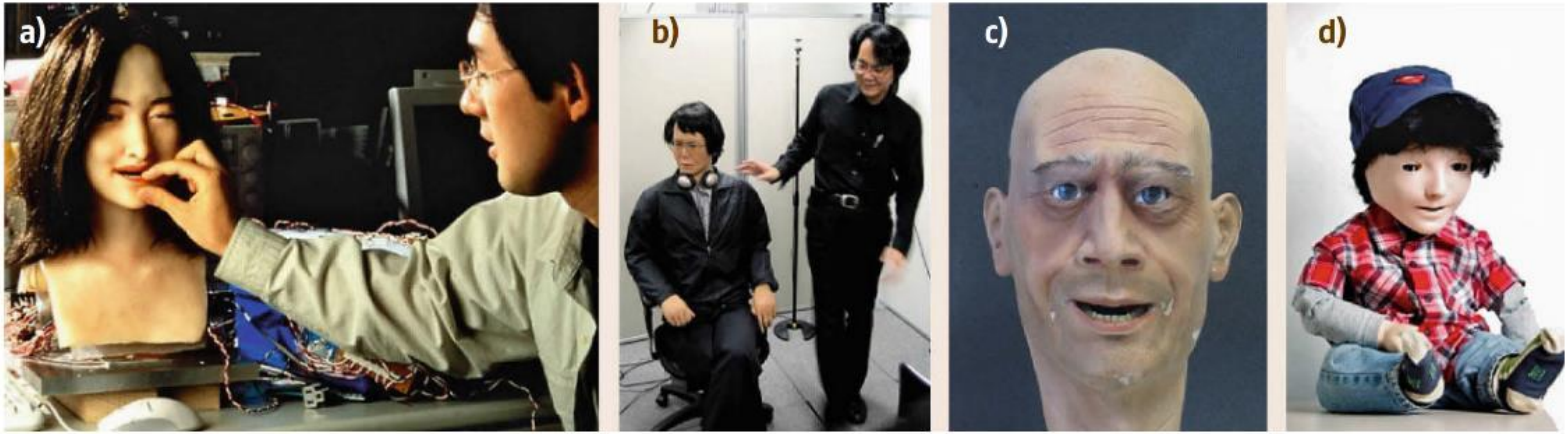
Not overtly humanoid or zoomorphic – capture key social attributes

Mobile social robots with faces

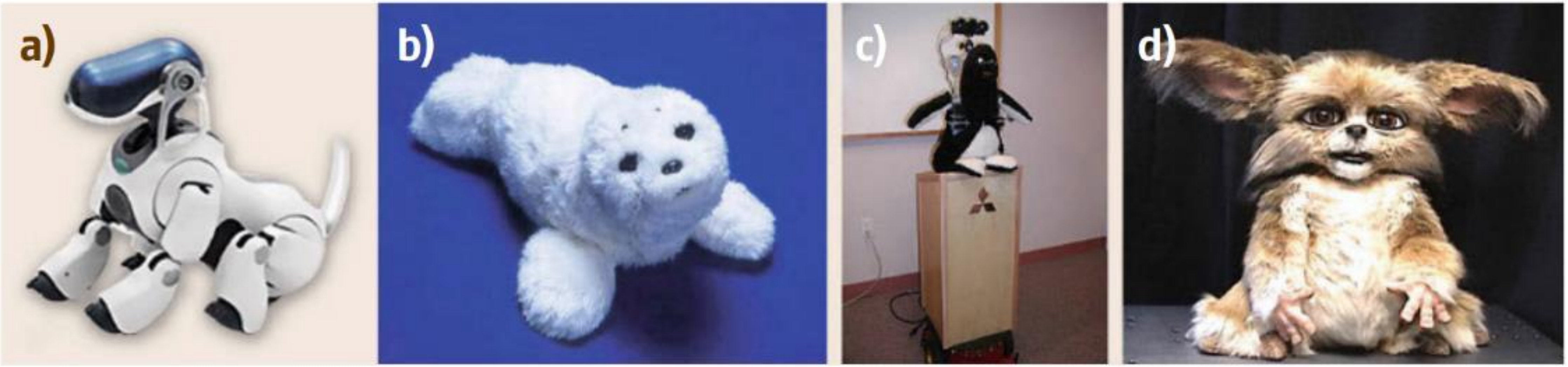
Socially interactive humanoid robots



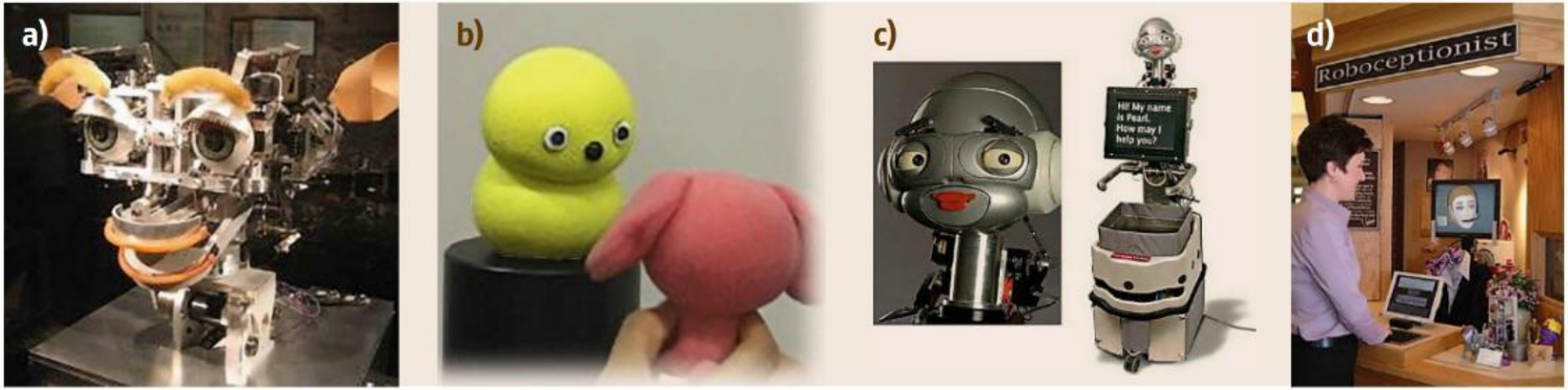
Androids



Animal-like robots



Neither humanoid nor zoomorphic



Socio-emotional intelligence

Robots need to …

- Recognise and interpret affective signals from humans
- Possess an internal model of emotions
- Communicate an affective state

Emotional displays can provide information about an agent’s internal state, and also elicit responses in response

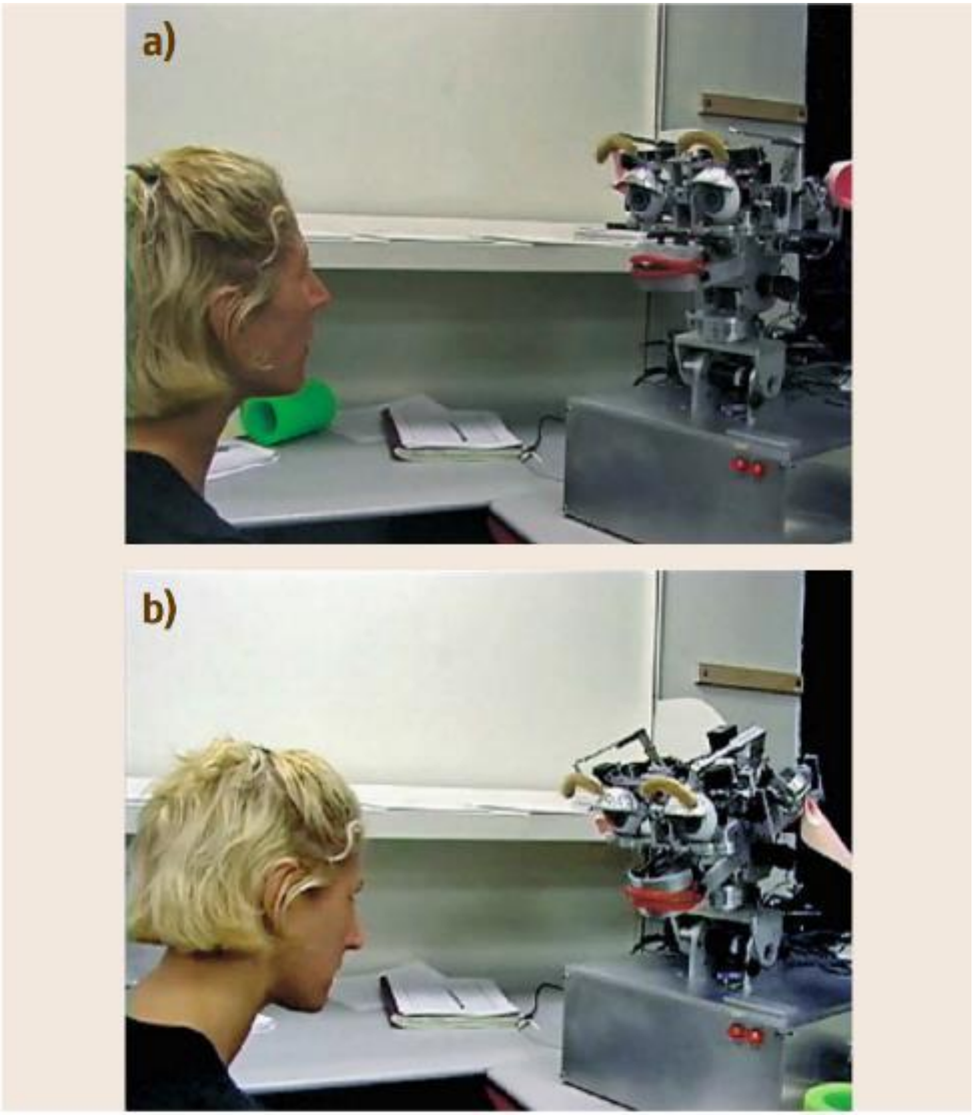
Emotional example: Kismet

First autonomous robot designed to explore socio-emotive face-to-face communication

Designed to be dependent on people to help satisfy goals

Facial expressions continuously computed based on affective state computed through **appraisal theory**

Many experiments focussed on mirroring emotions



Kismet video

http://handbookofrobotics.org/view-chapter/72/videodetails/557

Socio-cognitive skills

Socially intelligent robots must interact with entities whose behaviour is governed by having a mind and a body

Robots must recognise behaviour in terms of beliefs, intents, desires, feelings, etc.

Generally known as **Theory of Mind** (also mindreading, mental perception, social understanding, …)

Why do robots need theory of mind?

Robots must adjust behaviour as goals and needs change

Must flexibly attend to current objects of interest so that behaviour can be coordinated and focussed on the same thing

Perceiving a situation from different perspectives impacts knowledge

- … So they can bring important information to human's attention if needed

If robots are aware of affective state, they can prioritise what to do to please us or to do what is most relevant, important, or significant

Also, robot behaviour should adhere to user expectations so that they can use theory of mind as well

Mental perspective taking

Simulation theory: theory from neuroscience that parts of the brain are used to simulate the state of another person ("mirror neurons")

Some robot systems have used this as an inspiration

- Increase accuracy of action recognition by simulating environment of observed agent
- Reuse belief-construction system from human perspective to predict human beliefs
- Visual perspective taking to resolve references in human-robot collaboration
- Dynamically offer tools or support based on inferred goals or intentions

Robot inferring human's mental state

http://handbookofrobotics.org/view-chapter/72/videodetails/563

Human social responses to social robots

People respond more positively to artefacts with humanlike cues

- Increases social connection
- Helps people learn how to use it
- Enhances liking, engagement, and desire to collaborate

People hold richer mental models of anthropomorphic robots than mechanistic ones

Important: robot appearance and interface should match capabilities or user expectations, or else negative effects may result

Physical vs virtual embodiment

Advantages of physical social embodiment:

- Robots support physical contact in addition to visual and auditory cues
- Robots support joint manipulation of artifacts, shared physical space

Also, people show more trust, compliance, and enjoyment with physical robots

- Games, educational contexts, assistive tasks, health-related activities, Wizard-of-Oz user studies

Virtual agents can be difficult to understand with cognitive or social deficits

- Especially useful for, e.g., children with autism

Screens "capture eyeballs", robots support face-to-face communication

Social rapport and social support

Rapport: power interpersonal influence and responsiveness

Often signalled by coordinated social signals – robots can use this to build perceived rapport

Social support: helping people achieve personal goals (helped by rapport)

- Emotional support: empathy, nurturing, encouragement, acceptance
- Instrumental support: financial assistance, material goods, services
- Informational support: offering guidance, advice, information
- Companionship support: sense of social belonging and having another to participate in shared social activities

Social support applications

Can be provided by a robot through direct interaction, or indirectly by connecting people

Applications: tutors, learning companions, coaches, domestic helpers, therapeutic aids

Broad applicability in domains where it can extend and augment (not replace) social support provided by people

Communication skills

Basic tools: speech recognition and synthesis

However, in natural conversation, nonverbal cues are equally important

Early human-robot communication (1970s)

- Language was primary; other cues were processed in support of language
- Regulatory cues: gazes, poses, vocalisations
- State displays: indications of internal state
- Illustrators: pointing, iconic gestures

Human-robot dialogue

Basic (easier!) version: turn-based dialogue (including multi-party and multi-modal settings)

More recently: using the robot's motor behaviour to manage interaction (e.g., approaching in a certain way)

Another option: exploit joint attention to initiate an interaction

Challenges:

- Exploring and understanding the range of communication cues that are used
- Moving from turn-based architectures to dynamic structures

Long-term interaction with robot companions

Companion robots: provide companionship, and also (often) carry out tasks for users

Main application: assisting elderly/disabled people in their homes

Living lab settings often used to develop and test such robots

Engagement and long-term relationships

Relationship is affected by robot role, embodiment, and behavioural repertoire

Many social robots exist in short-term settings – often novelty effect can be exploited

After repeated interactions, novelty effect wears off – how to keep people engaged?

What is long-term?

- 10 hours?
- 3 months?
- 25 days?

Robot in shopping mall over several days

http://handbookofrobotics.org/view-chapter/72/videodetails/809

Field studies vs lab-based studies

Field studies often preferable, more **ecologically valid**

Challenges are significant (practical, technical, methodological)

Bringing a robot into the wild does not necessarily make interactions more “natural”

Ultimately, a companion may be amusing or a nuisance

Robots often do not fit into daily routines

Robot guiding children “in the wild”

http://handbookofrobotics.org/view-chapter/72/videodetails/808

Example: long-term HRI with a robot weight-loss coach

- Clear function and role – but also needs to be sure to interact in a socially appropriate and comfortable manner
  - Users must understand the robot, engage with it, and **listen** to it
- Key task: create a relationship between the user and the robot
  - Uses a physically inspired relationship model – robot as caregiver
  - Engages in dialogue inspired by patient-care professional dialogue
- Role of robot is different from, e.g., a kiosk – must **motivate** as opposed to providing information

Autom video

http://handbookofrobotics.org/view-chapter/72/videodetails/558

Long-term study

45 participants, 6 weeks with robot

Results were “very encouraging”:

- Participants developed a close relationship with robot
- Tracked calorie consumption and exercise longer with robot

Above factors related to long-term weight loss success

Challenges for long-term engagement

Many projects are in early stages – more results from long-term, multi-site trials needed

Key task: measuring engagement in real time and responding to it

- Before that: what is "engagement" and how can it be measured?

Identify robot features that lead to engagement (necessary and sufficient)

Ethical issues with human-robot relationships (more next week on this!)

Practical issues: charging, maintenance

Tactile interaction for social robotics

- Physical touch is a basic form of human communication
  - Plays crucial role in developing cognitive, social, and emotional skills
  - Establishing and maintaining attachment and social relationships
- Touch is important for social robots as well
  - E.g., shaking hands can influence perceived persuasiveness

Touch sensors for HRI

Tactile skin covering the whole body

Specific touch-sensitive areas (e.g., on Pepper)

Huggable robots – especially in the context of therapeutic/care focussed robots or toy robots

Sensor processing challenges

- Identify geometrical relationship between sensors and body parts
- Identify **semantic** relationship between sensor data and communicative intention

Example: teaching children with autism about tactile interaction

Focus on **robot-assisted play**

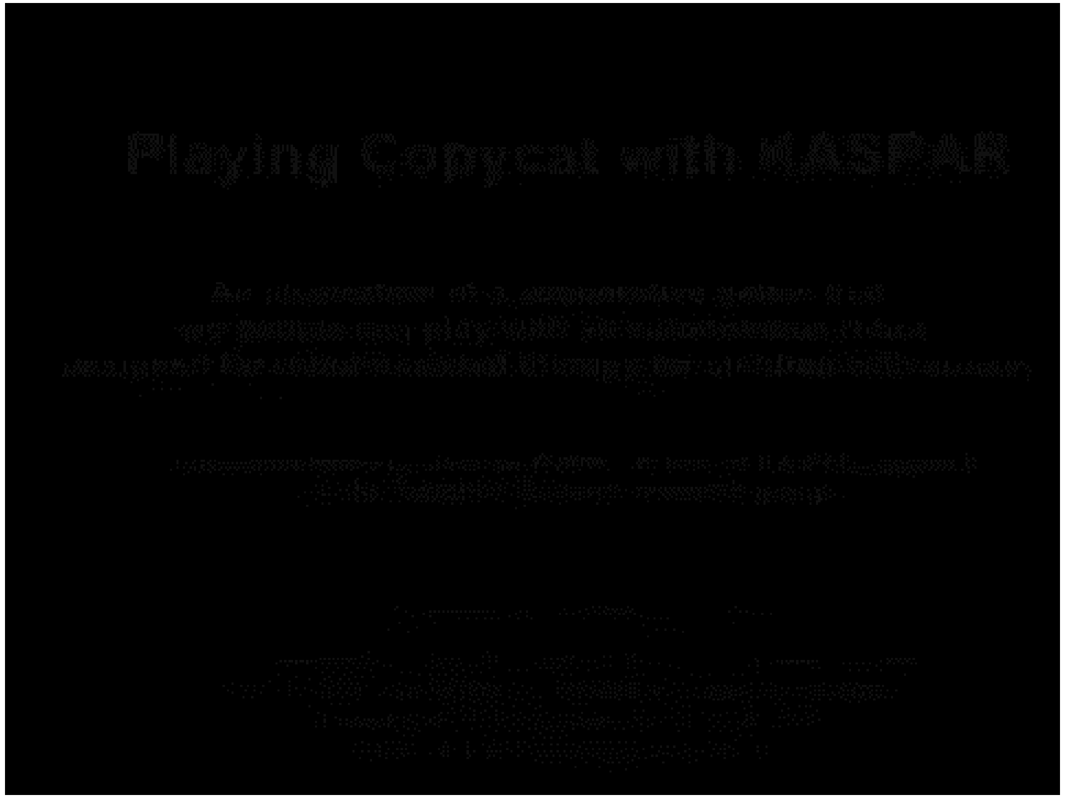
- Play allows children to learn about themselves and their environments and to develop cognitive, social, and perceptual skills

Robots allow a controlled and predictable environment where complexity can be gradually increased

Options:

- Dyadic games: children playing directly with robot
- Triadic games: two children, one robot – robot is a social mediator

Triadic interaction with Kaspar robot



http://handbookofrobotics.org/view-chapter/72/videodetails/220

Tactile studies for children with ASD

Tactile experiments – attach robot skin to Kaspar, respond appropriately based on different tactile interactions (tickling, hitting)

- Semi-autonomous – behaviour can be triggered by experimenter if sensors not present or signal not reliable

Steps in therapeutic play scenarios

1. Prevent or discourage repetitive behaviours
2. Help the child engage in play
3. Give a better pace to the game if it has already been experienced by the child
4. Bootstrap a higher level of play
5. Ask questions related to reasoning or affect

Social robotics and teamwork

Communication is crucial during joint action and collaborative tasks

Each teammate may have

- Partial knowledge
- Different capabilities
- Diverging beliefs about task state

All teammates must establish **common ground** to ensure task success

Coordination mechanisms

Spoken dialogue – speaker composes description that is intended as adequate, listener has goal of understanding the speaker – robust team behaviour

Non-verbal skills: visual perspective taking, shared attention

Human-robot team communication

http://handbookofrobotics.org/view-chapter/72/videodetails/555

Conclusions (Breazeal et al.)

Important goal of social robotics (applied HRI) is “the creation of robots that are human-compatible and human-centered in their design”

- Differences from human abilities should “complement and enhance our strengths and support how people help one another”
- Similarities to human abilities will “make them more intuitive for people to understand and interact with”

Social robots are also being used to help understand human social behaviour

Social robots have a wide range of applications, and are developing increasingly sophisticated repertoire of interaction possibilities

Will Smith meets Sophia the Robot

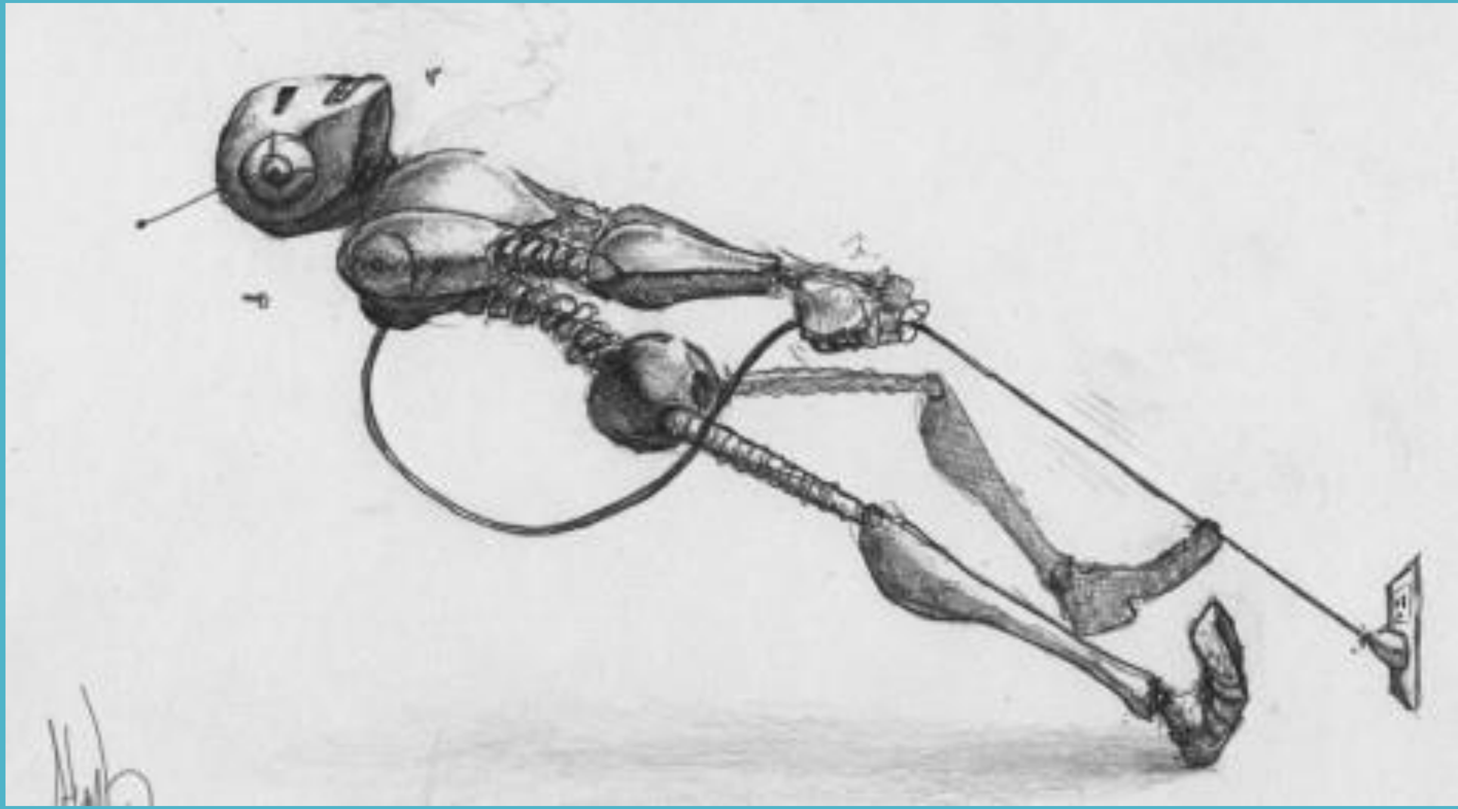
Video

https://youtu.be/Ml9v3wHLuWI

After the break …

Social robotics for autism therapy

Social robots “in the wild” – challenges



Unplug for 10 minutes

Social robotics for autism

Main source for this presentation:

Cabibihan, JJ., Javed, H., Ang, M. et al. Why Robots? A Survey on the Roles and Benefits of Social Robots in the Therapy of Children with Autism. Int J of Soc Robotics (2013) 5: 593. https://doi.org/10.1007/s12369-013-0202-2

Other useful references:

Joshua J. Diehl, Lauren M. Schmitt, Michael Villano, Charles R. Crowell. The clinical use of robots for individuals with Autism Spectrum Disorders: A critical review. Research in Autism Spectrum Disorders, Volume 6, Issue 1, 2012, Pages 249-262. https://doi.org/10.1016/j.rasd.2011.05.006.

Pennisi, P. , Tonacci, A. , Tartarisco, G. , Billeci, L. , Ruta, L. , Gangemi, S. and Pioggia, G. (2016), Autism and social robotics: A systematic review. Autism Research, 9: 165-183. doi:10.1002/aur.1527

Background on Autism

Developmental disorder that involves impairment of social relationships, communication, and imagination

Severity and nature of symptoms vary among individuals

“If you’ve met one person with autism, you’ve met one person with autism”

No single best therapeutic approach established as the best

Triad of impairments:

1. Social relationships/interaction
2. Social communication
3. Imagination

Social relationships/interaction

In some cases, complete indifference to others

For other people, desire to make friends, but unable to understand social cues, and others' behaviours and feelings

Absence of mentalising ("theory of mind")

Social situations are challenging and stressful

Children with autism often play alone rather than cooperatively

Lack of social/environmental exploration prevents learning of fundamental skills and hinders developmental progress

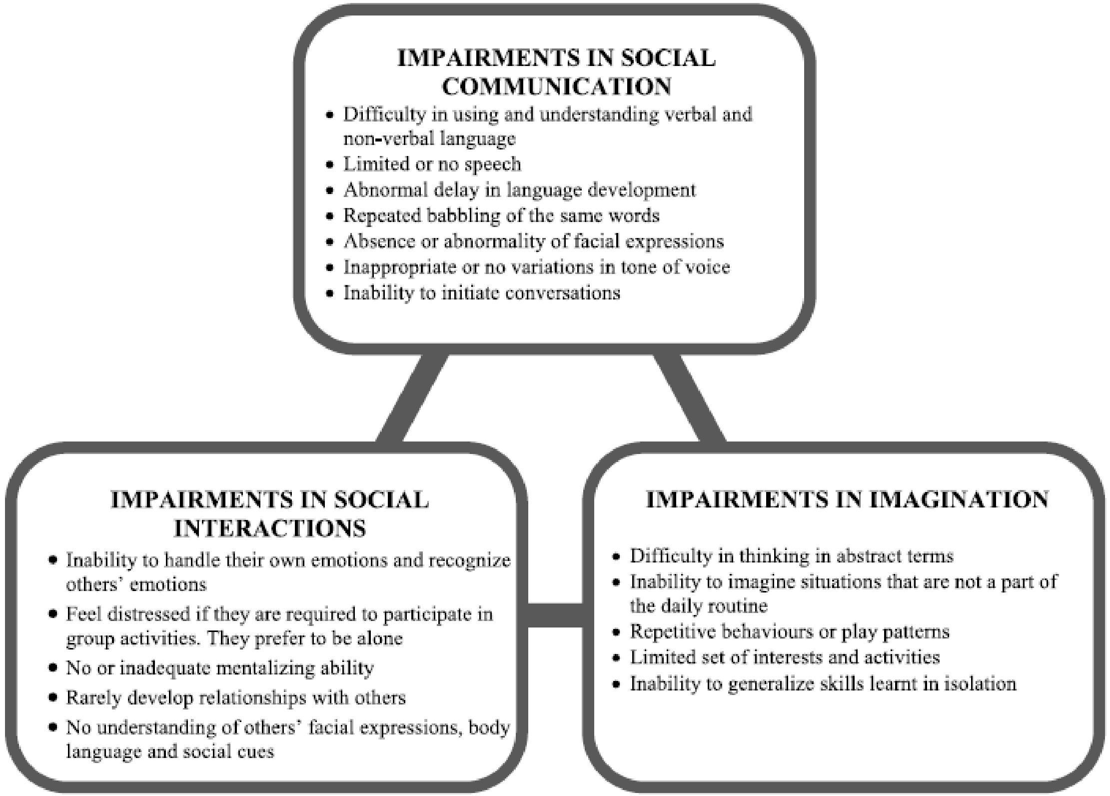
Social communication

- Difficult with verbal and non-verbal communication
- Speech may be absent, or may be impaired in tone and pitch variation
  - Impairments in use of intonation, lack of understanding of others’ use
- Speech may be focussed on individual’s own obsessive ideas rather than conversation
  - Consequence of inability to read deeper meaning of situations
  - Inability to initiate or contribute to conversations
- Non-verbal signals tend to be learned from social environment
  - So individuals with autism tend not to learn them …
  - … Which means individuals with autism tend to have limited understanding and expression of social cues

Imagination

- Sometimes inability to generalise skills learned in isolation to other situations
- Results in rigid way of thinking and doing, repetitive actions, narrow interests
- Changes in routine met with anxiety and distress
  - Play patterns, food choices, activity schedules, etc
- Lack of imagination and play skills
- Profound impact on daily lives of children and families

Summary of impairments



More background on autism

- “Asperger’s syndrome” – higher functioning end of spectrum
- Rate of occurrence (across the spectrum): estimated 1 in 88 children in US
  - Rates vary due to different approaches, cultural contexts
- Not every person shows all of the impairments – for diagnosis one needs
  - Six symptoms from across the “triad”
  - At least two from **social interactions**
  - At least one from **social communication** and **imagination**
- No knowledge of cause – likely combination of genetic, cognitive, and neural factors

Social robotics and autism

Social robots are able to
- Communicate and perceive emotions
- Maintain social relationships
- Interpret natural cues
- Develop social competencies

Used as tools to teach skills to children with autism, to play with them, and to elicit desired behaviours

Create interesting and meaningful situations that compel children to interact

Demonstrated to work better than other computer-mediated therapy options

Design features: appearance

Visual: bright colours but not too bright; colour different body parts for emphasis; different shapes, lights, rotation appealing; avoid sharp edges, ropes, bright colours

Realism: not too human-like or too machine-like; facial expressions should be simplified; child must always be aware it is artificial

Size: roughly same size as child – permits eye contact, encourages transfer, not too intimidating

Design features: functionality

Sensory rewards: correct execution of task must be rewarded – explicit positive feedback; could be light, sound, or clapping

Locomotion: children with autism are attracted to moving things; interaction is enhanced if robot can interact with other objects (e.g., kicking a ball)

Choice and control: learning is more effective if child can make choices; e.g., if child can choose reward (with a button), they will be more engaged in getting that reward

Other design features

Safety: children can be impulsive or exuberant – robot should have no sharp edges, and ideally should be able to survive being dropped or thrown at a wall

Autonomy: therapist should not need to control every action – however, with current tech, presence of a human decision maker is still vital

Modularity and adaptability: children with ASD vary in preferences – robot should be able to adapt; also, hardware should be replaceable if damaged; robot behaviour should show progressive growth to support continuous training

Robots that have been used

Behaviours to elicit

Imitation – nearly every study does this; learning new skills, exploring physical env't

Eye contact – naturally deficient, so robot support is highly valuable

Joint attention – following, and later initiating; promising direction

Turn-taking – engaging in simple games with robot, e.g., kicking balls

Emotion recognition and expression – simple designs and expressions can help

Self-initiated interactions – robot only performs actions after child requests

Triadic interactions – child + robot + therapist – helps with generalisation

Categorisation of robot roles in therapy

Diagnostic agent

Friendly playmate

Behaviour eliciting agent

Social mediator

Social actor

Personal therapist

Robots are less complex than humans

Robots make embodied interactions possible

Robots are less intimidating than humans

Current projects on social robots for ASD

DE-ENIGMA – sophisticated sensing for child-robot interaction

SoCoRo project – job skills for adults with ASD

DE-ENIGMA

http://de-enigma.eu/

Project objectives

Goal: create robust, context-sensitive, multimodal and naturalistic human-robot interaction (HRI) aimed at enhancing the social imagination skills of children with autism

Extends state-of-the-art in social signal processing and long-term adaptive child-robot interaction

Preliminary results (18 months)

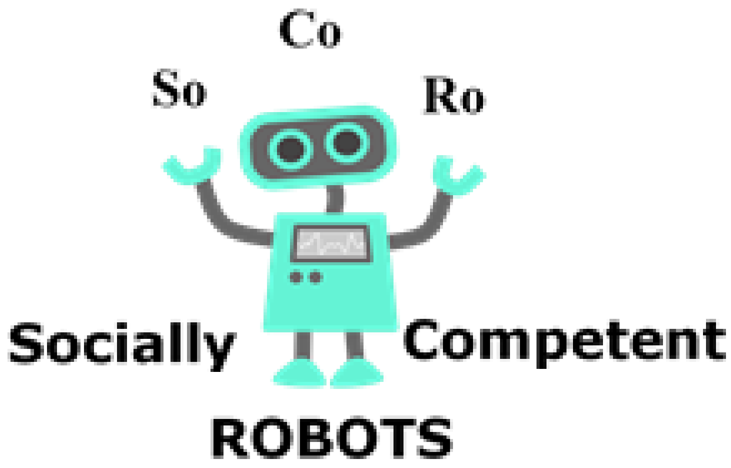
Children participated in sessions with “Zeno” robot in Belgrade and London

Almost all children showed improvement in socio-emotional skills and their use in context; including:

- Improving social interaction, developing relationships with people through Zeno;
- Developing empathy, ability and desire to help others;
- Improving social interaction, skill of sharing with others, control and subtle display of emotions;
- Developing empathy and an adequate response to the emotions of others;
- Improving communication and vocabulary (in verbal children).

DE-ENIGMA project video

SoCoRo

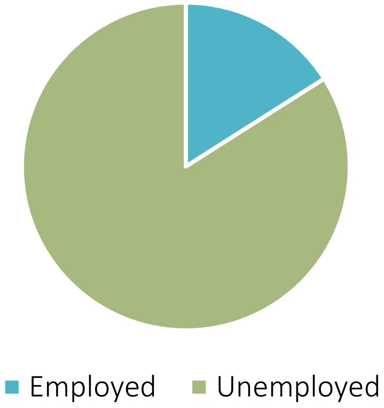


Presentation based on slides by Peter McKenna, Thusha Rajendran, and Frank Broz

Lifespan of high-functioning adults with an ASD

KASPAR the robot

FTE of adults with ASD in UK



Infancy

Primary education

Secondary education

Unemployment

Employment

Higher education

ASD in the workplace

People with ASD have trouble interpreting social signals

- Facial expressions
- Vocalisations
- Gestures

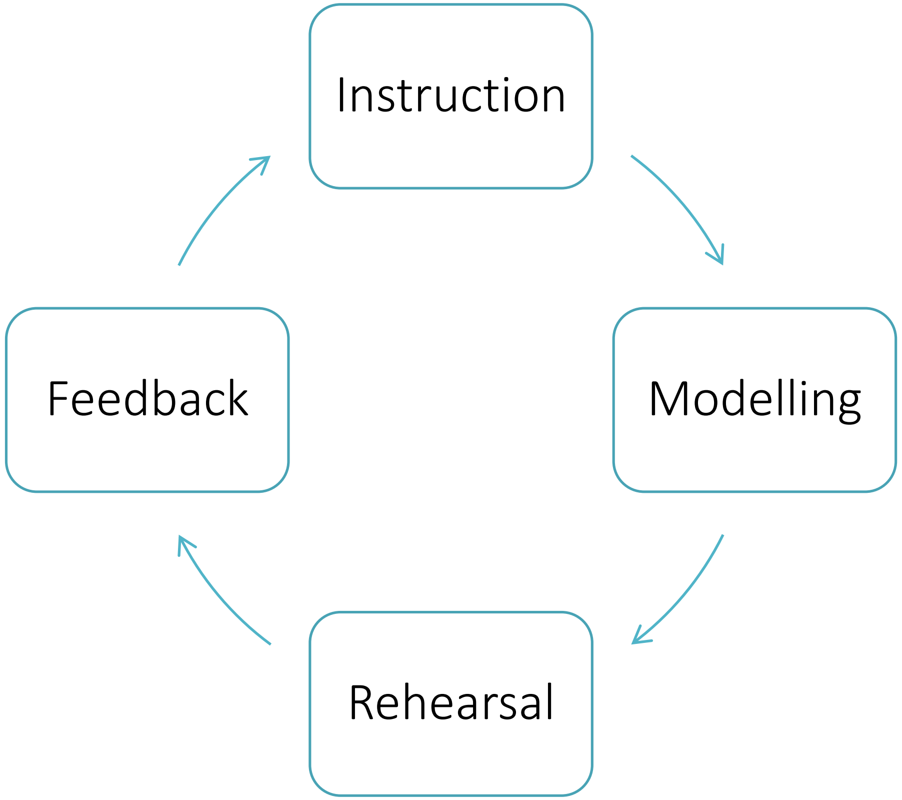
Cues about intentions

Can't correctly interpret co-worker or supervisor behaviour

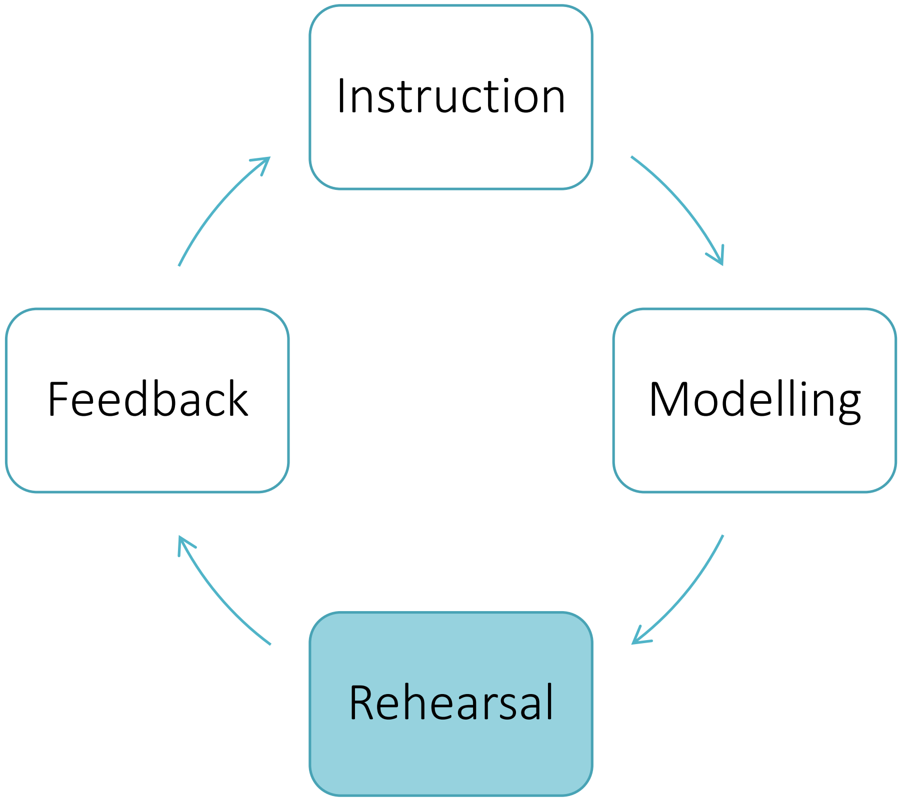
- Leads to workplace conflict

"Oh, yeah? Lewis, you're fired! You apparently forgot this is a cartoon, and I can read every word you think!"

Therapy: Behavioural skills training (BST)



Therapy: Behavioural skills training (BST)



Social signal processing in the workplace

Why robots?

Signal-to-noise ratio

Feasible workplace social skills of interest

Interpreting facial expressions

Coping with interruptions/transitions

Completing time-sensitive tasks

Dealing with feedback

Expressive behaviour

Approval

1: Head up, jaw drop

2: Outer brow raiser, lips part

3: Wink, head left

4: Upper lid raiser, jaw drop

Disapproval

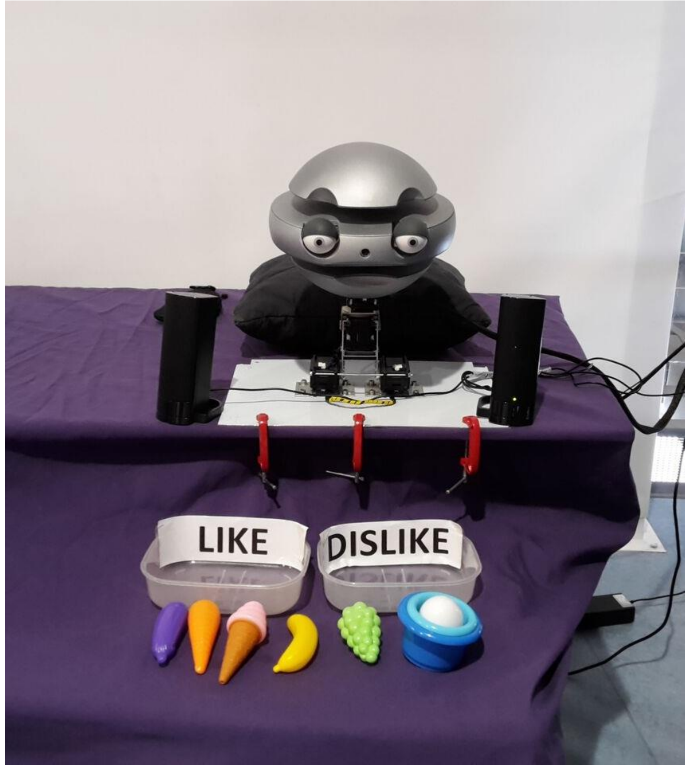
5: Inner brow raiser, lower lip depressor

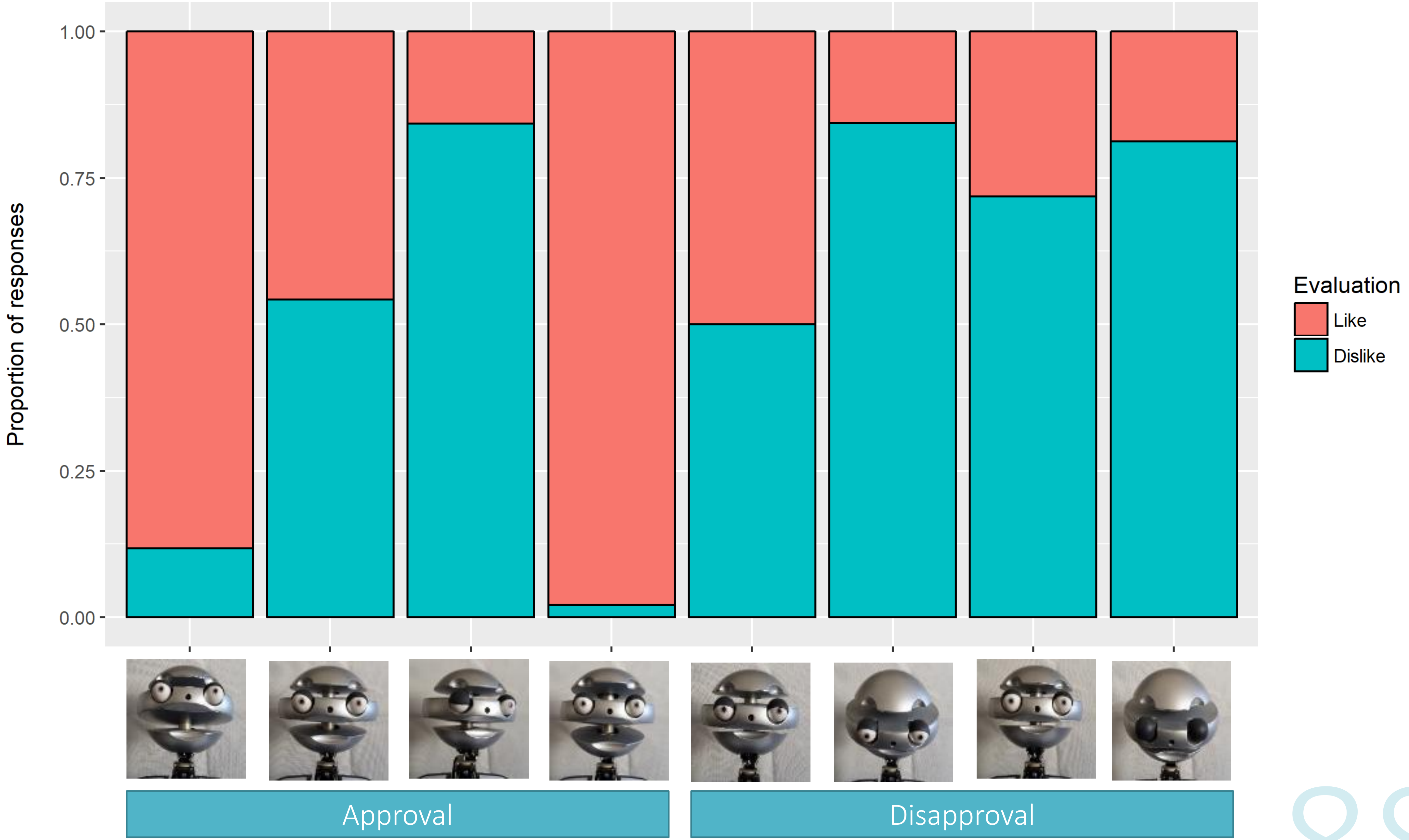
6: Chin raise, head down

7: Brow lowerer, chin raise

8: Eyes closed, head down

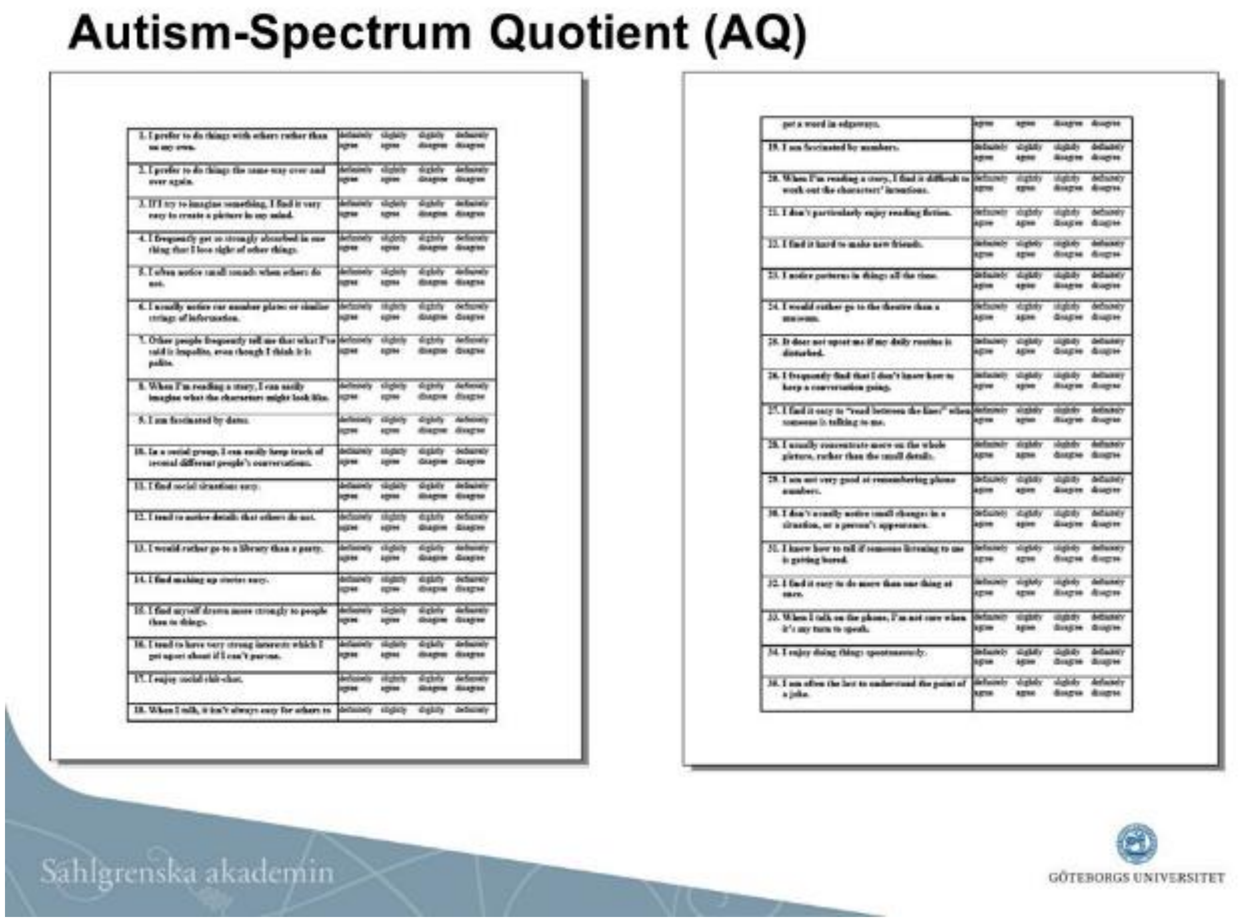
Experiment 1: Example trial



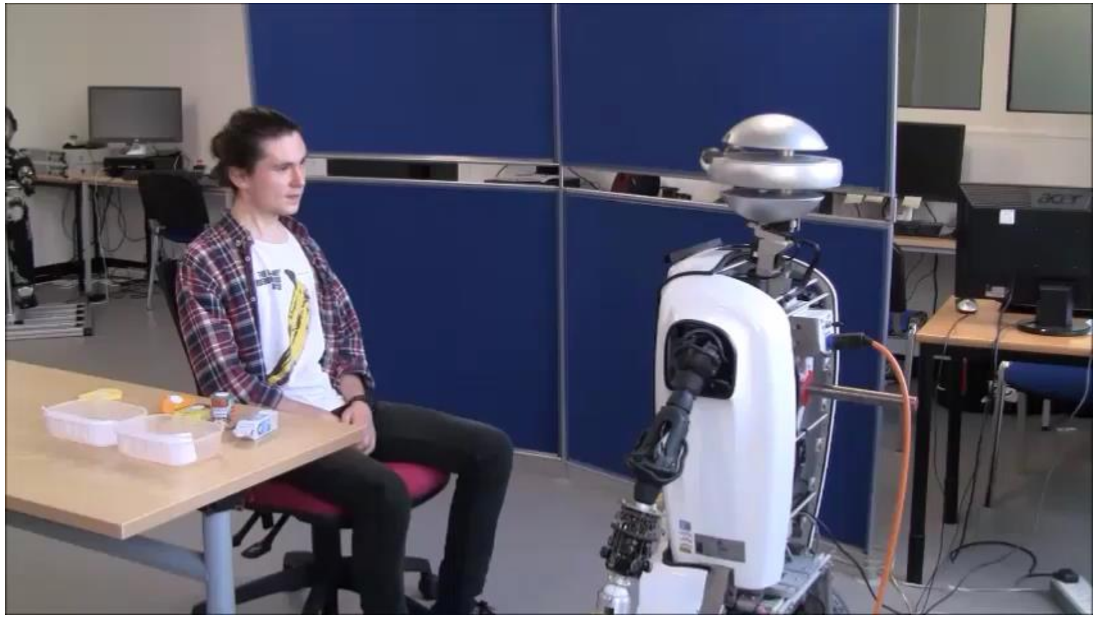


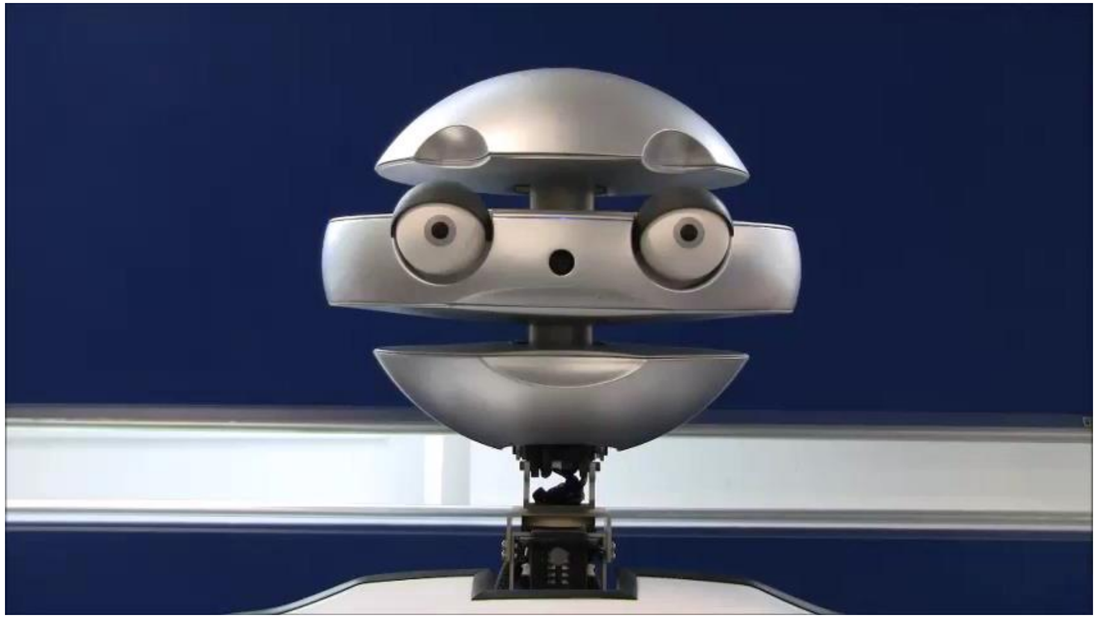
Proportion of responses
1.00
0.75
0.50
0.25
0.00
Evaluation
Like
Dislike
Approval
Disapproval

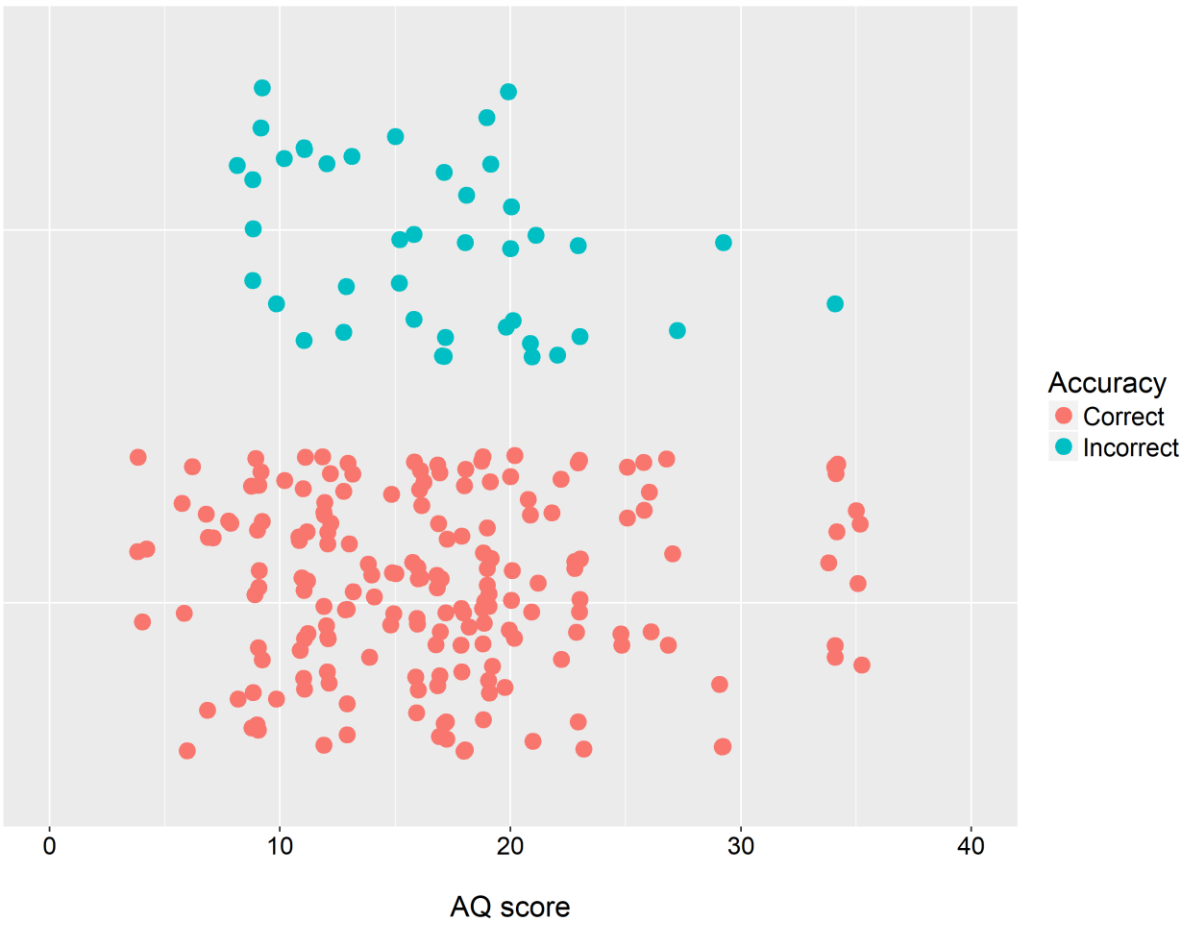
Experiment 2

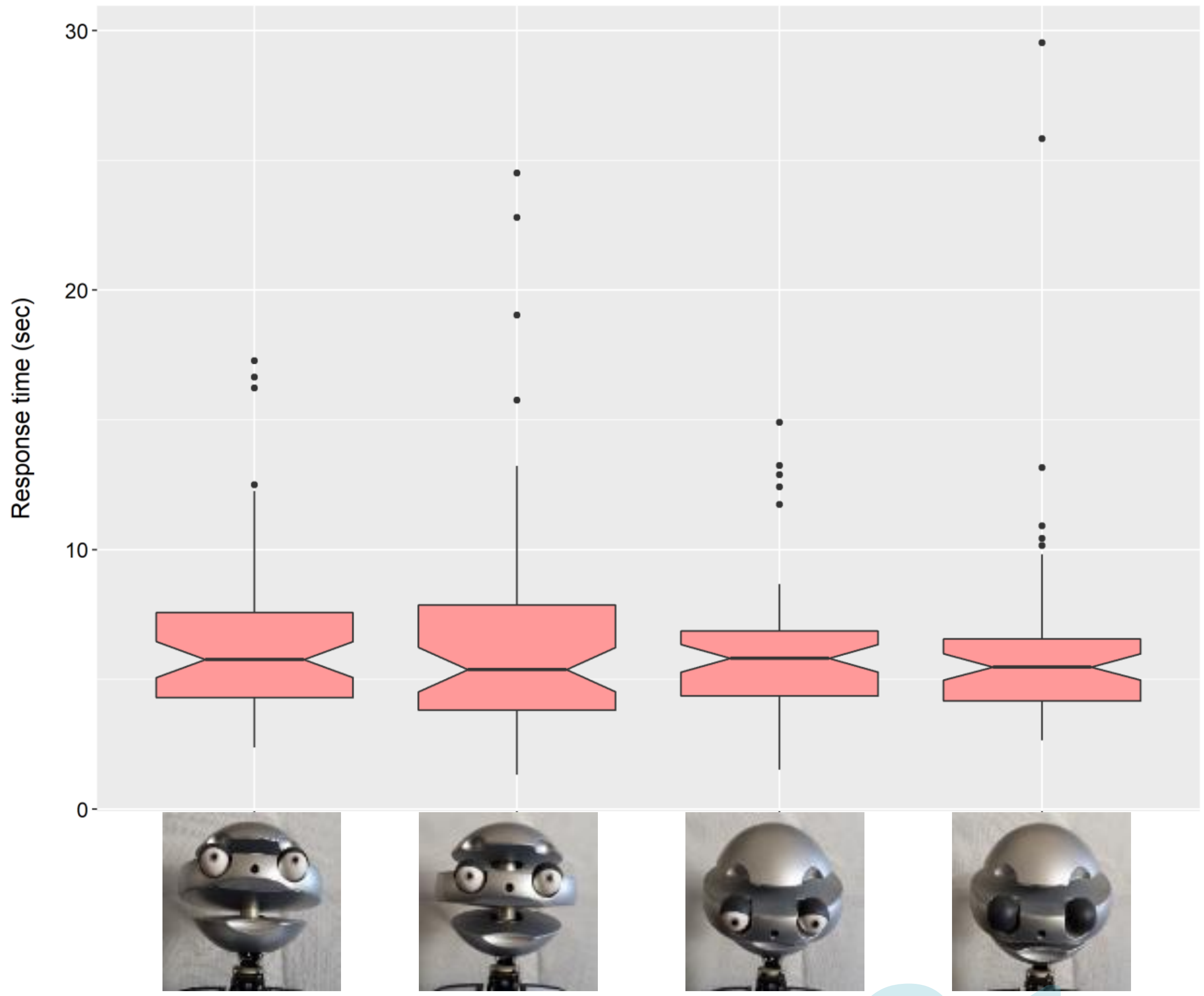


Experiment 2: Example trial






0
10
20
30
40
AQ score
Accuracy
Correct
Incorrect


30
20
10
0
Response time (sec)

Experiment 3 (future): Office induction day

- High-functioning adults to complete induction day.
- Will complete a set of clerical tasks (e.g. filing paper, printing documents, responding to emails).
- Begin with human-human role play of scenarios to determine robot capabilities
- Experiment parameters
    - Robot play role of boss or colleague
    - Robot will give the user feedback
    - Robot will interrupt participant mid-task to request assistance

Social robots in the wild

Recent workshop on this topic: http://socialrobotsinthewild.org/

Workshop motivation: affordable, mass-produced robots are available

Theories and techniques developed in the lab are released to the general public

Available social robots differ from those used in research

- Requirements: cost, reliability, variability in environment, need to provide immediate value

Selected papers from workshop (all are worth reading):

- Exploring the Use of Robots for Gathering Customer Feedback in the Hospitality Industry
- "Hi human, can we talk?" An in-the-wild study template for robots approaching unsuspecting participants
- HRI - "In the wild" In Rural India

Exploring the Use of Robots for Gathering Customer Feedback in the Hospitality Industry

Authors: Chung and Cakmak; URL http://socialrobotsinthewild.org/wp-content/uploads/2018/02/HRI-SRW_2018_paper_7.pdf

Semi-structured interviews with employees at 5 hotels that use a Relay robot for guest room delivery

- Robot has lockable interior bin – staff places item in bin, robot navigates to guest room, then phones room and guest retrieves item

Relay robot in action

https://youtu.be/nRjXu4wQsU8

Procedure: “need finding” interviews

- Proposed using robots to gather guest feedback in addition to other methods (e.g., Tripadvisor)
- Robot usage summary
  - More used on weekends by leisure travellers – selfies, etc
  - Special interest from children
- Responses from staff were mixed:
  - Real-time feedback would be helpful for fixing problems
  - Might increase chance of getting feedback, and would increase robot utilisation
  - Screen is small – limited amount of rich feedback

"Hi human, can we talk?" An in-the-wild study template for robots approaching unsuspecting participants

Authors: Sanoubari and Young; URL http://socialrobotsinthewild.org/wp-content/uploads/2018/02/HRI-SRW_2018_paper_14.pdf

Goal: provide a structure to allow robots to

- Approach and engage unsuspecting people
- Ask them for help with a task

Key problem for "in-the-wild" studies: ethical approval (i.e., informed consent)

Solution involves post-interaction discussion with the researcher (approved by at least one ethics board)

Issues with ethical approval

Pre-study consent significantly affects interactions with robot

Although study is in public, robot encounter would be unexpected – general "reasonable expectation" of being observed was not acceptable

Study may involve deception – robot should be treated as autonomous but actually tele-operated ("Wizard of Oz")

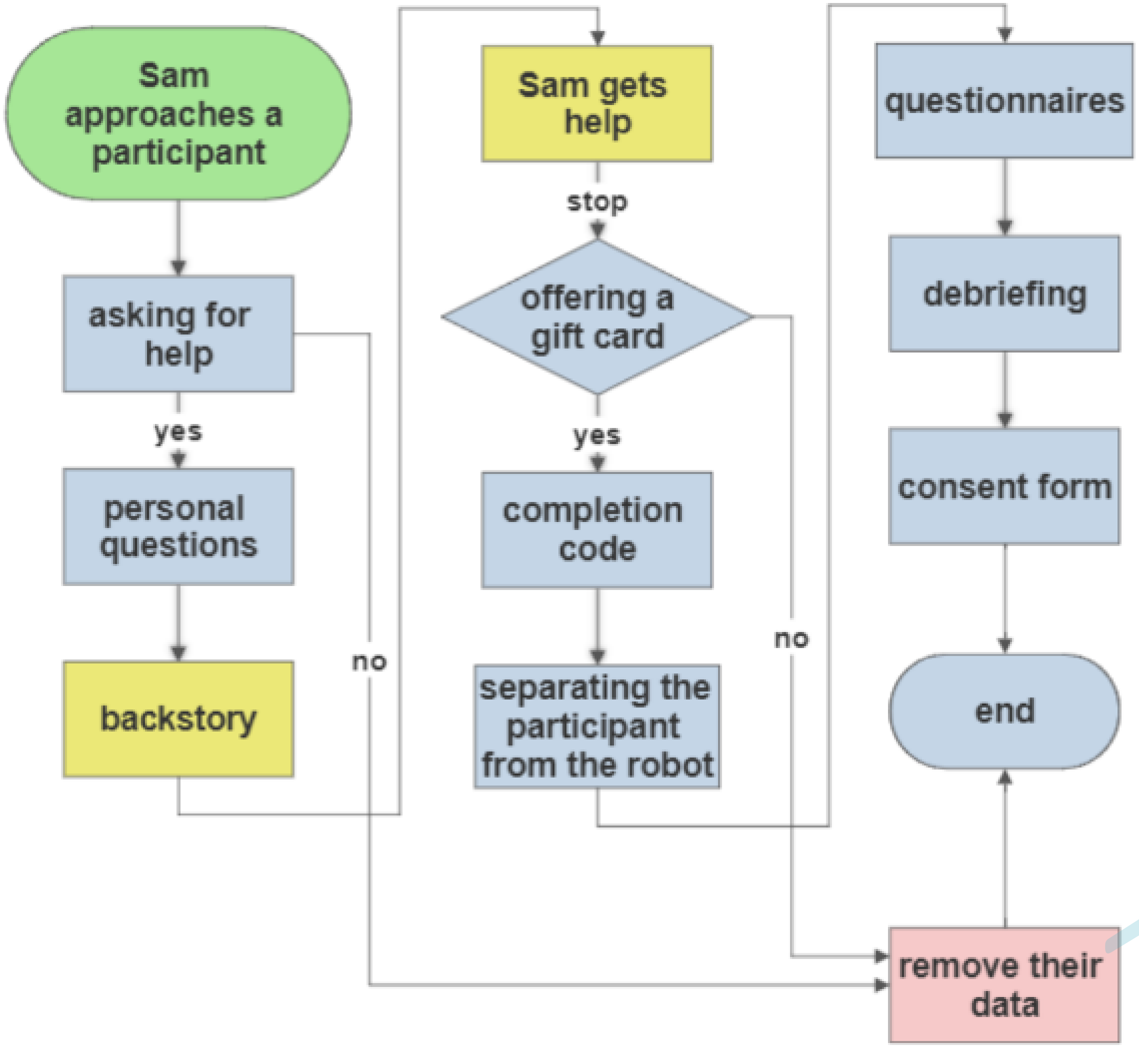
- Immediately debriefing in the wild could inform other passersby

Participants must be able to withdraw consent at any time and have all data destroyed

Solution to challenges

- Provide public awareness while distracting attention from the real study purpose
  - Make clear that an experiment is taking place, but pretend the robot is being tested
- Clearly advertise multiple means for people to contact researchers to have their data destroyed
  - Mitigates issues of lack of pre-study consent; allows researchers to stand further back (increasing “wild” factor)
- Post-interaction informed consent
  - Incentivise with promise of a gift card – include a completion code to minimise abuse
- Near-immediate debriefing in a semi-private space
  - Reduces chance of other participants overhearing the details of the study

Interaction template



HRI “In the wild” in rural India

https://youtu.be/SHvReymf9a0

Next week

Social/ethical implications of socially intelligent robots