Social Robotics

Albert-Ludwigs-Universität Freiburg

Bernhard Nebel, Felix Lindner, Thorsten Engesser,
Barbara Kuhnert, Laura Wächter
WS 2017/18

Child-Robot Interaction (cHRI)

Children as Target Group[1]

- Anthropomorphisation is already strong at the age of 3
  - Children attribute characteristics to the robot which are typically expected to be attributed to living systems.
  - This propensity for social play spills over into technology: toys and specifically robots are readily treated as being alive and having “beliefs, desires and intentions”
- Expected differences to Adult-Robot Interaction
  - Children are not just small adults
  - Their neurophysical, physical and mental development are ongoing, and this might create entirely different conditions for HRI to operate in. E.g., language processing.
- Difficulty: Asking children for self-report or to fill out questionnaires does not work out well. Need for behavioral measures, which are harder to analyse.

[1] T. Belpaeme, P. Baxter, J. de Greeff, K. Kennedy, R. Read, R. Looje, M. Neerincx, I. Baroni, M. C. Zelati. Child-Robot interaction: perspectives and challenges. In Social Robotics (ICSR), pp. 452–459, 2013.

Experiences from Wissenschaftsmarkt 2017

Felix Lindner und Henriette Flach mit dem verkleideten Roboter.

- Tendency: Children much more open-minded, enthusiastic about the robot, and more willing to interact with it as compared to adults.
- Children take the robot as it is also with its failures, wheras adults tend to lurk for the point they can criticize.

Outline

- Robots as Toys for Children
- Robots in Therapy for Children
- Robots in Education for Children
- Children as a Robot's Threat ;-)

Robotic Toy Pleo[2]

- Robotic Toy: "Robots intended for basic leisure activities such as play, creativity, playful learning, entertainment, relaxation. Importantly, robotic toys are interactive and have a software component." ⇒Video

[2] Y. Fernaeus, M. Hakansson, M. Jacobsson, S. Ljungblad. How do you play with a robotic toy animal? A long-term study of Pleo. In Proceedings of the 9th International Conference on Interaction Design and Children, pp. 39–48, 2010.

Toy's Goals

- Promise
  - Encourage open-ended exploration and play.
  - Long-term mode of interaction.
- Research
  - Question: How do people actually interact with Pleo on a long-term basis?
  - Data Collection: Exploratory study
  - Six families for a period of 2 to 10 month borrow one Pleo each (>2 month needed to study use beyond 'novelty effect')

Picking the Sample

- Post-cards containing a web link were distributed in the city center.
- On the website, people could state interest for particular robots.
- Among those who picked Pleo, six families were chosen, that have children of a varied age range and agreed to be interviewed.

Data Collection and Analysis

- Self-report using video
- Video-recorded semi-structured interviews
- ⇒Qualitative Data
  - Videos must be transcribed for analysis (viz., finding re-occuring themes, issues, and conflicts)

Result: Interaction

- Main reason to have Pleo: Substitute for a pet. Leads to tensions.
- Modes of Interaction
  - Giving nicknames to the toy, adorn it with different items (e.g., scarf), petting, tickling, touching, talking to it, create special places (e.g., sleeping hut) or assign things to it.
  - Long-term: Disappointment that Pleo does not move much and is not responsive to commands (as expected from pets like dogs):

    "I have mostly petted it... I really don't know how to play with it. [giggles] It really doesn't work to throw a ball. That doesn't work... [...] Petting it. I usually take it slow because it doesn't do much, maybe I put something in its mouth..."

Result: Development / Life Cycle

- Marketing promises Pleo's development over time ("learning"). No participant noticed any change in Pleo's behavior.
- Children go through themes of interest: The child played with Pleo the most was currently interested in dinosaurs.

Result: Maintenance

- Spending time with Pleo:
  - *"And then like what is this? Nothing happens. He is just as stupid as a week ago, he still walks only backwards. He still only takes just a step forward and "uuuuuhhh" is the only thing he can say. Then you lose interest. No, I really made some good efforts there during some weeks."*
- Recharging Pleo: 4 hours charging for 1 hour play. Not integrated as a part of play but responsibility of parents. Possible solution: putting Pleo in some bed to have it recharge or s.th. similar.

⇒Study nicely showcases todays limitations of autonomous social robots.

Robots in Child Therapy

- Animal assisted therapy (AAT) is an often used method to improve the well-being of children during a stay in hospital.
- Unfortunately, AAT is expensive and not available to all young patients for hygiene reasons. However, robots provide an attractive alternative for this.

Huggable: Motivation[3]

- Certified child life specialists (CCLS) engage and support child-patients and their families to create a less intimidating and more comfortable health care experience by applying developmental interventions and therapeutic play.
- Research Question: Can social robots add something?

[3] S. Jeong, C. Breazeal, D. Logan, P. Weinstock, Huggable: Impact of Embodiment on Promoting Verbal and Physical Engagement for Young Pediatric Inpatients, In Proceedings of the 26th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), pp. 121–126, 2017.

Hypotheses

H1: Children will interact longer in order of *Robot* > *Avatar* > *Plush*.
H2: The number of verbal utterances produced by children will be in order of *Robot* > *Avatar* > *Plush*.
H3: The number of verbal utterances produced by all interaction participants will be in order of *Robot* > *Avatar* > *Plush*.
H4: *Robot* will produce more physical movement for children over time during the interaction than *Avatar* and *Plush*.

Study Design

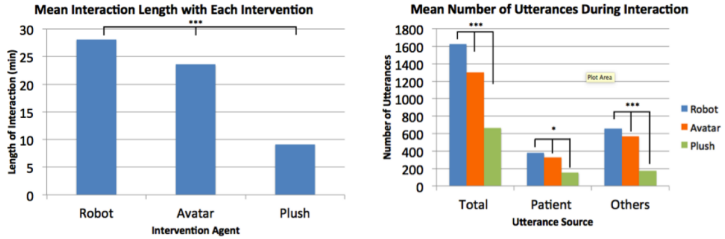
- Between-Subjects Design: Every Participants participates in only one condition (as compared to Within-Subjects Design).
- Robot and Avatar were teleoperated by a CCLS in a neighbor room; the plush bear was puppeteer-ed as usual by the CCLS.
- Interactions were video recorded.
- Family members and medical staff was asked to behave as usual.

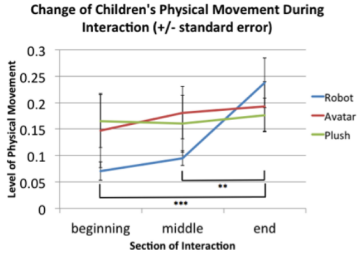
⇒Video

Data Analysis

- Video transcription (48 videos of 30 minutes length):
  - Speaker: Patient, Huggable, Moderator, Other (Family members etc.)
  - Movement (using a Joystick): 0 [no movement] to 1 [active body movement]

Results





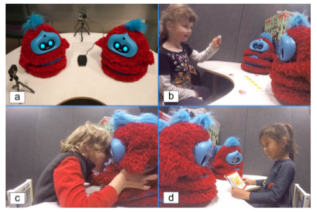
A Robotic Storytelling Listener[4]

- Research Question: How can a peer-like social robot successfully foster the development of early language skills of preschoolers and kindergarteners?
- Setting: Story-telling, which is a key to children's language development and is a mutually regulated activity between speaker and listener.

[4] H. W. Park, M. Gelsomini, J. J. Lee, C. Breazeal. Telling Stories to Robots: The Effect of Backchanneling on a Child's Storytelling. In Proceedings of HRI'17, pp. 100–108, 2017.

Hypotheses

- One robot listener implements contingent backchanneling (based on classifier), the other robot implements random backchanneling



H1: Children will direct their storytelling more toward the contingent BOP robot.
H2: Non-contingent BC responses from a robot will interrupt children's storytelling.
H3: Children will perceive the contingent BOP robot as more attentive and interested in their story.

Experiment: Procedure

- At the time of study enrollment, parents were asked to provide information on what story their child likes to tell.
- Using this information, the experimenter engaged the child in a story brainstorming session.
- Afterwards, the experimenter provided the following backstory:

  We have a problem. The two Tegas you were supposed to meet today are baby Tegas. They fell asleep and I can't wake them up. But their favorite activ- ity is listening to children's stories! Maybe if you tell them you're here to tell them stories, they might wake up! Would you like to come try?

- Participants were then asked to give a sticker to the robot they thought to be the better listener and was more interested in their story.

Experiment: Controlled Variables

- To prevent any bias in the study results:
  - The robots looked identical, used the same name, and the expressivity level of the behaviors was matched between conditions.
  - The placement of the robots was counter-balanced — in 45% of the sessions, the contingent robot was placed on the left side and 55% of the sessions on the right.

⇒Video

Results H1

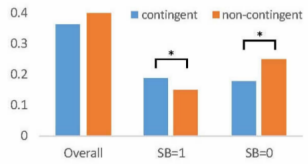


Figure 7: An average fraction of gaze length over the entire length of a session. Children gazed significantly more at the contingent robot ($p < 0.05$) when telling a story ($SB = 1$).

"[...] children significantly gazed more at the contingent robot when telling a story (SB=1) (contingent: M = 0.185, SD = 0.076, non-contingent: M = 0.146, SD = 0.040; t(38) = 2.031, p = 0.049). This confirms our main hypothesis H1."

Results H2

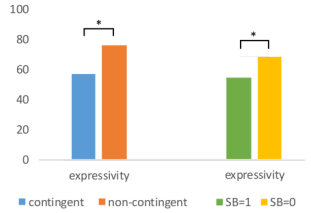


Figure 8: Level of expressivity is shown in scale [0,100]. Children's facial expressivity significantly increases toward the non-contingent robot. Correlation analysis reveals that children tend to be more calm when telling a story ($SB = 1$).

"[...] children lation analysis reveals that children were more calm towards the contingent robot (contingent: M = 56.42, SD = 19.23, non-contingent: M = 76.34, SD = 24.35; t(38) = 2.871, p < 0.01)." "Analysis revealed high correlation between expressiveness and pauses from storytelling (SB=0) (SB=0: M = 67.83, SD = 19.21 ; SB=1: M = 54.25, SD = 12.38 ; t(38) = 2.658, p = 0.012)"

Results H3

"Based on the sticker test, 15 out of 20 children selected the contingent robot as the more attentive listener than the non-contingent robot (p=0.0038)."

Escaping from Children

D. Brscic, H, Kidokoro, Y. Suehiro, T. Kanda. Escaping from children's abuse of social robots. In Proceedings of HRI'15, 2015.

⇒Video