Social Robotics

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Child-Robot Interaction (cHRI)

Children as Target Group¹

- 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.

¹T. 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





- 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.



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

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



²Y. 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.

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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')



- 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.



- 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)

- 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..."



- 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.

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.

 \Rightarrow Study nicely showcases todays limitations of autonomous social robots.



- 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.



- 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?

³S. 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



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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*.





- 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



- 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







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BURG

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- 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.

⁴H. 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.







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.



- 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.



- 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; f(28) = 2.871, $\rho < 0.01$)." "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; f(28) = 2.658, p = 0.012)"



"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)."



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

⇒Video