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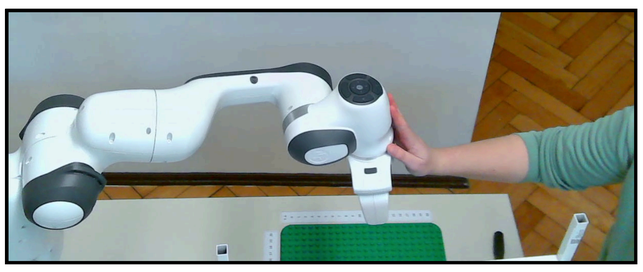


"Can you hold that for a sec?": Speech Acts in Human-Robot and Human-Human Interaction

Motivation & Background

- Investigation of the differences and links between Human-Human (H-H) and Human-Robot (H-R) communication in the context of an assembly task with a robotic arm
- Identification of the (human) aspects of communication with robotic arms
- **Goal for the future:** Realization of intuitive communication taking into account the linguistic dimension
- So far focus only on social robots – lack of research in industrial robot arms [1]
- Porcheron et. al. (2021, 2020) present an ethnomethodological analysis of the Wizard of Oz methods and a study with a voice-controlled vacuum robot [2, 3]
- Analysis of the conversations using Searle's taxonomy of illocutionary acts [4]

Method / Study Design

- 13 adult native German speakers randomly assigned to one of the two conditions
  - 3 experiments in the group: Human-Human
  - 7 experiments in the group: Human-Robot
- Task: building an IKEA shelf together without instructions
- Robot: FR3 robotic arm from Franka Robotics
- Wizard-of-Oz
  - telemanipulates the robot via a 3D mouse
  - plays pre-defined statements with NottReal [2]
- Audio & video recordings
- Collection of user experience data in online survey & oral interview

Results

Experiment

- **Speech acts**: Participants in the Human-Robot condition used more directives (see Tables below).
- **Turns**: Humans speak in longer turns when communicating with a robot.
- **Complexity**: In the Human-Robot condition, humans used simpler language.

Survey

- **Communication**: All Human-Human participants **fully agreed** that it was **appropriately fast**; in Human-Robot condition, 3 **agreed**, 3 **disagreed**, 1 was **neutral**.
- **Coordination**: All Human-Human participants **fully agreed** that it was **reliable**; in Human-Robot condition, 3 **disagreed**, 3 **agreed**, 1 was **neutral**.
- **Support**: 5 Human-Human and 4 Human-Robot participants **fully agreed** that it was **reliable**.

Discussion

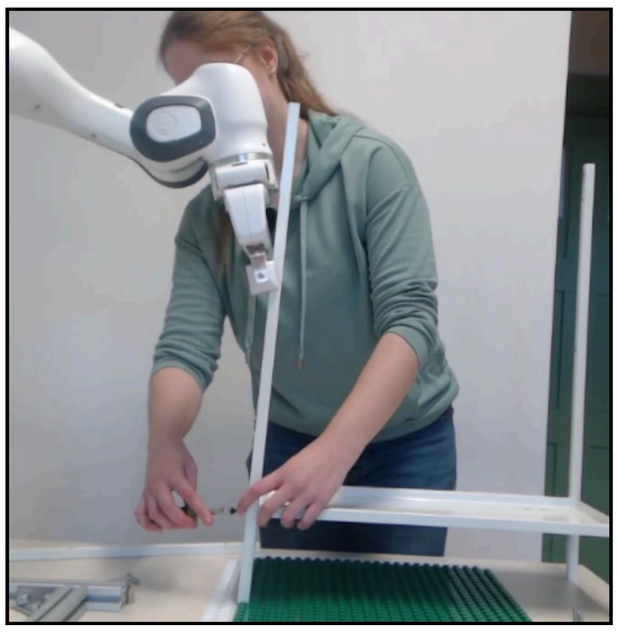
Human-Robot communication

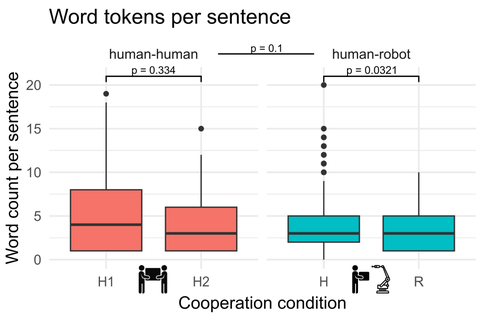
- is based on more commands,
- makes humans produce longer turns,
- uses simpler language and
- involves an unexpectedly large amount of expressions of feelings/emotions

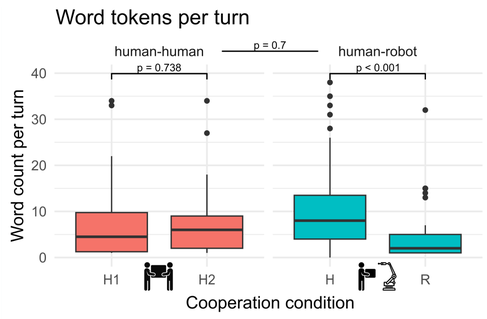
compared to Human-Human communication

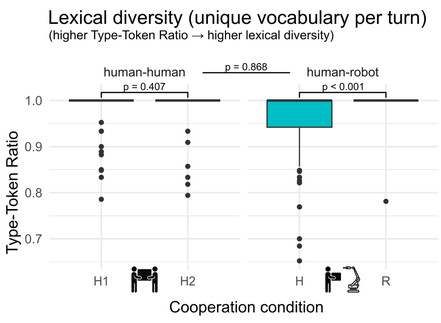
- which involves more statements about the situation and
- which tends to express more feelings/emotions.

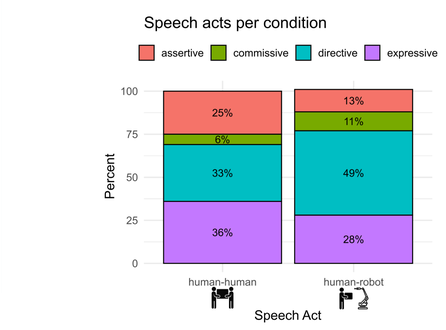
Human-Robot communication is more direct and wordier but simpler than Human-Human communication in the same situation.











Speech act	Effect	Example H-H	Example H-R	Count (%) H-H	Count (%) H-R
assertive (aka representative)	commit the speaker to the truth of the expressed proposition	"Ich glaube es sind so zwei, also verschiedene Böden." "I think there are about two, basically different shelves."	"Es kommen zwei Böden, das ist der Schraubenzieher." "There are two shelves coming, this is the screwdriver."	34 (25%)	50 (13%)
commissives	commit the speaker to some future course of action	"Das können wir machen." "We can do that."	"Ja, mache ich." "Yes, I'll do it."	8 (6%)	43 (11%)
directives	attempt by the speaker to get the addressee to do something	"Jetzt vielleicht machst du wieder." "Maybe now you can do it again."	"So, bitte wieder loslassen." "Now, please let go again."	45 (33%)	196 (49%)
expressives	express a psychological state	"Ach ja, du hast Recht." "Ah yes, you are right."	"Das machst du gut." "You are doing a good job."	49 (36%)	110 (28%)

Conversation snippet between Human and Human	Conversation snippet between Human and Robot
H1: Apparently, it's not the one on the bottom, but the one that goes in at the top. H2: I think so too. I would have somehow started at the top first and kind of flipped it over, right? H1: Okay, we can do that. H2: Like this. Kind of like this.	H: So, please let go again. And hold the second leg. Thanks. Oh, something went wrong now. R: No problem. H: You need to let go again or lift it a bit higher. That helps me too. R: Yes, sure.

Scan the QR code to **download the poster**

References

1. Kunold, L., & Onnasch, L. (2022). A framework to study and design communication with social robots. *Robotics*, *11*(6), 129. https://doi.org/10.3390/robotics11060129
2. Porcheron, M., Fischer, J. E., & Reeves, S. (2021). Pulling back the curtain on the Wizards of Oz. *Proc. ACM Hum.-Comput. Interact.*, *4*(CSCW3), 243:1-243:22. https://doi.org/10.1145/3432942
3. Porcheron, M., Fischer, J. E., & Valstar, M. (2020). NottReal: A tool for voice-based Wizard of Oz studies. *Proceedings of the 2nd Conference on Conversational User Interfaces*, 1–3. https://doi.org/10.1145/3405755.3406168
4. Searle, J. R. (1976). A classification of illocutionary acts. *Language in Society*, *5*(1), 1–23.