The Role of Social Dialogue and Errors in Robots

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Research Goal

- To investigate the extent to which rapport-building can benefit (or harm) conversations with robots and agents, and under what circumstances this occurs.

Related Work

- Robots and virtual agents that can be used for both assistance on tasks as well as social interaction (e.g., REA [Cassell et al., '03] and SASO [Traum et al., '05])
- Virtual agents: Errors in dialogue systems can reduce influencing the user [Wang et al., '13; Blascovich et al., '13].
- Robots: Some work finds that errors have no impact on robots' influence [Salem et al., '15], while other work indicates that errors negatively affect their influence [Desai et al., '12, '13; Wiegmann et al., '01].
- **Open question**
  - The impact of robots' social dialogue on mitigating the impact of errors.

Present Research

- Agent: NAO robot (Softbank Robotics Corp.)
- WOZ experimental setting
- 2x2 design
  - Ice-breaking conversation vs. control task
  - Conversational errors vs. no errors
- 112 participants (recruited from Craigslist)
- Task 1: First ranking task
  - Participants were asked to rank 10 items as to their importance.
  - Participants then engaged in dialogue with the robot.
  - Participants re-ranked the items; the differences between initial rankings and final rankings served as a measure of influence.
- Task 2:
  - *Ice-breaker condition*: the participant had an interactive dialogue with the robot, where they exchanged answers to personal questions.
  - *Control condition*: the subject participated in a non-interactive oral survey with the same personal questions.
- Task 3: Second ranking task
  - Influence was measured as in the first task.
  - Error condition: the robot made a series of errors while interacting with the participant on the second survival task.
  - Errors were introduced into the dialogue according to a set order at a rate of about one of these errors per two utterances

Results

Increase in influence from 1st to 2nd task
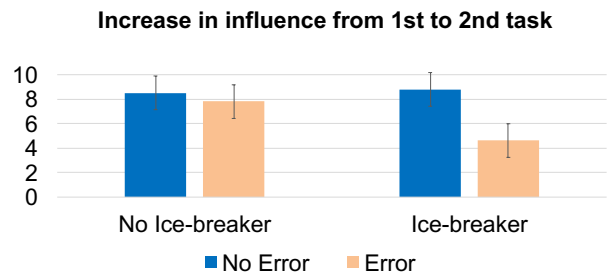
- There was a main effect such that participants were marginally influenced more in the absence of errors ($F(1,95) = 3.27$, $p = .07$). While there did not seem to be an effect of ice-breaker $F(1,96) = 1.082$, $p = .30$), the interaction between error and ice-breaker conditions approached a trend ($F(1,96) = 1.54$, $p = .22$).
- The effect of errors, if anything, tended to be driven more by the ice-breaker condition than the control condition.

Discussion

- This work contributes further evidence to an area that has mixed findings.
  - Some work finds that errors have no impact on the robot's influence.
  - On the other hand, our work and others' indicates that errors in robot's dialogue systems negatively affect their influence.
- Seems to depend on when the errors occur: errors after a period of good performance were much more harmful to influence than those that occur earlier.
- Errors are found more harmful after good performance during an ice-breaker conversation than without such a conversation.
- **Implications for HRI and robot design**
  - We have shown that conversational errors hinder users from taking the advice of the robot, undermining the robot's persuasiveness.
  - It seems that errors are particularly damaging when they suddenly appear after good performance (here during a social dialogue),
  - More research is needed to isolate the precise impact of errors and possible interventions.

Conclusion

- Our work highlights the risk of errors in robot's dialogue.
- Errors appear to reduce robots' influence.
- Design could still focus on other ways of mitigating errors, but merely placing a social dialogue before the errors appears to be a poor option.