FurNav: Development and Preliminary Study of a Robot Direction Giver

Bruce W. Wilson, Yann Schlosser, Rayane Tarkany, Meriam Moujahid, Birthe Nesset, Tanvi Dinkar, and Verena Rieser*
Heriot-Watt University, *Now at Google DeepMind

INTRODUCTION

When giving directions to a lost-looking tourist, would you first reference the street-names, cardinal directions, landmarks, or simply tell them to walk five hundred metres in one direction then turn left? Research on direction giving with a robot does not often look at how these different direction styles impact perceptions of the robot's intelligence, nor does it take into account how users prior dispositions may impact ratings. We present a methodology and preliminary experiment with our robot direction giver in a lab setting.

Scan to ask questions

BACKGROUND

- An interactive robot can be equipped with common ground capabilities to improve effective communication [1].
- Common ground can be achieved in multiple ways, with landmarks in navigational environments improving efficiency and reliability of route instructions [2].

METHOD

- A Furhat robot was set up to provide navigation instructions in one of two conditions: landmark or skeletal based directions. Participants navigated around a map (shown in Figure 2) based on these instructions, drawing their path with a pen (shown in Figure 1).
- Our natural language generation system draws from a neo4J graph database, constructed to represent the rooms, corridors, and properties used by the skeletal and landmark direction systems.

Figure 1 - The Furhat direction giver setup with a user interacting with the preliminary study system. The map shown is visible in Figure 2.

- We then focused on whether the use of landmark-based directions, and in turn, an assumed level of common ground with the user, impacted users perceived intelligence and animacy rating of the robot using the Godspeed questionnaire sub-scales.
- We also factor in users' prior attitudes towards robots, specifically their propensity to trust robots and their negative attitudes towards robots.

RESULTS

Paired sample Wilcoxon signed-rank tests across conditions:
- Skeletal Godspeed Intelligence Score Mean = 3.40, Landmark Godspeed Intelligence Score Mean = 3.74, N=7, z=-0.94, sig two-tailed p=0.40
- Skeletal Task Success Mean = 1.57, Landmark Task Success Mean = 2.29, N=7, z=-1.83, sig two-tailed p=0.09
- All of which showed no statistically significant results, and at this stage of the preliminary study, it is not possible to draw any conclusions.

NARS Score is negatively correlated with the PTT Score (Pearson's r=-0.912, $p \leq 0.05$), meaning that participants with a higher negative attitude towards robots have a lower propensity to trust technology, which falls in line with previous work [3].

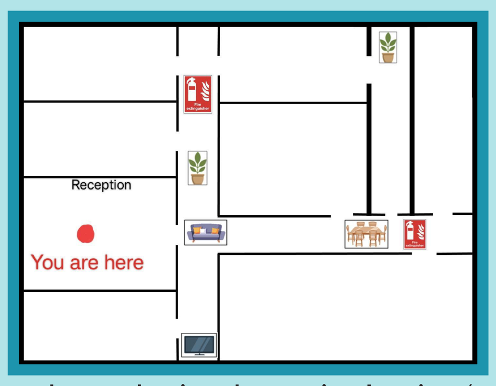

Figure 2 - Our created map showing the starting location (reception), alongside visible landmarks, corridors, and rooms. The generated text will guide participants around the map as if they were actually walking the direction.

CONCLUSION & FUTURE WORK

- Mostly resulted in statistically insignificant results.
- Due to this, we plan to run a larger scale experiment with a larger sample size to result in larger statistical power.
- We would like to switch from measuring perceived intelligence to measuring perceived social intelligence to closer link to existing work on common ground, using for example the PSI Scales [4].
- We would like to collect more objective measures, such as task time, clarification requests, and specifics on wrong destinations.

ACKNOWLEDGMENTS

The authors would like to thank Jose Berlin Durai Yoseppu for his work on the development of the Furhat NLU system, alongside the group members for the F21CA class.
Tanvi Dinkar and Verena Rieser were supported by the EPSRC project `Gender Bias in Conversational AI' (EP/T023767/1), `Equally Safe Online' (EP/W025493/1), and `AISEC: AI Secure and Explainable by Construction' (EP/T026952/1), Verena Rieser was also supported by a Leverhulme Trust Senior Research Fellowship (SRF/R1/201100).

REFERENCES

[1] S. Kiesler, "Fostering common ground in human-robot interaction," in ROMAN 2005. IEEE International Workshop on Robot and Human Interactive Communication, 2005., Aug. 2005, pp. 729–734, iSSN: 1944-9437.
[2] M. Denis, F. Pazzaglia, C. Cornoldi, and L. Bertolo, "Spatial discourse and navigation: an analysis of route directions in the city of Venice," Applied Cognitive Psychology, vol. 13, no. 2, 1999.
[3] M. Y. Lim, J. D. A. Lopes, D. A. Robb, B. W. Wilson, M. Moujahid, E. De Pellegrin, and H. Hastie, "We are all Individuals: The Role of Robot Personality and Human Traits in Trustworthy Interaction," in 2022 31st IEEE International Conference on Robot and Human Interactive Communication (RO-MAN), Aug. 2022, pp. 538–545, iSSN:1944-9437.
[4] K. A. Barchard, L. Lapping-Carr, R. S. Westfall, A. Fink-Armold, S. B. Banisetty, and D. Feil-Seifer, "Measuring the Perceived Social Intelligence of Robots," ACM Transactions on Human-Robot Interaction, vol. 9, no. 4, pp. 24:1–24:29, Sept. 2020.

EDINBURGH CENTRE FOR ROBOTICS

HERIOT WATT UNIVERSITY