Interacting with Wheelchair Mounted Navigator Robot

Akiko Yamazaki
Tokyo University of Technology
Tokyo, Japan
ayamazaki@stf.teu.ac.jp

Keiichi Yamazaki
Saitama University
Saitama, Japan
BYI06561@nifty.com

Yusuke Arano
Saitama University
Saitama, Japan
arano@mail.saitama-u.ac.jp

Yosuke Saito
Saitama University
Saitama, Japan
y.saito.776@ms.saitama-u.ac.jp

Emi Iiyama
Saitama University
Saitama, Japan
e.iiyama@cv.ics.saitama-u.ac.jp

Hisato Fukuda
Saitama University
Saitama, Japan
fukuda@cv.ics.saitama-u.ac.jp

Yoshinori Kobayashi
Saitama University
Saitama, Japan
yosinori@hci.ics.saitama-u.ac.jp

Yoshinori Kuno
Saitama University
Saitama, Japan
kuno@cv.ics.saitama-u.ac.jp

ABSTRACT

Currently, robotic researchers focus on developing robot systems that are explicitly designed to operate cooperatively with people in public, and provide the resources for projections for humans in public places. Our socio-technological project, engineers developed a robotic wheelchair with attaching a robot in order to provide embodied projective signals to human and designed two settings for the robot's behavior. One is the robot turns its face towards the human (Face-to-Face model), the other is robot turns its face and they turn around its body in order to index where to go (Body Torque model). The reasons of attaching a robot to a robotic wheelchair and designed two settings are, by analysis of sociologiosts, we reveal how embodied actions of the robot as a resource for projection and considered what kind of projection are possible and how such projections provide the coordination of co-operative actions between multiple people in the public places.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics

KEYWORDS

Ethnomethodollogy, automatic wheelchair, co-operative actions, multimodal, body-torque, face-to-face.

MuC'19 Workshops, Hamburg, Deutschland.
© Proceedings of the Mensch und Computer 2019 Workshop on Interacting with Robots and Virtual Agents? Robotic Systems in Situated Action and Social Encounters. Copyright held by the owner/author(s).
https://doi.org/10.18420/muc2019-ws-651

1 Introduction

In Japan, with rapid growth of aging population, developing robot system to supprot elderly persons has got huge attention. In order to support elderly persons, we designed robotic wheelchair and in

Figure 1: Robotic Wheelchair with navigator robot (left: Face-to-Face, right: Body-Torque).

order to provide projectability, we attached a robot to a robotic wheelchair. experimental setting is as follows; One participant played the role of wheelchair user and the other participant played the role of companion. One design is the robot turns its face towards the human (Face-to-Face model), the other design is robot turns its face and they turn around its body in order to index where to go (Body Torque model) (Figure 1).Participants went the shopping for hotpot cuisine (is a type of Japanese cuisine cooked and served in a large pot which contains seafood, meat, vegetables and so on) using the wheelchair robot with a navigation robot which moved along a pre-defined root (Figure 1).

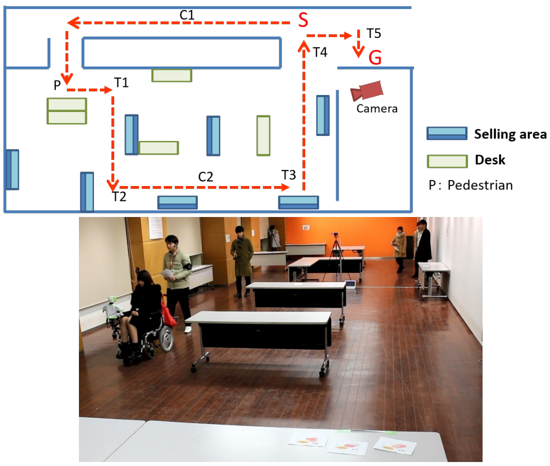
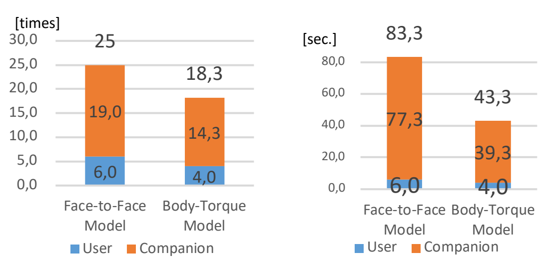


Figure 2: Experimental environment.

We analyzed the interactions based on ethnomethodology and conversation analysis. A lot of literature of ethnomethodology and conversation analysis, how multiple people achieve to coordinate their actions [5]. Kendon argued bodily positions for coordination of human actions as "O-Space" [3]. Goodwin analyzed a basic configuration of joint action and reveals the importance of coordination of semiotic resources not only verbal actions, embodied actions but also its environment such as tools [1][2]. Schegloff defines the turning of ones own's body parts from home position as body torque and argues that one of the most important features of body-torque is that it affords for displays of engagement of courses of actions occurring at the current moment [6].

2 Results

We analyze whether robot's visible actions worked as resource of projection or not. Firstly, we counted the participants' gaze guidance when the robot indicated its moving directions in both Face-to-Face setting and Body Torque setting. The results are shown in the figure 2.



(Left) Number of times (Right) Time

Figure 2. Number of gaze shifting to robot while when the wheelchair is moving.

The reasons of user and companion shift their gaze in Face-to-Face model is, since the robot was always facing the direction of the participants, it seems that the effect of moving direction indication by pointing did not work.

By contrast, in the Body-Torque model, robot would enhance the effects of the moving direction instruction by pointing. This result suggests Body Torque model gives effective resources of projection.

By conversation analysis, we found out the robot utterance, in particular Body-Torque model provides not only the resource for projection but also evoking a lively conversation.

Fragment 1(English translation of original Japanese conversation)
F1: companion, F2: user

1 R：By the way, my favorite is scallops.
2 F1：hhh
3 F2：The s(h)callops? then [scallop eh *sak*[e↑ scallop Let us put the scallop
4 F1： [*sake*(rice wine)[scallop
5 F1：carrot↓
6 R：good
7 F1：hhh good
8 F2：Which is good, hotpot, hotpot
9 F1:carrot
10 F2:carrot

When the navigation robot says "By the way, my favorite is scallops" with body torue,F1 laughs and F2 quoted 'scallop' (*hotate*) but F1 confused scallop with rice wine (*sake'*) (because of each word's last vowels is the same "e"). When F1 catches up, F2 propose "Let us put the scallop", F1 proposed "carrot". Then the robot says "good", F1 quotes "good" again with laughter. F2 is wondering, F1 proposes F1's previous proposal "carrot", F2 agrees with saying "carrot"

As like this example, when robot says with turning tis head, 'by the way, my favorite is carrot', almost all participants laughed, and they cite robot's words, the communication between user(s) and companion(s) become smoothly. Because of the smooth communication, user and companion create the new proposal (in this fragment, "carrot".) The robot's utterance worked as like fishing device as Pomerantz pointed as well [8]. Robot's favorite is scallop" successfully elicits interactants' responses.

3 Conclusion

In this paper, we argued the robot's embodiment becomes the resources for projection for participants and increase interactions between participants. In particular, Body-Torque setting is better than Face-to-Face setting in regard to evoking conversations.

REFERENCES

[1] C. Goodwin, 2007. Participation, stance and affect in the organization of activities. Discourse & Society, 18(1), 53-73.
[2] C. Goodwin. 2017. Co-Operative Action. Cambridge: Cambridge University Press.
[3] A. Kendon. 1990. Conducting Interaction:Patterns of Behavior in Focused Encounters. Cambridge:Cambridge University Press.

[4] A. Pomerantz, 1980, Telling my side: “Limited access” as a fishing device. Sociological Inquiry, vol. 50, no. 3-4, pp. 186–198.
[5] H. Sacks, E. A. Schegloff, and G. Jefferson. 1974. A Simplest Systematics for the Organization of Turn-Taking for Conversation. Language 50 (4, Part1): 696-735. http://www.jstor.org/stable/10.2307/412243.
[6] E. A. Schegloff. 1998. Body Torque, Social Research, Vol. 65, No. 3, pp. 535-596.