

Effects of uncovering gaze target mismatch in human-robot joint visual attention on evaluation of understanding and impressions of robot

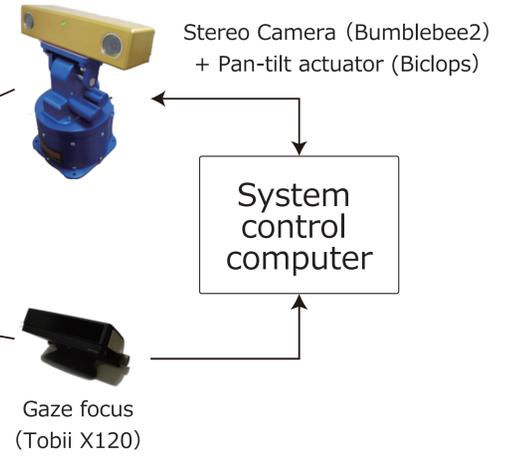
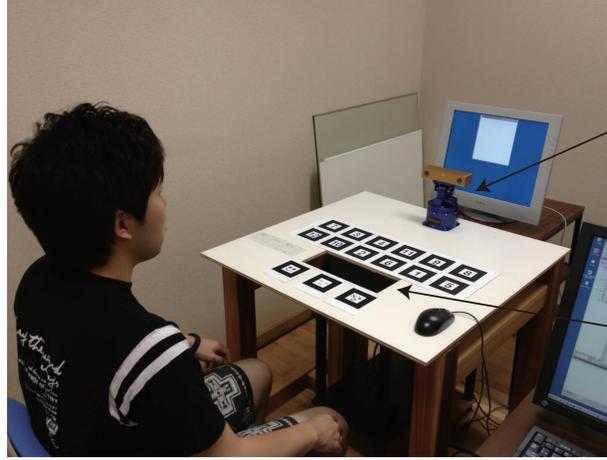
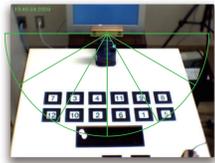


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When mismatches of the gaze focus between human and robot are uncovered, how change the humans' subjective evaluation to the robot ?

Joint Visual Attention between human and robot

- A person sits in front of the robot, and looks at one of 12 numbers. The positions are fixed.
- The robot recognizes the human's eyes-direction in a resolution of 30 [deg] (rough).
- The robot gazes at the person and the number alternately.



Experiment 1

Purpose is to confirm effects of covering - uncovering mismatches.

Procedure

- Participants selected a gaze target from 12 numbers in each round, and they tried to convey it to the robot by gaze alternation.
- 5 participants in Japanese students (3 males, mean age 26.8)
- Participants were engaged in two conditions with 24 rounds.

1st test Covered mismatch cond. → 2nd test Uncovered mismatch cond.

Participants judge the robot's gaze focus from head direction.

The robot's gaze focus displayed in a monitor at eye contact.

- After the 2nd test, participants answered a questionnaire.

Understanding of the robot

- Q2.1 Do you think the robot recognized your target?
- Q2.2 Did you recognize what robot gazed at?

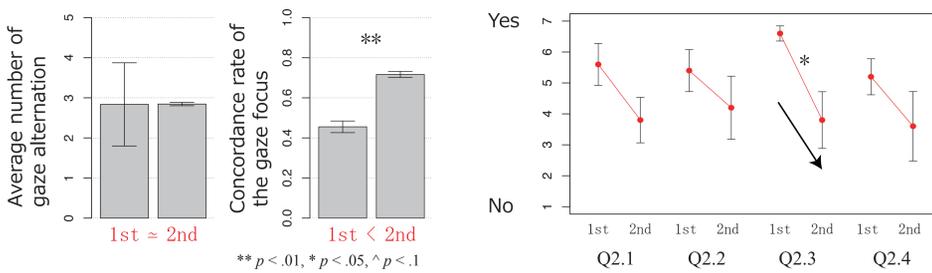
Intentionality of the robot

- Q2.3 Did you feel the robot tried to understand what you were looking at?
- Q2.4 Did you feel the robot has an intention to do something?

Impression evaluation by 28 pairs of adjectives (Kanda et.al. 2001)

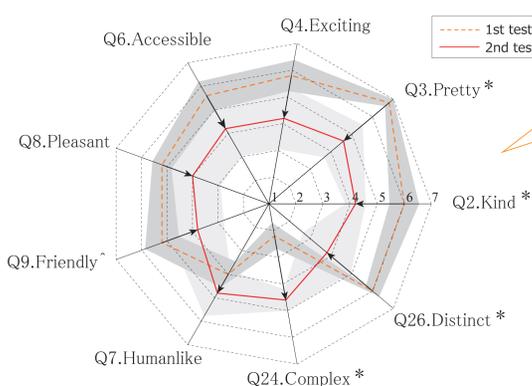
- Q3.1 - 3.28 ex. "kind" - "cruel" , "complex" - "simple"

Results



Although the concordance rate of the gaze focus in the 2nd test was high, humans' evaluation of understanding and intentionality tended to be worse.

Q3 Impression evaluation



From 1st to 2nd test, positive impressions changed to neutral. "Humanlike" was slightly increased.

Conclusion

- The appearance of mismatches may be accepted as a factor of humanity and complexity, but it leads to reduced positive impressions.
- However, when the robot interacts with not only the eyes but also facial expressions, this shortcoming may be resolved.

Experiment 2

Purpose is to confirm effects of interaction of personal preferences.

Procedure

- **Insert an expression phase** of the participant's preference of numbers.
- At the beginning of a round, they showed a preference (like, neutral, hate) with a card.



Twelve numbers were classified before the 1st test

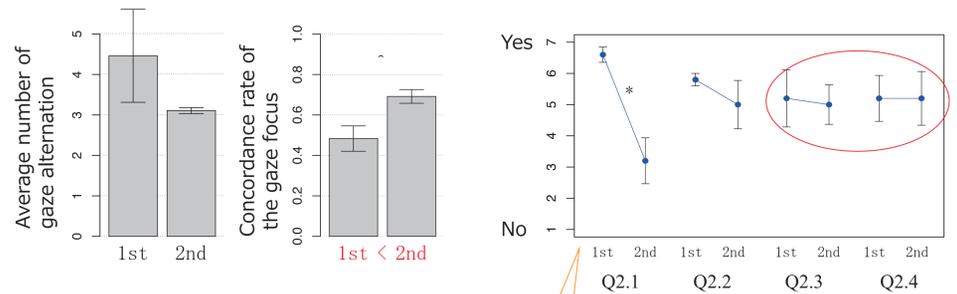
😊 Like	— Neutral	☒ Hate
2, 6, 7, 8	4, 9, 10, 12	1, 5, 3, 11

- When the robot recognized the card, face-like characters displayed on the monitor.

- New 5 participants in Japanese students (4 males, mean age 26.6)

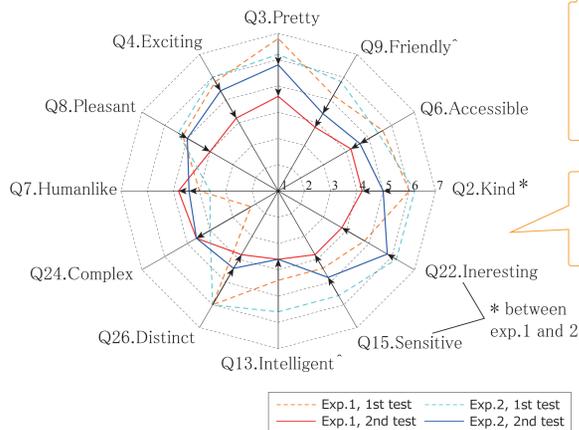
The rest part was the same as the experiment 1.

Results



The evaluation of intentionality did not change, although the understanding was decreased.

The downward trend in impressions became weak.



Bibliography

- Kanda, T., Ishiguro, H., and Ishida, T. (2001). Psychological analysis on human-robot interaction. Proceedings in IEEE International Conference on Robotics and Automation (ICRA) 2001, volume 4, 4166-4173.

