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Frustration and Learning in Human-Robot Cooperation

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Introduction

A physically close interaction with robots has to be easy, safe, intuitive and individually adapted to the human interaction partner. In order to achieve a **human-centered interaction** with a robot, the observation of the user's experience gives important information about the human being and his feelings. Factors such as emotions and learning play an important role [1].
Currently I investigate the **influence of emotions**, namely **frustration**, on **learning processes**, the quality of interaction, and acceptance in human-robot interaction. Frustration is one emotion that can occur during an interaction with a technical system when expectations of the technical system is not fulfilled [2].

Human-Robot Cooperation Experiment

Humans interact with humanoid robots and robot arms. The robot is located in a zone that humans are not allowed to enter. In the cooperative task, the human should learn in which way the interaction succeeds best to trigger the desired action of the robot to achieve a common goal. Depending on the test group, the participants pass through different levels of frustration during the collaboration. How much frustration influence learning processes is measured. Furthermore, evidence on how robots can be developed to prevent frustrating experiences can be identified.

Goal in the cooperation

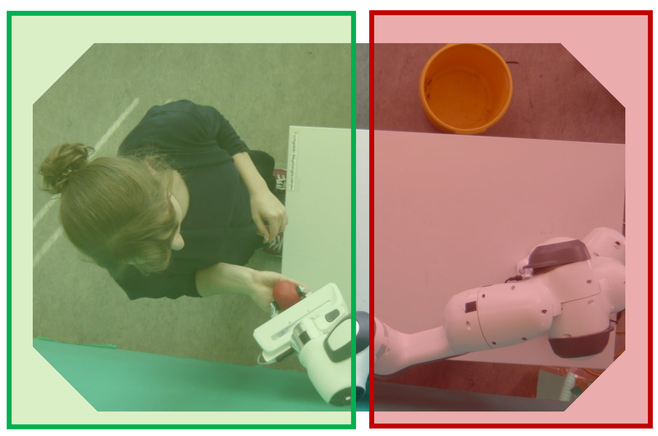
The human has to find out what trigger gesture or word does the robot respond to and throw three balls (yellow and blue) into the corresponding containers with the help of the robot.

Equipment and methods

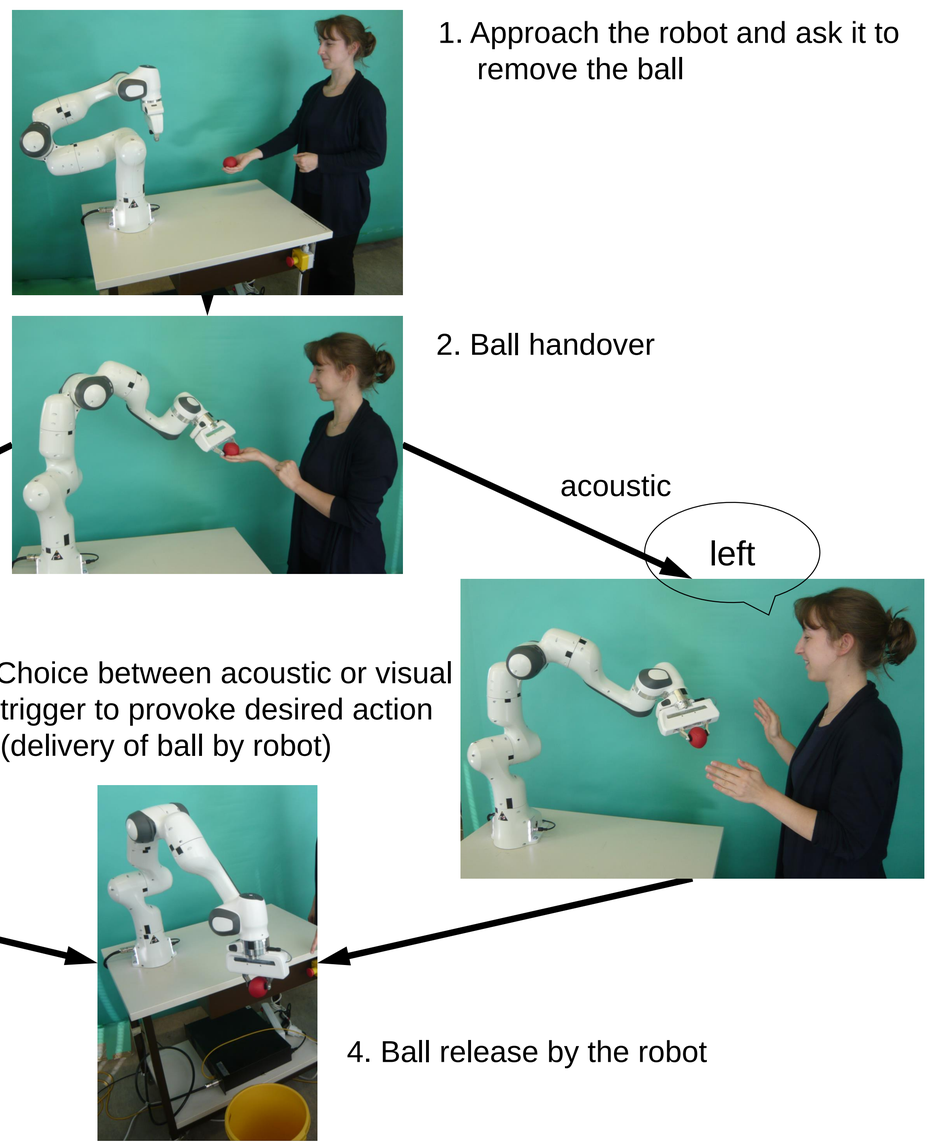
- Objective and subjective methods
- Juggling balls

Setup

The robot is located in a zone that humans are not allowed to enter. The colored baskets are in the area of the robot.



Execution



Outlook

The knowledge of the experiments can be used to measure and minimize frustration. The information about the human condition during the interaction can be applied for the robot actions. The robot is thus enabled to support the abilities of humans. With that the quality of interaction and acceptance is improved. This knowledge can serve as a basis for (further) development and therefore acceptance of robots.

[1] C.F. Graumann, Interaktion und Kommunikation. In C. F. Graumann (Hrsg.) Sozialpsychologie. Handbuch der Psychologie, 7, 1972, p. 1109-1262.
M. Thüring und S. Mahlke, Usability, aesthetics and emotions in human-technology interaction, International Journal of Psychology, 2007, 42 (4), 253-264
M. Thüring & M. Minge, Nutzererleben messen – geht das überhaupt? Mittelstand- Digital: Wissenschaft Trifft Praxis, 1 (1), 2014, p. 45–53.
I. Prändl, Verhalten und Erleben, Lerntheorien; URL: http://lernen.psycho-wissen.net/verhalten-und-erleben/index.html, 2014 (Stand: 15.05.2018)
N. Reich & F. Eyssel, Attitudes towards service robots in domestic environments: The role of personality characteristics, individual interests, and demographic variables; PALADYN Journal of Behavioral Robotics; 4(2), 2013, p. 123-130
D.O. Hebb, Drives and the C.N.S. (conceptual nervous system). The Psychological Review, 62(4), 1955, p. 243–254.
[2] A. Amsel, Frustration theory: An analysis of dispositional learning and memory. Cambridge: Cambridge University Press. Pp. xiii, 1992, 278 pp.
L. Berkowitz, Frustration-aggression hypothesis: Examination and reformulation. Psychology Bulletin, 106, 1989, 59–73.
S. Freud, Group Psychology and the Analysis of the Ego. The Standard Edition of the Complete Psychological Works of Sigmund Freud, Volume XVIII (1920-1922): Beyond the Pleasure Principle, Group Psychology and Other Works, 1921, p. 65-14
Bortz, J. & Döring, N., Forschungsmethoden und Evaluation: für Human- und Sozialwissenschaftler, Springer, 2013, p.67