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The Role of Situational Factors in User Experience during Human-Robot Interaction

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Abstract : While social robots have been increasingly developed and rapidly applied in our daily life, how robots should interact with humans is still an urgent problem to be explored. Appropriate use of interactive behavior is likely to create a good user experience in human-robot interaction situations, which in turn can improve people's acceptance of robots. This paper aimed to systematically and quantitatively examine the effects of several important situational factors (i.e., interaction distance, interaction posture, and feedback style) on user experience during human-robot interaction. A three-factor mixed designed experiment was adopted in this study, where subjects were asked to interact with a social robot in different interaction situations by combinations of varied interaction distance, interaction posture, and feedback style. A set of data on users' behavioral performance, subjective perceptions, and eye movement measures were tracked and collected, and analyzed by repeated measures analysis of variance. The results showed that the three situational factors showed no effects on behavioral performance in tasks during human-robot interaction. Interaction distance and feedback style yielded significant main effects and interaction effects on the proportion of fixation times. The proportion of fixation times on the robot is higher for negative feedback compared with positive feedback style. While the proportion of fixation times on the robot generally decreased with the increase of the interaction distance, it decreased more under the positive feedback style than under the negative feedback style. In addition, there were significant interaction effects on pupil diameter between interaction distance and posture. As interaction distance increased, mean pupil diameter became smaller in side interaction, while it became larger in frontal interaction. Moreover, the three situation factors had significant interaction effects on user acceptance of the interaction mode. The findings are helpful in the underlying mechanism of user experience in human-robot interaction situations and provide important implications for the design of robot behavioral expression and for optimal strategies to improve user experience during human-robot interaction.

Keywords : social robots, human-robot interaction, interaction posture, interaction distance, feedback style, user experience
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