« It’s in Your Eyes: Which Facial Design is Best Suited to Let a Robot Express Emotions? »

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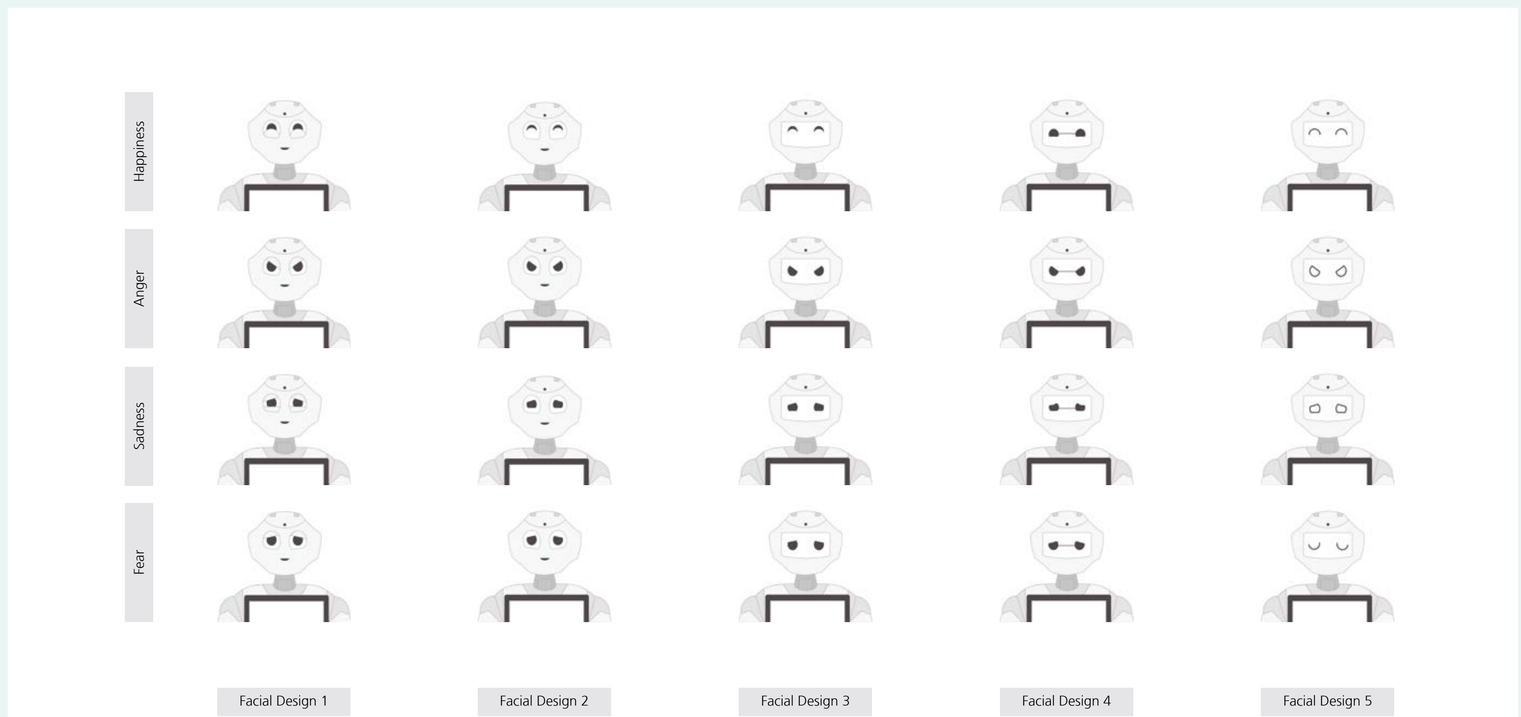

Fig. 1

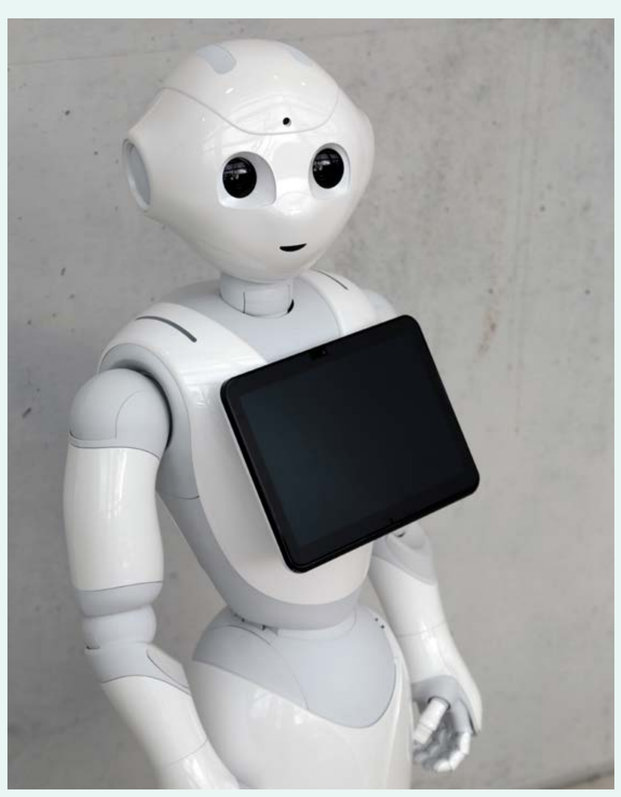

Fig. 2

Design

- Five fictional facial design variants for the Pepper robot (Fig. 2) to enable emotional facial expressions for four basis emotions (happiness, anger, sadness, fear)
- A total of 20 facial designs were tested (Fig.1)

Evaluation via Online Survey

- Rating of the 20 facial designs:
  To what extent does the shown face express each of the four emotions (happiness, anger, fear, sadness?

Likert scale: 1 (does not apply) - 4 (applies)

Participants

- 176 German participants
- age: 17 to 69 years (M = 27.6, SD = 7.39)
- 118 females
- General interest in technical devices above average

Results

- 13 facial designs were assigned to their correct emotion
- Happiness and anger were recognized correctly in all designs, sadness showed mixed results and fear could not be recognized in any design
- Facial Design 3,4, and 5 represented emotions best (Fig. 3)
- There was a difference in the quality of recognizing emotions between the three designs ($F_{(1.72,300.70)} = 47.48$, $p \leq .001$, $\eta^2 = 0.21$)
- Facial Design 3 was the best to recognize emotions compared to Design 4 ($p \leq .001$, $d = 0.74$) and Design 5 ($p \leq .001$, $d = 0.58$) (Fig. 4)

	Happiness	Anger	Sadness	Fear
Facial Design 1	X	X		
Facial Design 2	X	X		
Facial Design 3	X	X	X	
Facial Design 4	X	X	X	
Facial Design 4	X	X	X	

Fig. 3

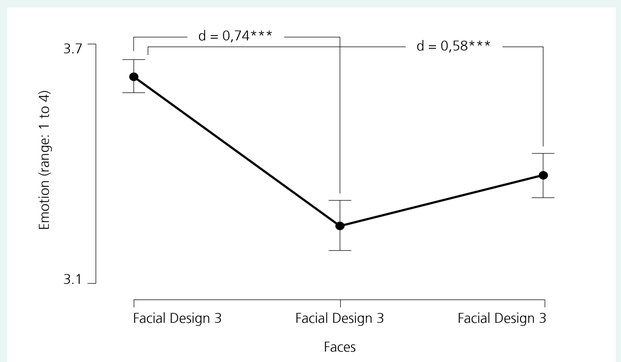

Fig. 4

Conclusion

Overall, we found that design variants with display eyes and no mouth (as in Design 3,4,5) conveyed the emotional expressions better than the ones with digital eyes and mouth. Amongst the three facial designs with display eyes, participants’ emotion ratings were most accurate for design 3.

Further research

- Human-centered design for human-robot interaction
- Personal social robots for older adults
- Design of non-verbal behaviors for social robots in domestic environments
- Interaction strategies and behavioral patterns for collaborative robots
- Personalized human-robot interaction
- Need-based design

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