# I FEEL WHEN "IT" FEELS:
# Physiological responses elicited by human and artificial entity stimuli

**Christina A. Basedow & Arvid Kappas**
**Jacobs University Bremen**

## Abstract

Do we respond emotionally to artificial entities as if they were human? Research has suggested that humans treat artificial entities in a social way and assign common social interaction rules. What if people are just confronted with emotional still images of artificial entities, do they spontaneously react, assigning emotions, with the same intensity, to comparable stimuli? This study focuses on physiological responses to the presentation of human and artificial entity stimuli and how trait empathy impacts responses. Images of humans and robots, toys and CGI characters, were selected in a first study from a set of *N*=190, by 46 participants, and vignettes selected in a second study from a set of *N*=52, by 57 participants. A third study paired the images with associated vignettes with 56 participants, creating a collection of 24 images and vignettes (12 human, 12 artificial) with equivalent intensity ratings of the primary emotions anger, sadness and happiness, and the secondary emotion pride. In the main study, 34 participants were presented with the 24 stimuli while we recorded facial EMG (*Corrugator supercilii, Zygomaticus major*), and skin conductance. The task of participants was to simply observe the stimuli. Additionally, the Interpersonal Reactivity Index (Davis, 1983) was completed. Results of facial EMG indicate significant increases of Corrugator activity for sadness and decreases for happiness and significant Zygomaticus activity for all four emotions. Overall the results suggest that individuals respond surprisingly similar to human and artificial entity stimuli.

## Background

- Human interaction with and interest in technology has increased dramatically over the last decades. Particularly, our reliance, dependence, and acceptance of information and communication technology (ICT).
- Humans engage with media/technology treating the technology as a "peer" in social interaction (Krämer et al., 2012). Social rules and expectations in communication are so effortlessly transferred to these sources as seen in the Media Equation (Reeves & Nass, 1996) and through the concept of ethopoeia (Nass & Moon, 2000) that it raises the question as to the ease of empathic and emotional response transfer towards an artificial entity.
- Research already exists on empathic or affective responses to artificial agents in extreme conditions (Rosenthal von der Pütten et al., 2013), however, there are very few studies that investigate humans physiological responses to moderate emotional stimuli of humans *and* artificial entities systematically.

**Aim of this research:**

- How do human beings respond when presented with emotionally stimulating standardized stimuli of humans and artificial entities?
- What is the extent to which humanness is ascribed to an artificial entity?
- Do still image and vignette paradigms differ in evoking behavioral affective responses?
- What is the moderating role of trait empathy in reactions to human and artificial stimuli?

## References

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Reeves, B., & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. New York: NY: Cambridge University Press.

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## Contact

Christina A. Basedow
c.basedow@jacobs-university.de
Jacobs University Bremen
Campus Ring 1
28759 Bremen, Germany

## Method

**Participants**

- *N* = 34 (25 female), 18 – 25 years old (*M* = 20.12, *SD* = 1.72)

**Design**

- Within-subject: Epoch (baseline, image, image/vignette), Emotion (anger, sadness, happiness, pride), Target (human, artificial entity)

**Measures**

- Psychophysiology – ANS (EDA, analyzed as SCL) and expressive facial behavior measured via facial EMG at the *Corrugator supercilii,* and *Zygomaticus major* sites (Figures 1 and 2)
- Trait empathy measured via the Interpersonal Reactivity Index (IRI) (Overall Score) by Davis (1983)

*Figure 1.* EDA electrode placement.

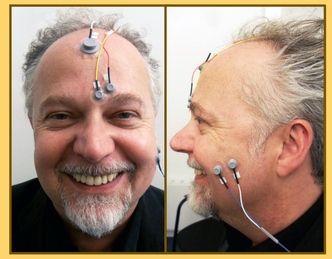

*Figure 2.* Facial EMG electrode placement.

**Procedure** (Figure 3)

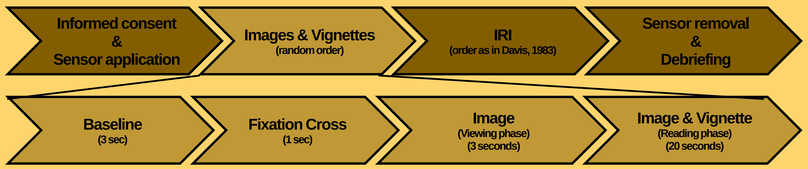


*Figure 3.* Schematic representation of experimental procedure flow.

**Materials**

- Images – Human(12) and Artificial Entity(12) (equivalent intensity ratings of the primary emotions anger, sadness and happiness, and the secondary emotion pride) based on pretest (Figure 4)
- Vignettes – Gender neutral, target neutral (24) (equivalent intensity ratings of the primary emotions anger, sadness and happiness, and the secondary emotion pride) based on pretest (Table 1)
- IRI (Davis, 1983)

| Vignette Examples |
|---|
| I was told that I was useless, worthless, and no good. I was just trying to do my job and one little mistake led to my 'boss' firing me. I have been let go from my job with no cause, no explanation, nothing! I will find a way to show my boss how this feels! I cannot believe how angry this has made me. |
| I don't want to fight anymore. She keeps blaming me for everything. This isn't the life she wants, I'm not good enough, I don't do enough for her. It just keeps going on and on. I have not felt this sad in a long time; I'm losing the relationship I thought I would be in forever. |
| I get to go to school! I get my own books, supplies and friends! I cannot wait. I have wanted to learn how to read for a long time. Finally, I'm just so happy! We were waiting for the acceptance letter for what seemed like forever. |
| Our team won! We have been practicing non-stop for the past four months. Training to make sure we were fit enough, fast enough, and good enough. Today when we scored our winning goal I could not have felt more proud. |

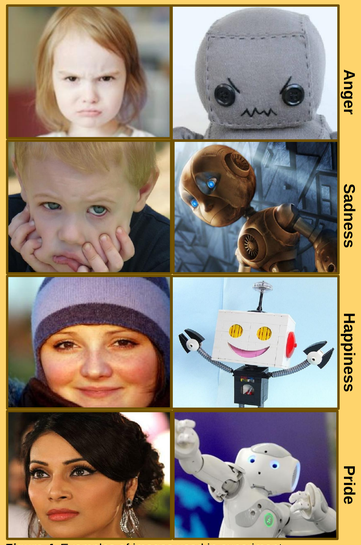


*Figure 4.* Examples of images used in experiment

## Results

**RM-MANOVA**

**Factors: Epoch x Emotion x Target x Individual Image**

**Main effects:**

Epoch → Zyg $p = .009$
Emotion → Cor $p = .010$
Emotion → Zyg $p = .015$

**Interaction effects:**

Epoch x Emotion
→Cor $p = .004$,
Pairwise comparisons
→Happiness: *Baseline* > *Image*, $p = .027$; *Baseline* > *Image/Vignette*, $p = .040$
→Sadness: *Baseline* < *Image/Vignette*, $p = .005$; *Image* < *Image/Vignette*, $p = .006$
→Zyg $p = .005$
Pairwise comparisons
→Anger: *Baseline* < *Image*, $p = .039$; *Baseline* < *Image/Vignette*, $p = .030$
→Sadness: *Image* > *Image/Vignette*, $p = .029$
→Happiness: *Baseline* < *Image*, $p = .009$; *Baseline* < *Image/Vignette*, $p = .008$
→Pride: *Baseline* < *Image*, $p = .025$; *Baseline* < *Image/Vignette*, $p = .032$

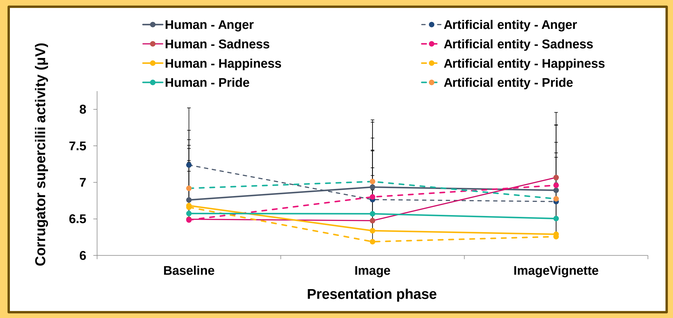


***Figure 5.*** Corrugator supercilii activity, during all epochs, for human and artificial entity stimuli. Error bars indicate +1SE of the mean.

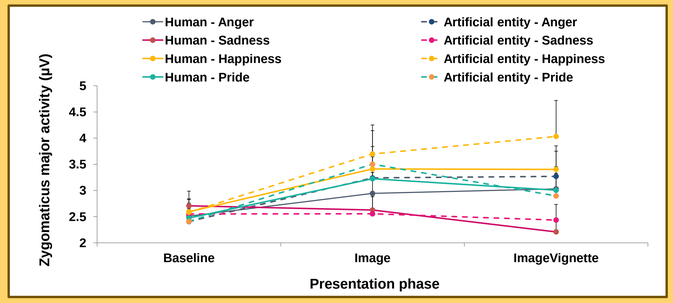


***Figure 6.*** Zygomaticus major activity, during all epochs, for human and artificial entity stimuli. Error bars indicate +1SE of the mean.

## Conclusion

The research highlights that the subjective evaluation of emotional still images of artificial entities and humans and corresponding vignettes had the same results in *Corrugator supercilii,* and *Zygomaticus major* activity. There was no effect based on trait empathy and no effect based on target. We expected behavioral differences. The differences between image presentation and vignette presentation provide opportunities for future research. The results suggest that primary and secondary emotions, and humanness are assigned with surprising believability to artificial entities.

## Next steps

Application in further research to understand the extent to which primary and secondary emotions in text are assigned to neutral images of humans and artificial entities and in which ways these responses can be manipulated through a priming (play) condition.