Variation of empathy in viewers impacts facial features encoded in their mental representation of pain expression

Marie-Pier Plouffer-Demers[1,3], Camille Saumure[1], Daniel Fiset[1], Stéphanie Cormier[1], Miriam Kunz[2], & Caroline Blais[1]

(1) Département de Psychologie, U. Québec en Outaouais; (2) Department of General Practice and Elderly Care Medicine, University of Groningen, (3) Department of psychology, University of Quebec in Montreal

Context

The experience of pain includes sensory, affective, cognitive and behavioral components and leads to the contraction of specific facial muscles[1] that are, to some extent, encoded in the mental representation of onlookers[2]. Exposition to facial expressions of pain has been demonstrated to entail a neural empathic experience in the viewer[3], which varies as a function of subjects' empathy level[4]. The objective of this study was to **verify the impact of empathy variations on the facial features stored by individuals in their mental representation of pain facial expressions**

Method

Participants. 54 (18 males)
Task: Reverse Correlation method[5] ; 500 trials per participant
Questionnaire: Emotional Quotient Test[6]

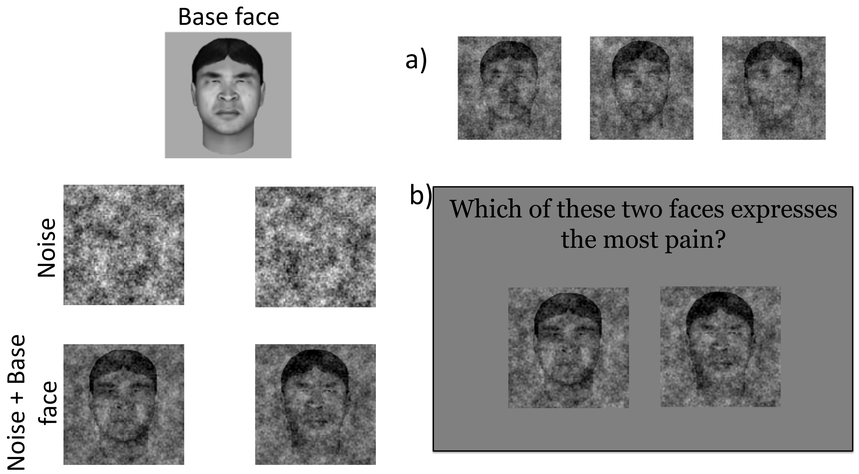


Figure 1. Steps involved in the creation of two stimuli for one trial.

Figure 2. a) Three examples of stimuli. b) Illustration of one trial.

Results

Classification images (CIs) were produced for each participant by averaging the noise patches corresponding to the stimulus selected as expressing the most pain on each trial.

Analysis 1. A weighted sum of the CIs was produced, using the empathy scores (transformed into z-scores) as weights. The stat4CI[7] toolbox was used to reveal which area of the resulting CI significantly varied as a function of empathy.

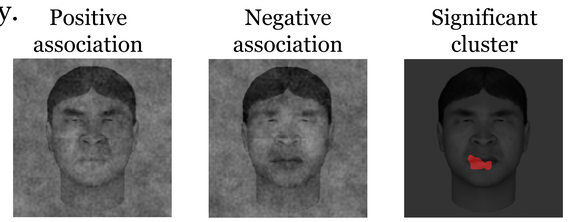


Figure 3. Left panel: Weighted sum of the Cis as a function of empathy scores, overlaid on the base face. *Middle panel*: Same, but using the inverse of the empathy scores. *Right panel*: Area of the CI significantly associated with empathy (Zcrit = 2.7, k=80. p<0.025).

Analysis 2. The amount of signal contained in each individual CI was calculated using the InfoVal metric[8]. A correlation between the individual InfoVals and the empathy scores was calculated.

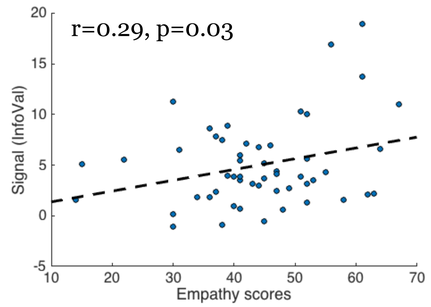
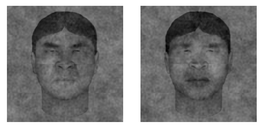


Figure 4. Scatter plot of the InfoVal as a function of empathy

Analysis 3. The "Positive association" and "Negative association" CIs were presented side-to-side to an independent group of 24 participants. They were asked to compare them on the degree to which the three features considered as the core of the facial pain expression were activated.



Brow lowering: χ^2=24, p<0.05
Eye narrowing: χ^2 = 6, p<0.05
Nose wrinkling/Upper lip raising: χ^2=11, p<0.05

Conclusion

- Salience of the mouth in the visual representation of pain facial expressions varies as a function of emptahy.
- Subjective evaluations of the CIs by an independant group suggests that the three core features of the pain expression are coded with more intensity in the mental representation of the most empathic participants.
- The more a person is empathic, the more their visual representation of pain facial expressions is clear (i.e. contains more signal).

References

1. Prkachin (1992). *Pain.*
2. Blais et al. (2019). *Journal of Pain.*
3. Botvinick et al. (2005). *Neuroimage.*
4. Saarela et al. (2007). *Cerebral Cortex.*
5. Mangini & Biederman (2004). *Cognitive Science.*
6. Baron-Cohen & Wheelwright (2004). *Journal of Autism and Developmental Disorders.*
7. Chauvin et al. (2005). *Journal of Vision.*
8. Brinkman et al. (2018). *Behavior Research Methods.*

NSERC CRSNG
CRSH SSHRC
Conseil de recherches en sciences humaines du Canada
Social Sciences and Humanities Research Council of Canada
UQO
GNS SNG
LPVS-UQO
lpvs-uqo.ca