The impact of sex on visual strategies underlying the discrimination of facial expressions of pain

Pierre-Louis Audette, Marie-Pier Plouffe-Demers, Daniel Fiset & Caroline Blais
Departement of psychoeducation and psychology, University of Quebec in Outaouais

Theoretical context

- Research has revealed that women are better than men at recognizing facial expressions of pain[1,2] and are more sensitive to variation in pain expression[2,3].
- Theoretical frameworks have been developed to explain this feminine advantage[4,5,6], but few have explored their perceptual basis.
- The goal of the present study is to compare the visual information used by men and women to discriminate the intensity of pain facial expressions.

Method

- 72 participants (37 males, M = 22)
- **Stimuli :** 16 face avatars (2 identities [male and female] x 2 ethnicities [Caucasian and Asian] x 4 levels of intensity) created with FACEGen and FACSGen.
- **Task :** Participants were asked to decide which of two faces expressed the most pain. The two faces differed in terms of expression intensity (33%, 66% or 100%).
- The faces were sampled through space and spatial frequencies using the Bubbles method[7].
- Each participant completed 3024 trials. The number of bubbles was adjusted separately for the three intensity conditions using QUEST[8] in order to maintain an average performance of 75% per intensity condition.

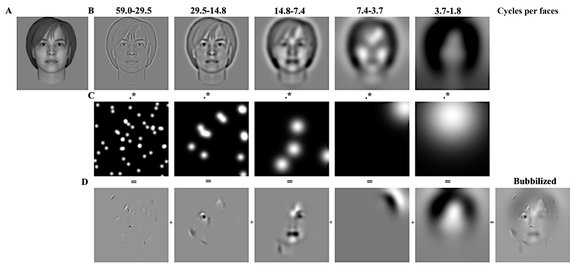

Figure 1. Procedure to create a stimulus with the Bubbles method.

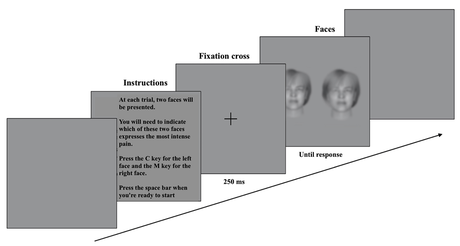

Figure 2. Sequence of events on each trial.

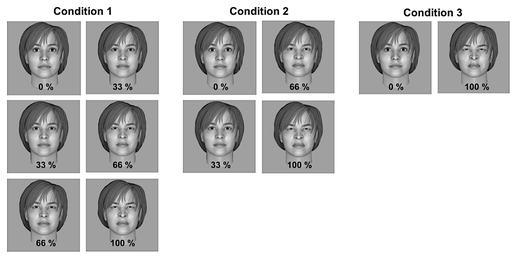

Figure 3. Representations of the three possible levels of difficulty.

Analyses and results

- **Women (*M*=44.49 bubbles**, *SD*=20.82) need less visual information than **Men (*M*=56.07 bubbles**, *SD*=23.16) to successfully complete the task.

Classification images

- The classification images (CIs) for each sex group were generated and consisted of weighted sums of the bubble masks presented during the experiment, using the accuracy transformed into z-scores as weights.
- A cluster test (Stat4CI[9]) was applied to determine the statistically significant regions (T_{crit}=2.7; k=2273.0; p<0.025).
- **No difference in the regions used by men and women was found** [*ClusterMax*=251, p=0.213] (See Figure 4).
- **Women relied on larger regions of the face** (clusters; *M*=2262.0, *SD*=1337.4) than men (*M*=1350.0, *SD*=1815.20), [t(70)=2.44, p=0.017] (See Figure 5 right).
- **Women had higher maximum z-scores** (*M*=3.4, *SD*=0.7) than men (*M*=3.0, *SD*=0.7), [t(70)=2.24, p=0.028] (See Figure 5 left).
- A mediation analysis showed that **this strategy seemed to completely mediate their discrimination advantage** [β=-6.06, 95% *CI* [-12.09 -1.12], p=0.01] (See figure 6).

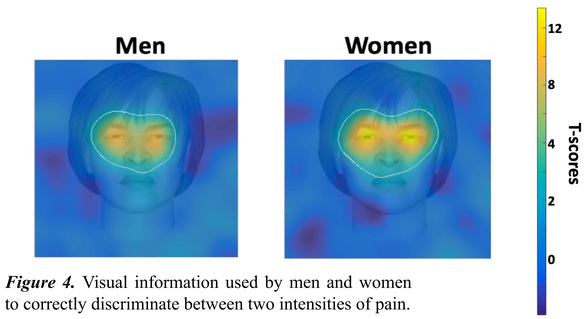

Figure 4. Visual information used by men and women to correctly discriminate between two intensities of pain.

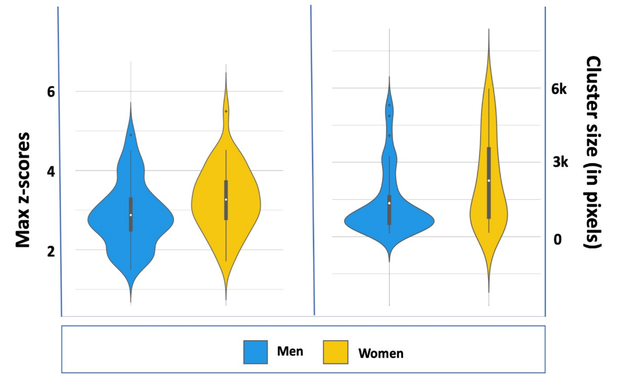

Figure 5. Left : maximum z-scores. Right : maximum cluster size (pixels).

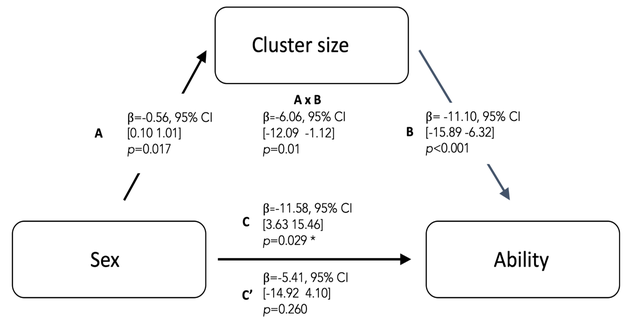

Figure 6. A = effect of sex on cluster size. B = effect of cluster size on ability. C = total effect of sex on ability. C'= Direct effect of sex on ability after adding cluster size to the model. AxB = mediation of the effect of sex on ability by cluster size.

Conclusion

The current study corroborates previous results suggesting a feminine advantage in the processing of pain perceived in others. However, it suggests that the ability in which women were found to better discriminate between different pain intensities do not necessarily rely on the utilization of specific facial features, but rather on a more efficient and/or flexible use of this information.

References. **1)** Hill, M. L., & Craig, K. D. (2004). Detecting deception in facial expressions of pain: accuracy and training. *The Clinical journal of pain, 20*(6); **2)** Prkachin, K. M., Mass, H., & Mercer, S. R. (2004). Effects of exposure on perception of pain expression. *Pain, 111*(1-2); **3)** Robinson, M. E., & Wise, E. A. (2003). Gender bias in the observation of experimental pain. *Pain, 104*(1-2); **4)** Brody, L. R. (1985). Gender differences in emotional development: A review of theories and research. *Journal of personality, 53*(2); **5)** Keogh, E. (2014). Gender differences in the nonverbal communication of pain: A new direction for sex, gender, and pain research?. *Pain, 155*(10); **6)** Kret, M. E., & De Gelder, B. (2012). A review on sex differences in processing emotional signals. *Neuropsychologia, 50*(7); **7)** Gosselin, F. & Schyns, P. G. (2001). Bubbles: A technique to reveal the use of information in recognition. *Vision Research, 41*; **8)** Watson, A. B. & Pelli, D. G. (1983). Quest: A bayesian adaptive psychometric method. *Perception and psychophysics, 33;* **9)** Chauvin, A., Worsley, K. J., Schyns, P. G., Arguin, M., & Gosselin, F. (2005). Accurate statistical tests for smooth classification images. *Journal of Vision, 5*(9).

NSERC CRSNG UQO GNS SNG LPVS-UQO lpvs-uqo.ca