It’s all in the mind

Keating, Connor; Cook, Jennifer

It's all in the mind: linking internal representations of emotion with facial expression recognition

Connor T. Keating[1] & Jennifer L Cook[1]
[1]University of Birmingham

Email: CXK655@bham.ac.uk

University/Lab Homepage: https://jencooklab.com

Twitter Handle: @ConnorTKeating

Keywords: Emotion recognition; Emotion Representations

Background and aims of the research

Over the past six decades, researchers have extensively studied emotion recognition (e.g., Ekman & Friesen, 1975; Bassili, 1979; Young et al., 1997; Goldman & Sripada, 2005; Zheng et al., 2017; Sowden, Schuster, Keating, Fraser & Cook, 2021). Despite being highly related to (and potentially important for) emotion recognition, it was only recently that researchers began investigating *internal representations* of emotion (e.g., Jack, Garrod, Yu, Caldara & Schyns, 2012; Jack, Garrod & Schyns, 2014; Jack, Sun, Delis, Garrod & Schyns, 2016; Chen, Garrod, Ince, Schyns & Jack, 2021). Such studies have typically adopted psychophysical approaches to index the way in which facial expressions appear in the "mind's eye" (i.e., internal representations) and compared these across emotions (e.g., Jack, Garrod & Schyns, 2014; Chen et al., 2018), cultures (e.g., Jack, Caldara & Schuns, 2012; Jack, Sun, Delis, Garrod & Schyns, 2016), and participant groups (e.g., Pichon et al., 2020). Despite great progress in these areas, research has not yet investigated the extent to which internal representations *influence* emotion recognition. For example, studies have not explored whether the precision/clarity of internal representations contributes to emotion recognition abilities and/or difficulties. In our recent study, we tested the hypothesis that individuals with less clear internal representations of emotion would have low scores on an emotion recognition task.

Methodology

To test this hypothesis, participants completed two tasks which employed dynamic point light displays (a series of dots that convey biological motion) of angry, happy and sad facial expressions (PLFs). In the first task (taken from Sowden, Schuster, Keating, Fraser & Cook, 2021; Keating, Fraser Sowden & Cook, 2021), participants viewed emotional PLFs and rated how angry, happy and sad the facial expressions appeared. We calculated emotion recognition accuracy scores by subtracting the mean of the two incorrect ratings from the correct rating. For example, for a trial that displayed an angry expression, the mean rating of the two incorrect emotions (happy and sad) was subtracted from the rating for the correct emotion (angry).

The second task was an adapted version of a task we had employed previously (Keating, Sowden & Cook, under revision). In this task, on each trial, participants moved a dial to manipulate the speed of a PLF until it moved at the speed of a typical angry, happy or sad expression. This task operates on the premise that, compared to participants with clear internal representations, those with less clear representations of emotion would attribute more variable speeds to the expressions. For instance, someone with a clear internal representation anger would be consistent in their attributions (e.g., by attributing 120% speed, 121% speed

and 119% speed to the angry expression). In contrast, someone with a less clear internal representation would be more variable (e.g., by attributing 120% speed, 60% speed and 180% speed to an angry expression). Therefore, to index the clarity (or lack thereof) of participants' internal representations, we calculated variability by taking the standard deviation of the speeds attributed to the angry, happy and sad expressions respectively. Mean variability was calculated by taking a mean of the variability scores for the angry, happy and sad PLFs.

Our preliminary results

Our preliminary results suggest that people that have less clear internal representations of emotion find it more difficult to recognise emotional facial expressions. However, further work needs to be done to replicate these findings and, to determine the direction of causality. In the case of the latter- it could be that those with less clear internal representations of facial expressions do not have consistent "templates" to compare observed expressions to, thus resulting in poorer emotion recognition. Alternatively, it could be that those who struggle to read emotional expressions do not build up clear internal representations as they do not know the correct "label" or give an incorrect "label" to expressions they observe. In addition, further work needs to be done to a) identify how other emotional processes are implicated in emotion recognition (e.g., the interoceptive *experience* of emotion) and b) identify how different traits (e.g., autistic and alexithymic) are implicated in these different emotional sub-abilities.

Next steps

In our next experiment, we aim to test how features of internal emotional experiences, such as the consistency and overlap between emotions, contribute to internal representations and facial emotion recognition. By doing so, we hope to construct a mechanistic model of emotion recognition that elucidates how different emotional sub-abilities and traits are associated with one another. We hope that such work will illuminate potential pathways for supporting emotion recognition in clinical and sub-clinical groups (see Keating & Cook, 2020).

Acknowledgements

We thank the British Psychological Society Cognitive Section for awarding us the grant. The funds were used to offset the costs of online testing (e.g., recruiting participants via Prolific).

References

Bassili, J. N. (1979). Emotion recognition: The role of facial movement and the relative importance of upper and lower areas of the face. *Journal of Personality and Social Psychology*, *37*(11), 2049–2058. https://doi.org/10.1037/0022-3514.37.11.2049

Chen, C., Crivelli, C., Garrod, O. G., Schyns, P. G., Fernández-Dols, J. M., & Jack, R. E. (2018). Distinct facial expressions represent pain and pleasure across cultures. *Proceedings of the National Academy of Sciences*, *115*(43), E10013-E10021. https://doi.org/10.1073/pnas.1807862115

Chen, C., Garrod, O. G., Ince, R. A., Schyns, P. G., & Jack, R. E. (2021). Facial Expressions Reveal Cross-Cultural Variance in Emotion Signaling. *Journal of Vision*, *21*(9), 2500-2500. https://doi.org/10.1167/jov.21.9.2500

Ekman, P., & Friesen, W. V. (1975). *Unmasking the face: A guide to recognizing emotions from facial clues*. Prentice Hall.

Goldman, A. I., & Sripada, C. S. (2005). Simulationist models of face-based emotion recognition. *Cognition*, *94*(3), 193-213.

Jack, R. E., Caldara, R., & Schyns, P. G. (2012). Internal representations reveal cultural diversity in expectations of facial expressions of emotion. *Journal of Experimental Psychology: General*, *141*(1), 19-25. https://doi.org/10.1037/a0023463

Jack, R. E., Garrod, O. G., & Schyns, P. G. (2014). Dynamic facial expressions of emotion transmit an evolving hierarchy of signals over time. *Current biology*, *24*(2), 187-192. https://doi.org/10.1016/j.cub.2013.11.064

Jack, R. E., Garrod, O. G., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. *Proceedings of the National Academy of Sciences*, *109*(19), 7241-7244. https://doi.org/10.1073/pnas.1200155109

Jack, R. E., Sun, W., Delis, I., Garrod, O. G., & Schyns, P. G. (2016). Four not six: Revealing culturally common facial expressions of emotion. *Journal of Experimental Psychology: General*, *145*(6), 708. https://doi.org/10.1037/xge0000162

Keating, C. T., & Cook, J. L. (2020). Facial expression production and recognition in autism spectrum disorders: A shifting landscape. *Child and Adolescent Psychiatric Clinics*, *29*(3), 557-571. https://doi.org/10.1016/j.chc.2020.02.006

Keating, C. T., Fraser, D. S., Sowden, S., & Cook, J. L. Differences Between Autistic and Non-Autistic Adults in the Recognition of Anger from Facial Motion Remain after Controlling for Alexithymia. *Journal of Autism and Developmental Disabilities, 1-17.* Advance online publication. https://doi.org/10.1007/s10803-021-05083-9

Keating, C. T., Sowden, S., & Cook, J. L. (2022). Comparing internal representations of facial expression kinematics between autistic and non-autistic adults. Autism Research, 15(3), 493-506. https://doi.org/10.1002/aur.2642

Pichon, S., Bediou, B., Antico, L., Jack, R., Garrod, O., Sims, C., Green, C. S., Schyns, P., & Bavelier, D. (2020). Emotion perception in habitual players of action video games. *Emotion*. https://doi.org/10.1037/emo0000740

Sowden, S., Schuster, B. A., Keating, C. T., Fraser, D. S., & Cook, J. L. (2021). The role of movement kinematics in facial emotion expression production and recognition. *Emotion*. http://dx.doi.org/10.1037/emo0000835

Young, A. W., Rowland, D., Calder, A. J., Etcoff, N. L., Seth, A., & Perrett, D. I. (1997). Facial expression megamix: Tests of dimensional and category accounts of emotion recognition. *Cognition*, *63*(3), 271-313.

Zheng, W. L., Zhu, J. Y., & Lu, B. L. (2017). Identifying stable patterns over time for emotion recognition from EEG. *IEEE Transactions on Affective Computing*, *10*(3), 417-429. https://doi.org/10.1109/TAFFC.2017.2712143.