Similar visual strategies are used to recognize spontaneous and posed facial expressions

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Theoretical Background –

The proper interpretation of the internal states of others is crucial to the success of social relations, and this is partly due to the recognition of facial expressions. Until now, most studies bearing on the visual strategies underlying facial expression recognition have been done using posed expressions (PE). However, evidence suggests that these expressions differ from spontaneous expressions (SE) in terms of appearance, at least with regard to intensity[1,2,3,4,5] and facial motion asymmetry[6].

The aim of this study is to compare the visual information obtained in order to recognize static spontaneous and posed facial expressions. These strategies will then be compared with those of an ideal observer (IO) to verify which regions of the face contain the most discriminating information for each of the expressions.

Method –

Participants : 20 Canadians (2 males), 22 years-old on average.

Stimuli : Pictures representing faces of 21 individuals (11 men) expressing spontaneous and posed disgust, happiness, surprise and sadness were used (MUG; Multimedia Understanding Group)[7].

Task : Categorization of spontaneous and posed facial expressions of emotions sampled through space and spatial frequencies using the Bubbles method[8]. Each participant completed 2016 trials with PEs, and 2016 trials with SEs. Both types of facial expressions were presented in different experimental blocks and the order of these blocks was counterbalanced. The number of bubbles was adjusted separately for SE and PE using QUEST[9] in order to maintain an average performance of 62.5% across the four expressions.

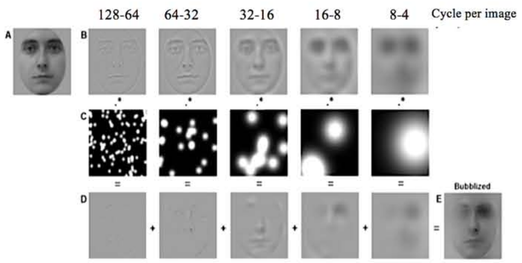

Figure 1. Procedure to create a stimulus with the Bubbles method

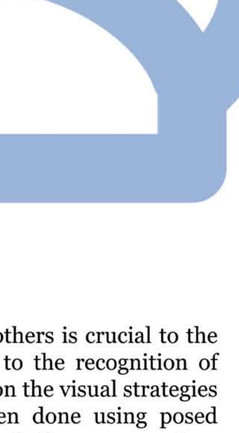

Figure 2. Examples of posed and spontaneous expressions

Analysis & Results –

The number of bubbles required to achieve an average accuracy of 62.5 % was higher with SE (M = 64.0, SD = 15.6) than with PE (M = 34.4, SD = 8.7) indicating that less visual information was needed with the latter to achieve a comparable accuracy rate [$t(19) = -15.07$, $p < 0.001$].

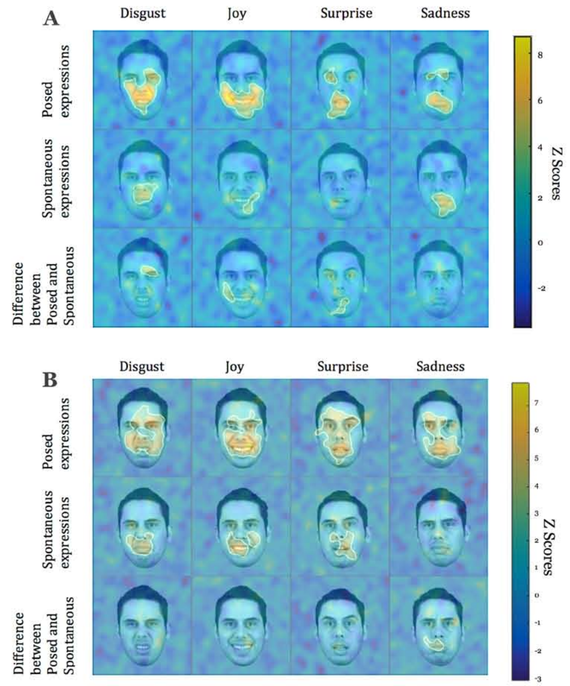

Figure 3. Panel A represents the visual information used by the participants and panel B, the most discriminating visual information according to the IO. Significant regions are delimited by a white contour.

Classification images. The visual information useful in categorizing facial expressions of emotions was determined by computing classification images (CIs), which consist in weighted sums of the bubble masks presented during the experiment, using the accuracy transformed into z-scores as weights. The CIs were then transformed into z-scores using a permutation method, and a cluster test (Stat4CI[10]) was applied to determine the statistically significant regions ($Z_{crit} = 3.0$, $p < 0.05$).

Region of interest analysis. The maximum Z-scores obtained by each participant in the eye and mouth areas were compared for both types of expressions. This analysis was conducted based on studies showing that the voluntary masking of a facial expression is done more effectively in the mouth area[11]. A significant interaction between the face region and the type of expression was observed [$F(1.19) = 7.87$, $p=0.011$]. Paired t-tests indicate that the maximum Z-scores were on average higher in the mouth area than in the eye area with PEs [$t(19) = -4.87$; $p < 0.001$] but not with SEs [$t(19) = -1.8$; $p=0.087$]. Moreover, while the maximum Z-scores in the mouth area were on average higher with PEs than with SEs [$t(19)=6.2$, $p<0.001$], they did not significantly differ in the eye area [$t(19)=1.8$, $p=0.089$].

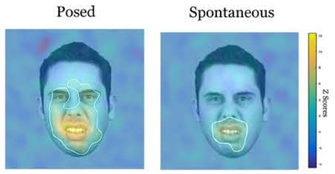

Figure 6. Areas significantly useful to recognize are delimited by a white contour.

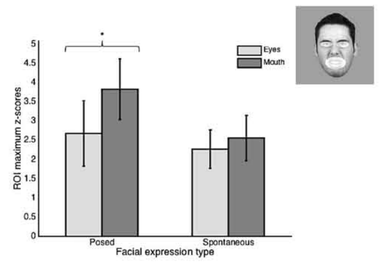

Figure 7. Average value of the maximum z-scores reached in the mouth and eye areas. Error bars represent standard deviation. Inset represents the masks used for the ROI analysis.

Conclusion –

- CIs obtained by the IO suggest that the most discriminating visual information was similar in the PEs and SEs selected in this study.
- CIs obtained with our participants suggest that similar visual strategies are used with both types of expressions. However, quantitative differences are observed, suggesting that the strategy for recognizing PEs is more systematic.
- A region of interest analysis suggests that the relative utilization of the mouth and eye areas differs in both types of expressions; compared with PEs, the features utilization is more equally distributed with SEs. The latter result may be related to the finding that the mouth is a less reliable signal of the emotion experienced by an individual, being easier to control in order to mask an expression.

References –

1. Borod, J. C., & Caron, H. S. (1980). Facedness and emotion related to lateral dominance, sex and expression type. *Neuropsychologia, 18*(2), 237–242.
2. Borod, J. C., Koff, E., & White, B. (1983). Facial asymmetry in posed and spontaneous expressions of emotion. *Brain and Cognition, 2*, 165–175.
3. Campbell, R. (1978). Asymmetries in interpreting and expressing a posed facial expression. *Cortex, 14*, 327–342.
4. Ekman, P., Hager, J. C., & Friesen, W. V. (1981). The symmetry of emotional and deliberate facial actions. *Psychophysiology, 18*(2), 101–106.
5. Sackeim, H. A., & Gur, R. C. (1978). Lateral asymmetry in intensity of emotional expression. *Neuropsychologia, 16*(4), 473–481.
6. Ross, E. D., & Pulusu, V. K. (2013). Posed versus spontaneous facial expressions are modulated by opposite cerebral hemispheres. Cortex, 49(5), 1280-1291.
7. Aifanti, N., Papachristou, C., & Delopoulos, A. (2010). The MUG facial expression database. In Image Analysis for Multimedia Interactive Services (WIAMIS), 11th International Workshop, 1-4.
8. Gosselin, F., & Schyns, P. G. (2001). Bubbles: a technique to reveal the use of information in recognition tasks. Vision research, 41(17), 2261-2271.
9. Watson, A. B., & Pelli, D. G. (1983). QUEST: a Bayesian adaptive psychometric method. Perception & Psychophysics, 33, 113–120.
10. Chauvin, A., Worsley, K. J., Schyns, P. G., Arguin, M., & Gosselin, F. (2005). Accurate statistical tests for smooth classification images. Journal of Vision, 5, 659-667.
11. Dunlap, K. (1927). The role of the eye muscles and mouthmuscles in the expression of emotions. Genetic Psychology Monographs, 2, 199–233.
12. Blais, C., Roy, C., Fiset, D., Arguin, M., & Gosselin, F. (2012). The eyes are not the window to basic emotions. Neuropsychologia, *50*(12), 2830-2838.

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