

ARE EMOTIONAL DISPLAYS AN EVOLUTIONARY PRECURSOR TO COMPOSITIONALITY IN LANGUAGE?

FEDERICA CAVICCHIO, LIVNAT LEEMOR,
SIMONE SHAMAY-TSOORY, WENDY SANDLER
Sign Language Linguistics Lab, University of Haifa
Haifa, Israel

Federica.cavicchio@gmail.com, livnatlib@gmail.com,
sshamay@psy.haifa.ac.il, wsandler@research.haifa.ac.il

Compositionality is a basic property of language, spoken and signed, according to which the meaning of a complex structure is determined by the meanings of its constituents and the way they combine (e.g., Jackendoff, 2011 for spoken language; Sandler 2012 for constituents conveyed by face and body signals in sign language; Kirby & Smith, 2012 for emergence of compositionality). Here we seek the foundations of this property in a more basic, and presumably prior, form of communication: the spontaneous expression of emotion. To this end, we ask whether features of facial expressions and body postures are combined and recombined to convey different complex meanings in extreme displays of emotions. There is evidence that facial expressions are processed in a compositional fashion (Chen & Chen, 2010). In addition, facial components such as nose wrinkles or eye opening elicit systematic confusion while decoding facial expressions of disgust and anger and fear and surprise, respectively (Jack et al., 2014), suggesting that other co-occurring signals contribute to their interpretation. In spontaneous emotional displays of athletes, the body – and not the face – better predicts participants' correct assessments of victory and loss pictures, as conveying positive or negative emotions (Aviezer et al., 2012), suggesting at least that face and body make different contributions to interpretations of the displays. Taken together, such studies lead to the hypothesis that emotional displays are compositional - that each signal component, or possibly specific clusters of components (Du et al., 2014), may have their own interpretations, and make a contribution to the complex meaning of the whole. On the assumption that emotional displays are older than language in evolution, our research program aims to determine whether the crucial property of compositionality is indeed present in communicative displays of emotion.

In this study, we aim at finding specific features typical of spontaneous

responses of athletes to victory or defeat. We suggest that these features contribute to the interpretation of the complex emotions experienced in these contexts (Scherer & Ellgring, 2007). In our study, 350 pictures of athletes photographed within moments of winning or losing. We coded facial expressions using FACS (Ekman, Friesen & Hagar, 2002) and body displays using BACS (Cavicchio & Marom, 2015). Only the visible face and body features were annotated. As a result, 305 features of facial expression and body posture were coded. We ran a Multiple Component Analysis to identify the features that were more frequently associated with win and loss. We found that a group of face and body features were prototypical of win contexts (e.g., Figure 1a: lowered brows, arms away from body), and others of loss (e.g., 1b: hands covering face/head, torso bent forward). A subset of these prototypical features was shared between the two contexts (e.g., 1c, d: eyes closed). We wish to determine whether the presence of the same signals shared across the two contexts contributes the same ‘meaning’ to each display – e.g., eye closure to avoid gaze and internalize an event that is too intense, whether joyful or painful. If so, this would suggest that emotional signals are understood compositionally rather than holistically, calling into question the notion of hardwired recognition of discrete emotions. To pursue this hypothesis, we tested participants’ interpretation of these displays.

In the first experiment, participants were asked to rate the displays according to whether they portrayed someone who just lost or won on a 0 (clear loss) to 7 (clear win) scale. Participants saw three types of pictures taken from our corpus of 350 pictures: pictures in which facial and body features were frequently associated with win (prototypical win, Fig. 1a), pictures in which displays were frequently associated with loss (prototypical loss, Fig 1b) and pictures in which the displays consist of a mixture of win and loss features. In the mixed group, half of the pictures portrayed athletes who had just won and half athletes who had just lost (mixed win, Fig. 1c, and mixed loss, Fig. 1d). As a result, participants consistently rated as loss (mean=2.5) or win (mean=6) the pictures with the prototypical win and loss body features, but rated the mixed pictures in the middle of the scale (mean=4.5). The differences between conditions (win vs. loss and a mixed vs. prototypical) were all significant.

In the second experiment, we showed participants the same pictures and asked them to rate along a continuum how submissive/dominant, ashamed/proud, angry/not angry, disappointed/not disappointed, not satisfied/satisfied, not frustrated/frustrated or sad/happy the athletes looked. Again, prototypical losing picture scores were at the bottom of each scale and prototypical winning pictures scores were at the top. Mixed win and mixed loss pictures were rated in the middle of each scale. The differences between conditions (win vs. loss and mixed vs. prototypical) were all significant.

From these first results we conclude that different combinations of body and face features can modulate emotion recognition and judgments of win and

loss, laying the groundwork for a theory of compositionality in the expression and interpretation of emotions. Our findings are compatible with a compositional model of communicative emotional displays, and lend credence to the proposal that they are a plausible communicative precursor to language.

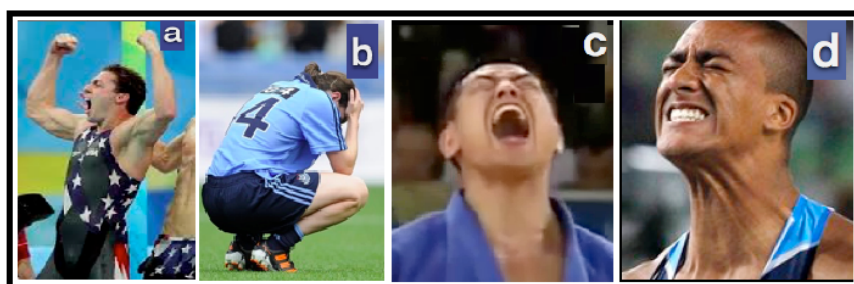


Figure 1: (a) Prototypical Win; (b) Prototypical Loss; (c) Mixed Win: eyes closed; (d) Mixed Loss: eyes closed.

Acknowledgements

This research is supported by ERC Grant Agreement 340140 for the Grammar of the Body project. The authors thank Noa Marom for her help with the collection and coding of the pictures.

References

- Aviezer, H., Trope, Y., & Todorov, A., (2012). Body Cues, Not Facial Expressions, Discriminate Between Intense Positive and Negative Emotions. *Science*, 338 (6111), 1225.
- Chen, M. Y., Chen, C. C., (2010). The contribution of the upper and lower face in happy and sad facial expression classification. *Vision Research*, 50, 1814-1823.
- Du, S., Tao, Y., & Martinez, A. M. (2014). Compound facial expressions of emotion. *Proceedings of the National Academy of Sciences of the United States of America*, 111(15), 1454–1462.
- Ekman, P., Friesen, W. V., & Hager, J. C., (2002). *Facial Action Coding System: The Manual on CD ROM*. Salt Lake City: A Human Face.
- Jack, R., Garrod, O. G. B., Schyns, P. G., (2014). Dynamic Facial Expressions of Emotion Transmit an Evolving Hierarchy of Signals over Time. *Current Biology*, 24, 1-6.
- Jackendoff, R. (2011). What is the human language faculty? Two views, *Language* 87(3), 586-624.
- Kirby, S. & Smith, K. (2012). Compositionality and linguistic evolution. *Oxford Handbook of Compositionality*. (pp. 493-509). Oxford: Oxford University Press.
- Sandler, W. (2012). Dedicated gestures and the emergence of sign language. *Gesture* 12(3). 265-307.
- Scherer, K. R., & Ellgring, H. (2007). Multimodal expression of emotion: Affect programs or componential appraisal patterns? *Emotion* 7(1), 158-17.