Application of Vector Representation for Revealing the Richness of Meaning of Facial Expressions

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Abstract : Studies investigating emotional facial expressions typically reveal consensus among observes regarding the meaning of basic expressions, whose number ranges between 6 to 15 emotional states. Given this limited number of discrete expressions, how is it that the human vocabulary of emotional states is so rich? The present study argues that perceivers use sequences of these discrete expressions as the basis for a much richer vocabulary of emotional states. Such mechanisms, in which a relatively small number of basic components is expanded to a much larger number of possible combinations of meanings, exist in other human communications modalities, such as spoken language and music. In these modalities, letters and notes, which serve as basic components of spoken language and music respectively, are temporally linked, resulting in the richness of expressions. In the current study, in each trial participants were presented with sequences of two images containing facial expression in different combinations sampled out of the eight static basic expressions (total 64; 8X8). In each trial, using single word participants were required to judge the 'state of mind' portrayed by the person whose face was presented. Utilizing word embedding methods (Global Vectors for Word Representation), employed in the field of Natural Language Processing, and relying on machine learning computational methods, it was found that the perceived meanings of the sequences of facial expressions were a weighted average of the single expressions comprising them, resulting in 22 new emotional states, in addition to the eight, classic basic expressions. An interaction between the first and the second expression in each sequence indicated that every single facial expression modulated the effect of the other facial expression thus leading to a different interpretation ascribed to the sequence as a whole. These findings suggest that the vocabulary of emotional states conveyed by facial expressions is not restricted to the (small) number of discrete facial expressions. Rather, the vocabulary is rich, as it results from combinations of these expressions. In addition, present research suggests that using word embedding in social perception studies, can be a powerful, accurate and efficient tool, to capture explicit and implicit perceptions and intentions. Acknowledgment: The study was supported by a grant from the Ministry of Defense in Israel to GA and CS. CS is also supported by the ABC initiative in Ben-Gurion University of the Negev.