

What can self-organizing maps reveal about the structure of emotion concepts: an Estonian case study

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The conceptual realm of emotions has gained considerable support in recent theories which claim that emotions can be understood as states that are both affective and conceptual at the same time (Feldman Barrett, 2006). Due to our inability to access concepts directly they have to be approached through different lexical tasks addressing emotional experience or verbal expression. In the field of psychology, a long tradition of lexical studies has led to partly controversial results and discussions on the topic of the structure of emotions vs. the structure of emotion lexicon and their potential isomorphism (e.g., Cacioppo & Berntson, 1999; Feldmann Barrett, 2004; Larsen & Diener, 1992; Ortony, Clore, & Collins, 1988).

According to P. Gärdenfors' Theory of Conceptual Spaces we can expect three non-competing levels of representations. Applied to the field of emotions it would mean that on the most abstract level we have emotion names, on the intermediate level we have emotion concepts and on the subconceptual level we have perceptual qualities of emotions. The theory offers a geometrical model of assessing concept similarity based on spatial relations. In this respect there is an analogy between the theoretical framework and the method of self-organizing maps (Kohonen, 2000) in which the topological layout and neighbourhood relations are expected to represent homology of input data.

In the case study a set of the Estonian emotion concepts were studied using self-organizing maps. One hundred participants assessed the semantics of 24 words in two different tests that provided access to the concepts from two different levels of representation of knowledge. The first task addressed the semantic interrelations of emotion terms (synonymy and antonymy) and the second addressed the qualities of emotional experience as measured on seven scales. The results revealed two visually different topological layouts where coherence of the conceptual structure was recognizable only in general terms. Two main clusters, positivity and negativity, were found in both maps. In addition, a cluster of alertness emerged while the concepts were accessed through the interrelations of emotion words.

We assume that the parts which were found to be shared between our two structures are most likely to belong to the conceptual level of representation. The details of the local neighbourhood relations which were not shared between our two structures as well as the cluster-like versus dimension-like occurrence of situation related alertness could be interpreted as belonging only to the symbolic and sub-conceptual levels, respectively.

Our result can, thus, be interpreted as a kind of empirical proof of the Gärdenfors' multilevel model of representations. The three levels of symbolic, conceptual and subconceptual representation of emotions are compatible also with the levels proposed by other students of emotion knowledge (Niedentahl, Setterlund, & Jones, 1994). With respect to emotion–lexicon isomorphism, we suppose that the question is rather in the expected degree of isomorphism of alternative reductional representations of those phenomena.

References

- Cacioppo, J. T., & Berntson, G. G. (1999). The affect system: Architecture and operating characteristics. *Current Directions in Psychological Science*, 8, 133–137.
- Feldman Barrett, L. (2006). Solving the emotion paradox: Categorization and the Experience of Emotion. *Personality and Social Psychology Review*, 10(1), 20–46.
- Feldman Barrett, L. (2004). Feelings or words? Understanding the content in self-report ratings of experienced emotion. *Journal of Personality and Social Psychology*, 87(2), 266–281.
- Gärdenfors, P. (2000). *Conceptual spaces. The geometry of thought*. London: The
- Kohonen, T. (2000). *Self-organizing maps* (3rd ed.). Berlin: Springer.
- Larsen, R. J., & Diener, E. (1992). Problems and promises with the circumplex model of emotion. *Review of Personality and Social Psychology*, 13, 25–59.
- Niedenthal, P. M., Setterlund, M. B., & Jones, D. E. (1994). Emotional organization of perceptual memory. In P. M. Niedenthal & S. Kitayama (Eds.), *The hearts eye. Emotional influences in perception and attention* (pp. 87–113). New York: Academic Press.
- Ortony, A., Clore, G. L., & Collins, A. (1988). *The cognitive structure of emotions*.