Affect, Biosensors, Creativity, and Distributed Groups:

Using physiological and qualitative measures of affect to inform the design of systems that support creative collaboration

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Abstract

We aim to determine how physiological measures of affect such as heart rate variability and galvanic skin response may be linked to other representations of affect that arise naturally during online collaboration (e.g., affect in text-based communication). Research in this area is important because workers increasingly collaborate in a distributed manner across greater distances, and text-based communication is one of the primary means of facilitating these collaborations.

Background

The complex systems model of collaborative creativity proposed by Aragon and Williams (2011) fills a gap in previous research at the intersection of creativity, affect, and groups. The model describes the "causal dynamics" of groups that contribute to creative processes. Concepts that originate from physics, such as resonance, damping, and driven harmonic motion, have analogues in creative, distributed collaborations. Affect is one such analogue that we are exploring.

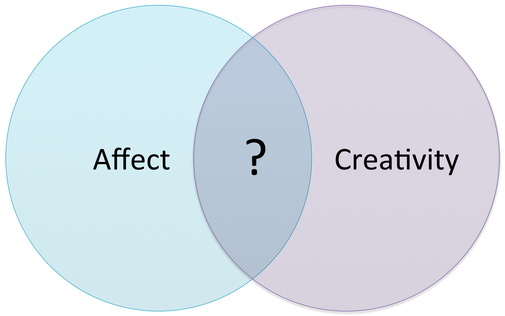

Figure 1: In relation to distributed collaboration, the relationship between affect and creativity is not fully understood.

Russ (1993) describes how "affective processes influence divergent thinking abilities" necessary for creative outcomes. However, the relationship between affect and creativity is not fully understood, especially in the realm of distributed, collaborative groups (Fig. 1). A major component of distributed collaborations is text-based communication, so we are specifically exploring affect in text-based communication. Our lab has developed a method to produce a representation of the affect present in lines of chat data (Scott et al., 2012; Brooks et al., 2013). This method combines manual labeling of affect in text with a pipeline of of natural language processing and machine learning.

Experiment Design

This study builds on recent studies to understand the role that affect plays in creative, distributed collaborations. In addition to the affect detected in chat data, we aim to use physiological measures of affect to explore the relationship between affect and creativity. The experiment design consists of four phases:

1. Pre-collaboration: During the pre-collaboration phase, four participants will be situated in separate rooms with computers. They will be connected to heart rate monitors and galvanic skin response sensors (Fig. 2). Participants will be tested for their emotional state at the beginning of the study using a standard questionnaire. To determine a baseline reading for the biosensors, participants will be asked to read a passage of text void of emotional content.

2. Warm-up: During the warm-up phase, participants will use a chat client (Fig. 3) to brainstorm as many animals as they can think of in one minute. This task is emotion-neutral, involves divergent thinking, and ensures that participants can use the chat client to communicate.

3. Task-collaboration: During the task-collaboration phase, participants will be asked to imagine that they are employees of an innovative company tasked with designing an automated post office (APO). Participants will be instructed to prepare a report that discusses the services the APO should offer. Participants will communicate through the chat client.

4. Post-collaboration: During the post-collaboration phase, participants' emotional states will be tested using a standard questionnaire.

Figure 2: Wireless sensor that measures emotional arousal.

Predicted Outcomes

- Creative events will be correlated with physiological measures of affect and the occurrence of affect in chat messages.
- Physiological representations of affect will be followed by expressions of affect in the text-based communication. In this way, affect will propagate from the individual level to the group level.
- Stages of creativity (focus, frame, create, complete) will be identifiable in the text-based communication.
- Different stages of creativity will be associated with the prevalence of a particular subset of affect codes. For example, the "complete" stage of creativity may be associated with more relief and less frustration than the "frame" stage.

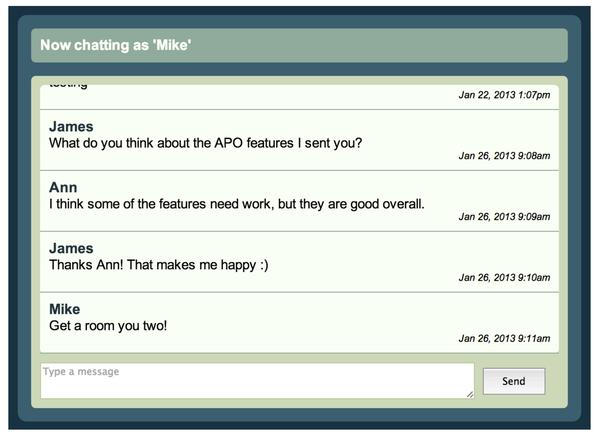

Figure 3: Chat client used during the experiment.

References

Aragon, C. R., & Williams, A. (2011, May). Collaborative creativity: a complex systems model with distributed affect. In Proceedings of the 2011 annual conference on Human factors in computing systems (pp. 1875-1884). ACM.

Berdahl, J. L., Arrow, H., & McGrath, J. E. (2000). Small groups as complex systems: Formation, coordination, development, and adaptation. Sage Publications, Incorporated.

Brooks, M., Kuksenok, K., Torkildson, M. K., Perry, D., Robinson, J. J., Scott, T. J., Anicello, O., Zukowski, A., Harris, P., & Aragon, C. R. (2013). Statistical Affect Detection in Collaborative Chat. *Computer Supported Cooperative Work (CSCW).*

Russ, S. W. (1993). Affect and creativity: The role of affect and play in the creative process. Lawrence Erlbaum Associates, Inc.

Scott, T. J., Kuksenok, K., Perry, D., Brooks, M., Anicello, O., & Aragon, C. (2012, October). Adapting grounded theory to construct a taxonomy of affect in collaborative online chat. In Proceedings of the 30th ACM international conference on Design of communication (pp. 197-204). ACM.

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