Computational Modeling of Cognition-Emotion Interactions: Relevance to Mechanisms of Affective Disorders and Therapeutic Action

Eva Hudlicka (hudlicka@cs.umass.edu)
Psychometrix Associates &
School of Computer Science, University of Massachusetts–Amherst
Amherst, MA 01002, US

Topics and Goals

Recent years have witnessed an increasing interest in developing computational models of emotion and emotion-cognition interaction, within the emerging area of computational affective science. At the same time, emotion theorists and clinical psychologists have been recognizing the importance of moving beyond descriptive characterizations of affective disorders, and identifying the underlying mechanisms that mediate both psychopathology and the processes mediating therapeutic action.

Computational models of cognition-emotion interactions have the potential to facilitate more accurate assessment and diagnosis of affective disorders, and to provide a basis for more efficient and targeted approaches to treatment, through an improved understanding of the mechanisms of therapeutic action.

In spite of the significant synergy that could result from a dialogue among researchers and practitioners in affective modeling, emotion research and clinical psychology, limited interaction exists among these communities. The goal of this workshop is to provide a forum for interdisciplinary dialog among the members of these research communities, and explore how computational models of emotion-cognition interaction can help elucidate the mechanisms mediating affective disorders, as well as the mechanisms of therapeutic action. To facilitate cross-disciplinary discussions, the workshop format will emphasize moderated panels and small working groups, in addition to the traditional paper sessions.

Examples of specific questions addressed include:

- Which processes involved in cognitive-affective interactions are sufficiently well understood to support the development and validation of computational models (e.g., affective biases on attention & perception; emotion regulation; cognitive appraisal)?
- How can models of these processes contribute to an understanding of the mechanisms of therapeutic action, across different types of psychotherapies (e.g., cognitive, psychodynamic, emotion-focused)?
- What are the relative benefits and drawbacks of the dominant theoretical perspectives on emotion with respect to computational models of emotion-cognition interaction and therapeutic action (e.g., discrete / categorical models, dimensional models (PAD), componential models)?
- What are the best representational and reasoning approaches for modeling cognitive-affective schemas and their transformation during therapy? Can we characterize the differences in these transformations across distinct therapeutic approaches (e.g., cognitive, metacognitive, emotion-focused, motivational interviewing, psychodynamic)?
- What are the most appropriate computational methods for modeling the distinct modalities of affective processes (e.g., physiological / somatic, expressive /behavioral, cognitive)?
- How can we model intermodal interactions across processes operating at different time scales?
- What types of data are necessary to develop these models, and how can these be obtained?
- For a given affective process and modality, what criteria determine the best level of model resolution (e.g., models of lower-level processes via connectionist methods vs. higher-level symbolic models)?
- How can we validate computational models of cognition-emotion interactions and therapeutic action, and what are the limits of this validation (e.g., validation of detailed symbolic models hypothesizing specific internal mental constructs, such as goals or plans, may not be possible with current technologies).

Addressing these questions from a multi-disciplinary perspective will provide the context within which concrete gaps in both theoretical knowledge and methodologies can be identified, and research priorities established.

Relevance for Cognitive Science

The workshop will address the emerging research area of computational affective science, and will provide a forum to facilitate cross-disciplinary interaction among computational affective modelers, researchers in affective science, and clinical psychologists, to improve our understanding the mechanisms mediating cognition-emotion interactions, and explore the implications of this understanding for psychotherapy.

Audience, Participation and Publicity

The workshop will be open to researchers, students and practitioners in the communities outlined above. We expect between 25 and 40 participants. The workshop will be publicized both via individual mailings to specific researchers in the relevant communities, and to relevant mailing lists within the following professional societies and research communities: *computational:* Cognitive Science, AAAI, Affective Computing; *emotion research*: ISRE, emotion research net; APS; and *clinical psychology*: SPR; APS; APA.

Post-Workshop Publication

The workshop papers will be published as a separate report during the conference, and both the papers and the presentations will be made available on the workshop web site. The workshop organizers will also pursue the possibility of publishing selected papers and summaries of panel discussions in a special issue of a relevant journal (TBD) and/or an edited volume in the Affective Science Series published by Oxford University Press.

Workshop Organizer

Eva Hudlicka has been working in the area of computational affective modeling since 1998. Her primary research interests are models of the mechanisms of affective biases on cognition, and the applications of these models in decision-support and in psychotherapy research and practice. She is also a psychotherapist, and currently divides her time between computational affective modeling research and clinical practice. More information about Dr. Hudlicka's research, as well as a CV and a list of publications, can be found at https://www.cs.umass.edu/faculty/directory/hudlicka_eva and at psychometrixassociates.com.

Program Committee (confirmed to date)

Michael Arbib, University of Southern California
Jorge Armony, McGill University
Luc Beaudoin, Simon Fraser University
Jean-Marc Fellous, University of Arizona
Ian Horswill, Northwestern University

Confirmations pending from six additional clinical psychologists and emotion researchers.

Confirmed invited speaker: Keith Oatley, University of Toronto