

GENEVA WORKSHOP DEMO PROPOSAL: ENABLING EMOTIONAL DISPLAYS IN ECAS THROUGH EXPRESSIVITY CONTROL

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1. TOPIC AND SCOPE

Embodied Conversational Agents (ECAs) are a powerful user interface paradigm to transfer the inherent richness of human-human interaction to human-computer interaction. Until now most ECA systems have concentrated solely on defining computational models of behavior selection – *which* behaviors to choose for a given communicative act. In our current work, we investigate the qualitative aspects of coverbal behavior – *how* people differ in their ways of performing behaviors that accompany acts of speech. Controlling qualitative variability is essential for realizing high-level agent functions such as emotional displays. To arbitrate between influences on behavior, we are developing an intermediate level of parameterization, a set of *dimensions of expressivity* (see Fig. 1), that allows us to generate phenomenologically accurate behaviors without having to fully model all influencing processes. We regard expressivity parameters as useful enabling tools to mediate between holistic, qualitative communicative goals and low-level animation parameters. Expressivity parameters should allow for the realization of a substantial subset of high level functions, while providing an efficient conversion into animation parameters in a near-realtime environment. We will be able to demonstrate our work with GRETA, our multimodal ECA, using video clips as well as live software runs.

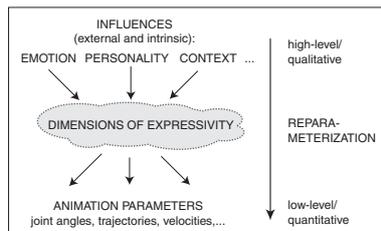


FIGURE 1. Tri-level mapping of high level agent functions via dimension of expressivity to low-level animation parameters.

2. EXPRESSIVITY ATTRIBUTES

Based a survey of social psychology literature, we propose to capture expressivity with a set of six attributes, briefly described below.

- *Overall activation*: amount of activity (quantity of movement – passive/static or animated/engaged).
- *Spatial extent*: amplitude of movements (e.g., amount of space taken up by body; amplitude of eyebrow raise)

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- *Temporal*: duration of movements (e.g., quick versus sustained actions)
- *Fluidity*: smoothness and continuity of overall movement (e.g., smooth, graceful versus sudden, jerky)
- *Power/Energy*: dynamic properties of the movement (e.g., weak/relaxed versus strong/tense)
- *Repetitivity*: tendency to rhythmic repeats of specific movements along specific modalities.

Overall activation, Fluidity and Power act on the entire agent animation calculated for a conversational turn, while the other parameters generate only local changes specific to one communicative act.

3. GRETA AGENT

GRETA interprets utterance text marked up in APML with communicative functions to generate synchronized speech, face, gaze and gesture animations. We can divide our current efforts into expressivity specification and expressivity animation (see Fig. 2). The specification module uses a database that contains a large list of (meaning, signal) pairs to suggest a combination of nonverbal signals and expressivity values to realize semantic and affective goals in the input text. The animation module then uses these behavior suggestions, combined with timing constraints from speech synthesis, to generate face/gaze and gesture animation using separate engines. Animation data is exported in MPEG4-compliant FAP/BAP format, which in turn drives a facial and skeletal body model in OpenGL.

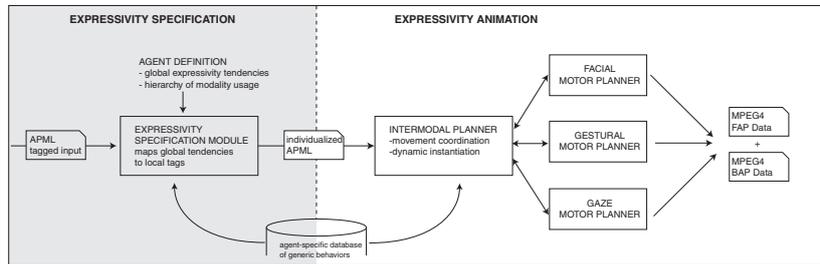


FIGURE 2. Agent architecture outline.

4. OPEN QUESTIONS

To further our efforts, we would like to raise the following questions at the workshop:

- How can we establish a mapping from theories of emotion (e.g., appraisal processes, dimensional spaces) into our expressivity attributes?
- What is the role of multimodal integration in emotional behavior? Do emotions manifest themselves coherently across modalities?
- Can we improve our characterization of expressivity by modifying our parameter set?

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