Evaluating a process model of emotion for virtual humans

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Motivation (Why get emotional?)

- Functional argument
- Realism argument
  - Important to understand/portray human behavior
    - Social interaction (natural language, non-verbal)
    - Perception
    - Decision making
Theoretical Perspective: Appraisal Theory

• Dominant paradigm in emotion psychology
  – Arnold, Lazarus, Frijda, Scherer, OCC
• Emphasizes role of cognition
• Emphasizes emotion as dynamic process
  – Immediate responses
  – Effects that unfold over time
Theoretical Perspective: Appraisal Theory

Smith and Lazarus' cognitive-motivational-emotive system
Towards a computation model

• Supported by data but only provides high-level requirements

• Have to map into an architecture
  How do we get beyond “cognition”
  – What specific mechanisms are involved?
  – What representational primitives are necessary?
  – How do these interactions interact/unfold over time?

• How do we measure success?
  – Rarely measured
  – Never measure dynamics
EMA Model of Appraisal and Coping
Reinterpret Appraisal theory from “agent perspective”

Working memory of events, beliefs, desires, intentions

- Past Events
  - Accident
    - Intend: False
    - Blame: ?

- Present
  - Child Healthy: False
  - Cell Phone: True

- Future Plans
  - Child-Healthy
    - Desire(ME) = 80
    - Belief: False
    - Probability: 75%

Get Help
- Actor: ME
- Intend: True

Cognitive Operations
- Planning
- Perception
- Dialogue
- Action
EMA Model of Appraisal and Coping

- **Appraisal as plan-evaluation**
  - Fast, reactive, parallel
  - Triggered by features in working memory

- **Coping as generalize plan revision**
  - Slower, Sequential
  - Alters features of working memory
    - Problem-focused $\rightarrow$ execute step, add plan step
    - Emotion-focused
      - Denial $\rightarrow$ Change belief
      - Distancing $\rightarrow$ Drop goal / intention
      - Shift blame $\rightarrow$ Change causal attribution
      - Dialogue moves
Accident
Blame: unresolved

Perspective: Self (Sgt)
Desirability: -80
Likelihood: 100%
Blame/Credit: unresolved

Distress: 80

Sgt’s Appraisal of Accident from his perspective
Accident
Blame: unresolved

Distress: 80

Child-Healthy
Desire: SGT
Satisfied: False

Child Healthy: False
Assist Eagle 1-6: False

Coping
Problem-Focused Coping: Form intention to help Boy
**Emotion-Focused Coping:**

- Blame Mother

**Accident**
- Blame: OTHER

**Get Medevac**
- Responsibility: LT

**Child-Healthy**
- Desire: SGT
- Satisfied: False
- Probability: 75%

**Distress:** 80

**Copied**

- Shift Blame
- Make Amends
Evaluation

• Given some situation, model should generate
  – Right emotion but also
  – Right appraisals
  – Right coping strategies
  – Right dynamics
    • How these change as a situation evolves

• Need a corpus of dynamic emotional situations
• Need data on how people interpret these situations
Evaluate EMA with Clinical Instrument

• Check if model generates “normal” emotional responses
  – Stress and Coping Process Questionnaire
  – Used to identify clinically depressed patients

• Presented people various evolving situations
  – At intervals, elicited self-reports of
    • Emotional state
    • Appraisals
    • Coping tendencies
  – Identifies “normal” emotional trajectories
Dynamic Emotional Scenarios

• Two prototypical scenarios
  – Aversive scenario
    • Goal was thwarted, some potential to reverse
    • Situation relatively controllable, changeable
  – Loss scenario
    • Potential threat to goal is looming
    • Less controllable, changeable

• Evolve over three discrete phases
  – Initial
  – Continuation
  – Good or Bad outcome

• Ask subject to self report aspects of their emotions
• E.g: aversive situation
  – Goal was thwarted, some potential to reverse
  – Situation relatively controllable, changeable
• Evolve scenario over phases: initial
• Evolve scenario over phases: continuation
- Evolve scenario over phases: outcome
• Translate, via a grammar, into text
  – **Onset**: You forgot to do something important for your partner. They get very angry and blame you
  – **Continuation**: After a while, their attitude hasn’t changed
  – **Outcome**: They leave in an angry state.
Data Elicitation

After each phase of each scenario, ask:

- **I feel:** (EMOTION)
  - Angry/furious
  - Depressed/sad
  - ...

- **My judgments** are: (APPRAISAL VARIABLES)
  - The chances of improving are:
  - The chances I can influence it are:
  - ...

- **My intentions** are (COPING STRATEGY)
  - To confront the other
  - To remain calm
  - ...
“Healthy” trends

1.1 “Aversive” situation $\rightarrow$ more appraised control
1.2 Control diminishes across phases
1.3 Negative valence increases across phases
1.3 Strong difference in valence on negative vs. positive outcomes

2.1 Less appraised control $\rightarrow$ less problem-directed coping
Methodology

• Encode situations in our model
• Evolve the situation
• After each phase, “quiz” the model
• Compare fit to “healthy” tendencies
Aversive Condition

**Past Act**
- Prob: 100%
- Responsibility: Other

**Future Act**
- Intend-to: True
- Probability: 66%
- Responsibility: self

**Goal**
- Utility: 100
- Probability: 66%
- Belief: False

**Desired state threatened**
- Desirability: -100
- Likelihood: 50%
- Attribution: Other
- Emotion: Fear(50), Anger(50)

**Desired state facilitated**
- Desirability: 66
- Likelihood: 50%
- Attribution: self
- Emotion: Hope(66)
Perceived Changeability

- Trend: Decreases across phases

![Graph showing decrease in perceived changeability across phases with trend lines for 'Loss (human)', 'Aversive (human)', 'Loss (model)', and 'Aversive (model)'.]
Perceived Negative Valence

- Trend: Negative Valence increases
- Trend: Large difference in good vs. bad outcome
## Coping strategies

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Aversive</th>
<th>Loss</th>
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</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
<td>Seek information</td>
<td>Suppress information</td>
</tr>
<tr>
<td></td>
<td>Take action</td>
<td>Procrastinate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seek instrumental support</td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
<td>Mental disengagement</td>
<td>Mental disengagement</td>
</tr>
<tr>
<td></td>
<td>Suppress information</td>
<td>Suppress information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resignation</td>
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<tr>
<td></td>
<td></td>
<td>Wishful thinking</td>
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<tr>
<td><strong>Good</strong></td>
<td>Accept responsibility</td>
<td></td>
</tr>
<tr>
<td><strong>Bad</strong></td>
<td>Mental disengagement</td>
<td>Mental disengagement</td>
</tr>
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<td></td>
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</tr>
</tbody>
</table>

### Problem Focused

### Emotion Focused
Results

• Trends largely supported
• Except:
  – OCC “distress” ≠ “sadness”
    • Does not distinguish sense of control
  – Responsibility ≠ blame
    • Need attribution theory (Mao & Gratch 04)
Issues

• Methodological issues
  – SCPQ collapses individual differences
  – Doesn’t assess appraisal/coping interactions
  – Issues with validity of self reports
  – Fitting trends but not data
  – Subjective interpretation in domain model
Conclusion

• Models can be tested against data
• Important to test dynamics