Interfacing Emotional Behavior Moderators with Intelligent Synthetic Forces

by

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Project Background

• Research contract with ARI
• Develop models of emotion for CGFs
• CGF system is SOF-Soar, developed for MSIAC
• Implement method by which emotional reactions of command entity can affect outcome of reconnaissance mission
SOF Reconnaissance

- Objective
- ObsPt
- 1-5 km
- 1-2 km
- ObsPt
- 1-5 km
- 1-5 km
- Moving transit point, 1-5 km from ObsPts
- 20-50 km
- Drop Zone
- Pickup Zone
- 100-200 km behind FEBA
- FEBA
- ORP
Symbolic/Connectionist Hybrid

• Symbolic
  – Rich, expressive representation language
  – Traceable, explicit, systematic
  – Limited by knowledge in system
  – Proven to be good at modeling high-level, cognitive behavior

• Connectionist
  – Vector-based or attribute-based representations
  – Implicit, not (typically) traceable, tolerant of noise or local failure
  – Term created by psychologists to describe use of neural networks in modeling human processes
  – Proven to be useful in signal-processing applications
Model Components

• Symbolic model – Behavior system
  – Cognition/Decision making (symbolic)

• Connectionist model – Emotional signal processor
  – Emotional intensity (connectionist)
  – Pleasure/Pain (connectionist)
  – Clarity/Confusion (connectionist)

• Interfaces
  – Emotional appraisal
  – Attention and responses
Long Term Memory
Decision making knowledge

Working Memory
Active symbols

Behavior Moderators

Emotions Interface
Perceptual modulators

Motor System
Perceptual System

Process modulators
Declarative signals
Emotional appraisal
Emotional signals

Pattern matching
Decisions and inferences

Simulation Environment

Soar
ModSAF

SMI

HLA/DIS
Cognitive Response to Emotion

• Emotions $\rightarrow$ Cognition

• Arousal
  – Short-term memory
    • Tags to focus attention
  – Long-term memory
    • Arousal thresholds to filter potential actions
    • Favor well-rehearsed knowledge under high arousal

• Pleasure/Pain
  – Long-term memory
    • Pursuit/avoidance preferences to filter potential actions
    • Goals represent “pleasurable” pursuits
Cognitive Situation Appraisal

- Cognition → Emotions
- Clarity/Confusion
  - Coherent and confounding situation assessments
  - Match observations to expectations
- Pleasure/Pain
  - Physical sensations
  - Cognitive interpretations
    - Impact on goals, anticipation of sensation
- Arousal
  - Purely arousing stimuli
## Example Interaction

<table>
<thead>
<tr>
<th>Emotional Subsystem</th>
<th>Inputs</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confusion</td>
<td>Enemy-exists</td>
<td>0.4</td>
</tr>
<tr>
<td>Confusion</td>
<td>Enemy-sees-me</td>
<td>0.2</td>
</tr>
<tr>
<td>Pain</td>
<td>People-shooting</td>
<td>0.3</td>
</tr>
<tr>
<td>Pain</td>
<td>People-shooting-at-me</td>
<td>0.6</td>
</tr>
<tr>
<td>Pain</td>
<td>Enemy-sees-me</td>
<td>0.5</td>
</tr>
<tr>
<td>Pain</td>
<td>Mission-in-jeopardy</td>
<td>0.3</td>
</tr>
<tr>
<td>Pain</td>
<td>High-enemy-to-friendly-ratio</td>
<td>0.3</td>
</tr>
<tr>
<td>Arousal</td>
<td>Loud-noise</td>
<td>0.3</td>
</tr>
<tr>
<td>Arousal</td>
<td>Dangerous-location</td>
<td>0.3</td>
</tr>
</tbody>
</table>
Acknowledgements

We gratefully acknowledge the support of U.S. Army Research Institute’s Emotional Synthetic Forces STTR – Ph II, contract number: DASW01-99-C-0037.