Autonomous Agents and Avatars in REVERIE’s Virtual Environment

Fons Kuijk (CWI), Konstantinos C. Apostolakis, Petros Daras (CERTH), Brian Ravenet (TPT), Haolin Wei, David S. Monaghan (DCU)
Siege of Haarlem (1572)
Teylers Museum (founded in 1784)
The Hiding Place (1940-1945)
Frans Hals Museum
These are facts and stories told on educational trips done in 1966-1967

Educational trips are not easy to organize

In REVERIE, an ambient, content-centric Internet-based immersive environment, people can work, meet, participate in live events, socialize and share experiences as they do in real life

REVERIE can be used for virtual educational trips (and for a 3D hangout and for Simon Says, and for …)
An educational trip to the European Parliament
An educational trip to a virtual gallery
Objectives of REVERIE’s Virtual Environment

• No need for fancy equipment.
• Users free to move and look around.
• Spatial audio.
• Virtual humans have natural behaviour:
  • gaze
  • movements
  • gestures
  • social interaction
• User driven and autonomous virtual characters plausibly interact.
### User Analysis

<table>
<thead>
<tr>
<th><strong>HOW</strong></th>
<th><strong>WHAT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>User data captured by:</td>
<td>Facial expressions for</td>
</tr>
<tr>
<td>• webcam</td>
<td>• Puppeting (face)</td>
</tr>
<tr>
<td>• (Kinect)</td>
<td>• Arousal &amp; Valence</td>
</tr>
<tr>
<td>• microphone</td>
<td>• Agree or Disagree</td>
</tr>
<tr>
<td></td>
<td>• Attention</td>
</tr>
<tr>
<td></td>
<td>Body gestures for</td>
</tr>
<tr>
<td></td>
<td>• Puppeting (body)</td>
</tr>
<tr>
<td></td>
<td>• Navigation</td>
</tr>
<tr>
<td></td>
<td>Speech for</td>
</tr>
<tr>
<td></td>
<td>• Simple dialog</td>
</tr>
</tbody>
</table>
Reasoning Framework for Autonomy

- Gaze & Attention Detection
- Emotion & Affect Identification
- Keyword Spotting
- Facts from the World
- User State
- Avatar Behavior Proposer
- Dialogue State
- Obstacle Avoidance & Path Finding
- World State
- Agent & Group State
- Gaze & Attention Behavior Assessment
- Affect & Social Assessment
- Agent Behavior Proposer
- Behavior Selection Planner & Realizer
- Script Proposer
- Navigation
- Animation
- Speech
- Rendering

Legend:
- Analyzers
- Interpreters
- Proposers
- Realizers
- States

Capturing

Rules & Attitude

Facts from the World

Keyword Spotting

Gaze & Attention Detection

Emotion & Affect Identification

User State

Avatar Behavior Proposer

Dialogue State

Obstacle Avoidance & Path Finding

World State

Agent & Group State

Gaze & Attention Behavior Assessment

Affect & Social Assessment

Agent Behavior Proposer

Behavior Selection Planner & Realizer

Script Proposer

Navigation

Animation

Speech

Rendering
Configurable Clients

WebSockets
Reasoning in REVERIE

Comes in levels:

Agents: fully autonomous

- Socio-emotional attitude
- Intention

Nonverbal signals (e.g. head upward, smile)

Avatar: system adds autonomy where needed
- gaze
- gestures
- pose based on user interaction.
Autonomous Gaze

Attentive:

Following user camera:

Not attentive: (may lead to agent reaction)
Autonomous Gesture

Request to speak
Options for Navigation

User controlled (small incremental steps):
- Keyboard
- Mouse
- Kinect

Autonomous (path planning):
- Map
- Follow Me
Conclusion

- Agents react on users’ activity.
- User control over avatar is configurable (the reasoning adds autonomy where needed).
- Agents and avatars have human-like behavior.
- Users feel being immersed.
- REVERIE components
  - can be deployed on regular computer system;
  - are well suited for web-based communication.
More detailed information:
http://www.reveriefp7.eu/