Instructor Support in Collaborative Multiplayer Serious Games for Learning

Game Mastering in the Serious Game ‘Woodment’

CSEDU 2014
Scenario

Collaborative Learning in Multiplayer Games

- Small group of learners (3-6)
- Teacher/Trainer supervising the learning process
- Focus on
  - Soft Skills
  - Specific learning content

Challenge

- Various simultaneous instructor tasks
  - Orchestration
  - Observation
  - Adaptation
  - Control
- Lots of action
Agenda

Scenario

Approach
- Game Mastering Framework
- Group Model
- Information Module
- Adaptation Module

Implementation
- Woodment
- Game Mastering Concept

Evaluation
- User Study
- Results
Our Approach

Game Mastering Framework
Entities Compound

- Defines game relevant entities
  - Player entities
  - Player parameters
  - Player representation
- Game Entities
  - Interactive 3D objects
  - Formal description
Architecture - Game Master Framework

Group Model

- **Player Model**
  - Describes gaming style/preferences
  - e.g. (Bartle, 1996), (Houlette, 2004)
- **Learner Model**
  - Learning progress
  - Modelled as hierarchical graph
  - after (Korossy, 1999)
- **Interaction Model**
  - Communication graph
  - Tracking of in-game interactions
Architecture - Game Master Framework

Information Module

- = Game-to-GM-interface
- Provides all relevant information
  - Game State
  - Player / Learner State (via Group Model)
Architecture - Game Master Framework

Adaptation Module

- **GM-to-Game-Interface**
- Defines **Actions**
- Enables instructor to adapt
  - Global Game Parameters
  - Parameters of an Entity
  - Parameters concerning players
  - Game Rules

<table>
<thead>
<tr>
<th>Action Name</th>
<th>Influence on PM</th>
<th>Influence on IM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Killer</td>
<td>Achiever</td>
</tr>
<tr>
<td>Action_1</td>
<td>0.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>Action_2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Action_n</td>
<td>0.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Proof-of-concept

Extension of *Woodment*

- 3D Multiplayer Serious Game
- 4-6 Players
- **Collaborative** and Competitive
- Integrated Editor for **freely customizable** learning content
- Unity3d
Proof-of-concept

Woodment Game Master Frontend
## Proof-of-concept

### Woodment Game Entities

<table>
<thead>
<tr>
<th>Game Entity Name</th>
<th>Description</th>
<th>Parameter name</th>
<th>Accessibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question orb</td>
<td>Contains questions</td>
<td>Size</td>
<td>true</td>
</tr>
<tr>
<td>Skill Canister</td>
<td>Gives player a skill bonus</td>
<td>Movement Speed</td>
<td>true</td>
</tr>
<tr>
<td>Worker</td>
<td>Gathers wood for players</td>
<td>Spawn frequency</td>
<td>true</td>
</tr>
<tr>
<td>Player base</td>
<td>Place where wood is stored</td>
<td>Resource type gathered</td>
<td>false</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spawn frequency</td>
<td>true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>State (e.g. idle, gathering wood, etc.)</td>
<td>false</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IsBurning</td>
<td>false</td>
</tr>
</tbody>
</table>
Proof-of-concept

Woodment Group model

<table>
<thead>
<tr>
<th>Action Name</th>
<th>Influence on PM</th>
<th>Influence on IM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Killer</td>
<td>Achiever</td>
</tr>
<tr>
<td>Pickup Canister</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Trigger Question</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Answer Question correctly</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Answer question wrong</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Ask for help with question</td>
<td>-0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Help player with question</td>
<td>-0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Run 10 meters</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Freeze enemy</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>De-Freeze friend</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Ignite enemy base</td>
<td>0.4</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Proof-of-concept

Woodment Adaptations
Evaluation

Setup

- 26 participants (av. age 19.12; sd=2.03)
- Vocational school in Germany
- Treating group with GM
- Control group without GM
- Game Time 40 minutes, then questionnaire
- Logging of Player/Game/GM actions

Hypotheses

- Compared to a scenario without a GM...
- (1) ... a GM increases the flow experience and user experience
- (2) ... a GM increases the learning success
## Evaluation

### Results – Performance

<table>
<thead>
<tr>
<th></th>
<th>GM</th>
<th>No GM</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Experience</td>
<td>6.14 ±1.44</td>
<td>4.90 ± 0.89</td>
</tr>
<tr>
<td>Questions solved (absolute)</td>
<td>13.25 ± 4.81</td>
<td>7.83 ± 5.31</td>
</tr>
<tr>
<td>Questions solved (%)</td>
<td>61.21 ± 14.24</td>
<td>41.58 ± 20.29</td>
</tr>
<tr>
<td>Gold (sum)</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>
Evaluation

Results - Problems
Evaluation

Results – Player Model

![Graphs showing evaluation results for Player Model with and without game mechanics (GM).](image-url)
Conclusion

Game Master Framework for collaborative Multiplayer Serious Games

Proof-of-Concept using Woodment

User study
- User Experience with GM better
- More Questions solved with GM

Limitations
- Small number of participants (26)
- Participants social background
- Only one game evaluated
References


Thank you!

Any questions?