Designing a Collaborative Serious Game for Team Building Using Minecraft

ECGBL 2013
Goal

How to design a Serious Game for teamwork and collaboration?

- Training of soft skills
- Teamwork
- Collaboration

Hypotheses

A digital multiplayer Serious Game for collaboration...

1) ... provides better User Experience for the player
2) ... leads to more trust in the other group members
3) ... leads to more cooperative behavior
Why Minecraft?

Most famous Indie game today
More than 12 million users (oct. 2013)
Big community

Revolutionized the sandbox game genre

Educational Projects
- MinecraftEDU (http://minecraftedu.com), etc.
- Uses at schools

Image source: http://mashable.com/2013/02/13/amazing-minecraft-creations/
Image source: http://techland.time.com
Design Foundations

Foundations derived from ...

Collaborative Learning (Johnson & Johnson, 1994)
- Positive Interdependence
- Individual Accountability
- Face-to-Face Promotive Interaction
- Social Skills
- Group Processing

Collaborative Gaming (Zagal et al., 2004)
- L1: Tension between individual utility and team utility
- L2: Individual Decisions
- L3: Tracing payoffs back to decisions
- L4: Different abilities and responsibilities
- P1: Avoid one player making decisions for whole team
- P2: Players need to care about the outcome
- P3: Different Experience each time -> Replayability
Game Design Concepts

Minecraft (sandbox) mechanic
- Freedom of movement

Creation of common goal
- „Last Gnome on Earth“
- Narrative background
- Victory or Failure for whole team

Player Separation
- Physically dividing players
- Different tasks based on physical location
Game Design Concepts

Gnome Handling
- Only one player at a time
- Slowed down continually
- Handing over requires physical proximity

Pseudo-random puzzles
- Collaborative puzzles change

Need for Communication
- Exchange of vital information
  - About puzzles
  - Coordination of actions
  - About handing over the gnome

L1: Individual <-> team utility
L3: Payoffs <-> decisions
Positive Interdependance
P3: Replayability

Social Skills
Group Processing
F2F Promotive Interaction
Game Design Concepts

Collaborative Multiplayer Puzzles (derived from (Reuter et al., 2012) )

- Difficult terrain
  - Gnome carrier cannot jump
  - Movement between players needs to be coordinated
  - Frequent handover of the gnome required
- Lever Color Puzzle (see image)
Game Design Concepts

Collaborative Puzzles

- Simple Math Puzzle
  - Information like $d = c + 5$; $c = b - 3$; $b = a - 1$; $a = 8$;
  - Distributed among the separated players
  - Necessity to exchange information
Game Design Concepts

Collaborative Puzzles

- Coordination puzzle
Implementation

Modding Minecraft

- Minecraft API announced since more than 18 months ...

- Bukkit Framework (bukkit.org)
  - Creates an API for Modding
  - However, only server-sided

- Spout + SpoutCraft (spout.org)
  - SpoutCraft provides a modified Minecraft client which is able to handle mods on client side
  - Spout provides API for client side modding
Modded Features

- Building Restrictions - Players were not allowed to place or destroy level blocks

- Gnome Handling
  - Prevention of deadlocks
  - Gnome may not be dropped or thrown
  - Gnome always in hand when carried
  - Special socket blocks for gnome handling
Implementation

Modded Features

- Logic Elements
  - Necessary for easy combination of levers/buttons with doors
  - No Redstone circuits necessary
  - Description using XML-file

- Zombie Control
  - Time pressure feature necessary
  - Special zombie behavior was necessary (focus gnome player, etc)
## Design of this study

- 2-factorial design
- Independent Variable: Kind of cooperative game (Jigsaw Puzzle / Minecraft Mod)
- Dependent measurements:
  - UX questionnaire
  - Group cooperation questionnaire
  - Prisoner's Dilemma game

<table>
<thead>
<tr>
<th>Decision of other player</th>
<th>Own Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share</td>
<td>Share</td>
</tr>
<tr>
<td>Do not share</td>
<td>Choice of Small candy</td>
</tr>
<tr>
<td>Choice of big candy</td>
<td>Choice of big candy</td>
</tr>
<tr>
<td>nothing</td>
<td>Random small candy</td>
</tr>
</tbody>
</table>

## Participants

- 28 participants (24 male, 2 female, 2 no information)
- Age ranged from 21 to 45 (m=25.81; sd = 5.16)
- Mean time of playing video games per week 9.04 (sd = 10.64)
Evaluation

Results

- Prisoner's Dilemma game:

  | Cooperate → do not cooperate | -1 |
  | No change                    | ±0 |
  | Do not cooperate → cooperate | +1 |

- 20 of 24 participants:
  cooperate → cooperate → no change → ±0

- Questionnaire:

<table>
<thead>
<tr>
<th></th>
<th>Minecraft Mod</th>
<th>Puzzle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fun</td>
<td>m=6.70; sd=0.90</td>
<td>m=5.85, sd=1.23</td>
</tr>
<tr>
<td>Group Interaction</td>
<td>m=8.15; sd=0.70</td>
<td>m=7.43; sd=1.05</td>
</tr>
</tbody>
</table>
Discussion

- UX is better in the MC Mod than in the puzzle
- Group cooperation showed better experience in MC Mod than in puzzle

Hypothesis I can be accepted

- No significant differences in trust
- No significant differences in cooperative behavior

Hypothesis II and III have to be rejected

Shortcomings

- One-sided sample of participants in terms of socio-cultural background
  - Students and PHD students
  - Participants are used to a high amount of collaboration and trust in their everyday work life
  - Might explain the initially high cooperation values (7.43 for the puzzle, 8.15 for the MC mod)
Future Work

Improve Mod
- Compatibility with future Minecraft Versions
- Using the official API

Repeat evaluation with better (and bigger) sample group
- Diversity in
  - Social background
  - Age
  - Gender
- Incentive
Thank you!

Any questions?