New Challenges of immersive Gaming Services

Agenda

- State-of-the-Art of Gaming QoE
- The Delay Sensitivity of Games
- Added value of Virtual Reality
What is so special about gaming?

<table>
<thead>
<tr>
<th>Task-directed Interactions</th>
<th>Gaming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task completion</td>
<td>Entertainment</td>
</tr>
<tr>
<td>Mainly external rewarding</td>
<td>Mainly intrinsic rewarding</td>
</tr>
<tr>
<td>Reach goal without high effort</td>
<td>Fun by beating obstacles</td>
</tr>
<tr>
<td>Intuitive use</td>
<td>Learning process</td>
</tr>
</tbody>
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(Amjad, 2016)

New challenges of immersive gaming services
New challenges

- No standard for Gaming QoE as an interactive system available yet
- New technologies such as cloud gaming and VR require new dimensions
- Many new influencing factors need to be considered

- Development of Gaming QoE model for Cloud Gaming services
- Benefits of Virtual Reality, Engagement and Gamification

- Establishment of three Work Items in ITU-T Study Group 12
  - P.GAME: Subjective testing methodology (Q.7/12)
  - G.QoE-Gaming: Factors affecting QoE in gaming (Q.13/12)
  - G.OMG: Opinion model for gaming applications (Q.13/12)
**Taxonomy**

<table>
<thead>
<tr>
<th>Influencing factors</th>
<th>Quality of Service (QoS)</th>
<th>Interaction performance</th>
</tr>
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<tbody>
<tr>
<td>User</td>
<td></td>
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</tr>
<tr>
<td>Experience</td>
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<td>Perceptual effort</td>
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<tr>
<td>Playing style</td>
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<td>Cognitive workload</td>
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<tr>
<td>Static factors</td>
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<td>Physical response effort</td>
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| System             |                          |                          |
| Game genre         |                          | Output performance       |
| Game structure     |                          | Interface software & device|
| Game rules         |                          | Input performance        |

| Context            |                          | Generation performance   |
| Physic. & social environment |                   | Interpretation performance|
| Extrinsic motivat. |                          | Game reaction performance|
| Service factors    |                          | Game control performance |

**Experience:**
- hardcore vs. casual gamer (based on time playing)
- newbie vs. pro gamer (based on abilities)

**Playing style:**
- achiever, explorer, socializer and killer (Bartle, 1996)

**Static and dynamic factors:**
- age, gender, native language
- emotional state, curiosity, workload

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(Möller, 2013)

New challenges of immersive gaming services
**Game genre:**
- action, racing, roleplaying, etc. (NDP Group, 2008)

**Game mechanics and rules:**
- Gameplay Bricks (Djaouti, 2008)

**Game structure:**
- single player or multiplayer, opponents (Fullerton, 2008)

**Technical system set-up:**
- Transmission channel (packet loss, bitrate, delay, fps)
- Display size, input device, modalities

(Möller, 2013)
Taxonomy

Physical environment factors:
- room characteristics (space, acoustics, lighting) and usage situation (in-house, on the move, etc.)

Social context:
- relationships to other players involved in the game

Extrinsic motivation:
- financial or social reward

Service factors:
- access restrictions, availability, costs

(Möller, 2013)
# Taxonomy

## Quality of Service (QoS)

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<td>Static factors</td>
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## Interaction performance

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<td>User</td>
<td>Backend platform</td>
<td>Game</td>
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## Quality of Experience (QoE)

<table>
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<th>Quality features</th>
<th>User</th>
<th>System</th>
<th>Context</th>
</tr>
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<tbody>
<tr>
<td>Aesthetics</td>
<td>Appeal</td>
<td>Output quality</td>
<td>Game reaction performance</td>
</tr>
<tr>
<td>Novelty</td>
<td>Interactivity behavior</td>
<td>Input quality</td>
<td>Interaction performance</td>
</tr>
<tr>
<td>Appeal</td>
<td>Interaction quality</td>
<td>Learnability</td>
<td></td>
</tr>
<tr>
<td>Tension</td>
<td>Positive affect</td>
<td>Intuitivity</td>
<td>Playing quality</td>
</tr>
<tr>
<td>Immersion</td>
<td>Negative affect</td>
<td>Acceptability</td>
<td></td>
</tr>
<tr>
<td>Hedonic</td>
<td>Challenge</td>
<td>Competence</td>
<td></td>
</tr>
<tr>
<td>Pragmatic</td>
<td>Flow</td>
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(Möller, 2013)

New challenges of immersive gaming services
Why Player Experience?

- **Dimension-based Quality Modeling** offers insights about the cause of a degradation:
  - Transmitted Speech: e.g., DIAL model by Côté

- **Why don’t we stop at the Interaction Quality?**
  - Low QoE ratings even without degradation
  - Player can tolerate issues

- **Great … so what is the problem?**
  - No standard for assessment of PX
  - Huge amount of influence factors

New challenges of immersive gaming services
Assessment of Quality Features

- **Game Experience Questionnaire** (GEQ): Immersion, Flow, positive and negative Affects, Competency, Challenge, Tension
- **User Engagement Scale** (UES): Aesthetics, Endurability, Involvement, Focused Attention/Flow, Novelty
- **Player Experience of Need Satisfaction** (PENS): Autonomy, Competency, Relatedness, Presence (physical, emotional, narrative)
- **Playful Experience Questionnaire** (PLEXQ): 22 Dimension such as Humor, Fellowship, Fantasy, Suffering, Sympathy, Competition…
- **Immersive Experience Questionnaire** (IEQ): Cognitive Involvement, Emotional Involvement, Real World Dissociation, Challenge, Control

New challenges of immersive gaming services
Towards the Delay Sensitivity of Games

- Network Delay is strong **impairment** factor
- Games are **differently** sensitive towards delay
- Player perceive delay differently
- No **Classification** of games with respect to degradations
- Use case: **resource** distribution of (cloud) servers

**Research Questions**

(1) Is the genre **classification** useful in this context?
(2) Is the selection of a game **scenario** important?
(3) What might be the **reason for differences** in the sensitivity?
Classification of Games

- Can a genre classification be any good?
- From a logical point of view: NO! => a game can consist of many genres
- “But I thought shooter are more sensitive than roll playing games”
- Judgement of game as a whole is critical => scenario is important!

- If not the genre what else?
  - Temporal and spatial accuracy
  - Predictability
  - Input Device and number of control elements
  - Underlying game rules => Gameplay Bricks
Classification of Games

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Gameplay Bricks - a rule-based classification (Djaouti, 2008)

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Study design

- Delay of 0, 100, 200, 300, 400 ms using an Arduino Microcontroller

- **Assessed Quality Features**
  - Perception of delay, Judgement of own performance
  - Control, Difficulty, Annoyance, Fairness
  - Overall Quality, Willingness to play

- Careful selection of **game scenarios**
  - Jump’n’run: static obstacles, oncoming obstacles
  - Shooter: static and moving targets
  - Racing: 1\textsuperscript{st} and 3\textsuperscript{rd} person camera

New challenges of immersive gaming services
Results

Fig. 2. DMOS of overall quality for all scenarios.

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Challenges in Virtual Reality

- Subjective Quality Assessment
  - Wheeling chair
  - Targeting Dimensions
  - How begin and finish the test

- Cyber sickness
  - Ethical issues
  - Carefully consider stimuli duration

- Novelty effect
  - Can dramatically change the results
  - Can be reduced by selecting experienced players
Virtual Reality study

- Does VR technology necessarily result in a richer gaming experience?
  - Presence and Immersion are effaced the most

- Does higher presence necessarily result in a richer experience?
  - Needs satisfaction theory

- Does “novelty effect” play a role in any VR experience?
  - How to avoid that novelty effect?

(Davies, 2014)

New challenges of immersive gaming services
## Virtual Reality study

### Six targeted dimensions

1. Overall quality
2. Immersion
   - PENS Questionnaire
   3. Presence
   4. Intuitive control
   5. Competency
   6. Autonomy

### The relation between dimensions

- Investigating the relation between Overall Quality and PENS dimensions
- Correlation between PENS Presence and self-designed presence question
- Correlation between PENS Presence and self-designed Immersion question

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**New challenges of immersive gaming services**
New challenges of immersive gaming services

- Higher **Presence** and **Autonomy** obtained by using HMD
- Presence alone did not improve the Overall Quality
- No apparent influence of Sickness was seen
Virtual Reality study

- Self-designed Presence question can predict PENS Presence
- Self-designed Presence and Immersion questions are most equivalent with Physical Presence

New challenges of immersive gaming services
Virtual Reality study

- To take advantage of the new technology, satisfaction of all psychological needs, especially Competency, must be assured.

New challenges of immersive gaming services
Conclusion and Future Work

- For every immersive service unique factors play a special role
- For cloud gaming the impact of delay highly depends on user factors and the chosen game scenarios
- For VR gaming additional influencing factors such as cyber sickness, novelty effect and presence have to be considered
- For the study design unwanted influencing factors should be avoided

Future Work
- Standardized questionnaires with low amount of items
- Classifications of games based on impairments
- How to deal with cyber sickness and novelty effect
New challenges of immersive gaming services

References


