The Impact of User, System, and Context factors on Gaming QoE: a Case Study Involving MMORPGs

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Quality of Experience (QoE) as a multidimensional construct
- Previous research focused mostly on network parameters

How do various user, system, and context factors and their degradations impact game QoE (both single factor and their various combinations)?

Experimental study inspecting 15 influence factors

Results of the study can be used for better understanding game QoE and building QoE models for MMORPGs
Outline

- Problem
- Introduction
- Methodology
- Results
- Conclusion
Introduction

- User’s QoE resulting from:
  “the fulfillment of his or her expectations with respect to the utility and/or enjoyment of the application or service in light of the user’s personality and current state

- QoE extends the notion of QoS
  - User related factors
  - Context related factors

- QoE for games- additionally complex
  - Not a task oriented activity

- QoE of the game service -> not going into gameplay!
Influence factors addressed in this study

- Game genre
- Packet loss
- Frame rate
- Delay
- Transport protocol
- Jerkiness
- Gender
- Player skill
- Age
- Social context
- Physical environment
- Action category
- Extrinsic motivation
- Service factors
- Multiple values
- One value
Experimental study

- Research questions:
  - How do various user, system, and context influence factors (IFs) and their degradations impact game QoE?
  - How do combinations of multiple influence factor degradations impact game QoE?

- Focus on context IFs and their relation with user and system IFs

- Study comprised two phases
  - Pre-survey
  - Laboratory experiment

- Realized in form of an laboratory exercise for the course Multimedia communications
Pre-survey

Goal:
- To gather data about participant’s previous gaming experience, preferences, and self-assessed skill

Characteristics
- Google form used
- 69 participants (students) submitted responses
- 50 male, 19 female
- Age 21 - 26

Information obtained used to form player groups of various characteristics for the laboratory

Some results:
- Average RTT on which degradations are noticed 143ms (self reported)
- Most players reported medium experience in games (>40%)
- Player prefer group over solitary actions in MMORPGs
- Digital distribution of games is preferred (>90%)
Laboratory experiment

♦ Characteristics:
  ■ 55 players divided into 11 groups
  ■ 38 male and 17 female
  ■ PCs used: Dell Optiplex 390, i3@3.3 GHz, 4GB RAM, ATI Radeon HD 6450
  ■ 5 minute play sessions (scenarios) + 1 minute for response gathering
  ■ One 10 minute break
  ■ Game used - World of Warcraft
Groups

- Each group consists of 5 players
  - Different activities (solo and group activities)
  - Small group activity in WoW is designed for 5 players

- Group compositions based on gender
  - Each group comprised at least one female

- Group compositions based on social context (self-reported experience - skill)
  - Homogenous (players of same skill level)
    - Experienced
    - Intermediate
    - Novice
  - Mixed (players of different skill levels)
Scenarios - Influence Factors

- Length - 5 minutes (approximately)

- Unique combination of IF values which could be directly manipulated

- System parameters - each taking one of 3 values: not degraded, mild degradation, severe degradation
  - Jerkiness with values: 0, 6.7%, 13.33% (percentage of time image was frozen)
  - Frame rate with values: 60 FPS, 25, FPS, 15 FPS
  - Packet loss with values: 0%, 5%, 10%
  - Latency with values: 0ms, 200ms, 400ms (latency added to RTT with base value of 40ms)

- Context parameters
  - Action category with values: Questing, Dungeons
Scenario - list

Constraints
- Too many possible combinations (162)
- Time limit < 3 hours (participants get tired)
- More responses per scenario - more accurate results
- How to fit as much as possible in 3 hours?

Applied solution - 22 scenarios per group

Scenarios performed by all groups
- First two scenarios - reference ones (best and worst)
- Next 8 scenarios - Questing with only one IF degraded
- Next 8 scenarios - Dungeons with only one IF degraded

Group specific scenarios
- Last 4 scenarios - Dungeons with all IF degraded (out of pool of 16 possibilities each group is assigned with different 4)

Answering 1st research question
Answering 2nd research question
Measured responses

- QoE related responses (5 pt. MOS scale 1 - bad, 5 - excellent)
  - Overall QoE
  - Perceived Immersion
  - Perceived Responsiveness
  - Perceived Fluidity

- Complexity metric (5 pt. MOS scale 1 - very simple, 5 - very challenging)
  - Perceived challenge

- Performance metrics
  - Level reached for Questing
  - Bosses slain for Dungeons
Flowchart of the experiment

Instructions

Character creation

Short familiarization with the game controls

Reference scenarios worst/best

4 X 😞

Dungeons scenarios 4 system IFs degraded

1 X 😞

Dungeons scenarios 1 IF degraded

Switch to previously created level 20 characters

10 minute break

1 X 😞

Questing scenarios 1 IF factor degraded

NetGames 2013
# Results for single IF degradation

<table>
<thead>
<tr>
<th>Latency</th>
<th>Loss ratio</th>
<th>Frame rate</th>
<th>Jerkiness</th>
<th>Action category</th>
<th>QoE</th>
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NetGames 2013
Results - multiple IF degradations

- Loss/Jerkiness severely degraded yields the worst reported QoE
- Reported QoE even lower from the reference worst for Questing
- Latency discrepancy!!!

<table>
<thead>
<tr>
<th>Jerkiness</th>
<th>Delay</th>
<th>Loss rate</th>
<th>0.05</th>
<th>0.1</th>
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<td>3.25</td>
<td>2</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Results - player skill

More experienced players demand more!

(extracted from first 18 common scenarios)
Results - social context

Playing with skilled players positively effects QoE!

(extracted from first 18 common scenarios)
Conclusions & Future work

- Problem - QoE as a multidimensional construct

- Quantified effects of several IFs
  - Jerkiness having most significant impact, followed by packet loss, frame rate, and last latency

- Examined combined effects of listed IFs
  - Degradation of jerkiness/loss lower QoE the most
  - Latency “invisible” to our testing group

- Future work
  - Further analysis of the collected dataset
  - Another round of experiments