

# 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

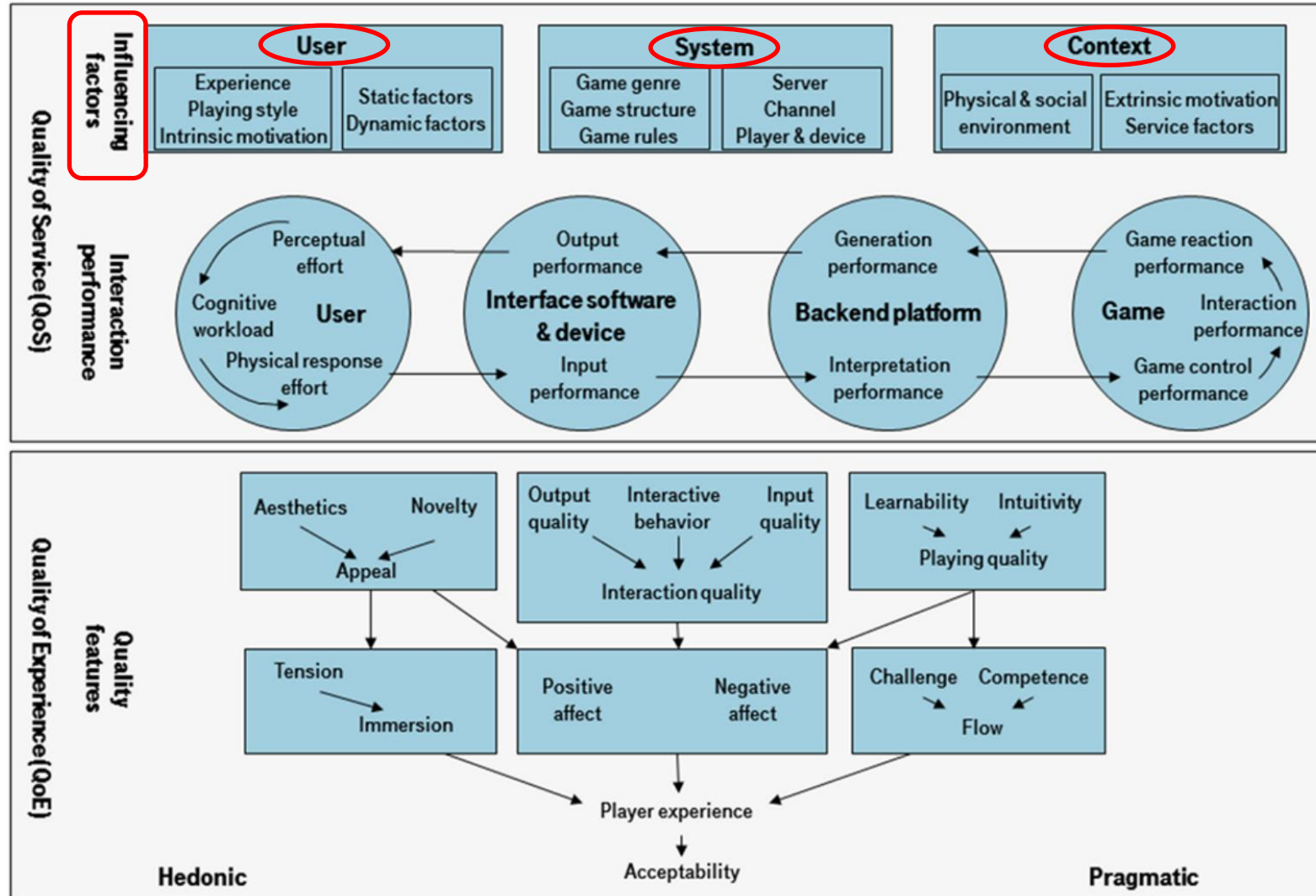
# Outline

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- ◆ Problem
- ◆ Introduction
- ◆ Methodology
- ◆ Results
- ◆ Conclusion

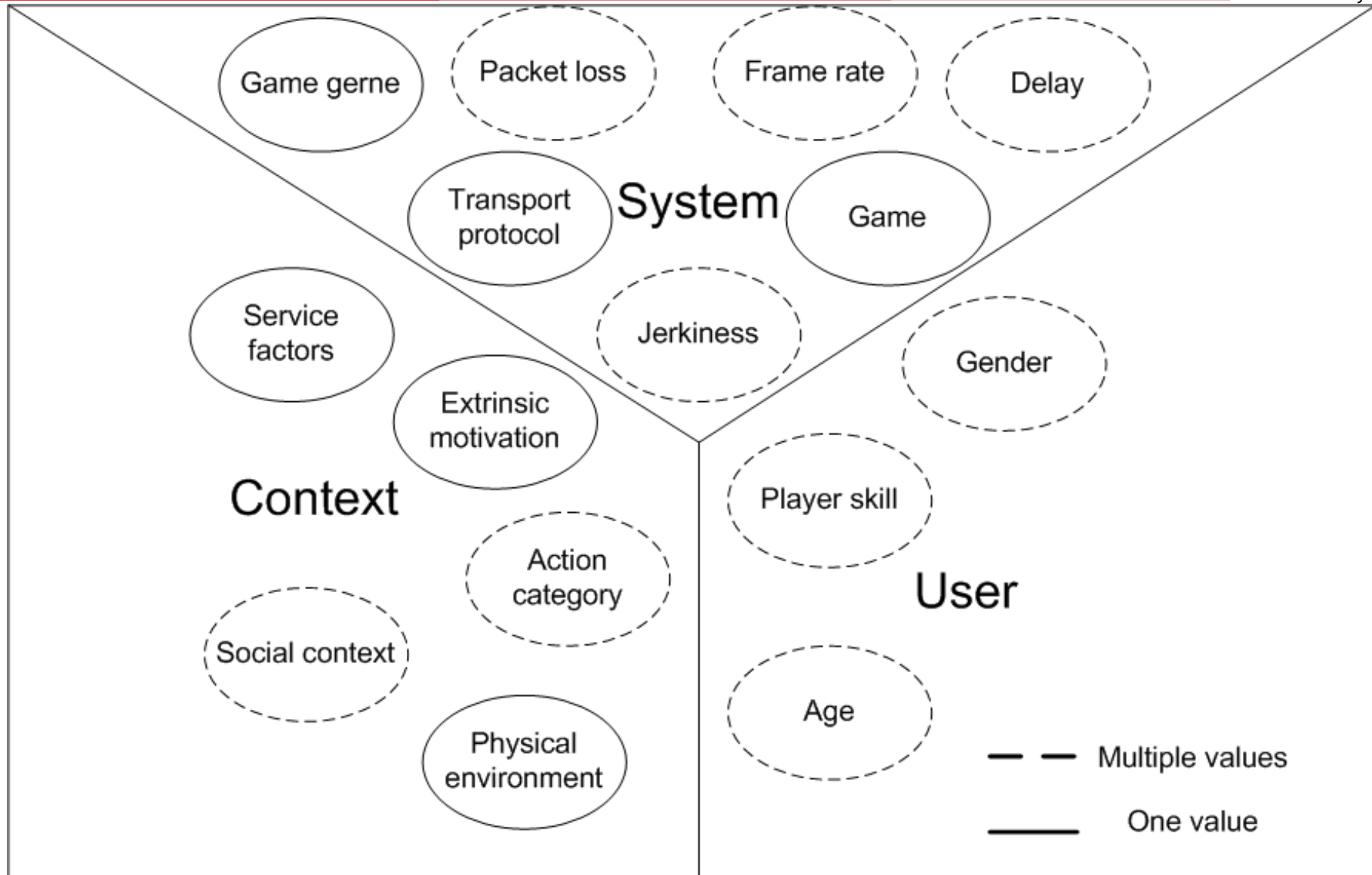
- ◆ User's QoE resulting from:
  - “the fulfillment of his or her expectations with respect to the utility and/or enjoyment of the application or service in light of the user's personality and current state*
- ◆ QoE extends the notion of QoS
  - User related factors
  - Context related factors
- ◆ QoE for games- additionally complex
  - Not a task oriented activity
- ◆ QoE of the game service -> not going into gameplay!

# Taxonomy of gaming QoE



S. Möller, S. Schmidt, and J. Beyer, "Gaming Taxonomy: An Overview of Concepts and Evaluation Methods for Computer Gaming QoE," in International Workshop on Quality of Multimedia Experience, QoMEX, 2013, pp. 1-6.

# Influence factors addressed in this 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

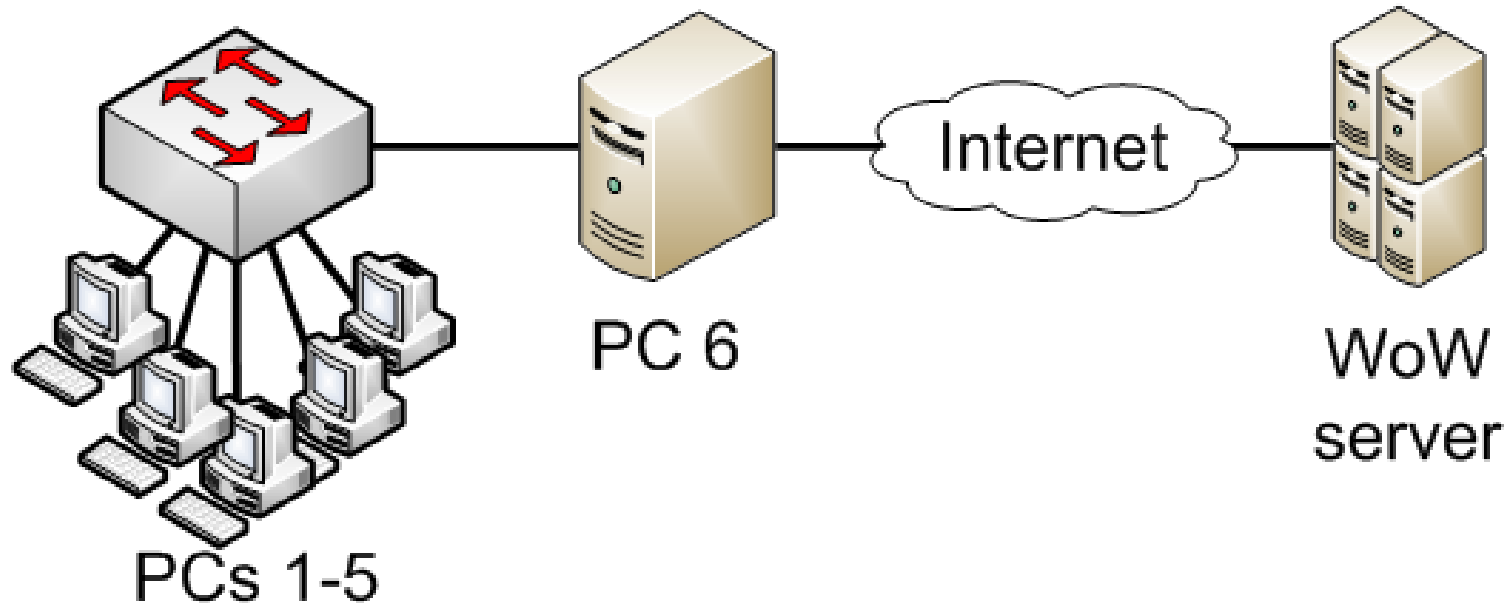
- ◆ Goal:
  - To gather data about participant's previous gaming experience, preferences, and self-assessed skill
- ◆ Characteristics
  - Google form used
  - 69 participants (students) submitted responses
  - 50 male, 19 female
  - Age 21 - 26
- ◆ Information obtained used to form player groups of various 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



- ◆ 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)

- ◆ 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

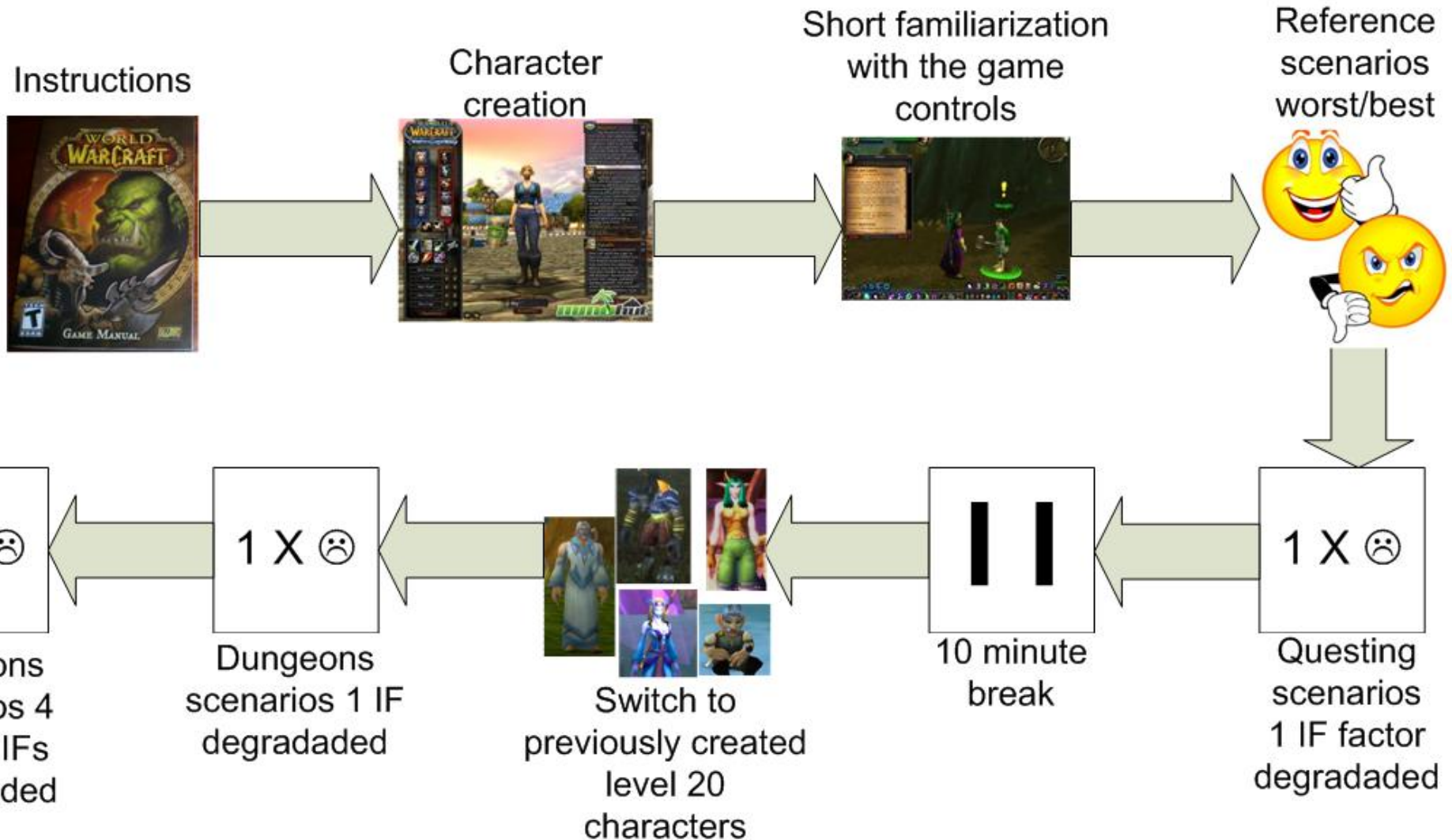
- ◆ Constraints
  - Too many possible combinations (162)
  - Time limit < 3 hours (participants get tired)
  - More responses per scenario - more accurate results
  - How to fit as much as possible in 3 hours?
  
- ◆ Applied solution - 22 scenarios per group
- ◆ Scenarios performed by all groups
  - 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

- ◆ 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



# Results single IF degradation

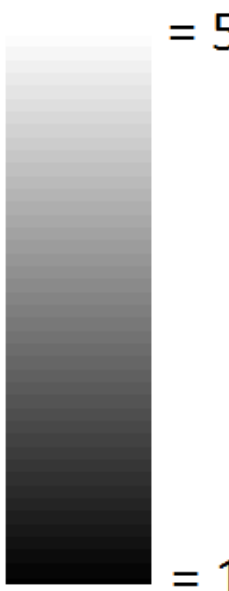


Latency	Loss ratio	Frame rate	Jerkiness	Action category	QoE					
					0	1	2	3	4	5
0	0	60	0	D						
				Q	[Bar chart showing QoE distribution for D=0, Q=0]					
400	0,1	15	0,133	D						
				Q	[Bar chart showing QoE distribution for D=400, Q=0,133]					
200	0	60	0	D	[Bar chart showing QoE distribution for D=200, Q=0]					
				Q	[Bar chart showing QoE distribution for D=200, Q=0]					
400	0	60	0	D	[Bar chart showing QoE distribution for D=400, Q=0]					
				Q	[Bar chart showing QoE distribution for D=400, Q=0]					
0	0,05	60	0	D	[Bar chart showing QoE distribution for D=0, Q=0,05]					
				Q	[Bar chart showing QoE distribution for D=0, Q=0,05]					
0	0,1	60	0	D	[Bar chart showing QoE distribution for D=0, Q=0,1]					
				Q	[Bar chart showing QoE distribution for D=0, Q=0,1]					
0	0	25	0	D	[Bar chart showing QoE distribution for D=0, Q=0,25]					
				Q	[Bar chart showing QoE distribution for D=0, Q=0,25]					
0	0	15	0	D	[Bar chart showing QoE distribution for D=0, Q=0,15]					
				Q	[Bar chart showing QoE distribution for D=0, Q=0,15]					
0	0	60	0,067	D	[Bar chart showing QoE distribution for D=0, Q=0,067]					
				Q	[Bar chart showing QoE distribution for D=0, Q=0,067]					
0	0	60	0,133	D	[Bar chart showing QoE distribution for D=0, Q=0,133]					
				Q	[Bar chart showing QoE distribution for D=0, Q=0,133]					

# 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!!!

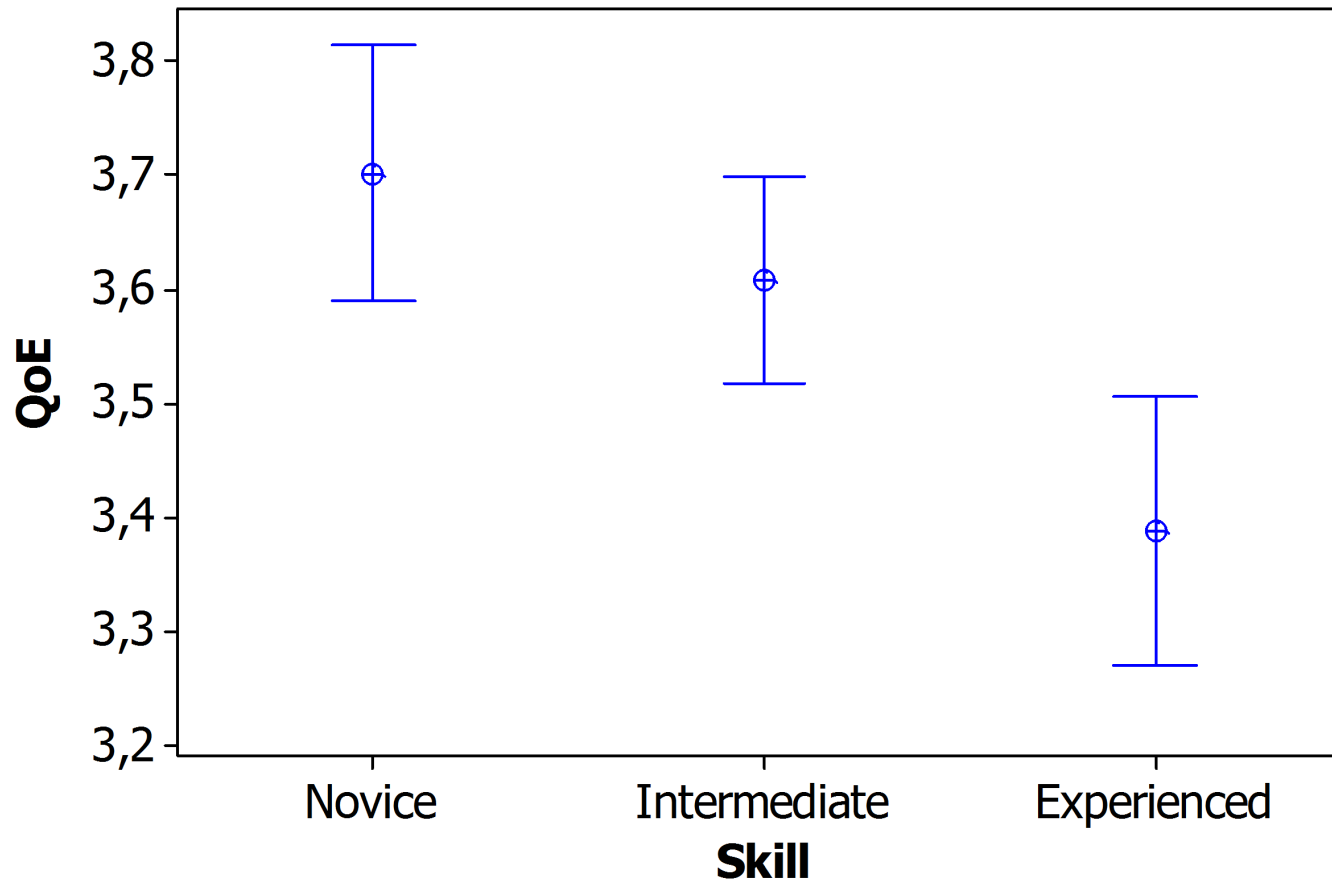
	Loss rate	0,05		0,1	
	Delay	200ms	400ms	200ms	400ms
Jerkiness	Frame rate				
0,067	25	2.7	2.8	1.9	2.19
	15	2.73	3.1	1.93	1.6
0,133	25	1.9	2.53	1.5	1.7
	15	3.25	2	1.5	1.7





# Results - player skill

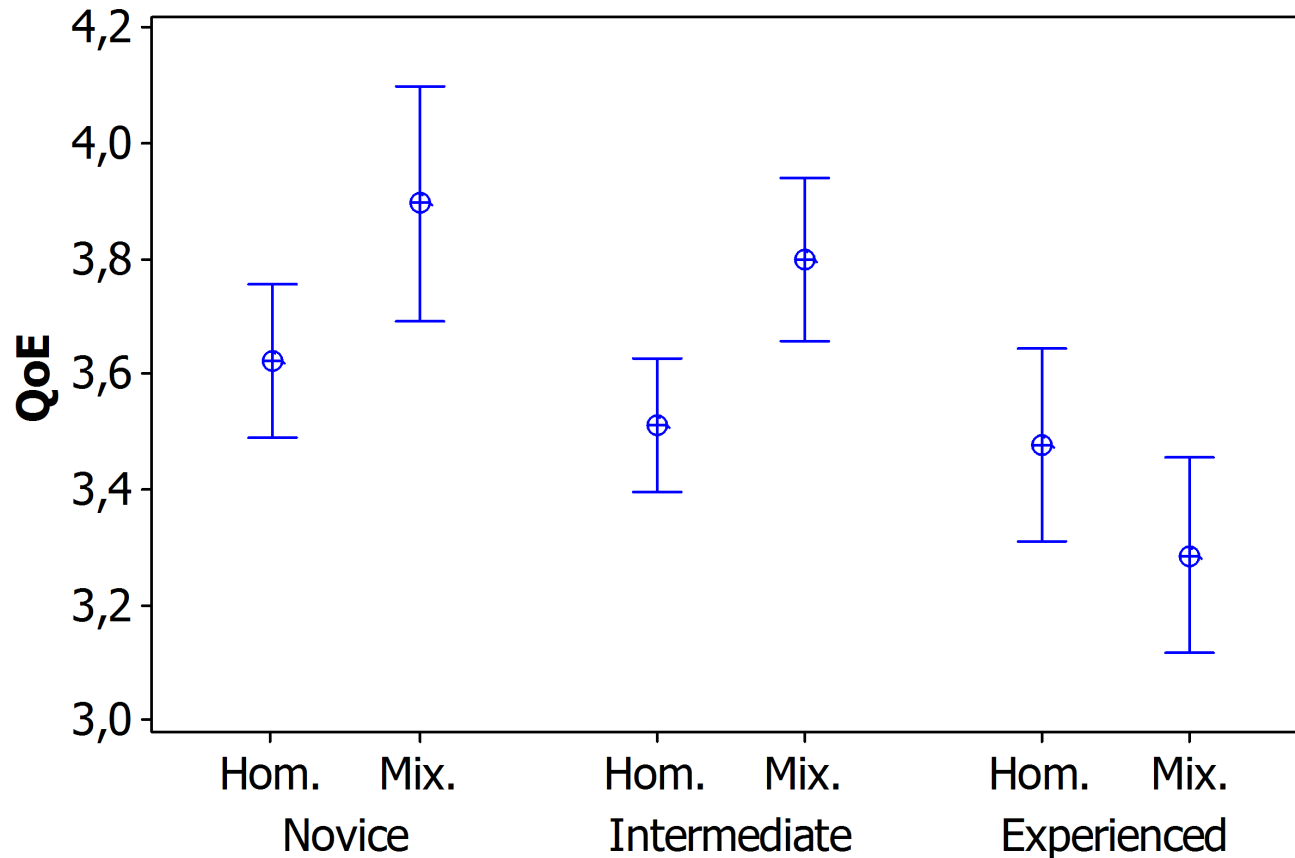
More experienced players demand more!



(extracted from first 18 common scenarios)

# Results - social context

Playing with skilled players positively effects QoE!



(extracted from first 18 common scenarios)

- ◆ 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