Ongoing Standardization Activities of Gaming Quality of Experience

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Motivation (I)

- 2.3 billion gamers will spend $137.9 billion on video games in 2018[1]

- Cloud Gaming is one of the most challenging online service

- Companies in the past could not provide acceptable QoE

- Identification of relevant influencing factors

- Investigate methods for gaming QoE assessment

- Apply this knowledge to develop a gaming QoE opinion model

[1] Newzoo quarterly update of its Global Games Market Report 2018

Motivation (II) – What is Cloud Gaming?
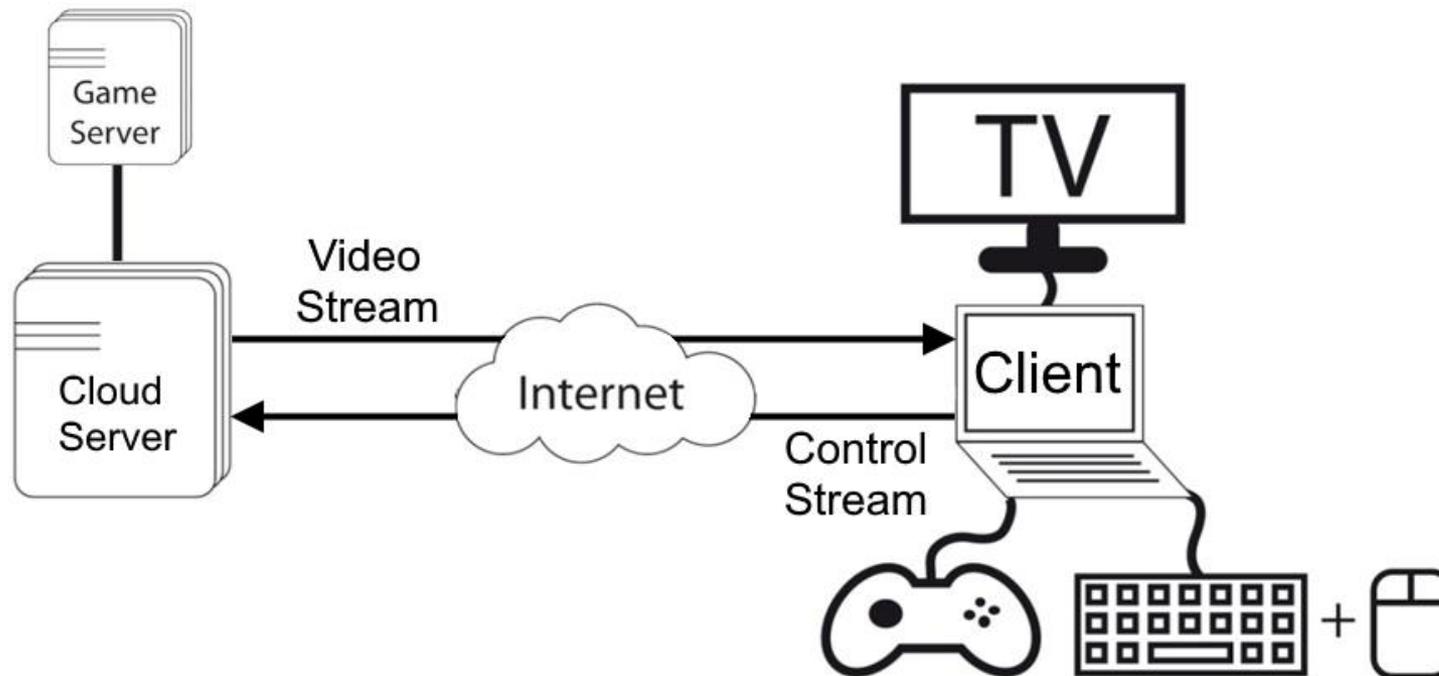
- Collaboration of Berlin Institute of Technology and T-Labs (Prof. Sebastian Möller)

- Investigation of QoS and **QoE** of OnLive (Dennis Pommer)

- Dissertation about **influencing factors** (Justus Beyer)

- **Taxonomy** defining gaming QoE (Steven Schmidt)
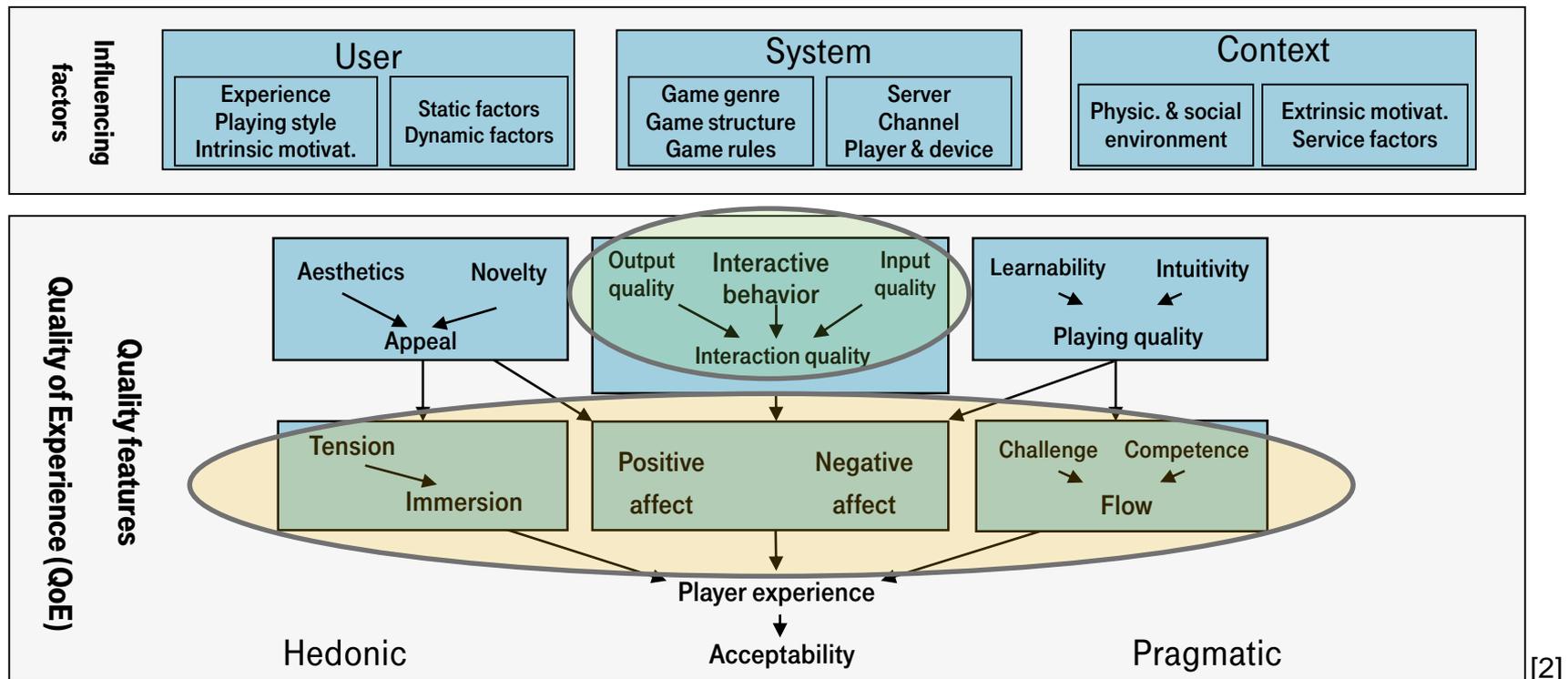
2013 | 2014 | 2015 | 2016 | 2017 | 2018

What is Gaming Quality of Experience?

Influencing factors

User	System	Context
Experience Playing style Intrinsic motivat. / **Static factors Dynamic factors**	**Game genre Game structure Game rules** / **Server Channel Player & device**	**Physic. & social environment** / **Extrinsic motivat. Service factors**

Quality features / Quality of Experience (QoE)

- Aesthetics — Novelty → Appeal
- Output quality — Interactive behavior — Input quality → Interaction quality
- Learnability — Intuitivity → Playing quality
- Tension → Immersion
- Positive affect — Negative affect
- Challenge — Competence → Flow
- → Player experience
- → Acceptability

Hedonic   Pragmatic

[2]

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- Creation of **3 work items** in ITU-T SG-12 [3]

- **ITU-T Rec. G.1032 (10/2017) – G.QoE-gaming:**
  - Influence factors on gaming quality of experience
- **ITU-T Rec. P.809 (05/2018) – P.GAME:**
  - Subjective evaluation methods for gaming quality
- **Future ITU-T Rec. G.OMG (studied in Q.13/12):**
  - Opinion model for gaming applications

2013 | **2014** | 2015 | 2016 | 2017 | 2018

- Connection with other researchers from AIT in Vienna, FER in Zagreb, University Würzburg, QoE-Net

- Variety of studies

    - **Feedback delay** of mobile devices

    - **Environment** influencing factors

    - **Physiological** measurement for gaming QoE

    - Impact of display size, game type, network delay

    - Open-Source Mobile Cloud Gaming Platform [4]

| 2013 | 2014 | 2015 | **2016** | 2017 | 2018 |

- **Approved Recommendation for G.QoE-Gaming** (**ITU-T Rec. G.1032**)

- Stronger focus on video encoding parameters

- Collaboration with Nabajeet Barman (Kingston)

  - Building **gaming video datasets**

  - Quality assessment metrics

  - Content comparison

- Evaluation of subjective test **paradigms** and **questionnaires** assessing gaming QoE

2013	2014	2015	2016	**2017**	2018

ITU-T Rec. G.1032 - G.QoE-Gaming [5]

- **Human** influence factors

  - Gaming experience, Intrinsic and extrinsic motivation, static and dynamic human factors (age, gender), human vision

- **System** influence factors

  - Game genre, mechanics and rules, temporal and spatial features (pace, accuracy), visual perspective, aesthetics and design characteristics, learning difficulty, device portability and size, input and output modalities

  - Network and encoding parameters: delay, jitter, bandwidth, framerate, resolution, rate controller, GoP, motion range, audio and video compression

- **Context** influence factors

  - Physical environment factors, Social context, Service factors, Novelty

- **Approved Recommendation for P.GAME (ITU-T Rec. P.809)**
- Encoding Complexity Classification
- Characteristics responsible for delay sensitivity
  - Saeed Sabet (Simula - Oslo) collaboration
- Questionnaire assessing input quality
- Dimension-based assessment of video quality
- Separation of spatial video and interaction quality
- Proposal for structure of G.OMG

2013 | 2014 | 2015 | 2016 | 2017 | **2018**

ITU-T Rec. P.809 – P.GAME [6]

- **QoE aspects** of gaming including five engagement concepts

- **Test paradigms: interactive vs. passive**

- **Passive** viewing-and-listening tests with audiovisual stimuli

- **Interactive tests** with game scenes

- Experimental set-up: duration, environment, game material

- How to ensure similar stimuli for participants

- Collection of **questionnaires** and scales

- Player performance measurement

Comparison of interactive and passive tests

[7]
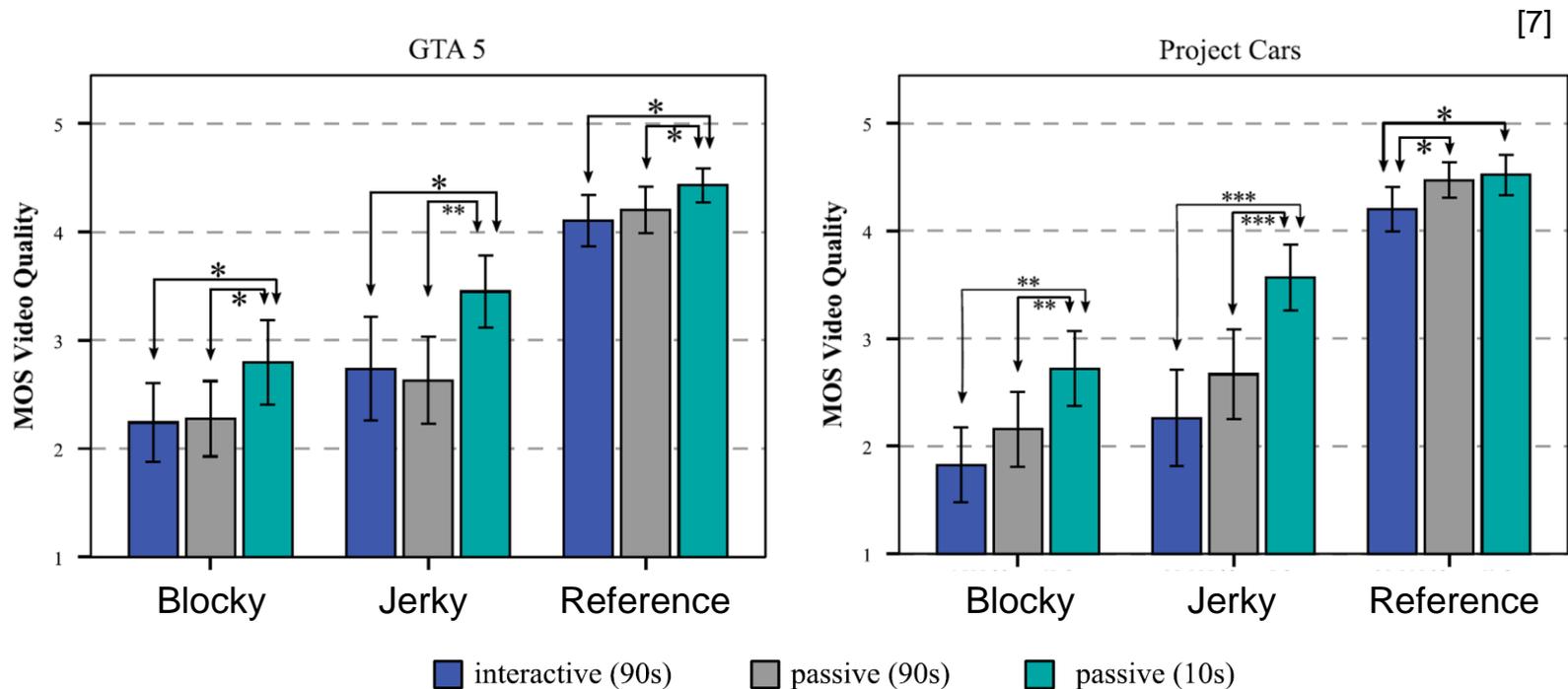
Future ITU-T Rec. G.OMG [8]

- **Predict** overall **quality or individual quality aspects** based on encoding and network parameters

- Two modes depending on available information about game content

- **Scope**:

  - Considering relevant factors identified in ITU-T Rec. G.1032

  - Network planning tool (infrastructure and resource distribution)

  - Target services: cloud gaming

  - Target group: non-professional gamer

  - Not: VR gaming, mobile devices, social aspects (but might be applicable)

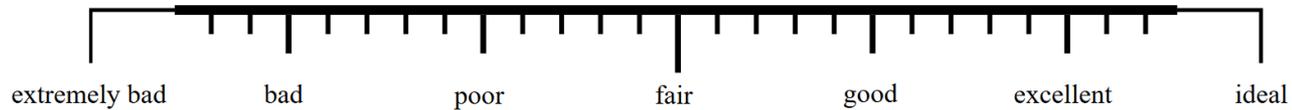 - Not: influence of the design of games or the motivation of users to play
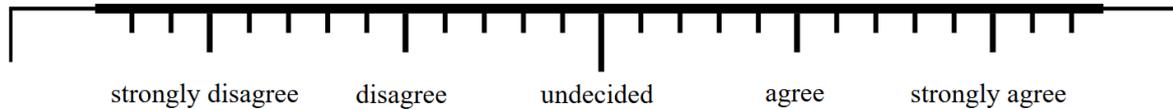
Future ITU-T Rec. G.OMG

[8]
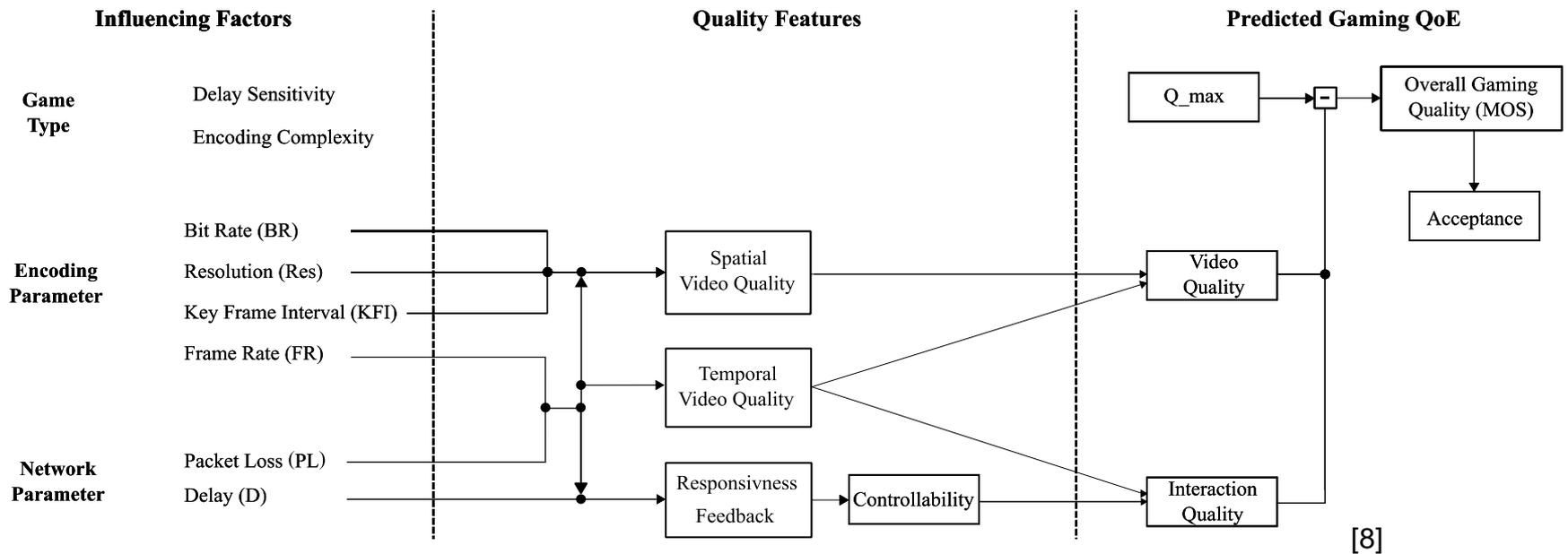
Future ITU-T Rec. G.OMG

How do you rate the overall quality of your gaming experience?

extremely bad   bad   poor   fair   good   excellent   ideal

I received immediate feedback on my actions.

strongly disagree   disagree   undecided   agree   strongly agree

Fragmentation

fragmented   unfragmented

Future ITU-T Rec. G.OMG

- **Requirement specification** submitted in May 2018

- **Data assessment** process will be discussed in Dec 2018

- Spatial video quality shows no impact on input quality

Database Name	Paradigm	Parameters	N	Location
VIDEO_DB	passive	bitrate, framerate, resolution, KFI, packet loss	150	Berlin
DELAY_DB	interactive	round-trip delay	30	Berlin
FRAME_DB	interactive	encoding framerate	30	London
PACKET_DB	interactive	input packet loss	30	Oslo
GRID_DB	interactive	bitrate, framerate, resolution	30	Berlin

Remaining challenges

- Input are system influence factors, potentially augmented by human and context influence factors

- Game characteristics largely determine the impact of system influence factors

- Parametric description of game characteristics missing

- Physiological measurement methods

- Performance metrics

- Fast development of cloud gaming systems

    - Individual network protocols (packet loss influence)

    - Current models not accurate for GPU encoding

Thank you for your Attention!

Ongoing Standardization Activities of
Gaming Quality of Experience

Steven Schmidt

We are always searching for collaborations ☺

Visit

www.qu.tu-berlin.de

for more information.

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Lab

References

[1] H.B. Duran, Newzoo quarterly update of its Global Games Market Report, 2018, URL:

http://www.alistdaily.com/entertainment/mobile-games-market-newzoo-april-2018/ (last accessed: 10.11.2018)

[2] S. Möller, S. Schmidt, and J. Beyer, "Gaming taxonomy: An overview of concepts and evaluation methods for computer gaming qoe," in *Quality of Multimedia Experience (QoMEX), 2013 Fifth International Workshop on*, 2013.

[3] S. Möller, S. Schmidt, and S. Zadtootaghaj, "New ITU-T Standards for Gaming QoE Evaluation and Management," in *Quality of Multimedia Experience (QoMEX), 2018 Tenth International Workshop on*, 2018.

[4] J. Beyer, "Quality-influencing factors in mobile gaming", http://dx.doi.org/10.14279/depositonce-6406, Dissertation, 2017.

[5] International Telecommunication Union, Study Group 12 (Source: Deutsche Telekom AG), "G.1032: G.1032 : Influence factors on gaming quality of experience" , Geneva, 2017.

[6] International Telecommunication Union, Study Group 12 (Source: Deutsche Telekom AG), "P.809 : Subjective evaluation methods for gaming quality" , Geneva, 2018.

[7] S. Schmidt, and S. Zadtootaghaj, S. Möller, "A Comparison of Interactive and Passive Quality Assessment for Gaming Research," in *Quality of Multimedia Experience (QoMEX), 2018 Tenth International Workshop on*, 2018.

[8] International Telecommunication Union, Study Group 12 (Source: Deutsche Telekom AG), "ITU-T Contribution SG12-C200: Requirement Specification and Possible Structure for an Opinion Model Predicting Gaming QoE (G.OMG)", Geneva, 2018.