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State of the Art of Multimedia Quality Assessment Methods

Takanori Hayashi

NTT Service Integration Labs.

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Outline

- Present state of multimedia quality assessment methods
- Future trends of quality assessment research
  - Multimodality
  - Multiparty
  - Wideband
- Examples of NTT's studies on multimedia quality assessment for audiovisual communication services

Relevant ITU-T/R Recommendations on Multimedia Quality Assessment

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- Multimedia quality assessment is at a reasonably advanced stage.

Media	Quality assessment method	
	Subjective	Objective
Audio	P.800, BS.562	P.563, P.862, BS.1387
Video	P.910, BT.500	J.144
Multimedia	P.911, P.920	J.148, P.931

Existing Subjective Multimedia Quality Assessment Methods (P.911)

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- Multimedia quality is assessed in a similar way to individual audio/video qualities.
  - Absolute Category Rating (ACR)
  - Degradation Category Rating (DCR)
  - Pair Comparison Method (PC)
  - Single Stimulus Continuous Quality Evaluation (SSCQE)
- Assessment paying attention to the cross-modal influences is important.
  - Interactions between differing quality levels in different modalities

Existing Subjective Multimedia Quality Assessment Methods (P.920)

- Several category judgment scales are used to evaluate multimedia quality.
  - Overall audiovisual quality
  - Individual audio/video qualities
  - Effort needed to interrupt
  - Communication difficulty
  - Acceptability of communication
- Communication quality depends on tasks used in conversational test.
- Assessment considering interactivity and usability is also important.

Existing Concept Model of Objective Multimedia Quality Evaluation (J.148)

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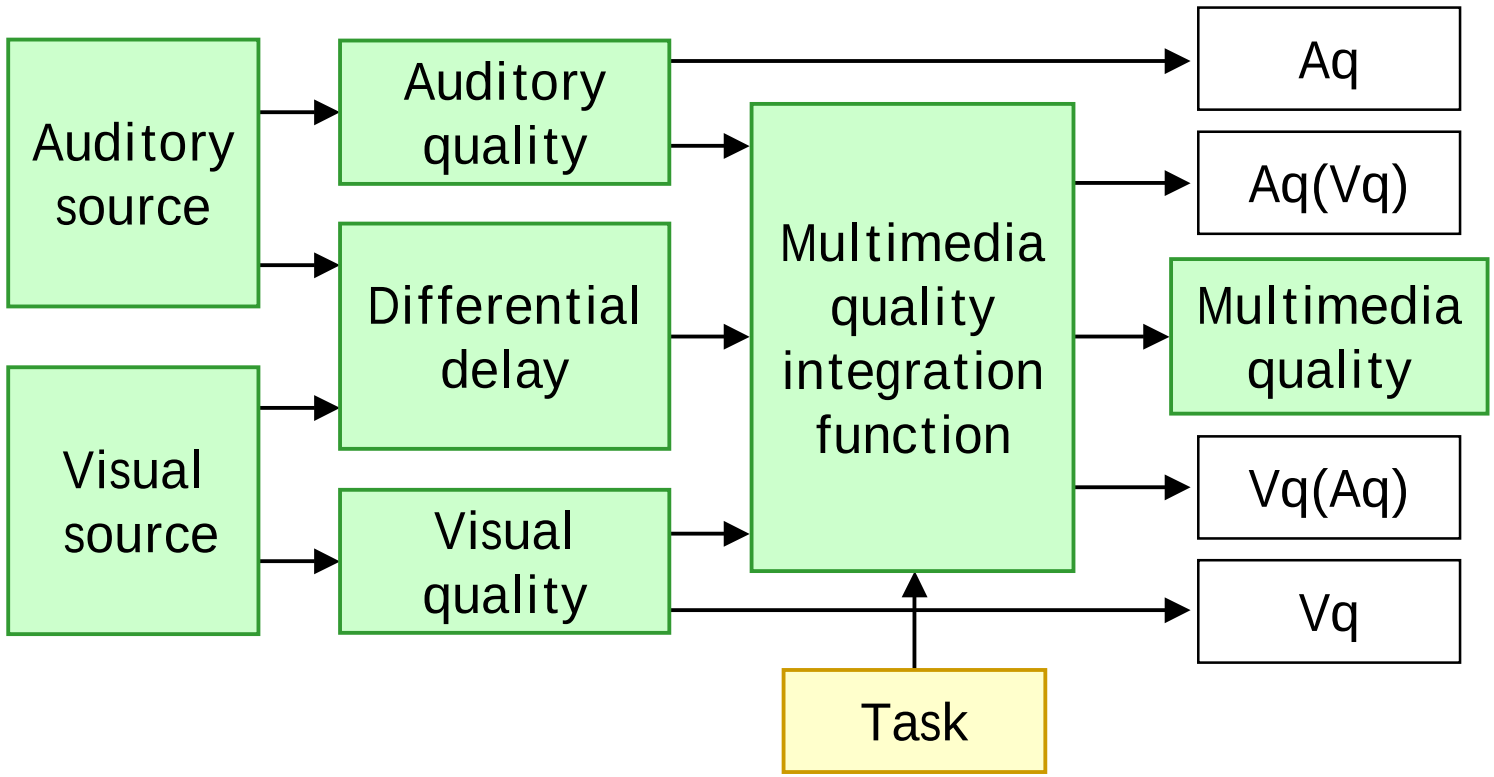
- Basic components of an objective multimedia quality model are defined.



Examples of Multimedia Quality Evaluation Model

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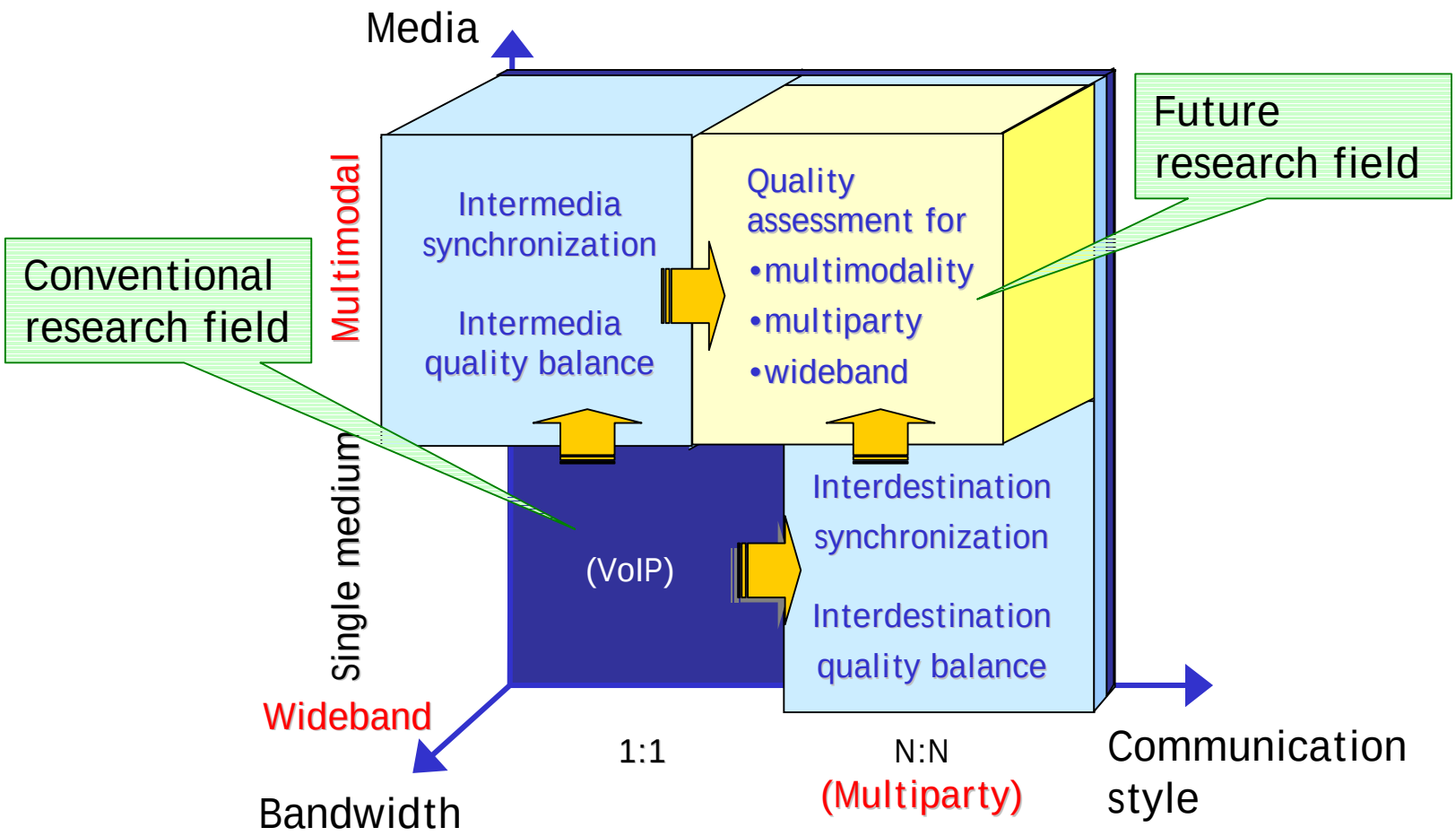
- ITU-T P.911 Annex
  - $MOS_{MM}=C_1MOS_AMOS_V+C_2$
- Other multimedia quality evaluation models have been proposed. [1-7]
  - $MOS_{MM}=C_1MOS_A+C_2MOS_V+C_3MOS_AMOS_V+C_4$
    - ✓ Constants vary with tasks (audiovisual contents, service environments, etc.).

MOS_{MM}: MOS for multimedia
MOS_A: MOS for audio
MOS_V: MOS for video
C: Constant

Framework for Conducting Quality Assessment Research [8]



Key Words for Future Trends of Multimedia Quality Assessment (1/3)

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- Multimodality
  - Combination of multiple media such as audio, video, text, graphics, fax, and telephony in the communication of information
  - Key points of quality assessment
    - ✓ Intermedia synchronization
    - ✓ Intermedia quality balance

Key Words for Future Trends of Multimedia Quality Assessment (2/3)

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- Multiparty
  - Communication style extending from 1:1 to N:N (e.g., instant messaging, teleconferencing, and distributed collaboration services)
  - Key points of quality assessment
    - ✓ Interdestination synchronization
    - ✓ Interdestination quality balance

Key Words for Future Trends of Multimedia Quality Assessment (3/3)

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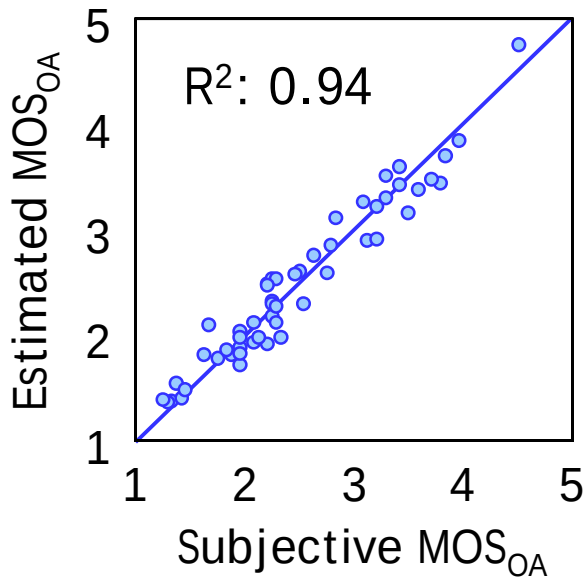
- Wideband
  - Telecommunications applications having more bandwidth available for higher-quality multimodal services
  - Key points of quality assessment
    - ✓ Psychological factors: We need to assess the richness of high-quality services not only on a one-dimensional scale, like MOS, but also on a multi-dimensional scale.

Examples of NTT's Studies on Quality Assessment for "Multimodality" (1/3)

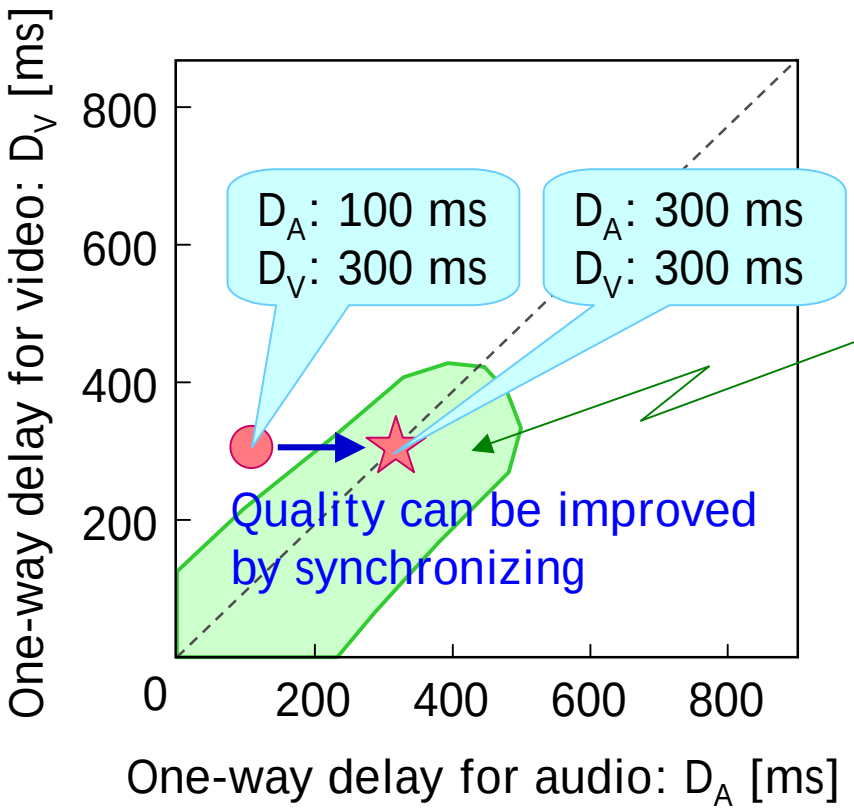
- Interactive multimodal quality model considering conversational delay [9]
  - $MOS_{OA}=(C_1MOS_{MM}+C_2)(C_3MOS_R+C_4)$
  - $MOS_R=C_5\exp(-D/C_6)+C_7$
    - ✓ Constants C_5, C_6, and C_7 depend on conversational task.



MOS_{OA}: MOS for overall quality
MOS_{MM}: MOS for multimedia
MOS_R: MOS for response
D: Delay
C: Constant

Examples of NTT's Studies on Quality Assessment for "Multimodality" (2/3)

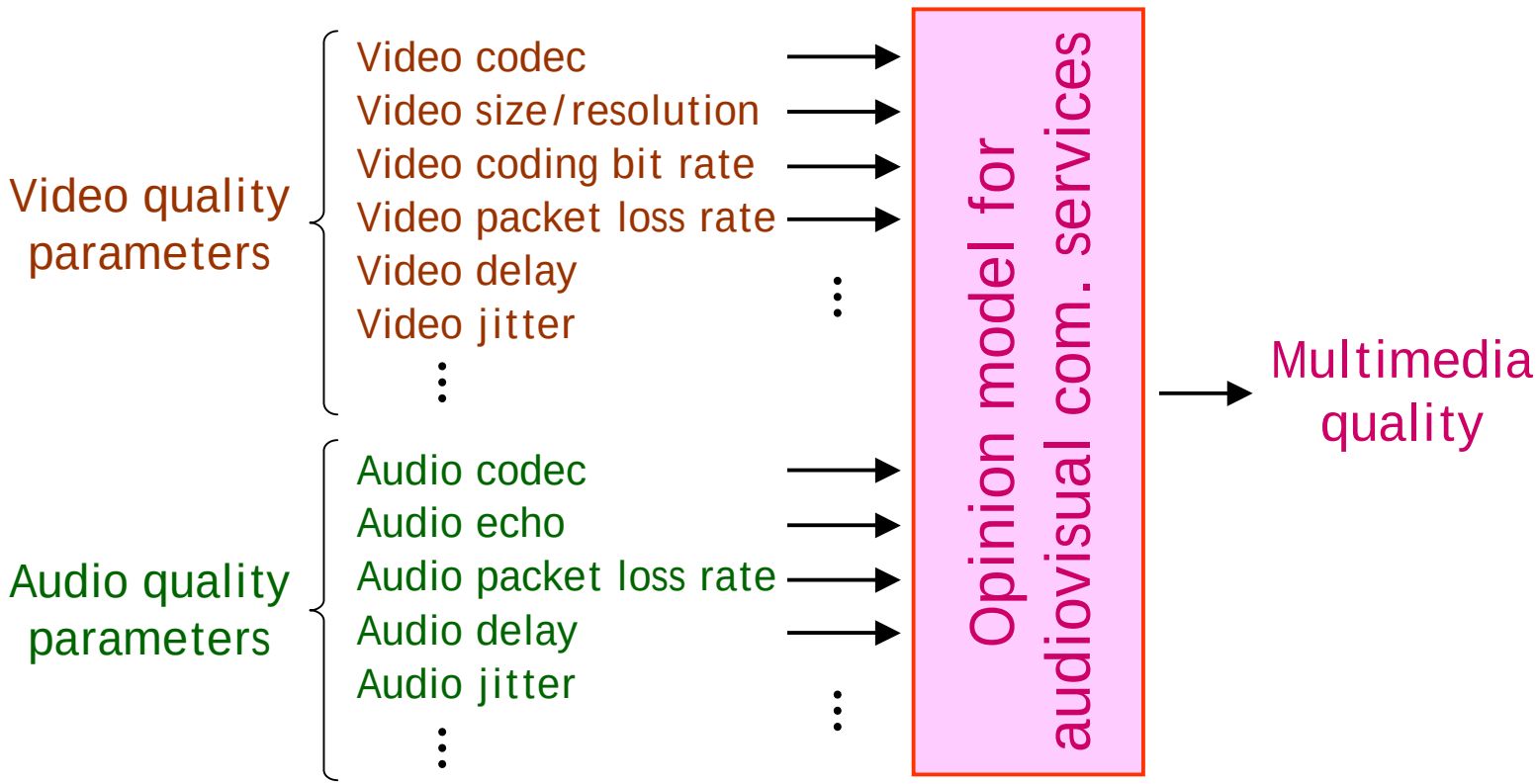
- Influence of differential delay is different when $D_A > D_V$ or $D_A < D_V$. [10]



Subjects: 4 experts
Task: Free conversation

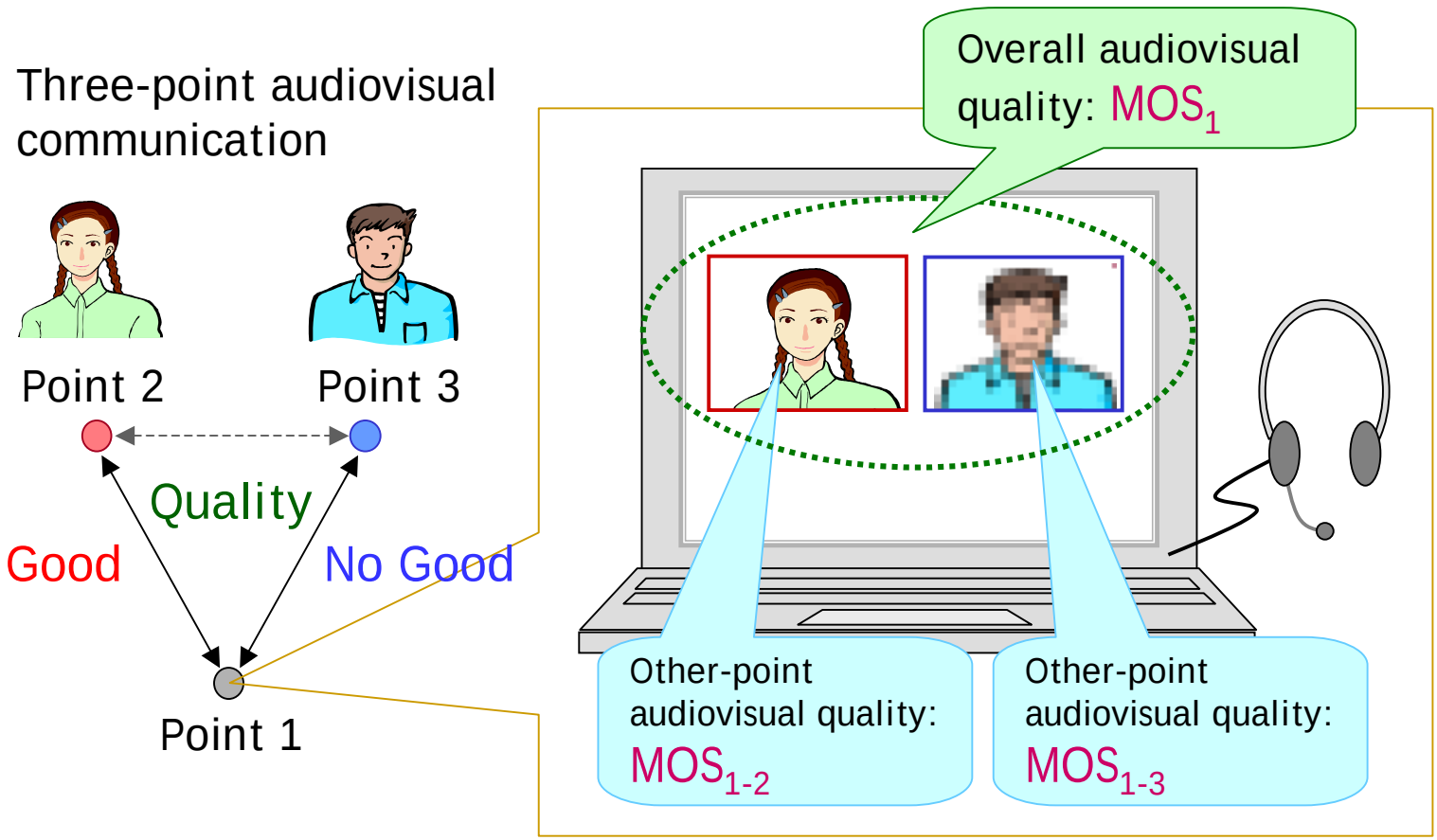
Examples of NTT's Studies on Quality Assessment for "Multimodality" (3/3)

- Opinion model for audiovisual communication services is now being discussed in ITU-T SG12. [11]



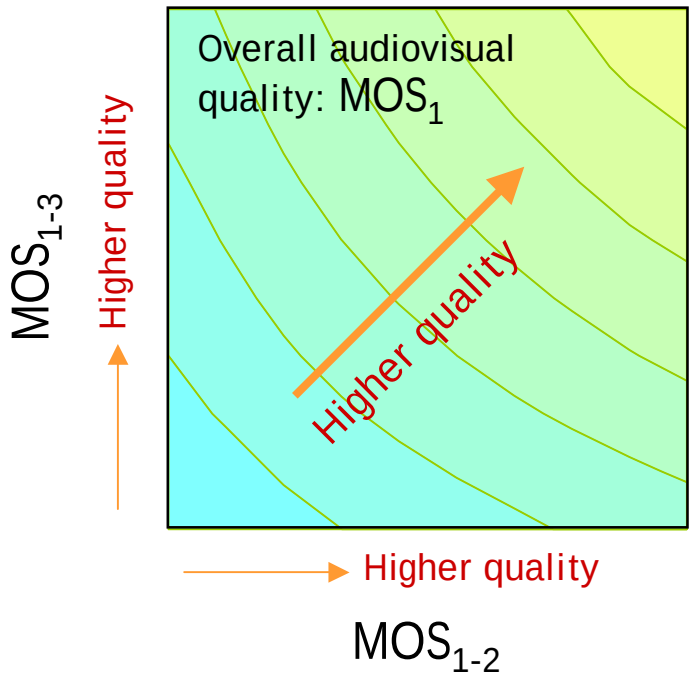
Examples of NTT's Studies on Quality Assessment for "Multiparty" (1/2)

- Quality imbalance is one of the multiparty quality degradation factors.



Examples of NTT's Studies on Quality Assessment for "Multiparty" (2/2)

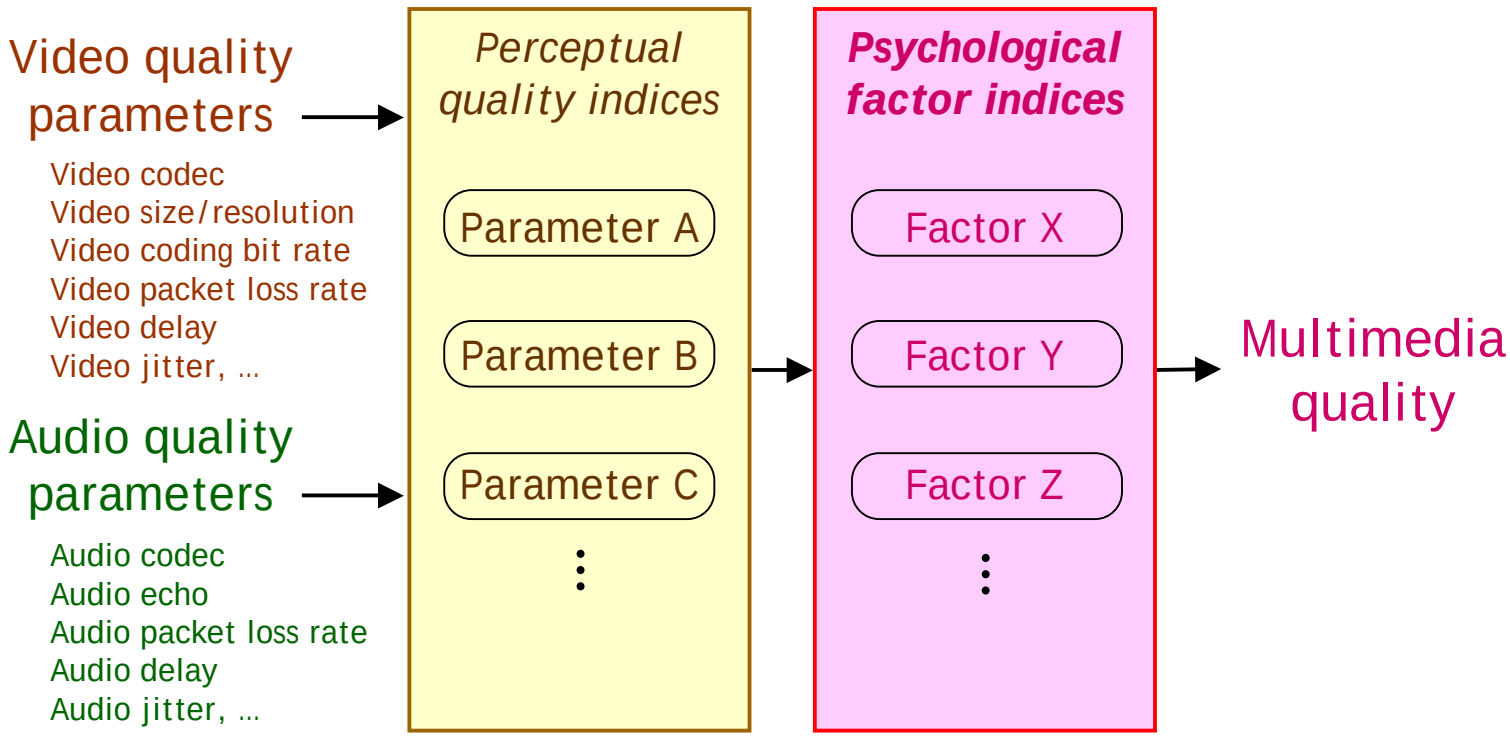
- Overall quality is strongly affected by the inferior quality at another point. [12]



- Other-point audiovisual quality depends on conversation task or roles.

Examples of NTT's Studies on Quality Assessment for "Wideband" (1/3)

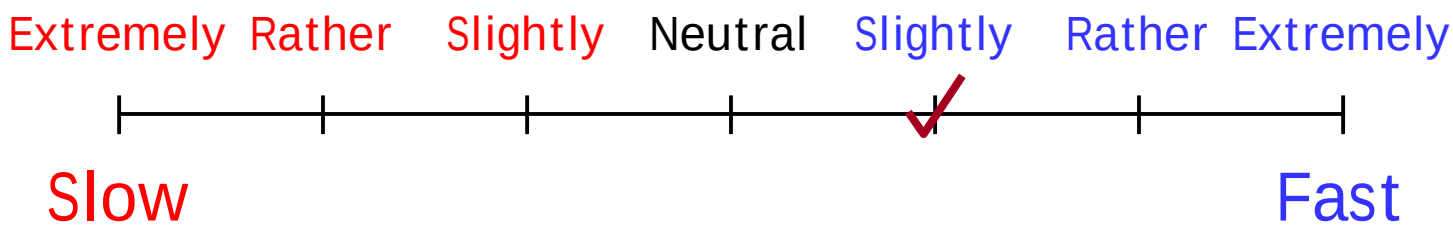
- Interactive multimodal quality can be evaluated using a multi-dimensional scale of psychological factors. [11]



Examples of NTT's Studies on Quality Assessment for "Wideband" (2/3)

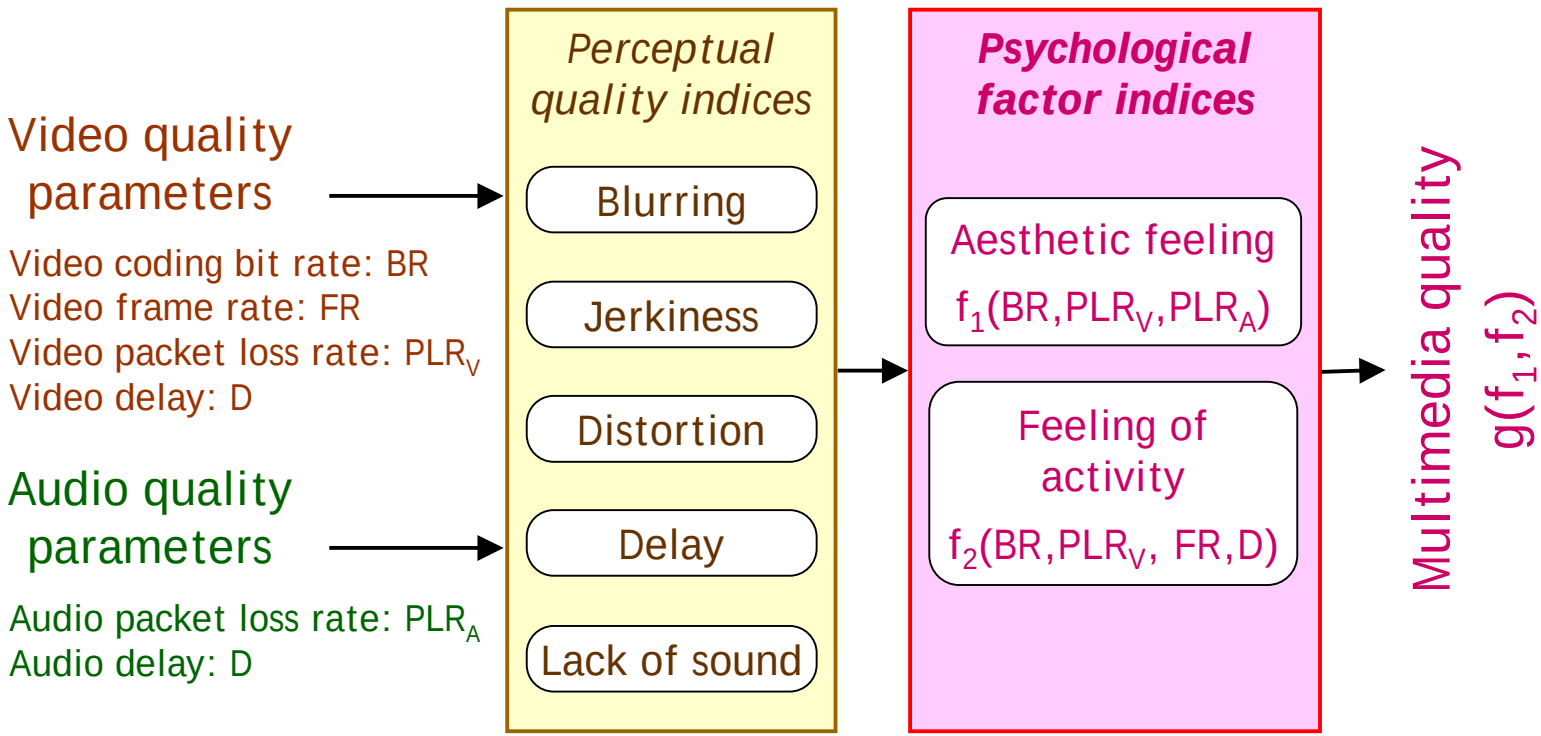
- Psychological factors were extracted by using the semantic differential (SD) technique and factor analysis. [13]
  - Subject's impression of an audiovisual communication service was evaluated on the basis of 25 pairs of bipolar adjectives on a seven-grade comparison scale.

Example of scale



Examples of NTT's Studies on Quality Assessment for "Wideband" (3/3)

- Multimedia quality was formulated as a function of two psychological factors expressing an *aesthetic feeling* and a *feeling of activity*. [13, 14]



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Conclusions

- Multimedia quality assessment is at an advanced stage.
- Perceptual quality assessment methodologies for multimedia communications systems of the next generation are being discussed.
- Three important characteristics of upcoming services have been revealed by recent studies on multimedia quality evaluation models:
  - Multimodality, multiparty, and wideband.

References (1/2)

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[3] A. Joly, N. Montard, and M. Buttin, "Audio-visual quality and interactions between television audio and video," Sixth International Symposium on Signal Processing and its Applications, Vol. 2, pp. 438 - 441, Aug. 2001.

[4] A. Watson, and M. A. Sasse, "Measuring perceived quality of speech and video in multimedia conferencing applications," Proceedings of the sixth ACM international conference on Multimedia, Sept. 1998.

[5] ITU-T Contribution COM12-19-E, "Relations between audio, video, and audiovisual quality," Dec. 1997.

[6] ITU-T Contribution COM12-61-E "Study of the influence of experimental context on the relationship between audio, video, and audiovisual subjective qualities," Sept. 1998.

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[7] ITU-T Contribution COM12-64-E "Results of an audiovisual desktop video teleconferencing subjective experiment," Sept. 1998.

[8] A. Takahashi, H. Yoshino, and N. Kitawaki, "Perceptual QoS Assessment Technologies for VoIP," IEEE Com. Magazine, pp. 28 - 34, July 2004.

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[11] ITU-T Contribution COM12-D13-E, "Proposal on basic concepts of a multimedia quality assessment model," Jan. 2005.

[12] T. Kurita, "Effects of Conversation Roles on Quality of Multiparty Audiovisual Communication Services," IEICE Tec. Rep. CQ, July 2005 (in Japanese).

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[14] K. Yamagishi, and T. Hayashi, "Analysis of psychological factors for quality assessment of interactive multimodal service," Electronic Imaging 2005, 5666-15, pp. 130 - 138, Jan. 2005.