

CONTENTS

1	INTRODUCTION	1
1.1	Motivation	1
1.2	Objectives and Scope	2
1.2.1	Structure of the thesis	3
2	RELATED WORK AND THEORETICAL BACKGROUND	5
2.1	Audio-Visual Perception	5
2.1.1	Perception of Video	5
2.1.2	Perception of Audio	5
2.2	Signal Transmission	6
2.2.1	Video and Audio-Video Data Transmission	6
2.2.2	Transmission Errors	7
2.2.3	Recovery Mechanisms	8
2.3	Quality of Transmitted Video	10
2.3.1	Quality of Transmitted Video	10
2.3.2	Definition of Perceived Quality	10
2.3.3	Subjective Quality Judgment	11
2.3.4	Audio-Visual Integration	12
2.4	Subjective Testing	14
2.5	Dimension-based Approach to Video Quality	15
2.5.1	Perceptual Features, Dimensions and Overall Quality	15
2.5.2	Dimension-Based Quality Models	16
2.5.3	Quality Dimensions and Overall Quality - Related Work	17
2.6	Experimental Paradigms	18
2.6.1	Semantic Differential and PCA	18
2.6.2	Paired Comparison and MDS	19
2.7	Instrumental Quality Estimation	20
2.7.1	Video Quality Estimation	20
2.7.2	Model Development	21
2.7.3	Video Quality Metrics	22
2.7.4	Video Quality Indicators	23
2.7.5	Acoustic Signals: Audio vs. Speech	25
2.7.6	Audio Quality Estimation	25
3	QUALITY FEATURE SPACE OF TRANSMITTED VIDEO	27
3.1	Experimental Set-Up	27
3.1.1	Processing of the Test Material	27
3.1.2	Test Rooms	33
3.1.3	Test Participants	33
3.2	Semantic Differential - Test	34
3.2.1	Determination of the SD Attributes	34
3.2.2	SD-Test – Test Procedure	36
3.2.3	Test Results and Interpretation	36
3.3	Paired Comparison - Test	41
3.3.1	PC-Test – Procedure	41
3.3.2	Test Results and Interpretation	42
3.4	Synthesis – perceptual Video Quality Space	45

4	DIRECT SCALING OF VIDEO QUALITY DIMENSIONS	47
4.1	Introduction	47
4.2	Dimension Rating Scales	47
4.3	DSCAL - Test Procedure	49
4.4	DSCAL - Video Telephony	50
4.4.1	Video Quality Dimension Test I (VQDIM I)	50
4.4.2	Video Quality Dimension Test II (VQDIM II)	52
4.5	DSCAL - Other Video Content	64
4.5.1	Video Quality Dimension Test III	64
4.6	DSCAL - Conclusion	71
5	QUALITY MODELING AND PREDICTION	75
5.1	Dimension-Based Modeling of Overall Video Quality	75
5.1.1	Linear Quality Model	75
5.1.2	Quality Modeling – VQDIM I	76
5.1.3	Quality Modeling – VQDIM II	77
5.1.4	Quality Modeling - Other Video Content - VQDIM III	77
5.1.5	Quality Modeling - Conclusion	79
6	INSTRUMENTAL DIMENSION-BASED VIDEO QUALITY MODELING	81
6.1	Instrumental Dimension Prediction	81
6.1.1	Introduction	81
6.1.2	Determination of the Dimension Estimators	83
6.1.3	Estimation Models	84
6.2	Dimension-Based Estimation of Overall Video Quality	89
7	AUDIO AND VIDEO QUALITY MODELING	93
7.1	Introduction	93
7.2	Audio-Visual Quality Dimension Test	93
7.2.1	Test Participants and Procedure:	94
7.2.2	AV-DIM – Data Analysis	95
7.2.3	Audio Quality and Prediction:	95
7.2.4	Video Quality and Prediction:	98
7.2.5	Overall Quality Prediction	100
7.2.6	Conclusion	103
8	INSTRUMENTAL ESTIMATION OF DIMENSION-BASED AUDIO-VISUAL QUALITY	105
8.1	Instrumental Audio Quality Estimation with DIAL	105
8.2	Synthesis – Instrumental Dimension-Based Transmitted Speech and Video Quality	108
9	CONCLUSION AND FUTURE WORK	111
9.1	Summary	111
9.2	Conclusion	112
9.3	Future Work	113
10	BIBLIOGRAPHY	117
A	APPENDIX - EXPERT SURVEY AND PRETEST	127
B	APPENDIX - TEST INSTRUCTION	133
C	APPENDIX - FILE PROCESSING	139
C.1	Fileprocessing - Matlab Code	139
C.2	Fileprocessing - Commandline Commands	147