Concert Halls and Opera Houses
Contents

Preface xv

CHAPTER ONE

MUSIC AND ACOUSTICS  1

What Are Good Acoustics?  1
Acoustics and the Performers  3
  Conductors  3
  Performers  7
Acoustics and Musical Periods  8
  Baroque Period  8
  Classical Period  10
  Romantic Period  12
  Twentieth-Century Music  13
  European Opera  14
Acoustics and Listeners  15

CHAPTER TWO

THE LANGUAGE OF MUSICAL ACOUSTICS  19
Definitions and Explanations of Selected Terms  19

Reverberation and Fullness of Tone  20
Direct Sound, Early Sound, Reverberant Sound  23
Early Decay Time (EDT) (Also Early Reverberation Time)  23
Speed of Successive Tones  24
Definition (or Clarity)  24
Resonance  27
Intimacy or Presence and Initial-Time-Delay Gap  27
Liveness and Mid-Frequencies  29
Spaciousness  29
Warmth  30
Listener Envelopment  30
Strength of Sound and Loudness  30
Timbre and Tone Color  31
Acoustical Glare  31
Brilliance  32
Balance  32
Blend  32
Ensemble  32
Immediacy of Response (Attack)  33
Texture  33
Echoes  33
Dynamic Range and Background Noise Level  33
Detriments to Tonal Quality  35
Uniformity of Sound in Audience Areas  35
Summary of the Musical Qualities Affected by Acoustics  35
CHAPTER FOUR

ACOUSTICS OF CONCERT HALLS 491

Rank-Orderings of Acoustical Quality of 58 Concert Halls
Developed from Interviews and Questionnaires 404
Reverberation Time: Musicians’ Preferences 495
Reverberation Time for Occupied Halls 497

Architectural Basics 498
Age 498
Shape 499
Music Power 500
Audience Absorption and Type of Chairs 501
Materials for Walls, Ceiling, and Stage 502

Physical Measures of Acoustical Quality 503
Reverberation Time (RT) 503
Early Decay Time (EDT) 505
Binaural Quality Index (BQI) 506
Loudness, the Strength of the Sound (G) 509
Warmth, Bass Ratio (BR) and Bass Strength (G_{ba}) 512
Intimacy, Initial-Time-Delay Gap (ITDG) 513
Lateral Fraction (L_{fa}) 519
Acoustical “Glare” and Surface Diffusivity Index (SDI) 521
Listener Envelopment 525
Clarity 526
Texture 527
Orthogonality of Objective Acoustical Measures 528
Special Structures for Reducing Acoustical “Glare” and for Diffusing Sound 529
Brilliance 534
Noise, Vibration and Echo 534

Further Architectural Considerations 535
Preferred Values for Acoustical Parameters 535
Stage Design 541
Balconies 545
Models 545
Multipurpose Halls 549

Architectural Design of Chamber Music Halls 550

Concluding Remarks 552

CHAPTER FIVE

Acoustics of Opera Houses 553

Questionnaire Rank-Orderings of Acoustical Quality of 21 Opera Houses 554
Objective Measurements of the Acoustical Properties of 23 Opera Houses 550
  Measurement Procedure 550
  Sound Quality Parameters 559

Orchestra Pits 504
  Types of Orchestra Pits 505
Boxes and Balconies 508
Echo and Distortion 570

Concluding Remarks 573

APPENDIX 1 Terminology, Definitions, and Conversion Factors 575

APPENDIX 2 Acoustical Data for Concert Halls & Opera Houses 583

APPENDIX 3 Equations, Technical Data, and Sound Absorption 615

Bibliography 641
Name Index 647
Subject Index XXX
Concert Halls and Opera Houses
Music, Acoustics, and Architecture
Beranek, L.
2004, XXIII, 661 p., Hardcover