

Rolf Bader

How Music Works

A Physical Culture Theory



Springer

สำนักหอสมุด มหาวิทยาลัยเชียงใหม่

Rolf Bader

b 16705270
O 12576979
i 2268539X

How Music Works

A Physical Culture Theory



 Springer

Contents

Part I

Some Fundamentals of Musical Acoustics	3
Play It Loud!	7
The Mysterious Sound of Friction	12
Linear Math and Nonlinear Nature	15
Hermann von Helmholtz	17
The First Synthesizers	19
Voice from Impulses	22
Unexpected Harmonicity	25
Why Are Musical Instruments Such Complex Boxes?	26
Who Wins the Game?	27
Eigenmodes Versus Forced Oscillations	29
What Makes a Musical Instrument Playable?	31
Damping Is a Feature, Determining Who Wins the Game	32
Synchronization as Output	33
Some Fundamentals of Music Psychology	35
Musical Instruments Treating the Psyche	37
Music and Trance	40
Aristoteles and the Beginning of Psychology	42
Transcendental Aesthetic	44
Transfer Effects of Music and Freedom of Will	45
Music and Politics	47
The Creation of Creativity	48
Brain Activities	50
The Split Between Hard and Soft Sciences	51
Fusion of Senses	52
Psychoacoustics	54

Some Fundamentals of Comparative Musicology	57
Music, DNA, and Sexuality	57
Diversity and Change	60
The Beginning of Comparative Musicology	62
Ethnomusicology and Music Archiving	64
Computational Music and Sound Archiving	66

Part II

Impulses	71
What Is a Frequency?	72
How to Deal with Many Frequencies: The Fourier Theorem	76
Beyond Sinusoids	78
Damping	80
Dispersion	84
Linearity or Nonlinearity	85
Impulse Pattern Formulation (IPF)	88
Environmental Noise	95
Musical Noise	99
Initial Transients	101
Information in Music	102
Turbulence	105
Turbulent and Laminar Flow	106
Navier-Stokes Equation	108
What Does Turbulence Lead To?	112
Saxophone	117
Saxophone Pitches Are Not Self-evident	117
Blowing in a Saxophone	119
Blowing Out of Normal Range	123
Multiphonics	126
Modeling Saxophones with Impulse Pattern Formulation	127
The Beginning of the Tone	128
The Saxophone Reed	129
More Wind Instruments	131
Recorder and Transverse Flute	134
Free Reed Instruments	138
Shawms, Oboes, Double-Reed Instruments	139
Brass Instruments	141
Articulation and Noise with Wind Instruments	144

Friction Instruments	149
Guitars and Plucked String Instruments	153
Practical Consequences for Guitar Acoustics	161
The Human Voice	167
Neurophysiology of Music	173
Self-organizing Models of the Brain	174
Music and Consciousness	181
Reconstructing Impulses—The Ear and the Auditory Pathway	191
Transfer of Acoustic Electricity into Neural Electricity: The Inner Ear	194
How Do We Hear a Pitch	197
A Spatio-Temporal Pitch Theory	202
How Do Tonal Systems Come into Place	205
Loops in the Auditory Pathway	208
Other Nerve Loops in the Auditory Pathway	210
Models of Music Perception	211
Timbre	215
Multidimensionality of Timbre	217
Music as Physical Adaption	221
IPF Comparison of Bowed and Wind Instruments	223
Neural Network Models of Timbre	224
Rhythm, Musical Form, and Memory	229
Neurophysiology of Time	229
Musical Form as Tension	230
Fractal Dimensions as Musical Density	231
Musical Form as Neural Synchronization	234
Efficient Coding	236
Brain Interactions in Music Therapy	238
Perception-by-Production as Self-organizing Process	239
 Part III	
Music, Meaning, and Emotion	243
Freedom! Jazz! Dance! Yeah!	243
Slave to the Rhythm	246
Politics and Philosophy	246
Logic of Music	250

Physical Culture Theory	253
Predicting Culture	255
Physical Modeling or Artificial Intelligence?	256
Notions as Spatio-Temporal Patterns	256
The Musical System	257
Is Culture Conscious?	258
 Notes	 261
Discography	269
References	277