pythagorean tuning

pythagorean tuning is a system of musical tuning based on the mathematical ratios derived from the ancient Greek philosopher Pythagoras. This tuning method focuses on tuning intervals using pure perfect fifths, forming the foundation of Western music theory and practice for centuries. Unlike equal temperament, which divides the octave into twelve equal parts, Pythagorean tuning prioritizes the purity of fifths and fourths, impacting the harmonic and melodic qualities of music. Understanding Pythagorean tuning involves exploring its historical background, the mathematical principles behind it, its advantages and limitations, and its influence on musical composition and performance. This article provides a comprehensive overview of Pythagorean tuning, examining its theoretical framework, practical applications, and how it compares to other tuning systems.

Historical Background of Pythagorean Tuning

Pythagorean tuning traces its origins to the ancient Greek mathematician and philosopher Pythagoras, who lived around 570–495 BCE. Pythagoras is credited with discovering the relationship between musical intervals and numerical ratios, laying the groundwork for the scientific study of music. His observations stemmed from experiments involving vibrating strings and the sounds they produced when divided into specific lengths. This tuning method was widely adopted in medieval and Renaissance music, influencing the development of Western musical scales and harmony. The focus on pure intervals based on the perfect fifth made Pythagorean tuning a foundational system before the emergence of other temperaments.

Mathematical Foundations of Pythagorean Tuning

The core principle of Pythagorean tuning is the tuning of intervals using the ratio 3:2, known as the perfect fifth. This ratio produces a consonant and harmonically rich sound when two notes are played together. By stacking perfect fifths on top of each other and adjusting them within the octave (a ratio of 2:1), a complete scale can be constructed. The mathematical process involves multiplying or dividing frequencies by the ratio 3:2 and then reducing the resulting frequency within the range of an octave by dividing or multiplying by 2 as needed.

Construction of the Pythagorean Scale

Starting from a reference pitch, the Pythagorean scale is built by ascending or descending in perfect fifths. For example, moving up a perfect fifth multiplies the frequency by 3/2, while moving down a perfect fifth divides the frequency by 3/2. After twelve such steps, the scale returns to a frequency close to seven octaves above the starting note, though not exact due to the Pythagorean comma—an important concept in this tuning system.

The Pythagorean Comma

The Pythagorean comma is the small discrepancy that arises because twelve perfect fifths do not precisely equal seven octaves. Numerically, twelve perfect fifths equal (3/2)^12, whereas seven octaves equal 2^7. The difference between these two values results in a slight tuning inconsistency, approximately 23.46 cents. This discrepancy presents challenges in tuning instruments and is a reason why Pythagorean tuning is not commonly used as a practical tuning system for fixed-pitch instruments today.

Characteristics and Interval Structure

Pythagorean tuning is characterized by its emphasis on pure perfect fifths and fourths. This system produces intervals that are harmonically pure and consonant, but some other intervals, especially major thirds and sixths, are noticeably wider or narrower compared to equal temperament. The distinct interval structure of the Pythagorean scale affects the overall sound and feel of the music composed or performed using this tuning.

Intervals in Pythagorean Tuning

The main intervals in Pythagorean tuning are derived from the 3:2 ratio and its multiples, including:

- **Perfect Fifth (3:2):** The foundational interval, tuned pure and consonant.
- **Perfect Fourth (4:3):** The inversion of the perfect fifth, equally consonant.
- **Major Second (9:8):** Slightly larger than in equal temperament.
- **Major Third (81:64):** Significantly sharper compared to equal temperament, often perceived as dissonant.
- **Minor Third (32:27):** Narrower than in equal temperament, affecting harmonic color.

Effect on Musical Harmony

The purity of fifths and fourths in Pythagorean tuning creates a tonal landscape that emphasizes harmonic clarity in these intervals. However, the discrepancies in thirds and sixths can make chords

sound less smooth or "out of tune" compared to modern equal temperament. This tuning system is particularly suited for monophonic or modal music, where emphasis on perfect consonances is more important than harmonic blending of thirds.

Advantages and Limitations

Pythagorean tuning offers several advantages but also presents notable limitations. Understanding these helps explain why it was historically significant yet largely supplanted by other tuning systems in contemporary music.

Advantages

- **Pure Perfect Fifths and Fourths:** Provides highly consonant and stable intervals foundational to Western music.
- **Clear Mathematical Basis:** Simple frequency ratios make the tuning system easy to understand and reproduce.
- **Historical Significance:** Influenced the development of musical theory and early instruments.

Limitations

- **Discrepancy in Thirds and Sixth Intervals:** Results in less harmonious chords compared to other systems.
- **Pythagorean Comma:** Causes tuning inconsistencies that complicate modulation and key changes.
- **Impractical for Fixed-Pitch Instruments:** Limits usability in keyboard and fretted instruments requiring consistent tuning across keys.

Comparison with Other Tuning Systems

Pythagorean tuning is one of several tuning systems developed over centuries, each with unique characteristics and applications. Comparing it to other systems highlights its strengths and weaknesses.

Equal Temperament

Equal temperament divides the octave into twelve equal parts, smoothing out discrepancies like the Pythagorean comma. This makes it ideal for modern instruments, allowing for easy modulation between keys and consistent harmonic quality. However, it sacrifices the pure intervals found in Pythagorean tuning, resulting in slightly "tempered" or less consonant fifths and fourths.

Just Intonation

Just intonation also uses simple ratios but focuses on tuning major and minor thirds and sixths more purely than Pythagorean tuning. This results in more harmonious chords but can introduce tuning issues when modulating to distant keys. Unlike Pythagorean tuning, just intonation prioritizes triadic harmony.

Applications in Music and Modern Usage

While Pythagorean tuning is not widely used in contemporary Western music due to its limitations, it remains relevant in certain contexts and historical studies.

Historical and Early Music Performance

Performers and scholars of medieval and Renaissance music often employ Pythagorean tuning to recreate the authentic sound of the period. This helps in understanding the tonal aesthetics and compositional techniques of early music traditions.

Ethnomusicology and Non-Western Traditions

Some non-Western musical systems share similarities with Pythagorean tuning, particularly in cultures emphasizing pure fifths and fourths. Studying Pythagorean tuning provides insight into the universal principles of musical consonance and tuning across cultures.

Contemporary Experimental Music

Certain modern composers and musicians explore Pythagorean tuning for its unique tonal color and historical significance. It offers an alternative sonic palette that contrasts with the uniformity of equal temperament.

Summary of Practical Considerations

1. Best suited for music prioritizing perfect fifths and fourths.

2. Challenges in modulation limit its use in complex harmonic contexts.

3. Primarily of academic, historical, or experimental interest in modern times.

Frequently Asked Questions

What is Pythagorean tuning?

Pythagorean tuning is a system of musical tuning based on the pure perfect fifth interval (3:2 ratio), derived from the ancient Greek mathematician Pythagoras' discoveries.

How is Pythagorean tuning constructed?

Pythagorean tuning is constructed by tuning notes using a series of perfect fifths (frequency ratio 3:2), stacking these intervals to build a scale.

What intervals are emphasized in Pythagorean tuning?

Pythagorean tuning emphasizes pure perfect fifths (3:2) and perfect fourths (4:3), with other intervals derived from these ratios.

How does Pythagorean tuning differ from equal temperament?

Unlike equal temperament, which divides the octave into 12 equal semitones, Pythagorean tuning uses pure perfect fifths, resulting in some intervals being slightly out of tune compared to equal temperament.

What are the advantages of Pythagorean tuning?

Advantages include very pure and consonant perfect fifths and fourths, which are beneficial for melodic and harmonic clarity in certain musical contexts.

What are the disadvantages of Pythagorean tuning?

Disadvantages include dissonant major thirds and other intervals that sound sharp or flat compared to modern tuning systems, limiting its use in harmony.

In which musical contexts is Pythagorean tuning commonly used?

Pythagorean tuning is commonly used in medieval and Renaissance music, as well as in historical performance practice and research.

What is the Pythagorean comma?

The Pythagorean comma is a small pitch discrepancy (about 23.46 cents) that arises because twelve perfect fifths do not exactly equal seven octaves, causing tuning challenges.

Can Pythagorean tuning be used for modern music?

While possible, Pythagorean tuning is rarely used for modern music due to its tuning discrepancies in thirds and sixths, which sound out of tune compared to equal temperament.

How does Pythagorean tuning affect chord quality?

In Pythagorean tuning, perfect fifths sound pure, but major thirds are sharper than in equal temperament, resulting in a distinct, sometimes harsher chord quality.

Additional Resources

1. *The Mathematics of Pythagorean Tuning*
This book delves into the mathematical foundations of Pythagorean tuning, explaining the ratios and intervals that define this ancient system. It covers the historical development of tuning theories and provides detailed analyses of how Pythagorean tuning affects musical harmony. Ideal for readers interested in the intersection of math and music theory.

2. *Sound and Symbol: The Pythagorean Tradition in Music*
Exploring the philosophical and symbolic aspects of Pythagorean tuning, this book connects the tuning system to broader themes in ancient philosophy and mysticism. It discusses how Pythagorean ideas influenced the development of Western music and the cultural significance of numerical relationships in sound.

3. *Pythagorean Tuning and Its Musical Applications*
Focused on practical applications, this work guides musicians and composers in applying Pythagorean tuning in performance and composition. It includes examples of scales, intervals, and tuning adjustments, along with comparisons to other tuning systems such as equal temperament.

4. *The History and Theory of Pythagorean Tuning*
A comprehensive historical overview, this book traces the origins of Pythagorean tuning from ancient Greece through the medieval period. It also explains the theoretical principles behind the tuning system and its impact on the evolution of Western music theory.

5. *Acoustic Foundations of Pythagorean Tuning*
This title examines the physical and acoustical basis of Pythagorean tuning, exploring how sound waves and harmonic series relate to the tuning ratios. It is suitable for readers with a background in physics or acoustics who want to understand the scientific principles behind the tuning system.

6. *Exploring Ancient Scales: The Pythagorean System*
A study of ancient musical scales, focusing on the Pythagorean system and its distinctive intervals. The book includes musical notation examples and discusses how Pythagorean tuning shapes melody and harmony in early music traditions.

7. *Pythagorean Tuning in Modern Music Practice*
This book investigates the relevance and use of Pythagorean tuning in contemporary music genres. It explores how modern musicians adapt the tuning system for new sounds and includes interviews with composers who incorporate historical tunings into their work.

8. *The Pythagorean Comma and Temperament Systems*
Focusing on the mathematical discrepancy known as the Pythagorean comma, this book explains its effects on tuning and temperament. It also discusses various methods developed to temper or adjust the Pythagorean system to fit different musical contexts.

9. *Harmony and Proportion: Pythagorean Tuning Explained*
An accessible introduction to the principles of Pythagorean tuning, this book breaks down complex concepts into clear explanations. It covers the relationship between harmony, proportion, and number theory, making it suitable for students and enthusiasts new to the topic.

Pythagorean Tuning

pythagorean tuning: FLOWER OF PYTHAGOREAN TUNING LIU LIAN-SHENG, 2017-04-18 Heptachord, commonly referred to as do-re-mi-fa-sol-la-ti, belongs to Pythagoras temperament system. After 2000 years' music practice, it has been deeply rooted. The 12 major modes are the best expression of music language. There are 792 kinds of Pythagorean Tuning in different structures. From the perspective of the standard format of Heptachord and through a large number of mathematical statistics and calculation, the author analyzes the characteristics of the 792 kinds of Pythagoras Tuning system in detail. Basing on the study of the Pythagorean Tuning system, the author hopes to trace back and have a macroscopic view on the Pythagorean Tuning system.

pythagorean tuning: Handbook of Signal Processing in Acoustics David Havelock, 2008

pythagorean tuning: Modern Computer Algebra Joachim von zur Gathen, Jürgen Gerhard, 2003-07-03 Computer algebra systems are gaining importance in all areas of science and engineering. This textbook gives a thorough introduction to the algorithmic basis of the mathematical engine in computer algebra systems. It is designed to accompany one- or two-semester courses for advanced undergraduate or graduate students in computer science or mathematics. Its comprehensiveness and authority also make it an essential reference for professionals in the area. Special features include: detailed study of algorithms including time analysis; implementation reports on several topics; complete proofs of the mathematical underpinnings; a wide variety of applications (among others, in chemistry, coding theory, cryptography, computational logic, and the design of calendars and musical scales). Some of this material has never appeared before in book form. For the new edition, errors have been corrected, the text has been smoothed and updated, and new sections on greatest common divisors and symbolic integration have been added.

pythagorean tuning: The Structure of Recognizable Diatonic Tunings Easley Blackwood, 2014-07-14 In a comprehensive work with important implications for tuning theory and musicology, Easley Blackwood, a distinguished-composer, establishes a mathematical basis for the family of diatonic tunings generated by combinations of perfect fifths and octaves. Originally published in 1986. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton

University Press since its founding in 1905.

pythagorean tuning: *A Smoother Pebble* Donald C. Benson, 2003-10-30 This book takes a novel look at the topics of school mathematics--arithmetic, geometry, algebra, and calculus. In this stroll on the mathematical seashore we hope to find, quoting Newton, ...a smoother pebble or a prettier shell than ordinary... This book assembles a collection of mathematical pebbles that are important as well as beautiful.

pythagorean tuning: *CelloMind* Hans Jørgen Jensen, Minna Rose Chung, 2017-11-03 CelloMind is a two-part pedagogical method book that focuses on intonation and left-hand cello technique. The coauthors of the book are Hans Jørgen Jensen, Professor of cello at the Bienen School of Music at Northwestern University and Minna Rose Chung, Associate Professor of Cello at the Desautels Faculty of Music at the University of Manitoba. Part I: Intonation. The mystery of intonation is revealed by defining and explaining the scientific principles that govern it. To know and understand how to combine the three primary intonation systems has never before been expounded in a methodology publication--and for good reason. Playing with exquisite intonation has mostly been reserved for those who possess a strong intuitive sense; however, CelloMind breaks down this taboo using a systematic approach with a highly attuned manner. The three systems of intonation that string players most commonly use today--equal temperament, just intonation, and Pythagorean tuning--are each explored and explained in great detail. All chapters in the book include many practical samples and listening exercises that bridge the gap between the theory and its application. The chapters on intonation conclude with practical examples from the following repertoire: Intonation Performance Practice in the Bach Solo Cello Suites and Intonation Performance Practice with Piano. Part II: Left-Hand Technique. The left-hand technique chapters in this section complement the study of intonation by providing a solid foundation of skills for essential cello playing. The topics and exercises have been selected to cover a wide range of technical skills that include playing with a light left-hand touch, speed, coordination, balanced vibrato, agility, finger independence, and efficient shifting. Original exercises developed for students over many years have also been incorporated into these chapters, as well as studies from Julius Klengel, Bernhard Cossmann, Louis R. Feuillard, Jean-Louis Duport, Yakov Rosenthal, and Fritz Albert Christian Rudinger.

pythagorean tuning: A Performer's Guide to Renaissance Music, Second Edition Jeffery Kite-Powell, 2007-08-02 Vocal/choral issues. The solo voice in the Renaissance / Ellen Hargis ; On singing and the vocal ensemble I / Alexander Blachly ; On singing and the vocal ensemble II / Alejandro Planchart ; Practical matters of vocal performance / Anthony Rooley -- Wind, string, and percussion instruments. Recorder ; Renaissance flute / Herbert Myers ; Capped double reeds : crumhorn--Kortholt--Schreierpfeif / Jeffery Kite-Powell ; Shawm and curtal / Ross Duffin ; Racket : rackett, Rankett (Ger.), cervelas (Fr.), cervello (It.) / Jeffery Kite-Powell ; Bagpipe / Adam Knight Gilbert ; Cornett / Douglas Kirk ; Sackbut / Stewart Carter -- Bowed instruments / Wendy Gillespie -- The violin / David Douglass -- Plucked instruments / Paul O'Dette -- The harp / Herbert Myers -- Early percussion / Benjamin Harms -- Keyboard instruments / Jack Ashworth -- Practical considerations/instrumentation. Proto-continuo / Jack Ashworth and Paul O'Dette ; Mixed ensembles / James Tyler ; Large ensembles / Jeffery Kite-Powell ; Rehearsal tips for directors / Adam Knight Gilbert ; Performance editions / Frederick Gable -- Performance practice. Tuning and temperament / Ross Duffin ; Pitch and transposition / Herbert Myers ; Ornamentation in sixteenth-century music / Bruce Dickey ; Pronunciation guides / Ross Duffin -- Aspects of theory. Eight brief rules for composing a si placet altus, ca. 1470-1510 / Adam Knight Gilbert ; Renaissance theory / Sarah Mead -- Introduction to Renaissance dance. Early Renaissance dance, 1450-1520 / Yvonne Kendall -- For the early music director. Starting from scratch / Jeffery Kite-Powell.

pythagorean tuning: *Polytempic Polymicrotonal Music* Peter Alexander Thoegersen, 2022-09-08 This book introduces polytempic polymicrotonality as a new musical aesthetic. It proposes music with more than one microtonal tuning system and discusses examples from the literature to give an historic framework showing that this tendency has been present throughout

human musical history. Polytempo is a tool for which polymicrotonal structures can function in relief from its background, and it acts as a frame, or ground structure, that is multidimensional, akin to the advancement of perspective in Renaissance art. The book has historic significance as it is the only book of its category, or genre, in music that features polymicrotonality in music composition or production. It displays examples of music literature for musical precedence in this area, focusing on Charles Ives's Universe Symphony, unfinished since 1925.

pythagorean tuning: Musical Temperaments Erich Neuwirth, 2012-12-06 Preface What you are now reading is the written version of an electronic document that explains the mathematical principles for different musical temperaments. The electronic version contains many music examples that you can listen to while you are working with this document at a computer. The written version obviously cannot offer this possibility. It serves therefore merely as a parallel study aid and guide and cannot replace actually working with the electronic text. Musical Temperaments Contents • V II Contents Introduction and Fundamental Properties 1 Pitch and Frequency 1 Preliminary Remarks 1 Frequencies and Intervals 2 Tuning Systems and Frequencies 5 Musical Scales in Different Tunings 5 Pure Tuning 5 Intervals and Triads in Pure Tuning 12 Pythagorean Tuning 23 Intervals and Triads in Pythagorean Tuning 31 Meantone Tuning 34 Intervals and Triads in Meantone Tuning 39 Equal Temperament (Tuning) 42 Intervals and Triads in Equal Temperament (Tuning) 47 Summary 50 Appendices 53 Pictorial explanations 53 Tables of Frequencies and Intervals 54 Operating Instructions 62 Glossary 67 Musical Temperaments Introduction and Fundamental Properties • 1 Introduction and Fundamental Properties Pitch and Frequency Preliminary Remarks It is well known that tones consist of periodically recurring phenomena, that is, beats repeating in a regular pattern. The number of repetitions of beats per second is measured in Hertz: 440 Hertz mean 440 beats per second. This number is also called the frequency of a beat.

pythagorean tuning: Counterpoint, Composition and Musica Ficta Margaret Bent, 2013-10-28 Musica ficta is the practice of sharpening or flattening certain notes to avoid awkward intervals in medieval and Renaissance music. This collection gathers Margaret Bent's influential writings on this controversial subject from the past 30 years, along with an extensive author's introduction discussing the current state of scholarship and responding to critics. Also includes 25 musical examples.

pythagorean tuning: *Keyboard Music Before 1700* Alexander Silbiger, 2004 Keyboard Music Before 1700 begins with an overview of the development of keyboard music in Europe. Then, individual chapters by noted authorities in the field cover the key composers and repertory before 1700 in England, France, Germany and the Netherlands, Italy, and Spain and Portugal. The book concludes with a chapter on performance practice, which addresses current issues in the interpretation and revival of this music.

pythagorean tuning: Signals, Sound, and Sensation William M. Hartmann, 2004-09-14 Designed to follow an introductory text on psychoacoustics, this book takes readers through the mathematics of signal processing from its beginnings in the Fourier transform to advanced topics in modulation, dispersion relations, minimum phase systems, sampled data, and nonlinear distortion. While organised like an introductory engineering text on signals, the examples and exercises come from research on the perception of sound. A unique feature of this book is its consistent application of the Fourier transform, which unifies topics as diverse as cochlear filtering and digital recording. More than 250 exercises are included, many of them devoted to practical research in perception, while others explore surprising auditory illusions generated by special signals. Periodic signals, aperiodic signals, and noise -- along with their linear and nonlinear transformations -- are covered in detail. More advanced mathematical topics are treated in the appendices. A working knowledge of elementary calculus is the only prerequisite. Indispensable for researchers and advanced students in the psychology of auditory perception.

pythagorean tuning: The SAGE International Encyclopedia of Music and Culture Janet Sturman, 2019-02-26 The SAGE Encyclopedia of Music and Culture presents key concepts in the study of music in its cultural context and provides an introduction to the discipline of

ethnomusicology, its methods, concerns, and its contributions to knowledge and understanding of the world′s musical cultures, styles, and practices. The diverse voices of contributors to this encyclopedia confirm ethnomusicology′s fundamental ethos of inclusion and respect for diversity. Combined, the multiplicity of topics and approaches are presented in an easy-to-search A-Z format and offer a fresh perspective on the field and the subject of music in culture. Key features include: Approximately 730 signed articles, authored by prominent scholars, are arranged A-to-Z and published in a choice of print or electronic editions Pedagogical elements include Further Readings and Cross References to conclude each article and a Reader's Guide in the front matter organizing entries by broad topical or thematic areas Back matter includes an annotated Resource Guide to further research (journals, books, and associations), an appendix listing notable archives, libraries, and museums, and a detailed Index The Index, Reader's Guide themes, and Cross References combine for thorough search-and-browse capabilities in the electronic edition

pythagorean tuning: A Performer's Guide to Medieval Music Ross W. Duffin, 2000 A Performer's Guide to Medieval Music is an essential compilation of essays on all aspects of medieval music performance, with 40 essays by experts on everything from repertoire, voices, and instruments to basic theory. This concise, readable guide has proven indispensable to performers and scholars of medieval music.

pythagorean tuning: The Harpsichord Owner's Guide Edward L. Kottick, 2013-01-01 Kottick presents technical information in an accessible, but entertaining, way: the forms and styles of harpsichords, advice on purchasing decisions, maintenance techniques (such as voicing, regulating, and changing strings, tongues, plectra, springs, and dampers), aids in troubleshooting common problems, and detailed instructions on tuning and temperament. As builder of some thirty keyboard instruments, Kottick is well qualified to speak on the subject.

pythagorean tuning: *The Oxford Handbook of Singing* Graham F. Welch, David M. Howard, John Nix, 2019-04-04 Singing has been a characteristic behaviour of humanity across several millennia. Chorus America (2009) estimated that 42.6 million adults and children regularly sing in one of 270,000 choruses in the US, representing more than 1:5 households. Similarly, recent European-based data suggest that more than 37 million adults take part in group singing. The Oxford Handbook of Singing is a landmark text on this topic. It is a comprehensive resource for anyone who wishes to know more about the pluralistic nature of singing. In part, the narrative adopts a lifespan approach, pre-cradle to senescence, to illustrate that singing is a commonplace behaviour which is an essential characteristic of our humanity. In the overall design of the Handbook, the chapter contents have been clustered into eight main sections, embracing fifty-three chapters by seventy-two authors, drawn from across the world, with each chapter illustrating and illuminating a particular aspect of singing. Offering a multi-disciplinary perspective embracing the arts and humanities, physical, social and clinical sciences, the book will be valuable for a broad audience within those fields.

pythagorean tuning: *Explorations in Music, the Arts, and Ideas* Leonard B. Meyer, Eugene Narmour, Ruth A. Solie,

pythagorean tuning: *Why You Like It* Nolan Gasser, 2019-04-30 From the chief architect of the Pandora Radio's Music Genome Project comes a definitive and groundbreaking examination of why we respond to music the way we do. Everyone loves music. But what is it that makes music so universally beloved and have such a powerful effect on us? In this sweeping and authoritative book, Dr. Nolan Gasser—a composer, pianist, and musicologist, and the chief architect of the Music Genome Project, which powers Pandora Radio—breaks down what musical taste is, where it comes from, and what our favorite songs say about us. Dr. Gasser delves into the science, psychology, and sociology that explains why humans love music so much; how our brains process music; and why you may love Queen but your best friend loves Kiss. He sheds light on why babies can clap along to rhythmic patterns and reveals the reason behind why different cultures around the globe identify the same kinds of music as happy, sad, or scary. Using easy-to-follow notated musical scores, Dr. Gasser teaches music fans how to become engaged listeners and provides them with the tools to enhance

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pythagorean tuning: Understanding Contemporary Music Editorial Team of the Iscm Contemporary Music Education Campaign, 2006 This teaching kit consists of fifteen modules, each dealing with a specific topic, such as How to listen to contemporary music, Minimalism and simplicity, Jazz, Keys, scales, modes and tunings, Experimental and avant-garde, East-West interaction, and Environmental music and sound installation. The teaching kit comes with two audio CDs.

pythagorean tuning: Listen Again David Wulstan, 2015-10-29 How do you tell the key of a piece—without looking at a score? How do you know when a musical work ended before an audience applauds or a radio announcer returns on air? Was there, in fact, a 'breakdown of tonality' in the nineteenth and twentieth centuries? These questions and others are the focus of David Wulstan's Listen Again: A New History of Music. He also shows where the nuove musiche of the early Baroque era came from and what the two critical but unlinked chords in the middle of Bach's Brandenburg Concerto No. III signify. Previous literature in music does not properly address these questions and innumerable others. In Listen Again, Wulstan illustrates how music from Bach to Bartók was far less revolutionary than customarily imagined and that the inversionist doctrine of Rameau and kindred acoustical misconceptions, courtesy of Heinrich Schenker and other analysts, solve fewer problems than their purveyor claim. In Listen Again, Wulstan takes to task early theorists, who were mostly clerics who ignored non-ecclesiastical music, and their modern equivalents, who consider only the blinding white of the written or printed score, whilst ignoring music as heard and interpreted by the ear and brain. Instead, Wulstan enquires into the musical activities of the common folk to addressing key issues that early and modern theorists have regularly overlooked. The book will appeal anyone who has dismissed harmony, theory and the like as alien, in effect, to practical music. Readers will find in Listen Again that the true history of music has far more practical relevance for performers than the aridity of music theory coursework, demonstrating by example how this work a book about music, not, as in the case of so much theoretical work, a book about books.

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