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CHORD LANGUAGE

(First name:Equal Temperament Logic and Equal Temperament Painting)

和弦语言

（首发名：平均律逻辑与平均律绘画）

(English and Chinese version)

（中，英文对照版）

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* Some chapters of this book are papers from the 24th and 25th World Congress of Philosophy.

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Overview Of Chord Language；和弦语言综述

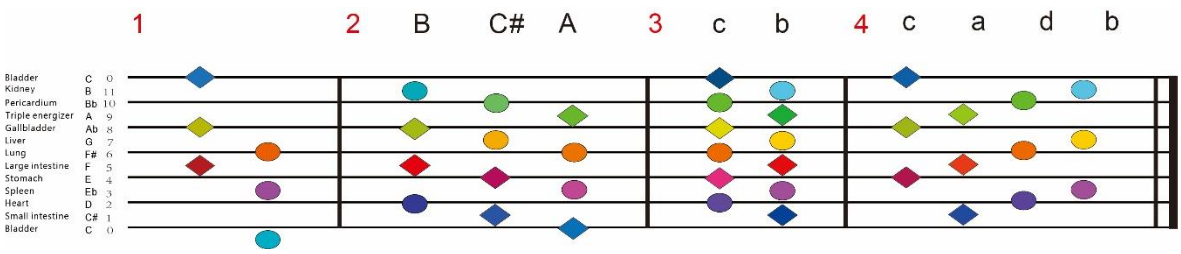
25 届世界哲学大会论文； Papers of the XXV World Congress of Philosophy

引言：和弦编码时空，生命，精神，宇宙基于和弦。

Introduction: Chord coding of space-time, life, spirit, and the universe is based on chords.

和弦语言以量子化频谱为编码结构，涵盖和弦几何（开、闭、膜弦）与和弦数学（代数结构、 群作用）。每个和弦都有唯一的特征频谱，映射至特定的和弦语义集合，生成：时间（音乐），空间（绘画），生命（经络），分布为和弦场。

Chord language uses a quantized spectrum as its encoding structure, encompassing chord geometry (open, closed, and membrane strings) and chord mathematics (algebraic structure and group action). Each chord has a unique characteristic spectrum, which is mapped to a specific set of chord semantics, generating: time (music), space (painting), life (meridians), and distributed as a chord field.



基本和弦表：1-1、大三和弦（闭弦），1-2、小三和弦（开弦）、2、减七和弦（膜弦）、3、全音阶和弦（膜弦），4、增三和弦（膜弦）

- 和弦频谱公式：n*f，H^n*f，（H=1.059463，n∈Z
- 符号：◆=+音符，●=-音符，音符色=色荷
- 频谱坐标：MOD12 群

Basic chord table: 1-1, major triad (closed string), 1-2, minor triad (open string), 2, diminished 7th (membrane string), 3, diatonic chord (membrane string), 4, augmented Triads (membrane strings)

Chord spectrum formula: n*f, H^n*f, (H=1.059463, n∈Z)

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Symbols: ◆=+ note, ●=- note, note color = color charge

Spectral coordinates: MOD12 group

关键词； Keywords:

时空，音乐，绘画，生命，经络，量子化，弦

Space-time, music, painting, life, meridians, quantization, strings

Chord Spacetime；和弦时空

时空是宇宙的“结构”或“框架”，是所有物理过程的基础。人类有两类时空观察者：和弦（调性）观察者与非和弦（无调性）观察者，分别观察到两种时空：

Spacetime is the "structure" or "framework" of the universe and the foundation of all physical processes. Humans have two types of spacetime observers: harmonic (tonal) observers and non-harmonic (atonal) observers, who observe two types of spacetime:

和弦（调性）时空：以量子化频谱为编码结构，映射到时空语义集合，生成和弦时空场，音乐（时间域）、绘画（空间域）是其常见形式。

Chord (tonality) space-time: Using the quantized spectrum as the encoding structure, it is mapped to the space-time semantic set to generate the chord space-time field. Music (time domain) and painting (space domain) are its common forms.

非和弦（无调性）时空：屏蔽了时空的和弦结构，只保留几何（图-底）与运动的纯粹关系性描述，从外部参考系统（如时钟、尺子、参照物）获得定量，常用于经典物理学框架中，也是日常的时空经验。

Non-chordal (atonal) spacetime : It blocks the chordal structure of spacetime, retains only the purely relational description of geometry (figure-ground) and motion, obtains quantification from external reference systems (such as clocks, rulers, reference objects), is often used in the framework of classical physics, and is also the daily experience of spacetime.

和弦频谱：和弦频谱与能量量子本质相通，均以一个基准频率 f 为单位，在整数 n 的调控下生成一组离散的频率/能量结构。

泛音频谱公式：n*f，N∈Z，f=频率

量子化假设：n*f*h（h=6.626×10^−34）N∈Z

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两个公式结构一致，当：n=1-6=大三和弦，n=1-7=大 7 和弦，n=1-9=大 9 和弦，n=1-11=大十一和弦——量子化基于和弦结构。

泛音是一维震荡模式，大于一维的震荡模式涉及到平均律：(1.059463)^n · f_0，两种模式可以切换。

将 n 切换为 (1.059463)^n，引入指数型量子化能级：E_n=h·1.059463^{n}·f_0，通过模 12 群 $\mathbb{Z}_{12}$ 的结构，实现和弦的系统生成。

Overtone spectrum formula: n*f, N∈Z, f=frequency

Quantization assumption: n*f*h (h=6.626×10^−34)N∈Z

The two formulas have the same structure, when: n=1-6=major triad, n=1-7=major 7th chord, n=1-9=major 9th chord, n=1-11=major eleven-chord—quantization is based on the chord structure.

Overtones are one-dimensional oscillation patterns. Oscillation patterns larger than one dimension involve equal temperament: 1.059463)^n·f_0. these two modes can be switched.

Switching n to (1.059463)^n introduces exponential quantized energy levels: E_n=h·1.059463^{n}·f_0. Through the structure of the module 12 group $\mathbb{Z}_{12}$, systematic generation of chords is achieved.

时空二相性：和弦时间与和弦空间镜像对称：{-7,-4,0} ↔ {0,4,7} mod 12（互为反和弦，反调），可数学转换；空间具有定域性，时间具有非定域性，共同表现为时空二相性；波粒二象性只能在和弦（调性）时空中成立。

Space-time duality : Chord time and chord space are mirror-symmetric: {-7,-4,0} ↔ {0,4,7} mod 12 (they are anti-chords and anti-tones), which can be mathematically converted; Space is local and time is non-local, which together manifest as the space-time duality. The wave-particle duality can only hold true in chord (tonal) space-time.

和弦几何：和弦编码（量子化频谱）包含几何语义：开弦，闭弦，膜弦，可生成所有空间状态，也是绘画空间的生成基础。

Chord geometry: Chord encoding (quantized spectrum) contains geometric semantics: open strings, closed strings, membrane strings, which can generate all spatial states and are also the basis for the generation of painting space.

±音符：音符具有±属性，这是频率的物理属性，应涉及所有波动、频率，也可以解释物理学中普遍存在的±属性。

±**Notes:** notes have ± properties, which are physical properties of frequency and should involve

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all waves and frequencies. They can also explain the ubiquitous ± properties in physics.

整体性：和弦系统具有整体性，其中的所有元素（音符，和弦，和弦包）在全局系统的控制下保持相互关联状态，与空间距离、尺度无关。

Holism: The chord system has wholeness, where all elements (notes, chords, chord bundles) remain interrelated under the control of the global system, regardless of spatial distance or scale.

和弦语言是时空语言，音乐（时间域）与绘画（空间域）是常见和弦时空现象，也是方便的观察途径。

Chord language is a space-time language. Music (time domain) and painting (space domain) are common chord space-time phenomena and are also convenient ways of observation.

Chord Space；和弦空间

和弦编码（量子化频谱）分别生成音乐（时间域）与绘画（空间域），两者镜像对称：{-7,-4,0} ↔ {0,4,7} mod 12，可数学转换。

Chord encoding (quantized spectrum) generates music (time domain) and painting (space domain) respectively, which are mirror-symmetric: {-7,-4,0} ↔ {0,4,7} mod 12 and can be mathematically converted.

和弦编码（量子化频谱）包含和弦几何语义 {开弦，闭弦，膜弦} 并构成和弦几何框架，以此定义和弦空间结构。

The chord encoding (quantized spectrum) contains the chord geometry semantics {open string, closed string, membrane string } and constitutes a chord geometry framework to define the chord space structure.

“弦”是“和弦”的几何语义，“和弦”是“弦”的特征频谱。不同和弦映射到不同的几何语义：

"String" is the geometric semantics of "chord", and "chord" is the characteristic spectrum of "strings". Different chords map different geometric semantics:

大三和弦 $(-7,-4,0) \bmod 12$ ↔ 闭弦（轮廓线）

小三和弦 $(-7,-3,0) \bmod 12$ ↔ 开弦（分面线）

等比和弦：减七和弦 (0,3,6,9) mod 12，全音阶和弦 (0,2,4,6,8,10)mod 12，增三和弦 (0,4,8) mod 12 ↔ 膜弦（非线性空间）

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三和弦（开弦，闭弦）定义等比和弦（膜弦）的边界（轮廓线，分面线），生成所有空间状态及相互作用。

Major triad (−7,−4,0)mod 12 ↔ closed string (contour line)

Minor triad (−7,−3,0)mod 12 ↔ open string (Facet line)

Geometric chords: diminished seventh chord (0,3,6,9) mod 12, diatonic chord (0,2,4,6,8,10)mod 12, augmented triad (0,4,8) mod 12 ↔ membrane chord (nonlinear space)

The triads (open strings,closed stirngs) define the boundaries (contours, facets) of the geometric chords (membrane strings), generating all spatial states and interactions.

以上结果来自和弦绘画中的独立观察，在绘画中可重复，并有视觉实验支持。

The above results come from independent observations in chord painting, are repeatable in painting, and are supported by visual experiments.

和弦空间是和弦语言的重要支柱与核心部分，绘画是其主要观察基础与应用领域。

Chord space is an important pillar and core part of chord language, and painting is its main observation basis and application field.

观察、实验案例：Observation and experimental cases:

Li, X. H. (2020). Chord Painting. ResearchGate. https://www.researchgate.net/publication/340492620_Chord_Painting

Li, X. H. (2024). Chord Language. Zenodo. https://zenodo.org/records/11817631

Griffiths, D. J. (2005). Introduction to Quantum Mechanics. Pearson.

Chord Biology；和弦生命

人类有两种时空-生命观察者：和弦（调性）观察者与非和弦（无调性）观察者，分别观察两种时空-生命形式：和弦包（基于量子化频谱，弦）与生物体（基于细胞），生命包含和弦与形态两个层。

Humans have two kinds of space-time-life observers: chord (tonality) observers and non-chord (atonality) observers, who respectively observe two kinds of space-time-life forms: chord packages (based on quantized spectrum, strings) and organisms (based on cells). Life contains two layers: chords and forms.

在人体中，和弦表现为经络（脉轮）系统，观察表明：十二经络系统具有受激频谱响应，其分布可

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近似为：

fn=H^n·f0 其中 H=2^1/12≈1.059463, n∈Z

In the human body, the chords are manifested as the meridian (chakra) system. Observations show that the twelve meridian systems have a stimulated spectrum response, and their distribution can be approximated as follows:

fn=H^n·f0 其中 H=2^1/12≈1.059463, n∈Z

这说明音乐（时间域）、绘画（空间域）与经络（生命域）共享同一组量子化频谱结构，是和弦场（Chord Field）在不同感知维度中的体现。

This shows that music (time domain), painting (space domain) and meridians (life domain) share the same set of quantized spectrum structures, which are the manifestation of the chord field in different perceptual dimensions.

纯小三和弦+导音减七和弦构成生命和弦包——生命的和弦编码形式；在特定状态下，生命和弦包可独立于生物体，不依赖生物体，具有灵魂的性质。

Pure minor triads + leading tone diminished seventh chords constitute the life chord package - the chord coding form of life; under certain conditions, the life chord package can be independent of the organism, not dependent on the organism, and has the nature of a soul.

和弦（经络）是生命的物理（离散频谱）编码结构。

Chords (meridians) are the physical (discrete spectrum) encoded structures of life.

Natural Spirit；自然精神

和弦语言是自然编码（量子化频谱）语言。

The chord language is a natural coding (quantized spectrum) language.

人类存在两套语言系统：符号语言（后天语言）与和弦语言（先天语言）；前者是人工信息系统，基于语音符号，如：自然语言；后者是自然信息系统，基于和弦（量子化频谱），如：音乐、绘画，经络等——精神是符号与和弦二层存有。

Humans possess two language systems: symbolic language (acquired language) and chord language (innate language). The former is an artificial information system based on phonetic symbols, such as natural language; the latter is a natural information system based on [1] chords (quantized

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spectra), such as music, painting, meridians, etc. Spirit is a dual existence of symbols and chords

人的认识来自两个观察者系统：和弦（调性）观察者与非和弦（无调性）观察者，前者是和弦系统的内部观察，依赖观察者的和弦系统，即：和弦系统观察和弦系统，不能区别主观-客观，如：和声学（音乐、绘画），经络（脉轮）等，或许还有量子-波粒二象性；后者屏蔽了和弦系统，主体与客体分离，无关；通常可用观察工具代替人类观察者，如：常规的科学。

Human cognition comes from two observer systems: the chord (tonal) observer and the non-chord (atonal) observer. The former is the internal observation of the chord system and depends on the chord system of the observer, that is, the chord system observes the chord system and cannot distinguish between subjective and objective, such as: harmony (music, painting), meridians (chakras), etc., and perhaps also quantum-wave-particle duality; the latter shields the chord system, and the subject and object are both isolated systems. The object has nothing to do with the subject, and observation tools can usually be used to replace human observers, such as: conventional science.

两种观察者的重要区别还在于：

和弦（调性）观察者所见是一个基于和弦框架的整体：时空，生命，精神共享和弦结构与数学模型。非和弦（无调性）观察者所见是随机，孤立事件，宇宙被割裂为碎片——任何观察都与观察者有关。

Another key difference between the two types of observers is this:

The chordal (tonal) observer sees a whole based on a chordal framework: spacetime, life, and mind share a chordal structure and mathematical model. The non-chordal (atonal) observer sees random, isolated events, a universe fragmented into pieces—any observation is relative to the observer.

和弦语义无法完全进入自然语言，具有不可言说的本体特征。

Chord semantics cannot be fully incorporated into natural language and has an unexpressible ontological characteristic.

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- 和弦语言出版物有：《和弦语言》与《和弦绘画》，前者介绍和弦语言的语法、语义规则及数学模型，侧重和弦空间语言。后者是和弦绘画（和弦空间）的视觉实验案例。
- Chord language publications include "Chord Language" and "Chord Painting." The former introduces the grammar, semantic rules, and mathematical models of chord language, focusing on the language of chord space. The latter provides visual experimental cases of chord painting (chord space).

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Catalogue；目录

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1. Chord Mathematics-1；和弦数学-1

和弦数学是波动与频率的自然法则映射，依赖和弦的物理属性。它涵盖音乐数学，并扩展至和弦绘画（和弦空间）与和弦生命（经络）领域的观察结果。作为一种理论框架，和弦数学应适用于所有涉及波动与频率的现象和事件。

Chord mathematics is a mapping of natural laws of wave motion and frequency, relying on the physical properties of chords. It encompasses the mathematics of music and extends to observations in the fields of chord painting (chord space) and chord life (meridians). As a theoretical framework, chord mathematics should apply to all phenomena and events involving wave motion and frequency.

关键词：和弦，波动，频率，色谱，±音符，镜像对称

Keywords: chord, wave, frequency, color spectrum, ± note, Mirror Symmetry

1-1.Temperament Systems ；律制

和弦由特定离散频谱构成，和弦数学具有离散数学结构，其取值的数学方法称为：律制（Temperament systems），如：五度相生律（Circle-of-fifths system），纯律（Just intonation），十二平均律（Equal Temperament）等。

Chords are composed of specific discrete spectra, and chord mathematics has a discrete mathematical structure. The mathematical method of determining their values is called a Temperament system, such as Circle-of-fifths system, Just intonation, Equal Temperament, etc.

所有律制（Temperament systems）基于两个数列集合：泛音数列 {n*f，n=1,2,3......}（等差数列）与平均律数列 {H^n*f，H=1.059463, n∈Z }（等比数列），{大三和弦}与{等比和弦} 分别是两者的子集。

All temperment systems are based on two sets of number series: the overtone series {n*f, n=1,2,3...} (arithmetic series) and the well-tempered series {H^n*f, H=1.059463, n∈Z } (geometric series), {major triads} and {geometric chords} are subsets of the two respectively.

倍频数列{2^n*f n=序数} 是 {泛音} 与 { 平均律 } 的交集，这是和弦语言保持统一的基础。

The octave series {2^n*f n= ordinal} is the intersection of {overtone} and { equal temperament }, which is the basis for chord language to remain unified.

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Overtone Sequence；泛音数列

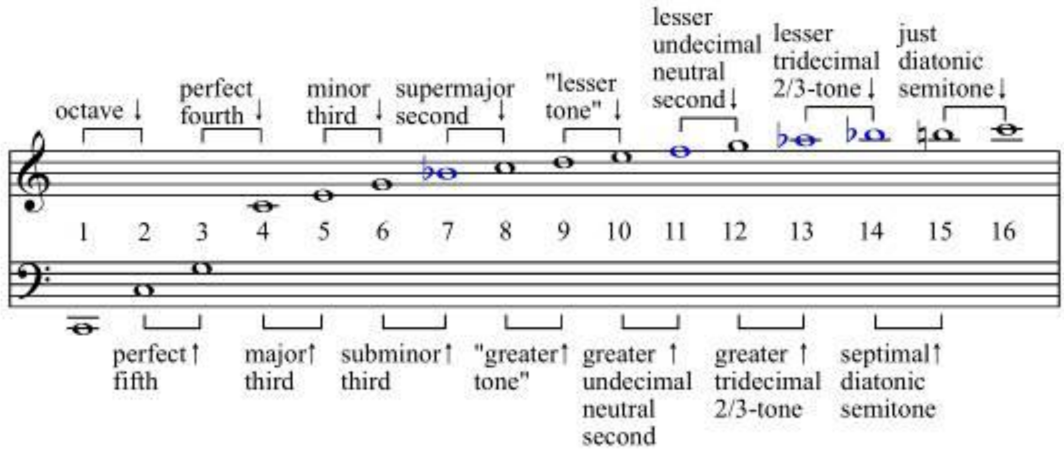

图 1-1.1、泛音频谱

Figure 1-1.1 Overtone spectrum

泛音频谱公式：n*f，N∈Z，f=频率

量子化假设：n*f*h（h=6.626×10^−34）N∈Z

两个公式结构一致，当：n=1-6=大三和弦，n=1-7=大 7 和弦，n=1-9=大 9 和弦，n=1-11=大十一和弦——量子来自和弦。

泛音是一维震荡模式，大于一维的震荡模式涉及到平均律：(1.059463)^n · f_0，两种模式可以切换。

将 n 切换为 (1.059463)^n，引入指数型量子化能级：E_n=h·1.059463^{n}·f_0，通过模 12 群 $\mathbb{Z}_{12}$ 的结构，实现和弦的系统生成。

Overtone spectrum formula: n*f, N∈Z, f=frequency

Quantization assumption: n*f*h (h=6.626×10^−34)N∈Z

The two formulas have the same structure when: n=1-6 = major triad, n=1-7 = major 7th chord, n=1-9 = major 9th chord, n=1-11 = major 11th chord—quantum comes from chords.

Overtones are one-dimensional oscillation patterns. Oscillation patterns larger than one dimension involve equal temperament: 1.059463)^n·f_0. these two modes can be switched.

Switching n to (1.059463)^n introduces exponential quantized energy levels: E_n=h·1.059463^{n}·f_0. Through the structure of the module 12 group $\mathbb{Z}_{12}$, systematic generation of chords is achieved.

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Equal Temperament Sequence；平均律数列

公式：H^n-1*f（H= half-step= 12√2=1.059463，n=序数，f=频率）

首项指数 1-1=0，默认首项指数=0，可用：H^n*f

将平均律数列的指数放入集合：{-11，-10，-9，-8，-7，-6，-5，-4，-3，-2，-1， 0，1，2，3，4，5，6，7，8，9，10，11 } mod 12，可以显示其数学结构并进行群运算。

Formula: H^n-1*f (H = half-step = 12√2 = 1.059463, n = ordinal number, f = frequency)

The leading exponent 1-1 = 0. The default leading exponent is 0. You can use: H^n*f

Put the exponents of the equal-tempered series into the set: {-11, -10, -9, -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11} mod 12 to display its mathematical structure and perform group operations.

十二平均律的音高分布是严格的等比数列： fn=f0·2^n/12。

其中，三种等比和弦（减七和弦、全音阶和弦、增三和弦）构成其核心生成基础：

减七和弦（小三度等距，公比=H^3≈1.189207）

全音阶和弦（大二度等距，公比= H^2≈1.122462）

增三和弦（大三度等距，公比= H^4≈1.259921）

The pitch distribution in the 12-tone equal temperament is a strict geometric sequence: fn=f0·2n/12fn=f0·2n/12, which possesses complete mathematical symmetry.

Among these, three types of Geometric chords (the diminished seventh chord, the whole-tone scale chord, and the augmented triad) form the core generative foundation:

The diminished seventh chord (equally spaced minor thirds, common ratio =H3≈1.189207=H3≈1.189207)

The whole-tone scale chord (equally spaced major seconds, common ratio =H2≈1.122462=H2≈1.122462)

The augmented triad (equally spaced major thirds, common ratio =H4≈1.259921=H4≈1.259921)

等比和弦（geometric chords）的几何语义是大于一维的非线空间，是和弦空间的生成基础之一；十二平均律虽来自数学，却契合几何法则。

The geometric semantics of geometric chords is a non-linear space greater than one dimension, which is one of the generation bases of chord space; although the twelve-tone equal temperament

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comes from mathematics, it conforms to the laws of geometry.

1-2. Symmetrical and Asymmetrical Chords；对称与非对称和弦

和弦分为对称和弦与非对称和弦，对称和弦基于平均律，如：减七和弦，全音阶和弦，增三和弦；非对称和弦基于泛音频谱，如：大三和弦，整体表现为：对称-破缺。

Chords are divided into symmetrical chords and asymmetric chords, and symmetrical chords are based on the equal temperament, such as: diminished seventh chord, diatonic chord, increased triad; Asymmetrical chords are based on the overtone spectrum, such as the major triad, and the overall performance is: symmetry-broken.

Geometric Chords；等比和弦

等比数列（Geometric sequence）和弦是对称和弦，基于平均律的数学框架（mod12 群），共有三种：

Geometric chords are symmetrical chords based on the mathematical framework of equal temperament (mod12 group). There are three types:

减七和弦、公比=H^3≈1.189207；小三度数列，{0,3,6,9}；七声音阶（Heptachord）特征和弦。

Diminished 7th, common ratio =H^3≈1.189207; Minor third series, {0,3,6,9}; Heptachord characteristic chords.

全音阶和弦、公比= H^2≈1.122462；全音阶数列，{0,2,4,6,8,10}，爵士音阶特征和弦。

Diatonic chord, common ratio = H^2≈1.122462; Diatonic series, {0,2,4,6,8,10}, characteristic chords of the jazz scale.

增三和弦（augmented triad）、公比= H^4≈1.259921，大三度（Major third）数列，{0，4，8}，爵士五声音阶特征和弦。

augmented triad, common ratio = H^4≈1.259921, Major third series, {0,4,8}, characteristic chord of the jazz pentatonic scale.

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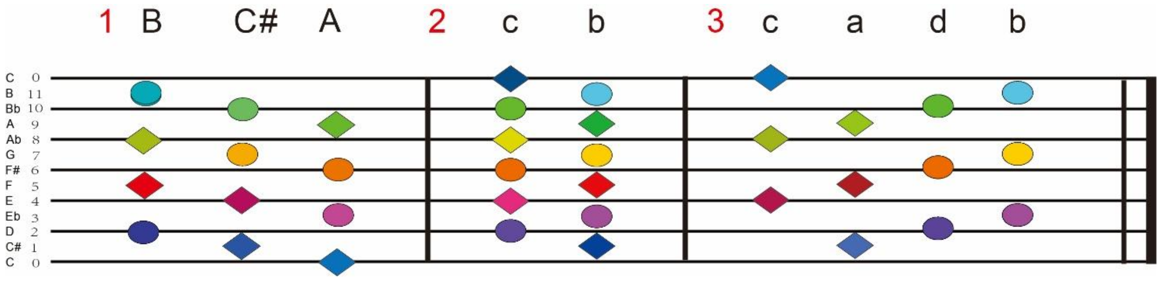

等比和弦表：1、减七和弦（膜弦）、2、全音阶和弦（膜弦），3、增三和弦（膜弦）

*◆=正音符，●=负音符，色彩=色荷

Geometric chords table: 1, diminished 7th chord (membrane chord), 2, diatonic chord (membrane chord), 3, augmented Triads (membrane chord)

* ◆=positive note, ●=negative note, color=color charge

三种等比和弦（Geometric chords）是三种音阶：七声音阶，爵士音阶，爵士五声音阶的构成基础。

The three Geometric chords are the basis of three scales: the heptatonic scale, the jazz scale, and the jazz pentatonic scale.

Triad；三和弦

三和弦是非对称和弦，包含纯五度，大三度或小三度。纯五度是是其特征音程（不存在于等比和弦中）。

Triads are asymmetrical chords that contain a perfect fifth, a major third, or a minor third. The perfect fifth is their characteristic interval (not present in geometric progression chords).

大三和弦是泛音频谱的 f1-f6，两者存在自然联系。

The major triad is f1-f6 of the overtone spectrum, and there is a natural connection between the two.

大三和弦（Major triad），{0,4,7}。

Major triad , {0,4,7}.

小三和弦（Minor triad），{0,3,7}

Minor triad , {0,3,7}

三和弦+等比和弦组成音阶，调，在后面部分有更多介绍。

Triads + Geometric chords make up the scale, key, more on this later section.

三和弦重叠等比和弦，或三和弦重叠三和弦还可产生众多的重叠和弦，它们是基本和弦的衍生形式，放在后面的章节介绍。

Triad overlap Geometric chords or triad overlap Triads can also produce numerous overlapping chords, which are derivative forms of the basic chords and are described in later sections.

Mirror Symmetry；镜像对称

三和弦（Triad）有升序与降序两种组织方式，音乐（时间域）采用升序方式，绘画（空间域）采用降序方式形式，数学形式为镜像对称（互为反和弦-反调）。

Triads can be organized in two ways: ascending and descending. Music (time domain) uses ascending order, and painting (space domain) uses descending order. The mathematical form is mirror symmetry (antichords - anti-tones).

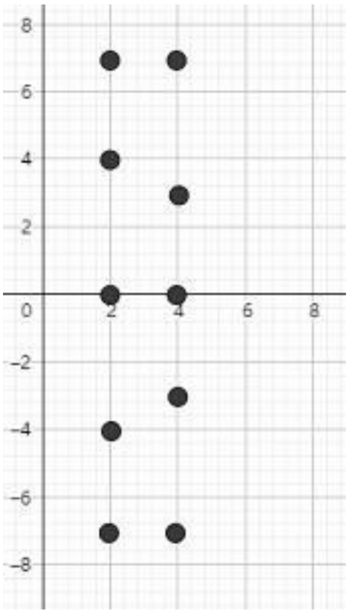

图 1-3、大三和弦-小三和弦的升序，降序，镜像对称形式。Y=平均律数列的指数

Figure 1-3, Major triad - minor triad ascending, descending, mirror-symmetric form. Y= exponents of the equal temperament series.

大三和弦，升序：{0，4，7}，大三和弦，降序：{-7，-4，0}（mod 12）

Major triad, ascending: {0,4,7}, Major triad, descending: {-7，-4，0}（mod 12）

小三和弦，升序：{0，3，7}，大三和弦，降序：{-7，-3，0} （mod 12）

Minor triad, ascending: {0,3,7}, Major triad, descending: {-7，-3，0}（mod 12）

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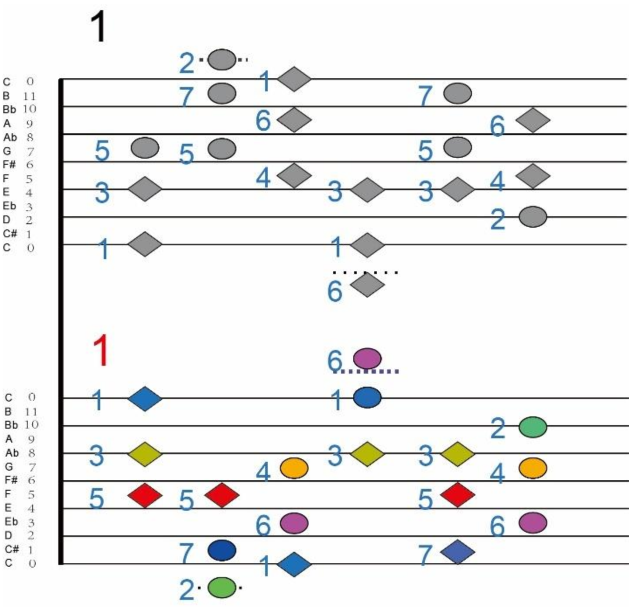

图 1-3.2、大三和弦-小三和弦的升序，降序，镜像对称形式。七声音阶（Heptachord），C 大调，关系小调。

Figure 1-3.2. Ascending, descending, mirror-symmetric forms of Major - minor triads. Heptachord, C major, relation minor.

Formula；公式：

C 大三和弦（升序）=H^0,4,7.C

C major chord, (ascending)= H ^ 0,4,7.C

a 小三和弦（升序）=H^0,3,7.a

a minor triad (ascending)=H^0,3,7.a

C 大三和弦（降序）=H^0,-4,-7.C

C major chord(descending)= H ^ 0, -4, -7.C

Eb 小三和弦（降序）=H^0,-3,-7.Eb

Eb minor triad (descending)=H^0,-3,-7.Eb

镜像对称产生了反和弦，反调，这是和弦数学的重要概念。

Mirror symmetry produces the antichord, the antikey, which is an important concept in chord mathematics.

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1-3. mod12 notation；mod12 记谱法

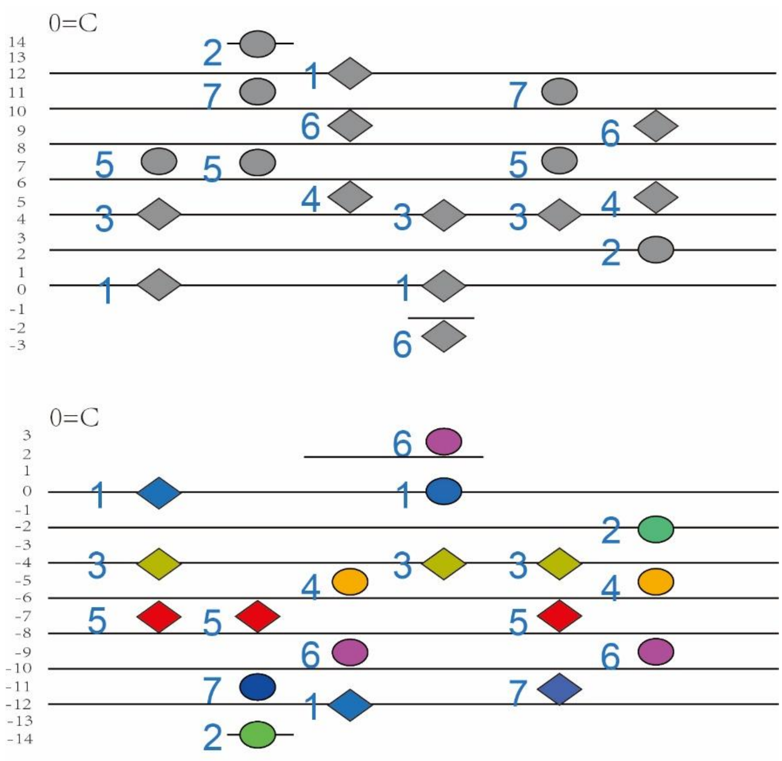

图 1-3、mod12 记谱与 mod12 群，上下表为镜像反转。

Figure 1-3, mod12 notation and mod12 group, the upper and lower tables are mirror inversion.

1. 结构概述

在绘画（空间域）中，和弦结构是音乐（时间域）的镜像反转。然而，传统五线谱难以完整表达这一结构。

Mod 12 记谱法以半音（小二度）为基本单位，构建对称、可计算的音高系统，并支持 mod 12 变换运算，提供更精准的和弦分析和调式变换工具。

1. Structure Overview

In painting (spatial domain), chord structure is the mirror inversion of music (temporal domain). However, traditional musical notation struggles to fully express this structure.

Mod 12 notation uses the semitone (minor second) as the basic unit, constructing a symmetrical, calculable pitch system. It supports mod 12 transformation operations, providing more precise tools for chord analysis and modal transformation.

2. 记谱方式

音高表示

音高以整数表示（mod 12），即：

$(-6,-5,-4,-3,-2,-1,0,1,2,3,4,5,6,7,\cdots) \bmod 12$

0 代表 C（或可定义其他调性起点），作为锚点，上下可自由加线扩展音域。

整数映射到音高：每个音高以 mod 12 进行归约，使音程关系计算更为直观。

谱表设计

均匀分布的音程体系：

相邻的线与空格均为 小二度（半音） 关系，确保音程分布均匀且对称完整。

示例：

线：0, 2, 4, 6, 8, 10, 0, 2, 4, 6, 8, 10

空格：1, 3, 5, 7, 9, 11, 1, 3, 5, 7, 9, 11

数学统一性：适用于和弦分析、调式变换、T/I 群变换等数学运算，使得音乐理论可以直接映射到数学结构中。

2. Notation Method

Pitch Representation

Pitches are represented by integers (mod 12), as follows:

$(-6,-5,-4,-3,-2,-1,0,1,2,3,4,5,6,7,\cdots) \bmod 12$

0 represents C (or another defined tonal starting point), serving as an anchor point. Lines can be freely added above and below to extend the range.

Integer Mapping to Pitches: Each pitch is reduced by mod 12, making the calculation of interval relationships more intuitive.

Staff Design

Evenly Distributed Intervals:

Adjacent lines and spaces are all in a minor second (semitone) relationship, ensuring that the intervals are evenly distributed and symmetrically complete.

Example:

Lines: 0, 2, 4, 6, 8, 10

Spaces: 1, 3, 5, 7, 9, 11

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Mathematical Unity: Suitable for mathematical operations such as chord analysis, modal transformation, and T/I group transformation, allowing music theory to be directly mapped into mathematical structures.

3. 兼容五线谱

保留传统五线谱的节奏、力度、连线、指法等符号，确保音乐家能够快速适应。

兼容现有音乐软件与 MIDI 处理，支持计算机辅助作曲和 AI 生成音乐。

3. Compatibility with Traditional Notation

Retains traditional symbols for rhythm, dynamics, slurs, fingering, etc., ensuring that musicians can adapt quickly.

Compatible with existing music software and MIDI processing, supporting computer-aided composition and AI-generated music.

4. 主要优势

图形化的 mod 12 群表示 → 能完整呈现音乐与绘画的数学结构。

数学对称性强，支持 mod 12 计算 → 适用于调式变换、对称和弦分析、T/I 群运算。

适用于计算机音乐、AI 作曲、音高变换计算 → 推动音乐科技、电子音乐的发展。

4. Main Advantages

Graphical representation of the mod 12 group → can fully represent the mathematical structure of music and painting.

Strong mathematical symmetry, supports mod 12 calculation → suitable for modal transformation, symmetrical chord analysis, and T/I group operations.

Applicable to computer music, AI composition, and pitch transformation calculation → promotes the development of music technology and electronic music.

总结

Mod 12 记谱法通过均匀的半音分布体系，打破传统五线谱的局限，使和弦、调式和音程变换更加数学化、对称化，并且能更好地与计算机音乐和 AI 结合。这种方法不仅能够提供更清晰的音高关系，还能拓展音乐与绘画的数学连接，为现代音乐理论和科技音乐提供新的工具。

Summary

Mod 12 notation, through its evenly distributed semitone system, breaks the limitations of

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traditional notation. It makes chord, mode, and interval transformations more mathematical and symmetrical, and can be better integrated with computer music and AI. This method not only provides clearer pitch relationships but also expands the mathematical connection between music and painting, providing new tools for modern music theory and technology.

1-4. Equal Temperament Chromatography；平均律色谱

平均律色谱（Equal Temperament Chromatography）包含 12 个色荷，是和弦空间语言与和弦绘画的基本定量，量纲。

Equal Temperament Chromatography contains 12 color charges and is the basic quantitative and dimension of chord space language and chord painting.

可见光的波长与频率对照表

Visible light wavelength and frequency comparison table

色彩名称（Color name），波长（Wavelength：nm），频率（frequency：MHz）

紫光（Purple）、400~435；790-680

蓝光（Blue）、450~480；680-620

青光（Cyan-blue）、480~490；600-620

绿光（Green）、500~560；600-530

黄光（Yellow）、580~595；530-510

橙光（Orange）、595~605；510-480

红光、（Red）605~700；480-405

采用：红≈410 作为初始值，用平均律（Equal Temperament）公式：Fn=H^n.F（H=1.05946，n=序数，F=初始频率）计算，得出平均律（Equal Temperament）色谱。

Using red = 410 as the initial value, using the equal temperament formula: Fn = H ^ n.F (H = 1.05946, n = ordinal number, F = initial frequency) to calculate the equal temperament chromatogram:

红（Red）：410

朱红（Rot-orange）≈434.3827

橙（Orange）≈460.1094922

橙-黄（Orange-yellow）≈487.472106

黄（Yellow）≈516.4620658

黄-绿（Yellow-green）≈547.1759951

绿（Green）≈579.7164508

绿兰（Green blue）≈614.1921343

兰（Blue）≈650.7181042

青紫（Indigo）≈691.5352454

紫（Violet）≈732.6607983

紫红（Surplish red）≈776.2320318

将平均律（Equal Temperament）色谱记入下表，并与音符，经络的频率关联。

Record the Equal Temperament chromatogram in the table below and associate it with the frequency of the notes and meridians.

音名 pitch names	色彩 Color	十二经络 Twelve Meridians	±
C	blue	足太阳膀胱经-Foot Taiyang Bladder Meridian	+
B	cyan	足少阴肾经-Foot Shaoyin Kidney Meridian	−
Bb	Green	手厥阴心包经 - Hand Jueyin Pericardium Meridian	−
A	Yellowgreen	手少阳三焦经-Hand Shaoyang Sanjiao (Triple Burner) Meridian	+
Ab	Yellow	足少阳胆经 - Foot Shaoyang Gallbladder Meridian	+
G	yelloworange	手厥阴肝经 - Hand Jueyin Liver Meridian	−
F#	orange	手太阴肺经 - Hand Taiyin Lung Meridian	−
F	Rot-orange	手阳明大肠经 - Hand Yangming Large Intestine Meridian	+
E	Red	足阳明胃经 - Foot Yangming Stomach Meridian	+
Eb	purplishred	足太阴脾经 - Foot Taiyin Spleen Meridian	−
D	purplishred	手少阴心经 - Hand Shaoyin Heart Meridian	−
C#	indigo	手太阳小肠经 - Hand Taiyang Small Intestine Meridian	+

平均律（Equal Temperament）元素对应表

Equal Temperament element correspondence table

1 列：音名（pitch names）。

Line 3: Pitch names.

2 列：色荷

Column 4: Color Charge

3 列：受激-反应经络及阴-阳属性。

3 columns: stimulus-response meridians and yin-yang properties.

1-5.±Notes；±音符

和弦语言基于一系列频率值，定量单位为“音符”，这里需要扩充定义：在本书中，音符=频符（Frequency note），包括声-光等所有频率。

Chord language is based on a series of frequency values, and the unit of quantification is "notes". Here we need to expand the definition: in this book, note = frequency note, including all frequencies such as sound and light.

和弦语言中，所有音符都具有正-负属性，它是频率的物理属性，不是数学中的正-负数。

In the chord language, all notes have a positive-negative attribute, which is a physical attribute of frequency, not a positive-negative number in mathematics.

音符的正-负属性继承自经络的阴-阳属性，由中医经典记载。（参见：和弦数学-2）。

The positive-negative properties of musical notes are inherited from the Yin-Yang properties of meridians, as documented in the classics of Chinese medicine (see: Chord Mathematics-2).

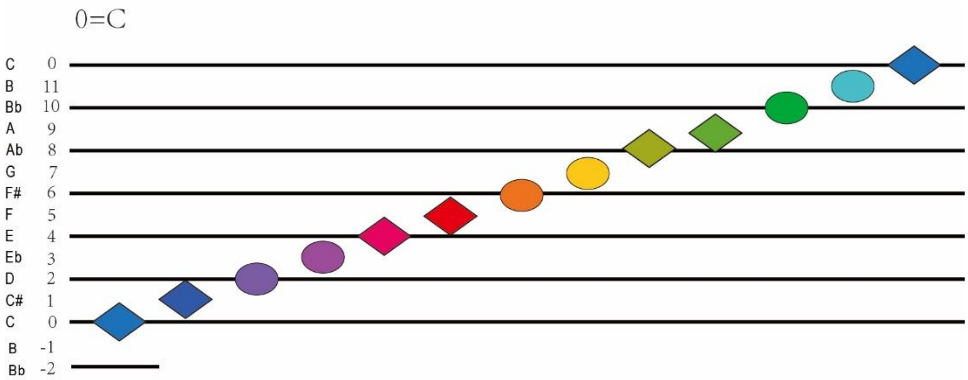

图 1-5、±音符表：椭圆=负音符，菱形=正音符。

Figure 1-5, ± note table: oval = negative note, diamond = positive note.

音符（频率）的正、负是重要的物理属性与和弦编码元素，涉及的内容比较多，放在后面章节（和弦数学-2）专门介绍。

The positive and negative values of notes (frequencies) are important physical properties and chord encoding elements. There is a lot of content involved, so it will be introduced in the following chapter (Chord Mathematics-2).

Reference；参考

Basic music theory; 基础音乐理论

Harmony; 和声学

Chord Painting; 和弦绘画

General Physics Textbooks: 普通物理学教材

Textbook of Meridian Studies; 经络学教材

12-ary cyclic group (mod 12)；12 元循环群（mod 12 群）

Common Formula；常用公式

Chord=H^n1,n2,n3,nx*f0；（H=1.05946，n=序数）

Chord = H ^ n1, n2, n3, nx * f0; (H=1.05946, n= ordinal)

大三和弦（Major Chord）=H^0,4,7.f0

小三和弦（Minor chord）=H^0,3,7.f0

大三和弦（降序）=H^0,-4,-7.f0

major chord(descending)= H ^ 0, -4, -7.f0

小三和弦（降序）=H^0,-3,-7.f0

minor triad (descending)=H^0,-3,-7.f0

减七和弦（Diminished 7th）=H^0,3,6,9.f0（Geometric sequence；等比数列）

增三和弦（Augmented triads）=H^0,4,8.f0（Geometric sequence；等比数列）

全音阶和弦（Diatonic chord）=H^0,2,4,6,8,10,12.f0（Geometric sequence；等比数列）

半音阶（Chromatic chord）= H ^ 0,1,2,3,4,5,6,7,8,9,10,11,12,13.f0（Geometric sequence；等比数列）

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2. Chord Mathematics-2；和弦数学-2

和弦数学是波动与频率的自然法则映射，依赖和弦的物理属性。它涵盖音乐数学，并扩展至和弦绘画（和弦空间）与和弦生命（经络）领域的观察结果。作为一种理论框架，和弦数学应适用于所有涉及波动与频率的现象和事件。

Chord mathematics is a mapping of natural laws of wave motion and frequency, relying on the physical properties of chords. It encompasses the mathematics of music and extends to observations in the fields of chord painting (chord space) and chord life (meridians). As a theoretical framework, chord mathematics should apply to all phenomena and events involving wave motion and frequency.

关键词：和弦，波动，频率，色谱，±音符，镜像对称

Keywords: chord, wave, frequency, color spectrum, ± note, Mirror Symmetry

和弦由三个以上的特定离散频率构成，基本分类为三和弦与等比和弦（Geometric chords），两者的结合产生和弦语句，表达和弦语义。

Chords are composed of three or more specific discrete frequencies, and are basically classified into triads and Geometric chords. The combination of the two produces chord statements and expresses chord semantics.

平均律数列（Equal temperament series）是和弦的常用取值范围，其中的每个音符都具有频率值与正-负值，两者是和弦的基本编码元素，前者构成离散频率值分布，后者构成正、负值分布，所有和弦都包含这两种分布，并由此决定和弦的时空语义以及其它属性。

The Equal temperament series is a commonly used range of values for chords. Each note in the series has a frequency value and a positive-negative value. These two are the basic encoding elements of chords. The former constitutes a discrete frequency value distribution, and the latter constitutes a positive-negative value distribution. All chords contain these two distributions, which determine the spatiotemporal semantics and other properties of the chord.

和弦的频率值分布在前面已经介绍（1、和弦数学-1），本章主要介绍和弦的正-负值分布及编码、语义规则，涉及和弦，调，调群的构成规则。

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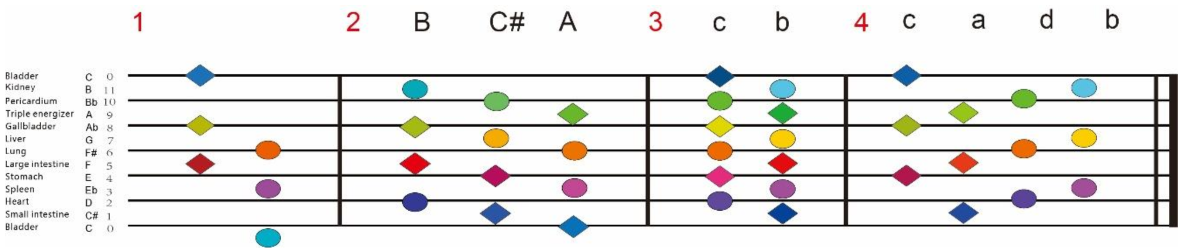
The frequency value distribution of chords has been introduced before (1. Chord Mathematics-1). This chapter mainly introduces the positive-negative value distribution, encoding and semantic rules of chords, involving the composition rules of chords, keys and key groups.



基本和弦表：1-1、大三和弦（闭弦），1-2、小三和弦（开弦）、2、减七和弦（膜弦）、3、全音阶和弦（膜弦），4、增三和弦（膜弦）

*和弦频谱公式：n*f，H^n*f,（H=1.059463，n∈Z）

*符号：◆=+音符，●=-音符，音符色=色荷

*本文使用 mod12 记谱法

Basic chord table: 1-1, major triad (closed string), 1-2, minor triad (open string), 2, diminished 7th (membrane string), 3, diatonic chord (membrane string), 4, augmented Triads (membrane strings)

* Chord spectrum formula: n*f, H^n*f (H=1.059463，n∊Z)

* Symbol: ◆=+ note, ●=- note, note color = color charge

** This article uses mod12 notation

±音符是频率的物理属性，继承自经络学，这里有未知的自然法则，我们只能通过观察它在和弦语言中的作用及数学规律，确定其真实性。（参见：15.和弦生命）

± notes are the physical properties of frequency, inherited from meridians. There are unknown natural laws here. We can only determine its authenticity by observing its role in chord language and mathematical laws. (See: 15. Chord life)

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音名 pitch names	色彩 Color	十二经络 Twelve Meridians	±
C	blue	足太阳膀胱经-Foot Taiyang Bladder Meridian	+
B	cyan	足少阴肾经-Foot Shaoyin Kidney Meridian	−
Bb	Green	手厥阴心包经 - Hand Jueyin Pericardium Meridian	−
A	Yellowgreen	手少阳三焦经-Hand Shaoyang Sanjiao (Triple Burner) Meridian	+
Ab	Yellow	足少阳胆经 - Foot Shaoyang Gallbladder Meridian	+
G	yelloworange	手厥阴肝经 - Hand Jueyin Liver Meridian	−
F#	orange	手太阴肺经 - Hand Taiyin Lung Meridian	−
F	Rot-orange	手阳明大肠经 - Hand Yangming Large Intestine Meridian	+
E	Red	足阳明胃经 - Foot Yangming Stomach Meridian	+
Eb	purplishred	足太阴脾经 - Foot Taiyin Spleen Meridian	−
D	purplishred	手少阴心经 - Hand Shaoyin Heart Meridian	−
C#	indigo	手太阳小肠经 - Hand Taiyang Small Intestine Meridian	+

平均律（Equal Temperament）元素对应表

Equal Temperament element correspondence table

1 列：音名（pitch names）。

Line 1: Pitch names.

2 列：色荷

Column 2: Color Charge

3 列：受激-反应经络及阴-阳（±）属性。

3 columns: stimulus-response meridians and yin-yang(±) properties.

*注：经络具有正、负（阴-阳）属性，并会传递给同一行中的声、光频率，这是频率的物理属性；也是最重要的和弦编码元素，涉及后面的所有章节。

*Note: Meridians have positive and negative (yin-yang) properties and will be transmitted to the sound and light frequencies in the same line. This is the physical property of frequency; it is also the most important chord coding element, involving all subsequent chapters.

上面表中的对应关系基于经络的受激反应特征频率，在本书第 15 章还有专门的介绍。（15.Chord Biology;和弦生命）

The corresponding relationship in the above table is based on the characteristic frequency of the stimulated response of the meridian, which is specifically introduced in Chapter 15 of this book. (15.Chord Biology;和弦生命)

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2-2.± Note Distribution In Triads；三和弦中的±音符分布

三和弦（triad）由三个离散频率值组成，在音乐中分别称为：根音（Root），三度（Third），五度（Fifth）本文仍沿用音乐中的术语。

A triad is composed of three discrete frequency values, which are called the root, third, and fifth in music. This article still uses the terminology in music.

三和弦又可分为大三和弦（Major triad）和小三和弦（Minor triad），这两种和弦的区别取决于它们的根色与三度（Third）的音程，大三度（major third）为大三和弦，小三度（minor third）为小三和弦，两种和弦在几何语义上有着重要的区别，在后面章节有详细的介绍。

Triads can be divided into major triads and minor triads. The difference between these two chords depends on their root color and the interval of the third. The major third is the major triad, and the minor third is the minor triad. The two chords have important differences in geometric semantics, which will be introduced in detail in the following chapters.

分别以 12 个色做根色（Root color），构成 24 个三和弦，12 个大三和弦，12 个小三和弦，包含了所有三和弦的±音符分布形式。

Use 12 colors as the root color, respectively, to form 24 triads, 12 major triads, and 12 minor triads, including the ± note distribution of all triads.

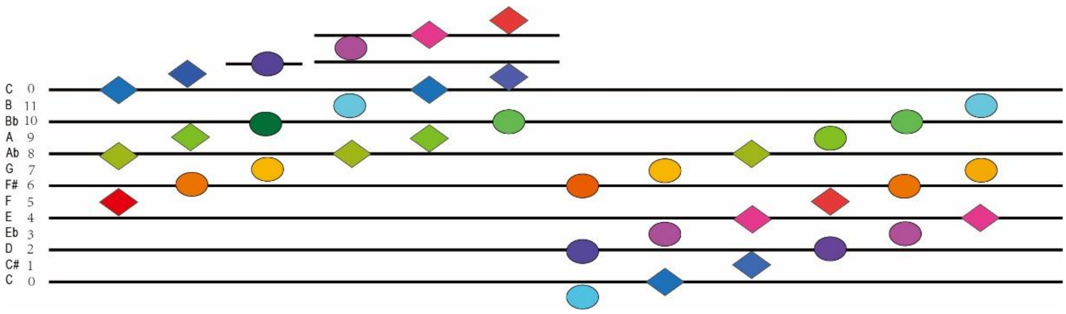

图 2-4.1：大三和弦表（菱形=+音符，圆形=-音符）

Figure 2-4.1: Major chord table(Diamond=+note, circle=-note)

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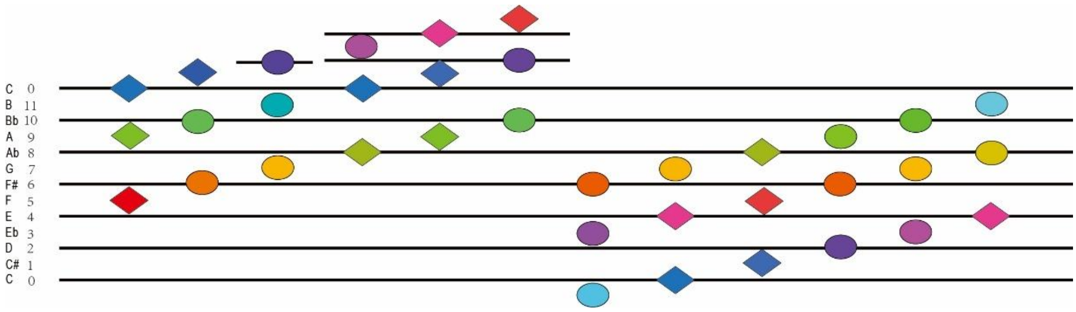

图 2-4.2：小三和弦表（菱形=+音符，圆形=-音符）

Figure 2-4.2: Minor chord table(Diamond=+note, circle=-note)

忽略表中的频率分布，保留正-负值分布，共有六种组合：

Ignoring the frequency distribution in the table and retaining the positive-negative value distribution, there are six combinations:

（+，+，+），（-，-，-），（-，-，+），（+，+，-），（-，+，+），（+，-，-）

六种组合在和弦语义上有重要的区别，涉及：开弦，闭弦，正-负电荷等。

The six combinations have important differences in chord semantics, involving: open strings, closed strings, positive-negative charges, etc.

六种组合可以是大-小三和弦，这里涉及以下规则：

The six combinations can be major-minor triads, where the following rules are involved:

（1）、+根三和弦（+，x，x）倾向生成大三和弦，-根三和弦（-，x，x）倾向生成小三和弦。

(1) + root triads (+, x, x) tend to generate major triads, while - root triads (-, x, x) tend to generate minor triads.

（2）、标准三和弦（Standard triads）：+根大三和弦（+，x，x）与 -根小三和弦（-，x，x）可充当调系统中的主和弦。

(2) The positive root major triad (+, ±, ±) and the negative root minor triad (-, ±, ±) act as the main chords in the tuning system.

（3）、非标准三和弦（Non-standard triads）：+根小三和弦（+，x，x）与-根大三和弦（-，x，x），不能充当调系统中的主和弦。

(3) Non-standard triads: + minor triad (+, x, x) and - major triad (-, x, x) cannot serve as the main chords in the key system.

标准三和弦又可分为两种：

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There are two types of standard triads:

纯三和弦（pure triad），如：纯大三和弦（+，+，+），纯小三和弦（-， -， -）。

pure triad, such as pure major triad (+,+,+), pure minor triad (-, -, -).

混合三和弦（Mixed triad ）：混合大三和弦（+，x，-）；混合小三和弦（-，x，+）。

Mixed triad: Mixed major triad (+, x, x); Mixed minor triads (-, x, x).

两种标准三和弦在调群中涉及以下规则：

The two standard triads involve the following rules in key groups:

纯三和弦（pure triad）在调群中充当主调的主和弦

A pure triad acts as the main chord of the main key in a key group

混合三和弦（Mixed triad）在调群中充当副调的主和弦。

Mixed triad are tonic chords that act as secondary keys in a key group.

上面规则适用于七声音阶系统，在爵士音阶系统中有一些区别，在后面相关章节分别介绍。

The above rules apply to the heptachord scale system, and there are some differences in the jazz scale system, which are described in the relevant sections later.

2-3.±Note Distribution In Geometric chords；等比和弦中的±音符分布

等比和弦（Geometric chords）的离散频率分布为等比数列（Geometric sequence），这类和弦在音乐中称作：不协和弦（Dissonant chords），等比和弦有：减七和弦，全音阶和弦，增三和弦，分别是不同音阶系统的特征和弦，在前面的章节已有介绍。（参见：1.Chord Mathematical;和弦数学）。

The discrete frequency distribution of Geometric chords is a geometric sequence. This type of chord is called dissonant chords in music. Geometric chords include diminished seventh chords, diatonic chords, and augmented triads, which are characteristic chords of different scale systems and have been introduced in the previous chapters. (See: 1. Chord Mathematical).

下图是等比和弦表，请注意各和弦中的±音符比例。

The figure below is a Geometric chords table, please pay attention to the proportion of ± notes in each chord.

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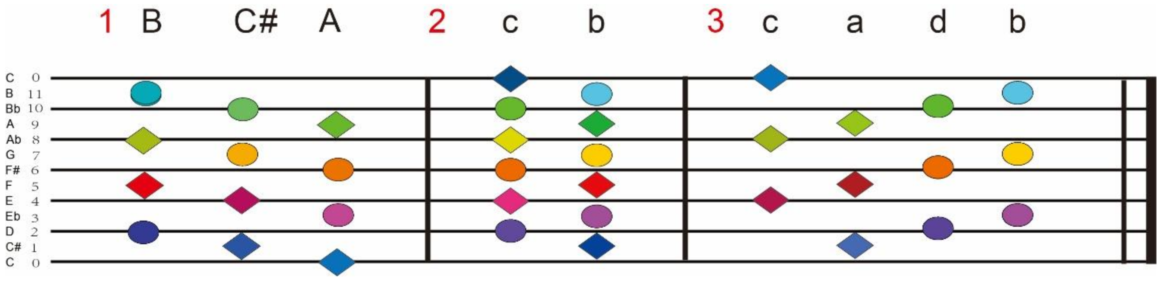

等比和弦表：1、减七和弦（膜弦）、2、全音阶和弦（膜弦），3、增三和弦（膜弦）

*◆=正音符，●=负音符，色彩=色荷

Geometric chords table: 1, diminished 7th chord (membrane chord), 2, diatonic chord (membrane chord), 3, augmented Triads (membrane chord)

* ◆=positive note, ●=negative note, color=color charge

忽略表中频率分布，只保留正-负值分布，可以记为以下组合：

Ignoring the frequency distribution in the table, only keeping the positive-negative value distribution, it can be recorded as the following combination:

（+，+，-，-），（+，-，+，-，+，-），（+，+，+），（-，-，-）

其中，减七和弦（diminished 7sh）与全音阶和弦（diatonic chord）表现出正-负对称性，增三和弦是全音阶和弦的包含部分。

等比和弦中的正-负音符可以构成正-负集合，在表现空间景深，大-小调性时具有重要的作用，因此具有相对的独立性，是等比和弦的特殊形式。

Among them, diminished 7th chords (diminished 7th) and diatonic chords exhibit positive-negative symmetry, and augmented triads are included within diatonic chords.

Positive and negative notes in Geometric Chords can form positive and negative sets, which play an important role in expressing spatial depth and major-minor tonality. Therefore, they have relative independence and are a special form of Geometric Chords.

Reference；参考

三和弦的正-负音符分布与中国古代易经中的八卦图有些相似，但是我无法证明它们是或不是同一对象，放在下面仅供参考。

The distribution of the positive and negative notes of the triad is somewhat similar to the Eight

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diagrams in the ancient Chinese Book of Changes, but I cannot prove that they are or are not the same object, which is placed below for reference only.

（+，+，+），（-，-，-），（-，-，+），（+，+，-），（-，+，+），（+，-，-）

乾（☰）、坎（☵）、艮（☶）、震（☳）、巽（☴）、离（☲）、坤（☷）、兑（☱）

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3. Chord Geometry；和弦几何

和弦语言是时空语言，包含空间的语义表达：由和弦编码结构（量子化频谱）包含的几何语义集合{开弦|闭弦|膜弦} 生成"和弦空间"，是量子化的空间结构。

Chord language is a spatiotemporal language that contains the semantic expression of space: the geometric semantic set {open string|closed string|membrane string} contained in the chord encoding structure (quantized spectrum) generates the "chord space", which is a quantized spatial structure.

在音乐中，基本频率单位是"音符"（机械波）。然而，和弦绘画的定量基础基于色彩频率（光，电磁波）。因此，我们需要扩充定义：音符 = 频符（Frequency Note）：包含所有频率的广义概念。其中，色彩频率可特称为色荷（Chromatic Charge）。

In music, the fundamental unit of frequency is the "note" (a mechanical wave). However, the quantitative basis of polyphonic painting is based on color frequencies (light and electromagnetic waves). Therefore, we need to expand the definition: note = frequency symbol: a broad concept that encompasses all frequencies. Color frequencies can be specifically called chromatic charges.

本文涉及两个关键术语："和弦"与"弦"。

和弦：由三个以上离散频率构成的和弦编码，以量子化频谱为编码结构。

弦：和弦编码包含的几何语义，是和弦信息（或量子信息），也是方便区别于“和弦”的概念。

关系：和弦是弦的编码形式，弦是和弦的几何语义。两者是一体两面，分别从编码结构和几何语义的角度进行描述。

Chords: Chord codes composed of three or more discrete frequencies, using a quantized spectrum as their encoding structure.

Strings: The geometric semantics contained in chord codes represent chord information (or quantum information), and are also a convenient way to distinguish them from "chords."

Relationship: Chords are the encoding form of strings, and strings are the geometric semantics of chords. The two are two sides of the same coin, described from the perspectives of encoding structure and geometric semantics, respectively.

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和弦语言；李晓虹；DOI: 10.13140/RG.2.2.25415.65440/3；ISBN:9781370273348；ASIN: B0919JJ3R7
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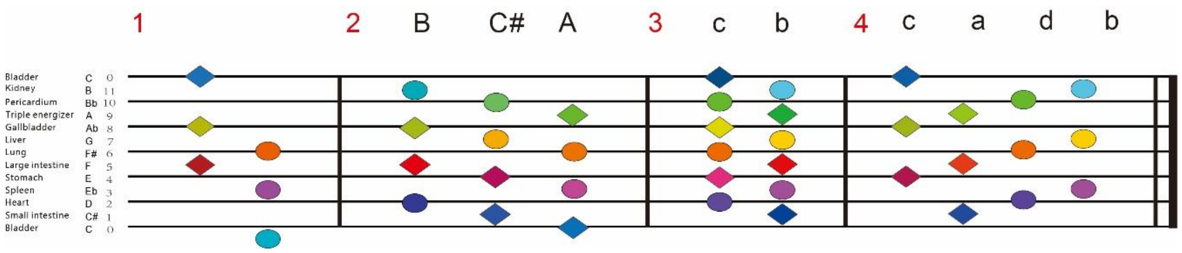
和弦空间的研究以和弦绘画为观察基础，以视觉实验为主要研究方法，采用代数、模 12 群（Mod 12）等数学工具，其观察表明：空间由和弦编码（量子化频谱）包含的几何语义集合生成，具有量子化特征，为认识空间与视觉艺术都提供了新的视角。

The study of chord space is based on the observation of chord painting, with visual experiments as the main research method, and uses mathematical tools such as algebra and Mod 12. The observation shows that the space is generated by the geometric semantic set contained in the chord code (quantized spectrum) and has quantized characteristics, providing a new perspective for understanding space and visual art.

3-1.Geometric semantics Of Chord ；和弦的几何语义

和弦以量子化频谱为编码形式，包含两个基本类型：对称和弦与非对称和弦，整体表现为对称-破缺结构。

The chords are encoded in the quantized spectrum and contain two basic types: symmetric chords and asymmetric chords, and the overall performance is symmetry-broken structure.



基本和弦表：1-1、大三和弦（闭弦），1-2、小三和弦（开弦）、2、减七和弦（膜弦）、3、全音阶和弦（膜弦），4、增三和弦（膜弦）

*和弦频谱公式：n*f，H^n*f,（H=1.059463，n∈Z）

*符号：◆=+音符，●=-音符，音符色=色荷

*本文使用 mod12 记谱法

Basic chord table: 1-1, major triad (closed string), 1-2, minor triad (open string), 2, diminished 7th (membrane string), 3, diatonic chord (membrane string), 4, augmented Triads (membrane strings)

* Chord spectrum formula: n*f, H^n*f (H=1.059463，n∊Z)

* Symbol: ◆=+ note, ●=- note, note color = color charge

** This article uses mod12 notation

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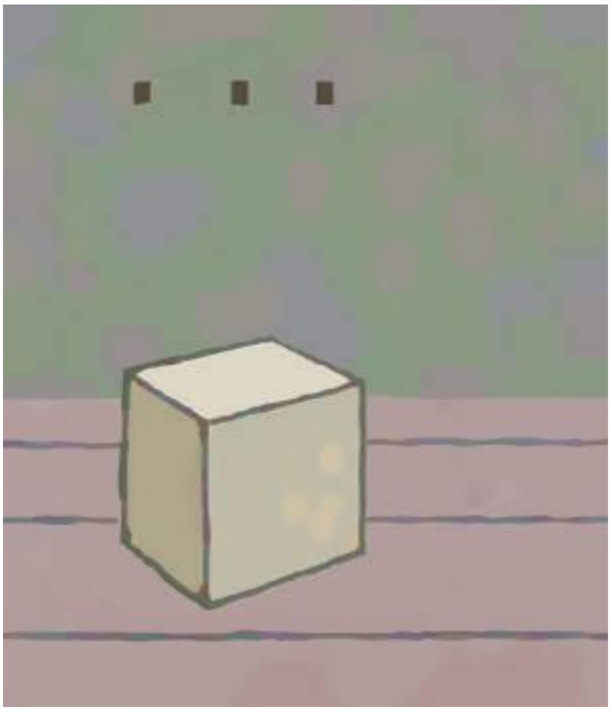
基本和弦表中的和弦按照几何语义可分为：1、线和弦与膜和弦；2、开和弦与闭和弦。

The chords in the basic chord table can be divided into: 1. line chords and membrane chords; 2. open chords and closed chords.



图：3.1：和弦几何语义图例，开和弦，闭和弦，膜和弦，点空间（线图）

Figure: 3.2: Semantic legend of chord space, open chord, closed chord, membrane chord, point space

说明：上面几何图形中的线有几种作用：1、用于构成图形边界（轮廓线），产生图形-背景关系；2、用于分面，如：分面线（绘画中称为：明暗交界线），4、点空间。

The line in the above geometric figure has several functions: 1. It is used to form the figure boundary (contour line) and produce the figure-ground relationship; 2, used for faceted, such as: Facet line (painting called: light and dark Facet line), 4, point space.

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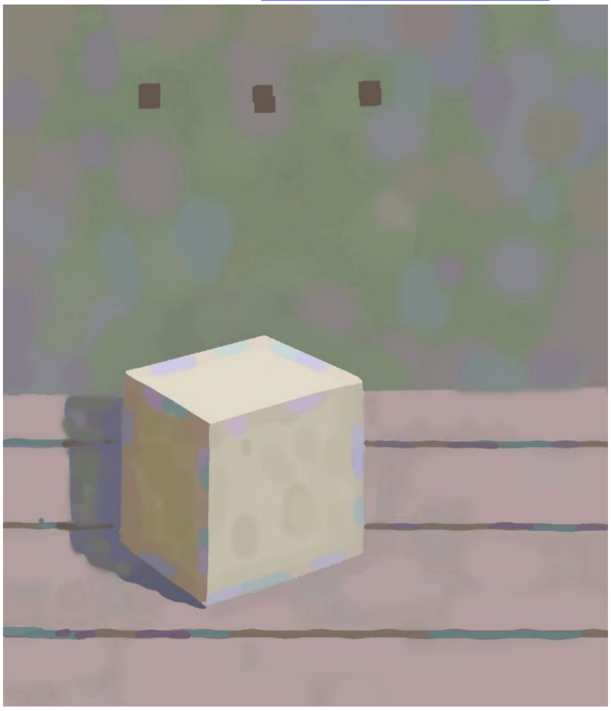

图：3.2：和弦几何语义图例，开和弦，闭和弦，膜和弦，点空间（详细图例）

Figure: 3.2: Semantic legend of chord space, open chord, closed chord, membrane chord, point space (detailed legend)

上图中出现的和弦及几何语义：

The chords and geometric semantics that appear in the picture above:

闭和弦具有闭合（闭合）倾向，用于构成图形空间的轮廓线，产生图-底关系（Figure-ground relation）。

Closed chords have a tendency to close (Close) and are used to form the contours of the figure space, resulting in a figure-ground relation.

2、开和弦没有闭合（闭合）倾向，用于非轮廓线，如：分面线，线状空间等。

2, open chord has no closing (Close) tendency, used for non-contour lines, such as: faceted lines, linear Spaces, etc.

3、点空间：点空间包括端点，角点，独立点空间，用线和弦中的音符表达，它是线和弦的特殊形式。

3. Point space: Point space includes end points, corner points, and independent point space, expressed by the notes in the line chord, which is a special form of the line chord.

4、膜和弦充满所有非线（点）空间。

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4. Membrane chords fill all non-linear (point) spaces.

3-2.Line And Membrane Chords；线和弦与膜和弦

和弦按几何语义分为两类：线和弦与膜和弦，分别表达两种空间状态“线”与“非线膜”；非线膜没有边界限定，无法用“维”进行描述，它是和弦空间特有的空间状态。

Chord are divided into two categories according to geometric semantics: line chords and membrane chords, which express two spatial states "line" and "non-line membrane" respectively; non-line membrane has no boundary limit and cannot be described by "dimensions", it is a chord space unique spatial state.

三和弦（大三和弦，小三和弦）的几何语义是“线”，表达“线空间”，称作：线和弦。见图 3-1。

The geometric semantics of triads (major triads, minor triads) is "line", which expresses "line space" and is called: line chord,. See Figure 3-1.

等比和弦（减七和弦、全音阶和弦，增三和弦）的几何语义为：非线膜，称作“膜和弦”。

The geometric semantics of Geometric chords (diminished 7th, diatonic chords, augmented triads,) are: non-linear membrane, called "membrane chord".

见图 3-1、和弦空间图例：膜和弦充满所有非线空间，线和弦（轮廓线、分面线）之外的空间都由膜和弦占据。

See Figure 3-1, chord space legend: membrane chords fill all non-linear spaces, and the space outside of linear chords (contours, Facet line) is occupied by membrane chords.

非线膜和弦只有在被线和弦限定边界后，才能形成二维，三维空间；膜和弦与线和弦相互依赖，孤立的线和弦与膜和弦都处于不稳定状态。

The Membrane chords can form a two-dimensional and three-dimensional space only after it is defined by the line chords; the Membrane chords and the line chords are interdependent, and the isolated L and Membrane chords are in an unstable state.

和弦空间由线和弦+膜和弦构成：线和弦定义膜和弦，产生轮廓线与分面线，形成二维面与三维体积，和弦空间是线和弦定义膜和弦的结果，未经定义的膜和弦处于任意维度。

The chord space is composed of line chords + membrane chords: line chords define membrane chords, generate contour lines and Facet line, and form two-dimensional surfaces and three-

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dimensional volumes. Chord space is the result of line chords defining membrane chords, undefined membrane chords are in arbitrary dimensions.

3-3.Closed And Open Chords ； 闭和弦与开和弦

线和弦分为两种：大三和弦与小三和弦，其几何语义分别为：闭和弦（闭弦）与开和弦（开弦），（见图 3.1）。

line chords are divided into two types: major triads and minor triads. Their Geometric semantics are: closed chords (closed strings) and open chords (opened strings), (see Figure 3.1).

大三和弦具有闭合性（闭合性），几何语义是闭弦，表达图形与背景交界处的轮廓线，产生图-底关系（Figure-ground relation）。

The major triad has closure (Close), and the geometric meaning is a closed string, which expresses the contour line at the junction of the Figure and the background, and generates a figure-ground relation.

小三和弦没有闭合性（闭合性），几何语义是开弦，表达开放的线空间，常用于三维体上的分面线。

Minor triads do not have closure (Close), and the geometric meaning is open string, expressing Facet line space, often used for faceted lines on a three-dimensional body.

两者的基本区别是：闭和弦（闭弦）表达轮廓线，开和弦（开弦）表达分面线。

The basic difference between the two is: closed chords (closed string) express contour lines, and open chords (open string) express Facet line.

Positive-Negative Closed And Open Strings ； 正-负闭弦与开弦

大三和弦（闭弦）构成轮廓线，小三和弦（开弦）构成分面线，两种和弦分别包含正-负两种形式：

正大三和弦 {+，x，x}

负大三和弦 {-，x，x}

正大三和弦在图底关系（figure-ground relation）中构成背景侧的轮廓线，负大三和弦在图底关系（figure-ground relation）中构成图形侧的轮廓线。

负小三和弦 {-,x,x}

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正小三和弦 {+,x,x}

负小三和弦构成凸分面线，正小三和弦构成凹分面线。

正大三和弦构成背景轮廓线，负大三和弦生成图形轮廓线；负小三和弦生成凸分面线，正小三和弦生成凹分面线。

Major Triads (Closed Chords) form contour lines, while minor triads (open chords) form facet lines. Both types of chords include positive and negative forms:

Positive Major Triad: {+, x, x}

Negative Major Triad: {-, x, x}

In a figure-ground relation, positive major triads create contour lines on the background side, and negative major triads create contour lines on the figure side.

Negative Minor Triad: {-, x, x}

Positive Minor Triad: {+, x, x}

Negative minor triads form convex facet lines, and positive minor triads form concave facet lines.

Positive major triads form background contour lines, negative major triads form figure contour lines; negative minor triads form convex facet lines, and positive minor triads form concave facet lines.

图 3.3.正-负、大-小三和弦

Figure 3.3. Positive - negative, major - minor triad

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Omitted Triads ； 省略三和弦

大三和弦与小三和弦都有确定的几何语义：闭弦-轮廓线，开弦-分面线，但三和弦在省略 1-2 音符后，确定性降低，空间语义也会相应的发生变化。

Both major and minor triads possess definitive geometric semantics: closed strings represent contour lines, while open strings correspond to facet lines. However, when a triad omits 1-2 notes, its determinacy diminishes, and the spatial semantics undergo corresponding transformations.

点空间：

所有音符都可以知觉为点空间，但是有图形意义的点空间是三和弦（线和弦）的省略、收缩形式。

将三和弦省略，只剩下一色，三和弦的线空间（1 维）便会收缩为“点空间”（0 维），点空间是线和弦的省略引起线空间收缩的结果。见图 3.1，图 3.2

在图例中、墙上的挂钩为点状空间，使用小三和弦（开弦）的根色；正方体的分面线为小三和弦，根色出现在各个转角的点上。

Point Space:

"All notes can be perceived as point spaces, but point spaces with graphical significance are abbreviated and contracted forms of triads (line chords).

By omitting the notes of a triad, leaving only one color, the line space (1-dimensional) of the triad contracts into a 'point space' (0-dimensional). The point space is the result of the line space contracting due to the omission of the line chord. See Figure 3.1 and Figure 3.2.

In the illustrations, the wall hooks serve as point spaces, using the root color of a minor triad (open chord); the facet lines of the cube are minor triads, with the root color appearing at the points of each corner."

不确定线：

开和弦（开弦）与闭和弦（闭弦）的区别在和弦的三度（大三度与小三度），如果省略和弦三度，两者的区别便消失，产生不确定的线空间。

Uncertainty line:

The difference between an open chord (open string) and a closed chord (closed string) is in the third of the chord (major and minor third), and if the chord third is omitted, the difference between the two disappears, creating an uncertain line space.

3-4、Overlapping Chords ； 重叠和弦

重叠和弦由同调中的不同和弦重叠构成，常见形式之一是：三和弦叠加等比和弦（Geometric chords）。

Overlapping chords are composed of overlapping chords in the same key. One of the common forms is triads superimposed on geometric chords.

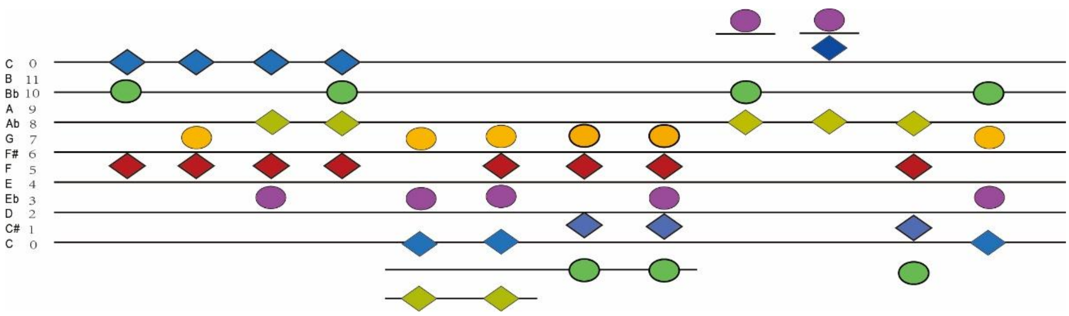

图 3-5、常见重叠和弦

Figure 3-5. Common Overlapping Chords

重叠和弦模糊了三和弦（线和弦）与等比和弦（膜和弦）的区别，能兼容线-膜两种空间语义，并产生更加丰富，复杂的空间语义变化。

重叠和弦涉及的内容比较多，放在后面的章节分别介绍。

Overlapping chords blur the distinction between triads (linear chords) and Geometric chords (membrane chords), can accommodate both linear and membrane spatial semantics, and produce more rich and complex spatial semantic changes.

Overlapping chords involve a lot of content and will be introduced separately in the following chapters.

4. Chord Packages；和弦包

在和弦时空中，孤立的三和弦（非对称和弦）与等比和弦（对称和弦）均无法独立构成完整的时空表达。只有通过将三和弦（非对称和弦）与等比和弦（对称和弦）组合为“和弦包”，并形成对称-破缺（Symmetry Breaking）结构，才能完整地表达时空。

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和弦包分为和弦时间包与和弦空间包。两者的核心三和弦（triad）满足镜像对称关系：

$\{-7,-4,0\}\leftrightarrow\{0,4,7\}\bmod 12$

分别表征和弦时间与和弦空间的几何对偶性。这一镜像对称关系（Mirror Symmetry）表明，时间和空间在和弦语言中可以通过几何结构相互映射。（参见：1-3.1.镜像对称）

在一个和弦包中：

三和弦作为边界算子，生成时空边界：

时间维度：定义时段边界（起始点、终止点）。

空间维度：定义空间边界（轮廓线、分面线）。

等比和弦作为场填充（Field Filling）：

通过等比频率分布（减七和弦，全音阶和弦，增三和弦）渗透边界内外的时空连续体，其作用类似于经典物理中的以太场（Ether Field）或量子场论中的背景场（Background Field）。

和弦包（Chordal Package）可形式化定义为：

和弦包 = 三和弦（边界） + 等比和弦（场填充）

其中，“+”表示对称-破缺耦合，最终生成稳定的和弦时空流形。

和弦语言中，和弦包又称为：调——包括大调，小调，及七声音阶，爵士音阶等，分别表达不同的时空含义，在后面章节将会逐步介绍。

In chordal spacetime, isolated triads (asymmetric chords) and Geometric chords (symmetric chords) cannot independently constitute a complete expression of spacetime. Only by combining triads (asymmetric chords) with Geometric chords (symmetric chords) to form a "chordal package," and establishing a symmetry-breaking structure, can spacetime be fully expressed.

Chordal packages are divided into chordal time packages and chordal space packages. The core triads (triads) of the two satisfy a mirror symmetry relationship:

$\{-7,-4,0\}\leftrightarrow\{0,4,7\}\bmod 12$

These respectively represent the geometric duality of chordal time and chordal space. This mirror symmetry relationship indicates that time and space can be mutually mapped through geometric structures in the language of chords. (See: 1-3.1. Mirror Symmetry)

Within a chordal package:

Triads act as boundary operators, generating spacetime boundaries:

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Time dimension: Define temporal boundaries (starting point, ending point).

Space dimension: Define spatial boundaries (contour lines, Facet lines).

Geometric chords act as field filling:

Through geometric frequency distributions (diminished seventh chords, whole-tone chords, augmented triads), they permeate the spacetime continuum inside and outside the boundaries, functioning similarly to the ether field in classical physics or the background field in quantum field theory.

The chordal package (Chordal Package) can be formally defined as:

Chordal Package=Triads (Boundary)+Geometric chords (Field Filling)Chordal Package=Triads (Boundary)+Geometric chords (Field Filling)

Here, "+" denotes symmetry-breaking coupling, ultimately generating a stable chordal spacetime manifold.

In the language of chords, chordal packages are also referred to as "keys"—including major keys, minor keys, diatonic scales, jazz scales, etc.—each expressing different spacetime meanings, which will be gradually introduced in later chapters.

4-1.Chord Space Packet ； 和弦空间包

一个和弦空间包必须包含两种和弦：线和弦（三和弦）与等比和弦（膜和弦），和弦空间包=线和弦+导音膜和弦，线和弦构成轮廓线、分面线，产生空间定义（图-底关系等），膜和弦充满所有非线空间，类似“以太”，和弦空间包是和弦空间的基本单元。

A chord space packet must contain two kinds of chords: line chords (triads) and Geometric chords (membrane chords), chord space packet = line chords + membrane chords, line chords form contour lines, Facet line, and produce space definitions (Figure-ground relationship, etc.), membrane chords fill all non-linear spaces, similar to "ether", chord space packet is the basic unit of chord space.

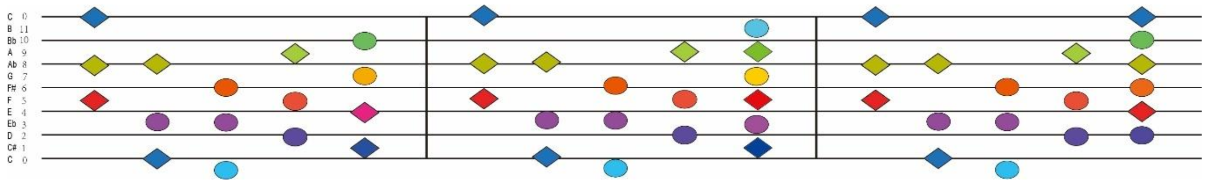

图 4.1、1、七声音阶和弦空间包；2-3、爵士音阶和弦空间包

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Figure 4.1, 1. Heptachord scale chord space packet; 2-3. Jazz scale chord space packet

三和弦的几何语义是：线（开弦，闭弦），等比和弦（Geometric chords）的几何语义是：非线膜，线和弦对膜和弦作边界定义（轮廓线，分面线），产生和弦空间包。

The geometric semantics of triads are: lines (open string, closed string), and the geometric semantics of Geometric chords are: non-linear membranes, line chords define boundaries (contours, Facet line) to membrane chords, resulting in Chord Space Packet.

一个完整的和弦空间包只含一个膜和弦，但通常需要两个线和弦：大三和弦（闭弦）与小三和弦（开弦），分别构成轮廓线与分面（分形）线。

A complete chord space packet contains only one membrane chord, but usually requires two line chords: a major triad (closed string) and a minor triad (open string), which form the contour line and the facet (fractal) line respectively.

图 4.2、七声音阶 C 大调-升 f 小调，大三和弦生成图形轮廓线，小三和弦生成分面线，减七和弦填充所有 M 维空间。

Figure 4.2. heptachord C major f-sharp, major triads generate figure contour lines, minor triads

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generate Facet line lines, and diminished 7th fill all M-dimensional spaces.

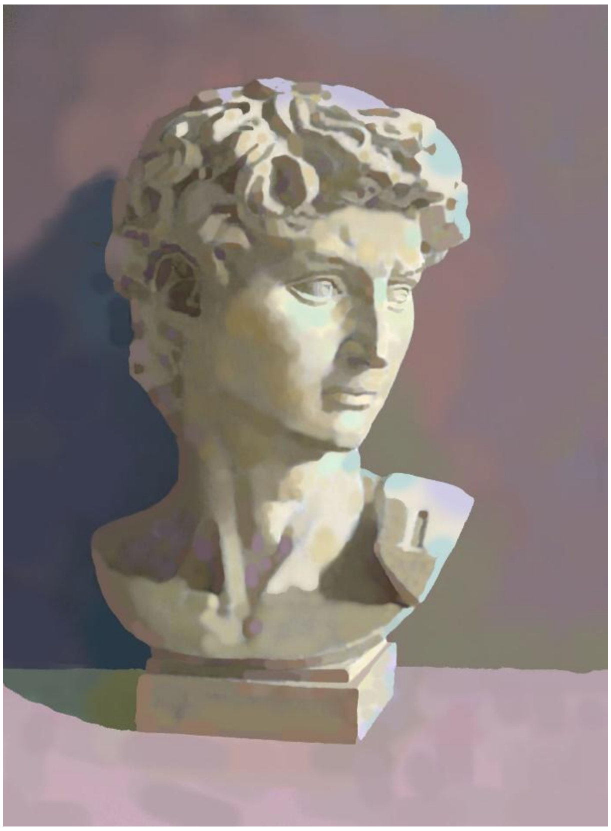

图 4.3、爵士音阶，升 f 小调，大三和弦生成图形轮廓线，小三和弦生成分面线，全音阶和弦填充所有非线空间。

Figure 4.3. Jazz scale f-sharp minor, major triads generate figure outlines, minor triads generate Facet line line, and diatonic chords fill all non-linear spaces.

3-5、Time Chord ； 时间和弦

时间和弦与空间和弦互为反和弦，两者在数学形式上表现为：镜像对称——这表明两者相互依存，联系。（参见：1-5. Mirror Symmetry；镜像对称）

Time chord and space chord are opposite to each other. The two are shown in mathematical form: mirror symmetry-which shows that the two are interdependent and connected. (Refer to: 1-5. Mirror Symmetry)

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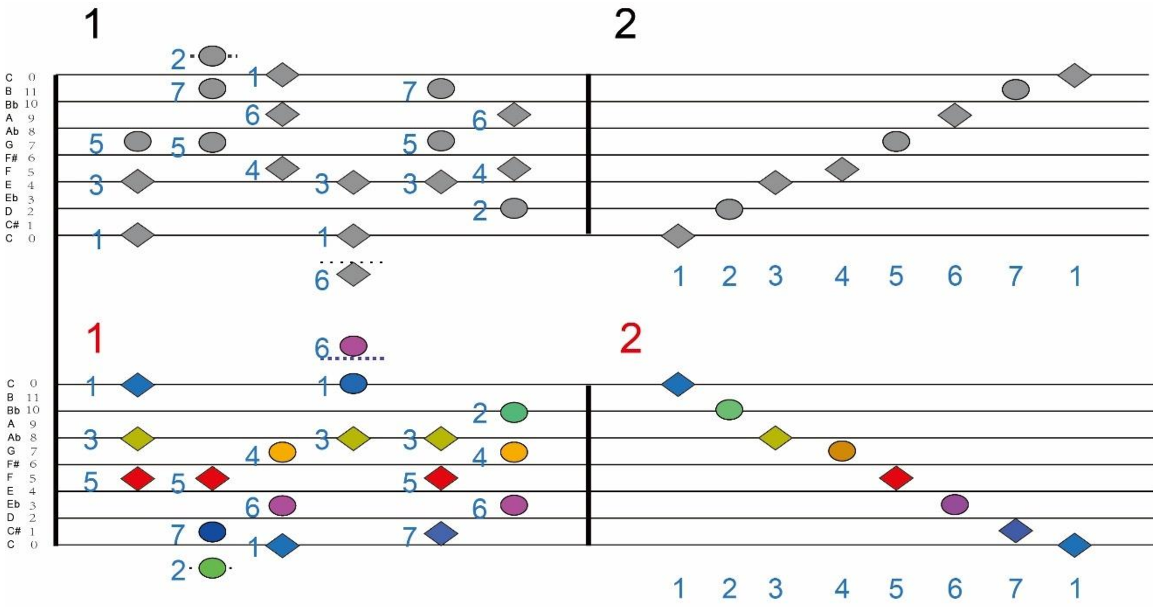

图 3-6、平均律镜像坐标，七声音阶（Heptachord），C 大调的三和弦与音阶

Figure 3-6, the equal temperament mirror coordinates, Heptachord, C major triad and scale

和弦时间用频率与振幅等能量变化产生时间表达。

Chord time is expressed in terms of time generated by energy changes such as frequency and amplitude.

和弦时间包的基本单元是“时段”，主和弦构成时段边界，等比和弦填充主和弦之外的时间。

The basic unit of the chord time Packet is the "period", the tonic forms the boundary of the period, and the Geometric chords fills the time outside the tonic.

时间与空间的边界都需要由三和弦定义，没有三和弦定义的膜和弦没有确定的时-空状态。

The boundaries of time and space need to be defined by triads, and membrane chords without triads have no definite space-time state.

时间和弦不含几何语义，没有空间状态，可以处于任意空间位置的叠加态（非定域性）；反之，空间和弦不含时间语义，没有时间状态，只能表达静止的空间（定域性）；定域性与非定域性产生了“时空二相性”（波粒二相性）。

Time chord does not contain geometric semantics, no space state, can be in any space position superposition state (non-locality); On the contrary, spatial chord has no time meaning, no time state, can only express the static space (locality); Locality and non-locality produce "space-time duality" (wave-particle duality).

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4-1.2.Figure-Ground Relation ； 图-底关系

图-底关系（figure-ground relation）是空间知觉的基本模式，“背景空间”与“图形空间”是产生空间知觉的必要条件；两种空间都与音符-和弦的正-负属性相关，正音符-和弦具有背景（远）倾向，负音符-和弦具有图形（近）倾向，图-底关系与“景深”相关。

The figure-ground relation is the basic mode of spatial perception, and "background space" and "figure space" are necessary conditions for spatial perception; both spaces are related to the positive-negative properties of note-chords, and the positive Note-chords have background (far) tendencies, negative note-chords have figure (near) tendencies, and the figure-ground relationship is related to "depth of field".

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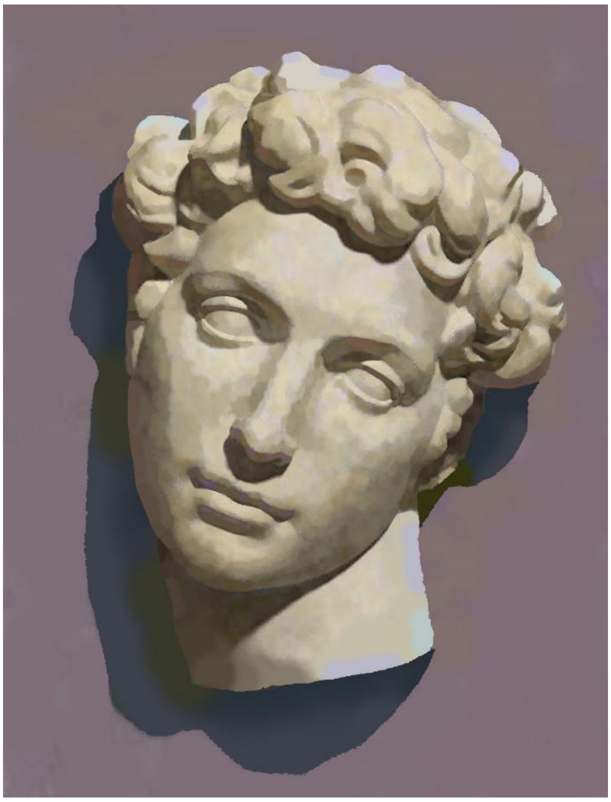

图 4-2、七声音阶，升 f 小调-C 大调图-底关系

Figure 4-2. Heptachord scale f-sharp minor,C major figure-ground relationship

图-底关系包括：三和弦图-底关系与等比和弦图-底关系。

The figure-ground relationship includes: triad figure-ground relationship and geometric chord figure-ground relationship.

三和弦图-底关系：图-底关系与三和弦相关，表现为：小调的图形（近）倾向，大调的背景（远）倾向，（参见：2-4、和弦中的±音符规则；3-3、正-负闭弦与开弦）。

Figure-ground relationship of triads: The figure-ground relationship is related to triads, which is manifested as: figure (near) tendency in minor keys, background (far) tendency in major keys (see: 2-4, ± note rule in chords; 3-3, positive-negative closed and open strings).

等比和弦图-底关系：等比和弦中的负音符具有图形（近）倾向，正音符具有背景（远）倾向。

Figure-ground relationship of geometric chords: The negative notes in a geometric chord have a figure (near) tendency, and the positive notes have a background (far) tendency.

下面例图中包含两种图-底关系。

The following example diagram contains two figure-ground relationships.

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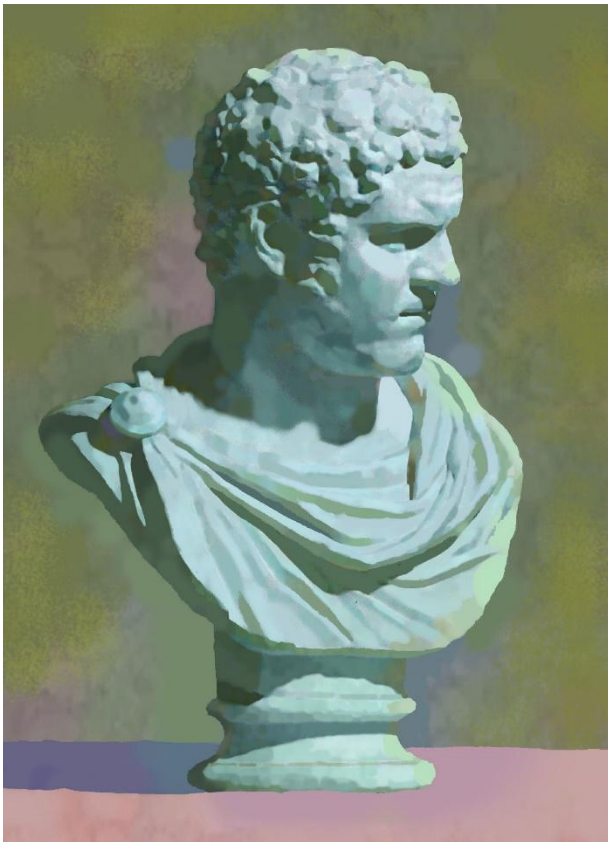

图 4-2.2、七声音阶 E 大调，降 b 小调

Figure 4-2.2, Heptachord scale E major, b-flat minor

4-2. Chord Time Packet ； 和弦时间包

和弦时间包与和弦空间包的区别在于其中的三和弦，两者互为反和弦（镜像对称）。（参见：1-5.Mirror Symmetry；镜像对称）

The difference between the chord time packet and the chord space packet is the triads in them, which are antichords (mirror-symmetrical) of each other. (See: 1-5.Mirror Symmetry)

和弦时间的进行由音符-和弦及强度（振幅）的变化产生，和弦时间的基本单位是时间包。

The progression of chord time is produced by changes in note-chord and intensity (amplitude), and the basic unit of chord time is the time packet.

和弦时间包构成“时段”，主和弦构成时段边界（开始与结束），等比和弦充满边界之外的时间。

The chord time packets make up the "periods", the tonic chords form the period boundaries (start and end), and the Geometric chords fill the time outside the boundaries.

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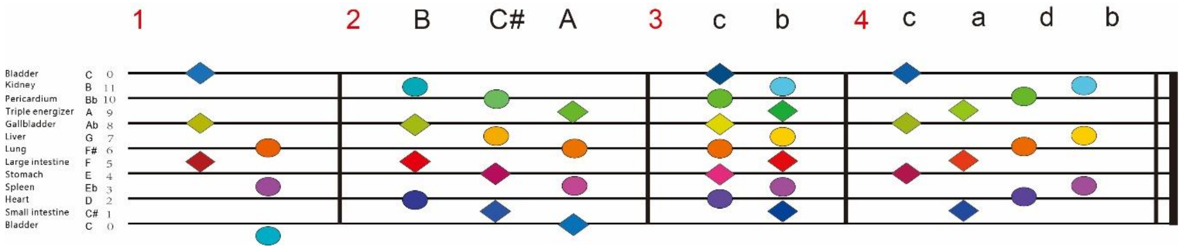
人类对时间的观察比对空间的观察少很多，和弦时间（音乐）是一个还需要更多关注的部分。

Humans observe a lot less of time than space, and chord time (music) is an area that needs more attention.

4-3.Scale System ； 音阶系统

和弦语言中有三种基本的等比和弦：减七和弦，全音阶和弦，增三和弦，等比和弦是不同音阶系统的特征和弦。

There are four basic geometric progression chords in the chord language: diminished seventh chords, diatonic chords, augmented triads, and diatonic chords. Geometric progression chords are the characteristic chords of different scale systems.



基本和弦表：1-1、大三和弦（闭弦），1-2、小三和弦（开弦）、2、减七和弦（膜弦）、3、全音阶和弦（膜弦），4、增三和弦（膜弦）

*和弦频谱公式：n*f，H^n*f,（H=1.059463，n∈Z）

*符号：◆=+音符，●=-音符，音符色=色荷

*本文使用 mod12 记谱法

Basic chord table: 1-1, major triad (closed string), 1-2, minor triad (open string), 2, diminished 7th (membrane string), 3, diatonic chord (membrane string), 4, augmented Triads (membrane strings)

* Chord spectrum formula: n*f, H^n*f (H=1.059463，n∊Z)

* Symbol: ◆=+ note, ●=- note, note color = color charge

** This article uses mod12 notation

减七和弦向三和弦解决，产生七声音阶（heptachord）；全音阶和弦与增三和弦向三和弦解决，产生爵士音阶，不同音阶系统有着重要的和弦语义差别，也是后面章节的主要内容。

The diminished seventh resolves to the triad, producing heptachord; Diatonic chords and augmented triads solve to triads, producing jazz scales. Different scale systems have important chord

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semantic differences, which are also the main content of the following chapters.

Reference, Prompt ； 参考、提示

*本书的 1-4 章是和弦语言的基础部分，请在完全熟悉之后再进入后面的内容。

*Tip: Chapters 1-4 of this book are the basic part of the chord language. Please enter the following content after you are fully familiar with it.

Bibliography；参考书目

Basic Theory Of Music；音乐基础理论

Harmony；和声学

Chord Painting；和弦绘画

General Physics；普通物理学

5. Heptachord；七声音阶

和弦语言包含三种和弦包：七声音阶（Heptachord），爵士音阶，无调性体系，七声音阶是其中的主系统，也是典型的调性体系。

The chord language contains three chord packet: Heptachord, jazz scale, and Atonal system, of which the heptatonic scale is the main system and a typical tonal system.

减七和弦（Diminished 7th）是七声音阶（Heptachord）的特征膜和弦，它是产生七声音阶系统的必须条件。

Close: Close is related to closed string, Diminished 7th, space packet interaction is related to Close, the higher the Close, the greater the binding force (gravity), which can produce cosmic order, such as: galaxies, stars, etc. See also: 8.Close; Close, 13.Multi-Layer Key Group; Multilayer tone group.

七声音阶（Heptachord）和弦包的基本语句形式是：三和弦（主和弦）+导音减七和弦（Leading note diminished 7th），在音乐中被称为：和声小音阶与和声大音阶。

The basic sentence form of the Heptachord is: triad (main chord) + leading note diminished 7th to form a heptachord chord packet, which is called in music: harmonic minor scale and Harmonic major scale.

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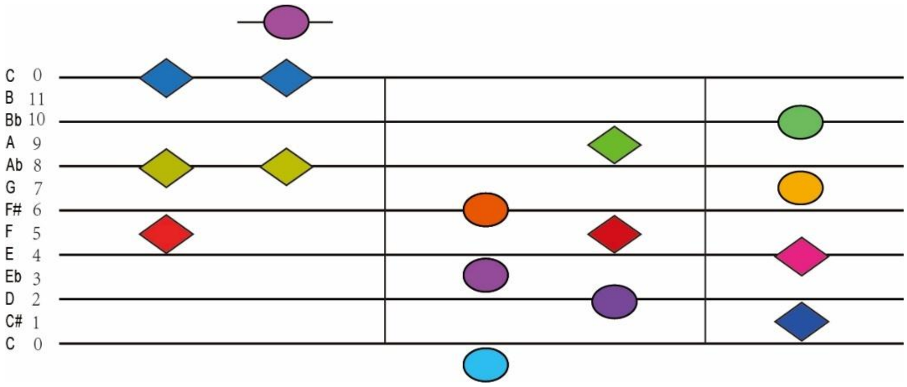

图 5.1、七声音阶基本型（和声大-小音阶），1、C 大三和弦、2、降 e 小三和弦，3、升 f 小三和弦，4、A 大三和弦，5、导音减七和弦（Leading note diminished 7th）。

Figure 5.1. Basic type of heptachord (harmonic major-minor scale), 1, C major triad, 2, e flat-minor triad, 3, f-sharp minor triad, 4, A major triad, 5, Leading note diminished 7th.

图 6.1 中，1、2、3、4 是主和弦（线和弦），用于定义减七和弦（膜弦）。

In the figure, 1, 2, 3, 4 are the tonics (line chords), used to define the Diminished 7th (membrane chords).

减七和弦中的四个色分别充当导音，可产生四个调，称为：同导音减七和弦调群（same leading note diminished 7th keys group），四个调具有相同的闭合性。（参见：8、闭合性）

Each of the four colors in the diminished 7th chord acts as a leading note, resulting in four tones, known as the same leading note diminished 7th keys group, all of which have the same Close. (See: 8, Close)

只有纯大调（主和弦为纯大三和弦），纯小调（主和弦为纯小三和弦）才能充当七声音阶系统的主调。参见：2-4、和弦中的±音符规则。

Only pure major (the tonic is a pure major triad) and pure minor (the tonic is a pure minor triad) can act as the tonic of the heptachord system. See: 2-4, ±note rule in chords.

七声音阶服从和弦中的±音符规则。参见：2-4、和弦中的±音符规则。

The heptachord obeys the ± note rule of the chord, see: 2-4, The ± Note Rule In Chord.

5-1. Figure-Ground Relation ； 图-底关系

图-底关系由图形与背景构成，是空间知觉的基本元素。

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The figure-ground relation is composed of figure and background, which is the basic element of spatial perception.

图-底关系（figure-ground relation）包括两种类型：绝对图-底关系与相对图-底关系；前者的图形与背景均具有确定性，绝对性；后者的图形与背景具有相对性。

There are two types of figure-ground relation: absolute figure-ground relation and relative figure-ground relation. In the former, both the figure and the ground are definite and absolute; in the latter, the figure and the ground are relative.

下面例图中，石膏模型是绝对图形，墙面是绝对背景，两者构成绝对图-底关系。

In the example picture below, the plaster model is the absolute figure and the wall is the absolute background, and the two form an absolute figure-ground relationship.

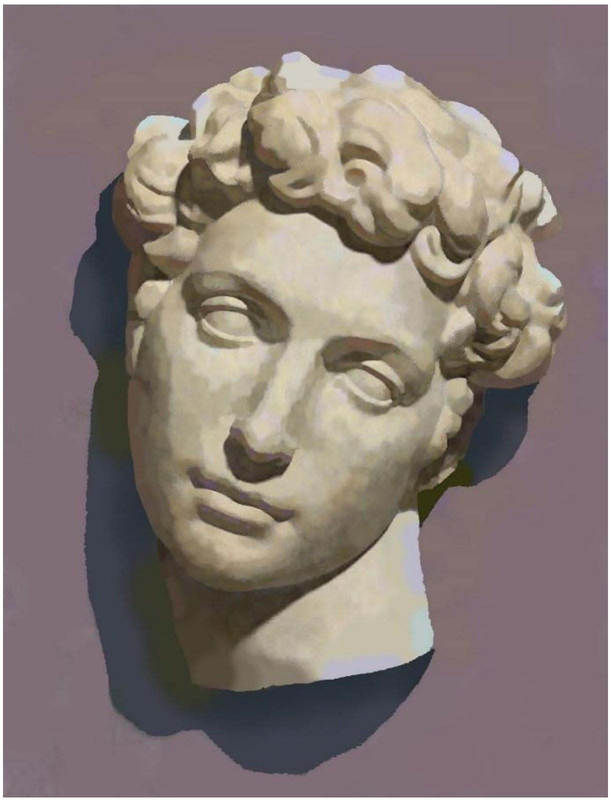

图 5-1.绝对图-底关系

Figure 5-1. Absolute Figure – Ground Relationship

下面例图中，部分图形与背景具有相对性，为相对图-底关系。

In the following example figure, some figures and background are relative, which is a relative figure-ground relationship.

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图 5-1.2.相对图-底关系

Figure 5-1.2. Relative figure-ground relationship

5-1.1. Absolute Figure-Ground Relationship；绝对图底关系

七声音阶（heptachord）中的绝对图-底关系（figure-ground relation）由纯大调与纯小调构成，两调的主音为增四度（Augmented fourth）关系，拥有相同的导音减七和弦（Leading note diminished 7th），纯大调表达绝对背景，纯小调表达绝对图形。（参见：2-2）

The absolute figure-ground relation in heptachord is composed of pure major key and pure minor key, and the tonic of the two keys is an Augmented fourth relation. With the same Leading note diminished 7th, the pure major expresses the absolute background and the pure minor expresses the absolute figure. (See: 2-2)

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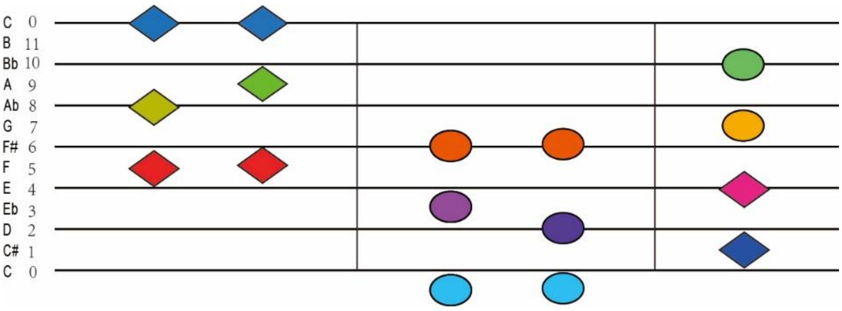

图 5-1.1、七声音阶（Heptachord）中的±纯三和弦（和弦 1、3）构成图-底大小调。

Figure 5-1.1.The ± Pure triads (chords 1, 3) in the Heptachord constitute a figure-ground relational key.

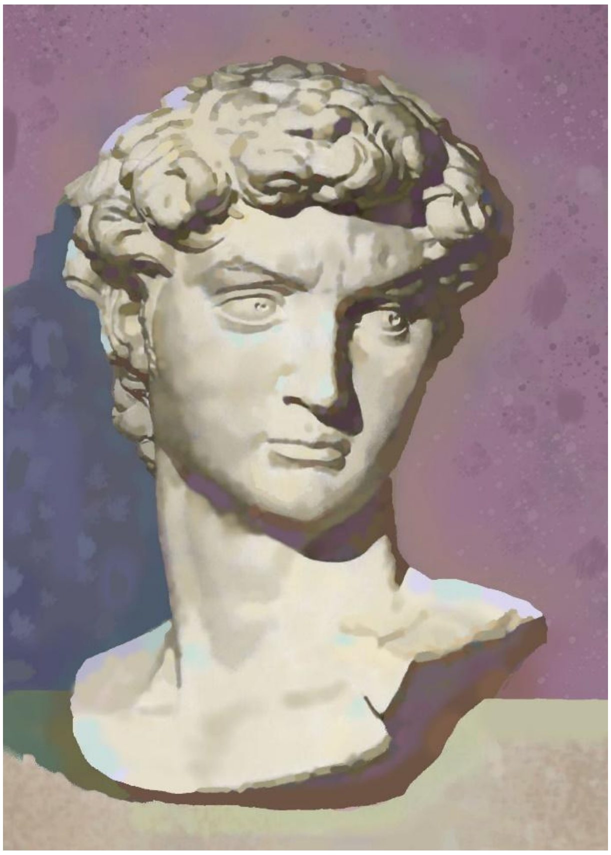

图 5-1.2、七声音阶，增四度大-小调

Figure 5-1.2, Heptatonic scale, Augmented fourth major-minor

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图 5-1.2、七声音阶，增四度大-小调

Figure 5-1.2, Heptatonic scale, Augmented fourth major-minor

5-1.2. Relative Figure-Ground Relationship；相对图底关系

七声音阶中的相对图-底关系由平行大-小调（Parallel Major-Minor）表达。

The relative figure-ground relationship in the heptatonic scale is expressed by Parallel Major-Minor.

平行大小调（Parallel Major-Minor）中的两个调分为：主调（first key）与副调（Second key），主调（First key）的主和弦（Tonic）是纯三和弦，副调（Second key）的主和弦（Tonic）是混合三和弦，两调的主音为小三度关系，拥有相同的导音减七和弦（Leading note diminished 7th）。

The two keys in Parallel Major-Minor are divided into: The first key and the Second key, the Tonic of the First key is a pure triad, the Tonic of the Second key is a mixed triad, and the tonic of the two keys is a minor third. It has the same Leading note diminished 7th.

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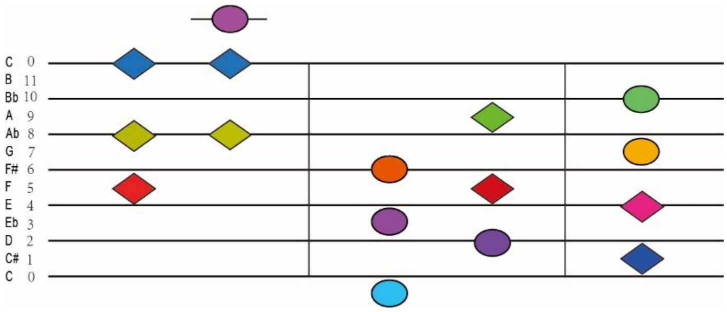

图 5-2.1、上图中，和弦 1、3 为纯三和弦；和弦 2、4 为混合三和弦。（菱形=+音符，圆形=-音符）

In Figure 5-2.1 and above, chords 1 and 3 are pure triads; Chords 2 and 4 are mixed triads. (Diamond =+ note, circle = -note)

下图中的部分图-底关系具有相对性，采用平行大-小调。

Some of the figure-ground relationships in the figure below are relative, using parallel major-minor scale.

图 5-2.2、七声音阶，平行大小调；C 大调，降 e 小调。

Figure 5-2.2, heptachore scale, parallel major and minor keys: C major, E flat minor.

图 5-2.3、七声音阶，平行大小调；A 大调，升 f 小调。

Figure 5-2.2, heptachore scale, parallel major and minor keys: A major, f-sharp minor.

平行大小调具有一些爵士音阶兼容性，参见：9、爵士音阶。

Parallel major-minor keys have some jazz scale compatibility. See also: 9. Jazz Scales

绝对图底关系（figure-ground relation）可以包含相对图底关系（figure-ground relation），共同构成空间系统：纯大调与纯小调构成绝对图底关系，纯大调与其关系小调，纯小调与其关系大调分别在图形-背景上构成相对图-底关系。

The absolute figure-ground relationship can encompass relative figure-ground relationships, collectively forming a spatial system: The pure major and pure minor scales establish an absolute figure-ground relationship, while the pure major and its relative minor, as well as the pure minor and its relative major, respectively form relative figure-ground relationships within the figure-ground framework.

平行大-小调的导音减七（diminished 7th）和弦通常采用省略形式：大调及关系小调中，其导音减七和弦省略负音符；小调及关系大调中，其导音减七和弦省略正音符。

The leading-tone diminished seventh (diminished 7th) chord in parallel major-minor keys typically employs an omitted form: in the major key and its relative minor, the leading-tone diminished seventh chord omits the negative note; in the minor key and its relative major, the leading-tone diminished seventh chord omits the positive note.

5-1.3.dim7 调群

完整的七声音阶空间系统包含两种图底关系，四个调，共享同一导音减七和弦：称之为：同导音减七和弦的调群，或：dim7 调群，和弦系统共有三个 dim7 调群，分别以减七和弦中的音符命名：C 调群，D 调群，E 调群。

The complete heptachord scale space system contains two figure-ground relationships, four keys, sharing the same leading tone diminished seventh chord: it is called: key group with the same leading tone diminished seventh chord, or: dim7 key group. There are three dim7 key groups in the chord system, named after the notes in the diminished seventh chord: C key group, D key group, and E key group.

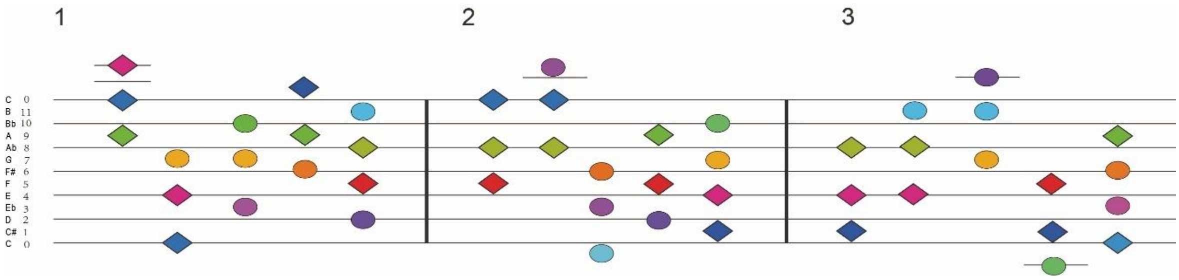

图 13-1.1、C，D，E 调群

Figure 13-2.1, C，D，E keys group

5-2. Same Root Major Minor ； 同根大-小调

根音符相同的大-小三和弦构成同根大-小调（Same Root Major Minor），同根大-小调只用于在同调中产生轮廓线与分面线，不产生图-底关系，其中的大三和弦生成轮廓线（闭弦），小三和弦生成分面线（开弦）。

Major-minor triads with the Same Root note form the Same Root Major Minor, which is only used to produce contours and Facet line in the homology, and does not produce a figrue-ground relationship, where the major triads generate contours (closed strings) and the minor triads generate Facet line (open strings).

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同根大-小调中，主和弦是标准三和弦。

In the same root major-minor key, the main chord is the standard triad.

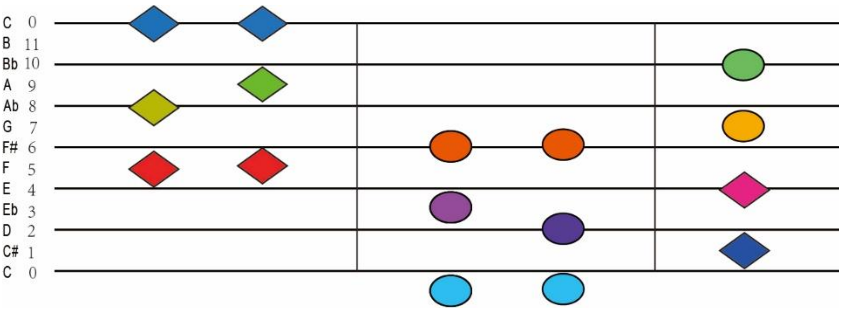

图 9-2.1、同根大-小三和弦，大-小调。

Figure 9-2.1, same root major - minor triad, major - minor.

图 9-2.1、同根音符大-小三和弦，大-小调。

same root major - minor triad, major - minor.

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图 9-2.1、同根音符大-小三和弦，大-小调。

Figure 9-2.1, same root major - minor triad, major - minor.

5-3、Solution ； 解决

七声音阶中，膜和弦具有寻找线和弦倾向，从而达到稳定，这一属性称作解决（solution）倾向。

膜和弦中各音符具有不同的解决倾向，与主和弦根音符为小二度关系的音符具有最强的解决倾向，该音符称作：导音。

在图-底调群中，各调都包含导音，系统具有多个导音，由此产生图-底调群的系统特征。

In the heptatonic scale, the membrane chord has a tendency to seek resolution towards the line chord, thereby achieving stability. This property is known as the resolution tendency.

Within the membrane chord, each note possesses a different resolution tendency. The note that has the strongest resolution tendency, being a minor second interval from the root note of the tonic chord, is called the leading tone.

In the figure-ground tonality group, each key contains a leading tone, and the system has multiple leading tones, which gives rise to the systemic characteristics of the figure-ground tonality group.

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5-4.Omit Chord ；省略和弦

省略减七和弦主要用于产生空间景深变化，无调性兼容性，跨音阶兼容性，常见的省略形式如下：

The omitted diminished seventh chord is mainly used to produce changes in spatial depth of field, atonal compatibility, and inter-scale compatibility. Common forms of omission are as follows:

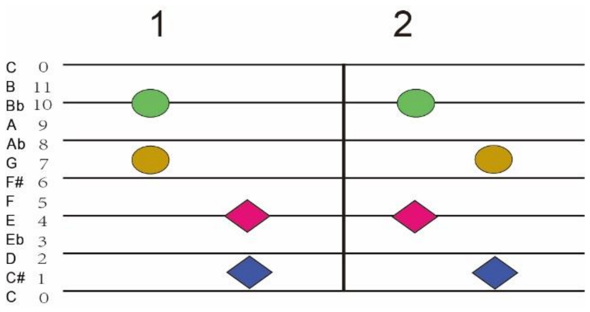

图 5-4，减七和弦的常见省略形式

Figure 5-4, common ellipsis of the diminished 7th

1）省略正或负音符、减七和弦被省略正或负音符后，空间景深会发生改变——正音符具有背景（远）倾向，负音符具有图形（近）倾向。

1) When the positive or negative notes are omitted, the spatial depth of field will change - the positive notes have a background (far) tendency, the negative notes have a graphic (near) tendency.

下图中的减七和弦省略了正音符，空间系统系统表现出向前靠近的倾向。

The diminished 7th in the image below omits positive notes, and the spatial system system shows a tendency to approach forward.

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图 7-3、省略了正音符的减七和弦

2）导音增四度（leading note augmented fourth）是减七和弦，全音阶和弦共同省略形式，减七和弦省略为导音增四度（leading note augmented fourth）音程时，七声音阶-爵士音阶的膜和弦没有区别。

下图中的减七和弦（Diminished 7th）省略为增四度（augmented fourth）音程，七声音阶音阶的确定性消失。

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图 7-4、减七和弦的省略形式：导音增四度（leading note augmented fourth）

Figure 7-4. The omitted form of the Diminished 7th: leading note augmented fourth

3）省略三和弦、当七声音阶中的三和弦省略 1-2 音符后，其和弦语义的确定性降低，可以兼容更多的空间状态。

When 1-2 notes are omitted for triads in the heptachord scale, the certainty of the chord semantics is reduced and more spatial states are compatible.

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6. Heptachord T-D-S Triad；七声音阶 T-D-S 三和弦

前面介绍了七声音阶（heptachord）和弦包（调）的基础结构：主和弦+导音减七和弦，在主和弦（tonic）的 5 度音符上生成属和弦（dominant chord），4 度音符上生成下属和弦（subordinate chord），系统中便有了三个三和弦，称作：T-D-S 三和弦，音乐理论中称为：正三和弦（Primary triad），用于表达调内分离图形与分面的亮度关系。

Earlier we introduced the basic structure of the heptachord chord package (key): tonic chord + diminished seventh chord. The dominant chord is generated on the 5th note of the tonic, and the subordinate chord is generated on the 4th note. There are three triads in the system, called T-D-S triads, which are called primary triads in music theory. They are used to express the brightness relationship between separated figures and facets within the key.

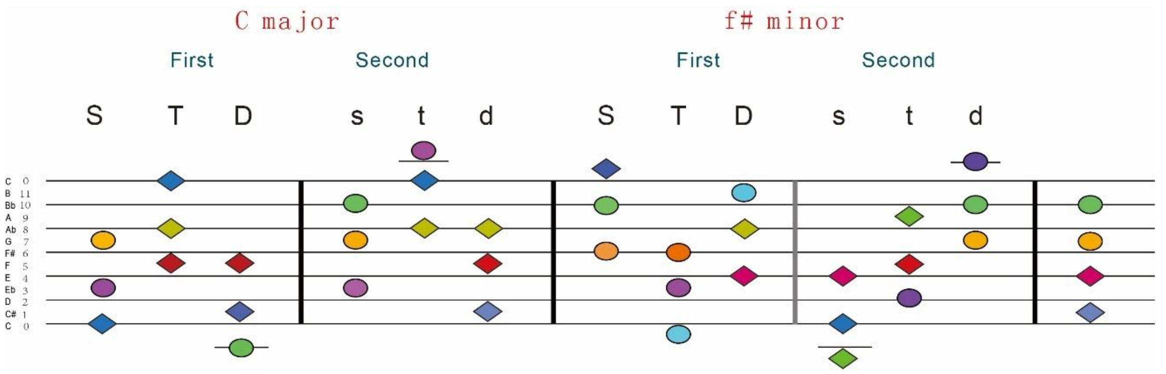

图 6.1、T-D-S 三和弦

Figure 7.1, T-D-S triad

T-D-S 三和弦中，主和弦（Tonic），属和弦，下属和弦具有不同的亮度（亮，暗，中），由此产生 T-D-S 亮度关系，大调，小调具有不同的 T-D-S 亮度关系。

Among the T-D-S triads, the Tonic, the dominant chord, and the subordinate chords have different brightness (bright, dark, medium), resulting in the T-D-S brightness relationship, and the major and minor keys have different T-D-S brightness relationships.

大调的 T-D-S 亮度关系表达不同亮度的相对图形；小调的 T-D-S 亮度关系表达图形上不同亮度的分面。

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The T-D-S luminance relation of major key expresses the relative figure of different luminance. The T-D-S luminance relation in a minor key expresses the different luminance facets of the figure.

属和弦与下属和弦共享主和弦的导音减七和弦。

The dominant and subordinate chords share the leading note diminished seventh chord of the tonic chord.

调-和弦 key-chord	亮度 brightness	空间语义 Spatial semantics
大调主和弦 Major Tonic Chord	中 Middle	系统背景 System Background
大调属和弦 Major dominant chord	暗 Dark	背景相对图形 Background relative figure
大调下属和弦 Major subordinate chord	亮 Bright	背景相对图形 Background relative figure
小调主和弦 Minor Tonic Chord	中 Middle	图形 figure
小调属和弦 Minor dominant chord	亮 Bright	图形亮面 Figure highlight
小调下属和弦 Minor subordinate chord	暗 Dark	图形暗面 Figure dark surface;

图 6-1.T-D-S 三和弦的亮度关系表

Luminance relationship table for T-D-S triad；

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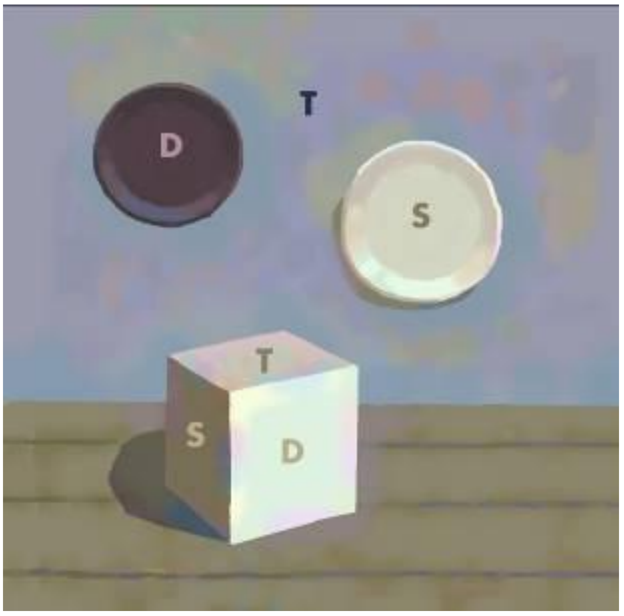

图 6.2、C 大调、#F 小调的 T-D-S 三和弦

Figure 6.2, T-D-S triad in C major, #F minor

C 大调（背景）、暗色挂盘=C 大调属和弦，亮色挂盘=C 大调下属和弦，中间色背景=C 大调主和弦。

C major (background), dark hanging plate = C major dominant chord, bright hanging plate = C major subordinate chord, mid-color background = C major tonic.

纯大调的属和弦与下属和弦可以构成背景上的相对图形。

The dominant and subdominant chords in the pure major scale can form relative figures on the background.

#F 小调（石膏正方性）、正方体上有三个不同亮度的分面，亮面=#F 小调属和弦，暗面=#F 小调下属和弦，中间色=#F 小调主和弦。

#F minor (plaster squareness), there are three facet of different brightness on the cube, bright side = #F minor dominant chord, dark side = #F minor subdominant chord, middle color = #F minor tonic.

背景上的挂盘与墙面产生调内图-底关系：主和弦构成背景，属和弦，下属和弦构成图形。

The hanging plate on the background and the wall produce an figure-ground relationship within the key: the main chord forms the background, the dominant chord, and the subordinate chord form the figure.

同根音符大-小调转换，可以产生不同图形，不同分面的转换，但服从主调的 T-D-S 亮度级关系。

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The same root note major to minor conversion, can produce different figures, different facets of conversion, but obey the main key T-D-S brightness level relationship.

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7. Overlapping Chords；和弦的重叠

三和弦+导音等比和弦（leading note geometric chords）构成和弦包，这两种和弦是基本和弦。不同和弦的重叠，如：三和弦重叠等比和弦，三和弦重叠三和弦，还可产生大量的重叠和弦，重叠和弦可模糊基本和弦的几何语义，生成更多的空间状态。

The triad + leading note geometric chords constitute the chord package, and these two chords are basic chords. The overlap of different chords, such as triads overlapping geometric chords and triads overlapping triads, can also generate a large number of overlapping chords. Overlapping chords can blur the geometric semantics of basic chords and generate more spatial states.

重叠和弦的形式非常多，如：扩展和弦（Extended Chords），挂留和弦（Sus Chords），附加音和弦（Added-Tone Chords）等，本文不逐一介绍，只讨论其一般构成原理。

There are many forms of overlapping chords, such as Extended Chords, Sus Chords, Added-Tone Chords, etc. This article will not introduce them one by one, but only discuss their general composition principles.

三和弦重叠三和弦只出现在七声音阶（heptachord）中，是较简单的形式；三和弦重叠等比和弦（Geometric Chords）则较复杂，可出现在七声音阶与爵士音阶中，下面将重点讨论。

Overlapping triads only appear in the heptachord, which is a simpler form; overlapping triads and geometric chords are more complex and can appear in the heptachord and jazz scales, which will be discussed in detail below.

一个调中只能包含一个等比和弦（geometric chords），每个调都有其唯一的关联等比和弦（Related geometric chords）。

A key can only contain one geometric chord (membrane chord), and each key has its own unique related geometric chords.

T-D-S 三和弦与关联等比和弦（Related geometric chords）的关系包括以下三种情况：

The relationship between the T-D-S triad and related geometric chords includes the following three situations:

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主和弦-关联等比和弦（Related geometric chords），{0，4，7}，{2，5，8，11}，三和弦与关联等比和弦（Related geometric chords）不重叠。

Main chords - Related geometric chords, {0, 4, 7}, {2, 5, 8, 11}, triads and related geometric chords do not overlap.

属和弦-关联等比和弦（Related geometric chords），{7，11，2}，{2，5，8，11}，三和弦的 3-5 音符与关联等比和弦（Related geometric chords）重叠，非根音重叠。

Dominant chords - Related geometric chords, {7, 11, 2}, {2, 5, 8, 11}, the 3-5 notes of the triad overlap with the Related geometric chords, and the non-root notes overlap.

下属和弦-关联等比和弦（Related geometric chords），{5，9，0}，{2，5，8，11}，三和弦根音符与关联等比和弦（Related geometric chords）重叠，根音重叠。

Subdominant chords - Related geometric chords, {5, 9, 0}, {2, 5, 8, 11}, the root notes of the triad overlap with the related geometric chords, and the root notes overlap.

属和弦，下属和弦都是重叠和弦，即：三和弦重叠关联等比和弦（Related geometric chords）。

Dominant chords and subdominant chords are overlapping chords, that is, triads overlapping related geometric chords.

重叠和弦的音符也不限于三个，原理上，三和弦+关联等比和弦（Related geometric chords）包含的音符都是取值范围，如：属和弦也可以是：{7，11，2，5}，下属和弦也可以是：{5，9，0，2}。

The notes of overlapping chords are not limited to three. In principle, the notes contained in triads + related geometric chords are all value ranges, such as: dominant chords can also be: {7, 11, 2, 5}, and subdominant chords can also be: {5, 9, 0, 2}.

属和弦与下属和弦也可以重叠关联等比和弦（Related geometric chords）之外的其它等比和弦，这就包含了暧昧的转调。

The dominant and subdominant chords can also overlap other geometric chords besides related geometric chords, which includes ambiguous modulations.

一些重叠和弦有专用名称，如：属七和弦（Dominant Seventh）、下属七和弦（Subdominant seventh），属九和弦（Dominant ninth），下属九和弦（Subordinate nine chords）等；但重叠和弦的形式很多，难以全部命名，只需要理解其生成原理，在应用中更多依赖直觉。

Some overlapping chords have special names, such as: Dominant Seventh, Subdominant Seventh,

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Dominant Nine, Subordinate Nine chords, etc.; but there are many forms of overlapping chords, and it is difficult to name them all. You only need to understand their generation principles and rely more on intuition in application.

T-D-S 三和弦中，不重叠和弦是主和弦，具有最大的稳定性，重叠和弦的稳定性较差，需要向主和弦解决。

In the T-D-S triad, the non-overlapping chord is the main chord and has the greatest stability, while the overlapping chord has poor stability and needs to be resolved towards the main chord.

七声音阶中的重叠和弦既是线和弦，又是膜和弦，同时又具有 T-D-S 亮度关系。

The overlapping chords in the heptachord scale are both linear chords and membrane chords, and at the same time have a T-D-S brightness relationship.

图 7-2、C 大调中的属七和弦：暗色挂盘，下属七和弦：亮色挂盘，#f 小调中的属七和弦：球体亮面

Figure 7.5. The dominant seventh chord in C major: dark hanging plate, subordinate seventh chord: bright hanging plate, dominant seventh chord in #f minor: bright surface of sphere.

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8. Closure；闭合性

七声音阶中，和弦空间包具有闭合倾向，即：图形轮廓线的闭合倾向，这是减七和弦的内禀属性，包含减七和弦的和弦包都具有闭合倾向。

In the heptachord, the chord space package has a tendency to be closed, that is, the graphic contour line tends to be closed. This is an inherent property of the diminished seventh chord. The chord package containing the diminished seventh chord has a tendency to be closed.

减七和弦是七声音阶特征膜和弦，三个减七和弦各有不同的闭合倾向（Closure tendency），由此产生了七声音阶和弦包的闭合梯度（Closed gradient）与空间秩序。

The diminished seventh chord is the characteristic membrane chord of the heptatonic scale. The three diminished seventh chords have different closure tendencies, which produces the closed gradient and spatial order of the heptatonic scale chord package.

不同闭合倾向的减七和弦包含不同的和弦语义，包括：几何语义，生命语义，自然道德语义；这是和弦语言中最难理解之处。

Diminished seventh chords with different closure tendencies contain different chord semantics, including: geometric semantics, life semantics, and natural moral semantics; this is the most difficult part of the chord language to understand.

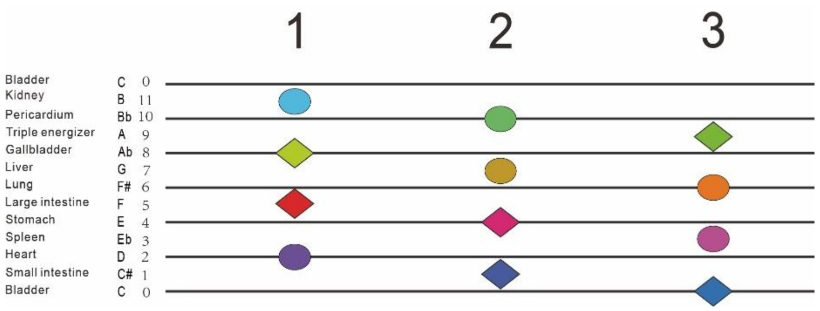

图 8.1、减七和弦表：1、{B,Ab,F,D}-高闭合性，2、{C#,Bb,G,E}-中闭合性，3、{A,F#,Eb,C} -低闭合性

Fig. 8.1 Table of minus seventh chords: 1, {B,Ab,F,D} - high closure, 2, {C#,Bb,G,E} - medium closure, 3, {A,F#,Eb,C} - low closure

也可使用缩写形式：B dim7，C# dim7，A dim7。

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Abbreviations can also be used: B dim7，C# dim7，A dim7。

三和弦+导音减七和弦（Liading note diminished 7th）生成调，一个减七和弦可生成四个调，即：同导音减七和弦调群，调群中的三和弦可继承其导音减七和弦的闭合性。

A triad + ligating note diminished 7th chord generates a key. A diminished seventh chord can generate four keys, namely: a key group with the same ligating note diminished seventh chord. The triads in the key group can inherit the closure of the ligating note diminished seventh chord.

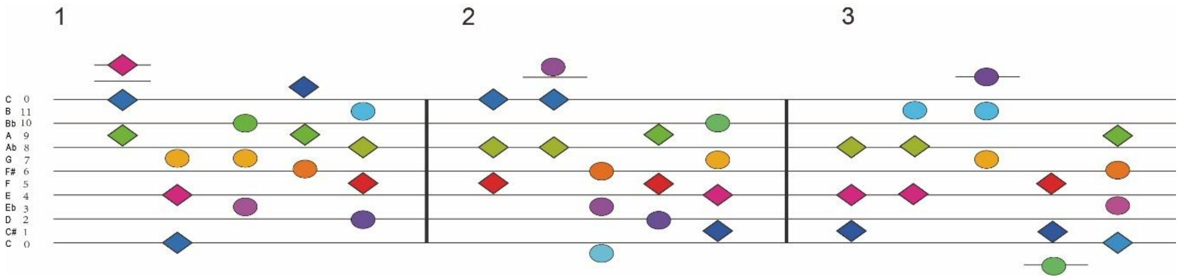

图 8-1.2、导音减七和弦生成的调群：{B,Ab,F,D}-{C#,Bb,G,E}-{A,F#,Eb,C}

Fig. 8-1.2 The key group generated by the leading note diminished 7th: {B,Ab,F,D}-{C#,Bb,G,E}-{A,F#,Eb,C}

8-1.Close level ； 闭合层级

三个减七和弦的数学表达相同（Diminished 7th={0,3,6,9} mod12），但是它们有着不同的闭合状态及空间规则，请看下面例图。

The mathematical expressions of the three diminished 7th are the same (Diminished 7th ={0,3,6,9}), but they have different Close states and space rules. Please see the following examples.

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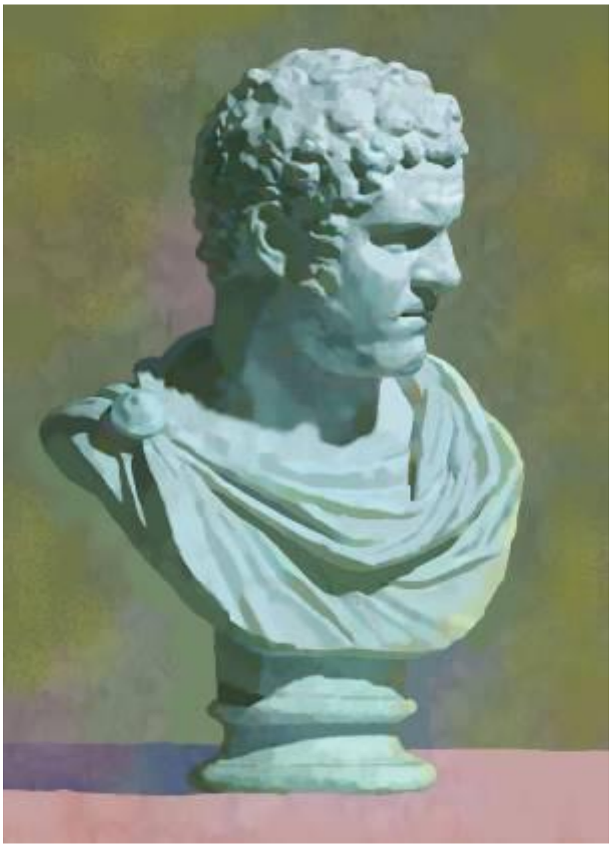

图 8.2：{B,Ab,F,D}，闭合图形

Figure 8-2: {B,Ab,F,D}, closed figure

{B,Ab,F,D}只能表现轮廓弦闭合的图形，我们将这种空间特征称作：闭合性。

{B,Ab,F,D} can only express figures with closed contour. We call this space feature: Close.

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图 8.3、{A,F#,Eb,C} 、开放图形

Figure 8-3. {A,F#,Eb,C} , Open figure

{A,F#,Eb,C} 只能表现轮廓线开放的图形，但是轮廓线仍有闭合倾向，我们将这种空间属性称作：弱闭合性。

{A,F#,Eb,C} can only express figure with open contours, but the contours still have a tendency to close. We call this space attribute: weak Close.

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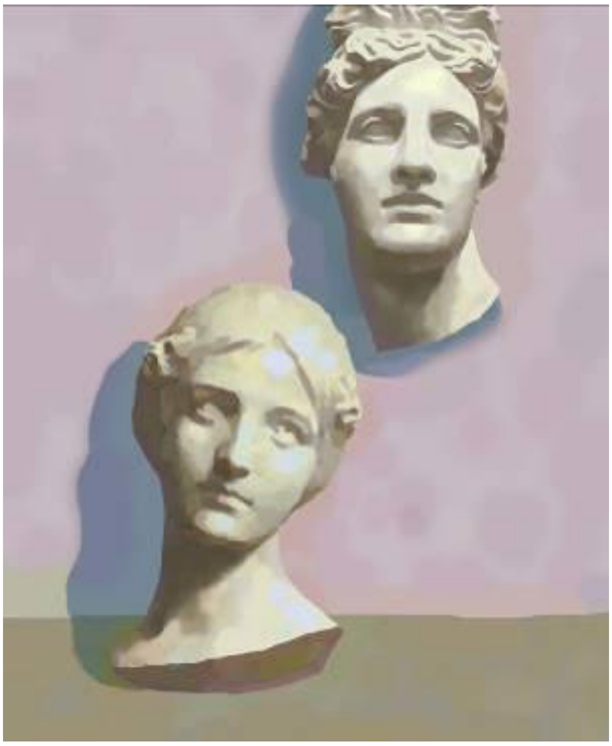

图 8.4、{C#,Bb,G,E}，闭合-开放兼容图形

Figure 8.4, {C#,Bb,G,E}, closed-open compatible figure

{C#,Bb,G,E}可表达轮廓线闭合图形，也可表达轮廓线开放图形，兼容两种闭合状态，我们将这种空间特征称作：次闭合性。

{C#,Bb,G,E} can express contour closed figure and contour open figure, and is compatible with two Close states. We call this spatial feature: sub Close.

综合以上观察，对三个减七和弦的闭合性规则总结如下：

Based on the above observations, the closure rules for the three diminished seventh chords are summarized as follows:

减七和弦 Diminished 7th	闭合倾向-稳定性 Closing tendency-stability
{B,Ab,F,D}， B dim7	高；High
{C#,Bb,G,E}， C# dim7	中；Medium,
{A,F#,Eb,C}， A dim7	低；low

● 三个减七和弦具有不同的闭合倾向，由此形成闭合倾向-稳定性层级，它在和弦空间中具有重

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要意义。

- The three diminished seventh chords have different closing tendencies, thus forming a closing tendency-stability hierarchy, which is of great significance in the chord space.
- 主-次秩序：空间系统同时存在三个减七和弦时，会依照减七和弦的闭合倾向-稳定性产生主-次秩序，高-中-低对应：主-次-最次，形成自然解决倾向：由低向高解决。
- Major-minor order: When there are three diminished seventh chords in a spatial system at the same time, a major-minor order will be generated according to the closing tendency-stability of the diminished seventh chord, with high-middle-low corresponding to: major-minor-least, forming a natural solution tendency: from low to high.
- 这一法则可投射到以其为导音膜和弦的三和弦，三和弦可以继承其导音减七和弦的闭合倾向，即使在其导音减七和弦缺位的状态下。
- This rule can be projected to the triad with it as the leading membrane chord. The triad can inherit the closing tendency of its leading tone diminished seventh chord even when its leading tone diminished seventh chord is absent.
- 在爵士音阶，无调性状态下，以上秩序失效，主次秩序可以发生逆转。
- In the jazz scale and atonal state, the above order becomes invalid and the primary and secondary order can be reversed.

8-2.The Close level of T-D-S ；T-D-S 的闭合级别

T-D-S 三和弦也包含闭合状态：主和弦（Tonic），属和弦（Dominant），下属和弦（Sub-dominant），都存在闭合状态差异，这种差异来自三和弦所属的导音减七和弦调群。

T-D-S triads also contain Close states: Tonic, Dominant, and Sub-dominant, all have Close state differences, which come from the leading diminished seventh chord group to which the triad belongs.

T-D-S 三和弦所在的和弦包中，闭合性较高的图形处于主体地位，闭合性较低的图形处于从属地位。

There are differences in Close between T-D-S triads, the figure with higher Close is in the dominant position, and the figure with lower Close is in the subordinate position.

T-D-S 三和弦的闭合状态差异，以及由此产生的主体-从属关系与恒星，行星的秩序相关。

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Close state differences of the T-D-S triad, and the resulting subject-subordination relationship is related to the order of stars, planets.

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9. Jazz Scale；爵士音阶

爵士音阶是弱调性系统，它屏蔽了七声音阶的部分和弦语义，并具有无调性兼容性，常见于一些现代音乐形式。

The jazz scale is a weak tonality system, which shields part of the chord semantics of the heptachord scale and has atonal compatibility. It is common in some modern forms of music.

爵士音阶的特征和弦是全音阶和弦（Diatonic chord），其中包含正-负两个增三和弦（Augmented triad），三和弦+全音阶和弦构成爵士音阶和弦包，三和弦+增三和弦构成爵士五声音阶和弦包。

The characteristic chords of the jazz scale are the Diatonic chord, which contains two Augmented triads, positive and negative; triads + diatonic chords form the jazz scale chord package; triads + augmented triads form the Jazz pentatonic chord package.

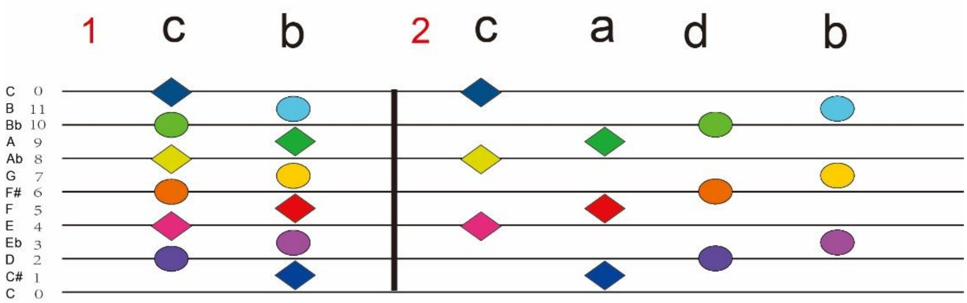

图 9-1、爵士音阶特征和弦，1、全音阶和弦（Diatonic chord），2、增三和弦（Augmented triad）（◆=正音符，●=负音符，色彩=色荷）

Figure 9-1. Characteristic chords of the jazz Scale, 1. Diatonic chord, 2. Augmented triad (◆=+note, ●=-note)

爵士音阶的主要特征如下：

The main features of the jazz Scale are as follows:

- 爵士音阶由主和弦+导音等比和弦（全音阶和弦，增三和弦）构成，与七声音阶（heptachord）不同的是：爵士音阶的三和弦与导音等比和弦有重叠音符，所有三和弦都是重叠和弦，并且允许主七和弦，主九和弦，主十一和弦等和弦形式，这是其独有特征。
- The jazz scale is composed of the tonic chord + the leading tone Geometric Chord (diatonic chord, augmented triad). Unlike the heptatonic scale (heptachord), the triads of the jazz scale have overlapping notes with the leading tone Geometric Chords. All triads are overlapping

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chords, and chord forms such as the tonic seventh chord, the tonic ninth chord, and the tonic eleventh chord are allowed. This is its unique feature.

- 爵士音阶中的等比和弦（Geometric Chord）可向无彩色（neutral colors）解决，构成无调性解决。
- Geometric chords in the jazz scale can be resolved towards neutral colors, constituting atonal solutions.
- 全音阶和弦，增三和弦没收闭合倾向，可以表达任意闭合状态的图形。（参见：8、闭合性）
- Diatonic chords and augmented triads do not contain Close tendencies and can express graphics of any Close state. (See: 8. Close)
- 爵士音阶常在多层调群（Multi-Layer Key Group）中充当从属调（参见：13、多层调群）；七声音阶调群中的爵士音阶可以保留闭合语义，这来自三和弦隐含的导音减七和弦。
- The jazz Scale often acts as a sub-key in the Multi-Layer Key Group (see: 13, Multi-Layer Key Group); the jazz Scale in the heptatonic key group can retain the Close semantics, which comes from Triads implicitly leading note diminished 7th chords.

9-1. Figure-Ground Relation ；图-底关系

图-底关系（figure-ground relation）由图形与背景构成，是空间知觉的基本模式，图-底关系包括：绝对图-底关系与相对图-底关系，构成形式分别为：大-小调图底关系与调内图底关系。

The figure-ground relation is composed of the figure and the background and is the basic model of spatial perception. The figure-ground relation includes: the absolute figure-ground relation and the relative figure-ground relation, and their constituent forms are respectively: the figure-ground relation of the major and minor keys and the figure-ground relation within the key.

爵士音阶与七声音阶的图-底关系构成既有联系，也有区别，参阅：5-1. Figure-Ground Relation 图-底关系。

The figure-ground relationship between the jazz scale and the heptachord scale is both related and different, see: 5-1. Figure-Ground Relation.

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9-1.1. Absolute Figure-Ground Relation ；绝对图底关系

爵士音阶中的绝对图-底关系（figure-ground relation）增四度大-小调群构成——两调的主音为增四度（Augmented fourth）关系，共享同一个导音全音阶和弦（Leading note diatonic Chords），大调表达绝对背景，小调表达绝对图形。

The absolute figure-ground relation in the jazz scale is composed of the augmented fourth major-minor group - the tonics of the two keys are in an augmented fourth relationship, sharing the same leading note diatonic chords, the major key expresses the absolute background, and the minor key expresses the absolute figure.

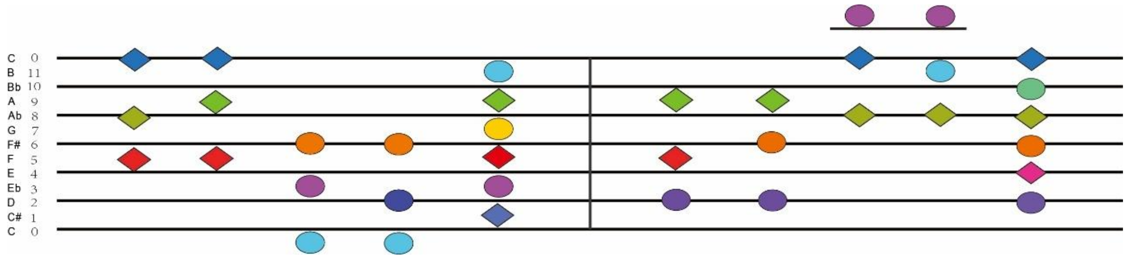

图 9-1.1、爵士音阶中的增四度大-小调群

Figure 9-1.1. Augmented fourth major-minor group in jazz scales

绝对图-底关系（figure-ground relation）生成的必要条件是：其中的图形轮廓线具有封闭倾向。

The necessary condition for generating the absolute figure-ground relation is that the contour lines of the figures therein have a tendency to be closed.

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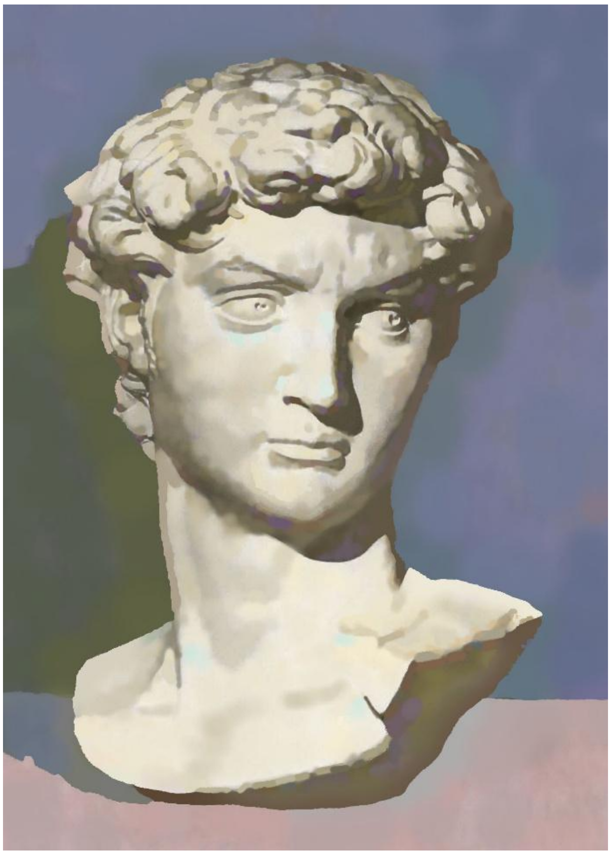

图 9-1.3、爵士音阶 C 大调，f#小调，绝对图-底关系。

Figure 9-1.3, jazz scale C major, f# minor, absolute figure-ground relationship.

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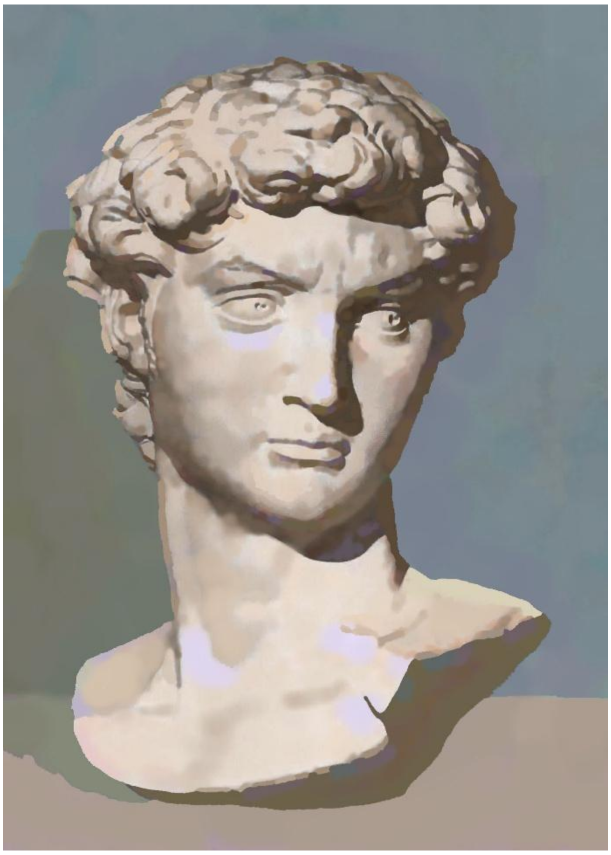

图 9-1.4、爵士音阶 C#大调，g 小调，绝对图-底关系。

Figure 9-1.4, Jazz scale C# major, g minor, absolute figure-ground relationship.

9-1.2. Relative Figure-Ground Relationship；相对图底关系

在七声音阶中，由平行大-小调生成相对图底关系。（参见：5-1.2.相对图底关系），但是在爵士音阶中没有平行大-小调， 相对图-底关系由绝对图-底关系的变化产生。

In the seven-tone scale, the relative figure-ground relationship is generated by the parallel major-minor relationship. (See: 5-1.2. Relative figure-ground relationship), but in the jazz scale, there is no parallel major-minor relationship, and the relative figure-ground relationship is generated by the change of the absolute figure-ground relationship.

将构成绝对图-底关系的增四度大-小调之一或全部主和弦转为重叠和弦形式，削弱绝对图-底关系，可表达相对图底关系。

By converting one or all of the main chords of the augmented fourth major-minor key that constitute the absolute figure-ground relationship into an overlapping chord form, the absolute figure-ground relationship can be weakened and a relative figure-ground relationship can be expressed.

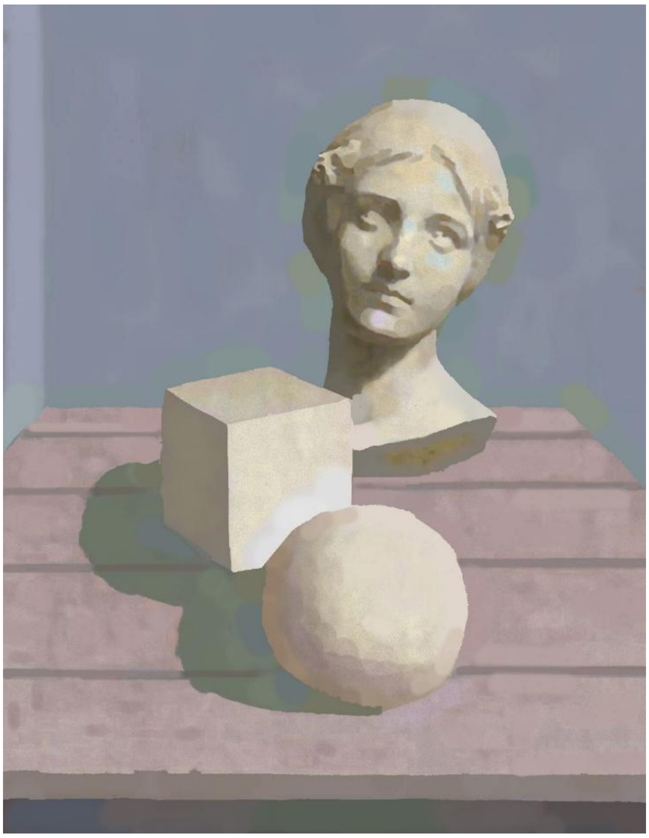

图 9-1.5、爵士音阶 C 大调，升 f 小调，相对图底关系

Figure 9-1.5, Jazz scale C major, F sharp minor, relative figure-ground relationship

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图 9-1.6、爵士音阶 C 大调，升 f 小调，相对图底关系

Figure 9-1.6, Jazz scale C major, F sharp minor, relative figure-ground relationship

相对图-底关系通常包含正-负大-小调，分别表达相对背景与相对图形；但在图-底关系含混，模糊的系统中，也可以只用一个调，借助正-负音符或正-负增三和弦表达图底关系。

The relative figure-ground relationship usually includes positive-negative major-minor keys, which express the relative background and relative figure respectively; but in a system where the figure-ground relationship is ambiguous and vague, it is also possible to use only one key to express the figure-ground relationship with the help of positive-negative notes or positive-negative augmented triads.

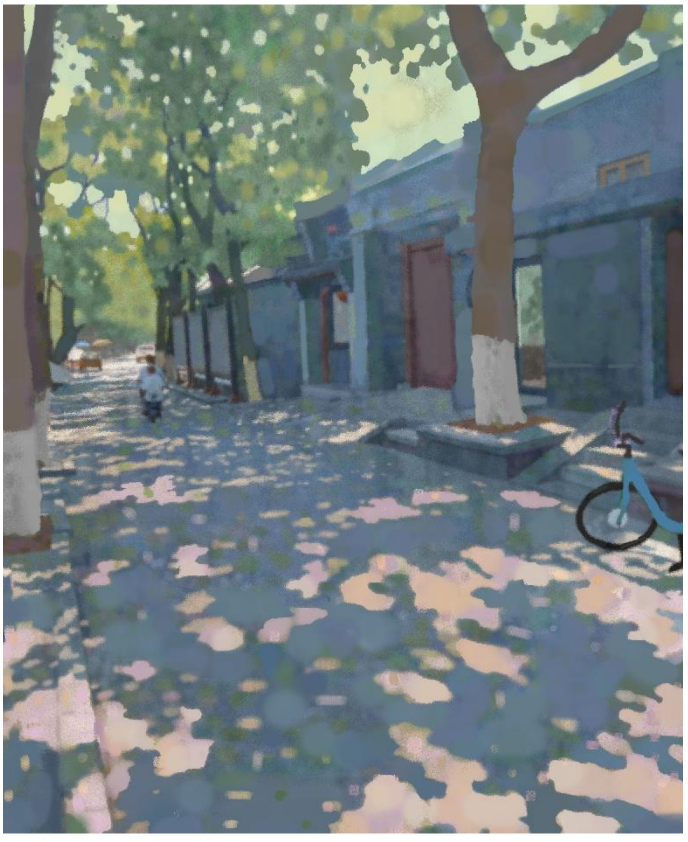

图 9-1.7,爵士音阶 C#大调，相对图底关系

Figure 9-1.7, Jazz scale C# major,relative figure-ground relationship

9-1.3、Overlapping Chord；重叠和弦

爵士音阶的调结构为：三和弦+导音等比和弦（Leading note geometric chords）——全音阶和弦。

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The key structure of the jazz scale is: triad + leading note geometric chords - diatonic chords.

在爵士音阶中，三和弦（线和弦）与导音等比和弦（膜和弦）有重叠音符。

In jazz scales, triads (line chords) and leading-tone geometric chords (membrane chords) have overlapping notes.

大调（Major）：{0，4，7}，{1，3，5，7，9，11}

小调（Minor）：{6，9，1}，{1，3，5，7，9，11}

重叠和弦的音符也不限于三个，原理上，三和弦+关联等比和弦（Related geometric chords）包含的音符都是取值范围。

The notes of overlapping chords are not limited to three. In principle, the notes contained in triads + related geometric chords are all within the value range.

爵士音阶的重叠和弦中包含了半音程，加强了无调性兼容性与解决倾向，是常用的无调性结构，如：如：主七和弦，主九和弦，主十一和弦，主十三和弦等。

The overlapping chords of the jazz scale contain semitones, which enhance the atonal compatibility and resolution tendency. It is a commonly used atonal structure, such as: the tonic seventh chord, the tonic ninth chord, the tonic eleventh chord, the tonic thirteenth chord, etc.

爵士音阶中的重叠和弦在后面章节（10.无调性）还有专门的介绍。

The overlapping chords in jazz scales are specially introduced in the following chapters (10. Atonality).

9-2、Same Root Major Minor ； 同根大-小调

根音符相同的大-小三和弦构成同根大-小调（Same Root Major Minor），同根大-小调只用于在同调中产生轮廓线与分面线，不产生图-底关系，其中的大三和弦生成轮廓线（闭弦），小三和弦生成分面线（开弦）。

Major-minor triads with the Same Root note form the Same Root Major Minor, which is only used to produce contours and Facet line in the homology, and does not produce a figrue-ground relationship, where the major triads generate contours (closed strings) and the minor triads generate Facet line (open strings).

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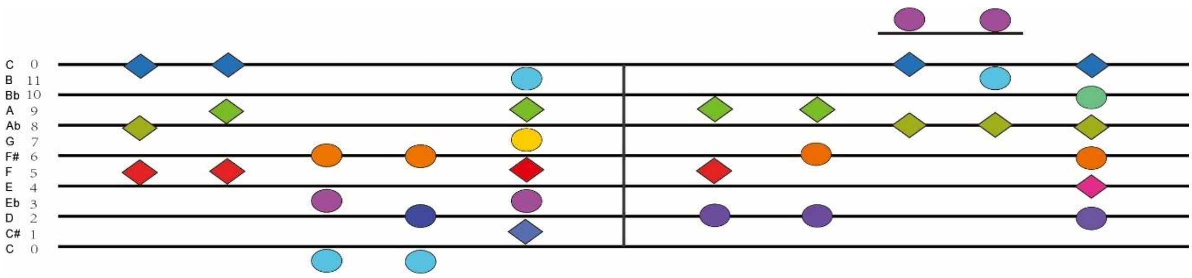

图 9-2.1、同根大-小三和弦，大-小调。

Figure 9-2.1, same root major - minor triad, major - minor.

同根大-小调中，主和弦是标准三和弦。

In the same root major-minor key, the main chord is the standard triad.

图 9-2.2.、同根大-小三和弦，大-小调。

Figure 9-2.2, same root major - minor triad, major - minor.

9-3. Augmented Triad ； 增三和弦

增三和弦（Augmented Triad）有两种主要用途：作为全音阶和弦的省略形式时，生成图底关系；单独构成空间系统时，可表现空间系统的整体景深。

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The augmented triad has two main uses: when used as an abbreviated form of a diatonic chord, it creates a figure-ground relationship; when used alone as a spatial system, it can express the overall depth of the spatial system.

9-3.1. 表达图底关系

全音阶和弦的包含正-负增三和弦，主要用于生成图-底关系（figure-ground relation）。

The diatonic chord scale consists of positive and negative augmented triads, which are mainly used to generate figure-ground relations.

增三和弦（Augmented triad）的三个音符具有相同的正-负属性：

正增三和弦具有向后的倾向（远）。

负增三和弦具有向前的倾向（近）。

可产生空间系统的景深（见图：9-1）。

三和弦+导音增三和弦可构成调，组织原则是：

大三和弦+正增三和弦，构成大调。

小三和弦+负增三和弦，构成小调。

The three notes of an augmented triad share the same positive or negative attribute:

A positive augmented triad tends to recede (appear farther away).

A negative augmented triad tends to advance (appear closer).

This property contributes to the depth perception within a spatial system (see Figure 9-1).

A triad + leading-tone augmented triad can form a key. The organizational principle is as follows:

A major triad + positive augmented triad forms a major key.

A minor triad + negative augmented triad forms a minor key.

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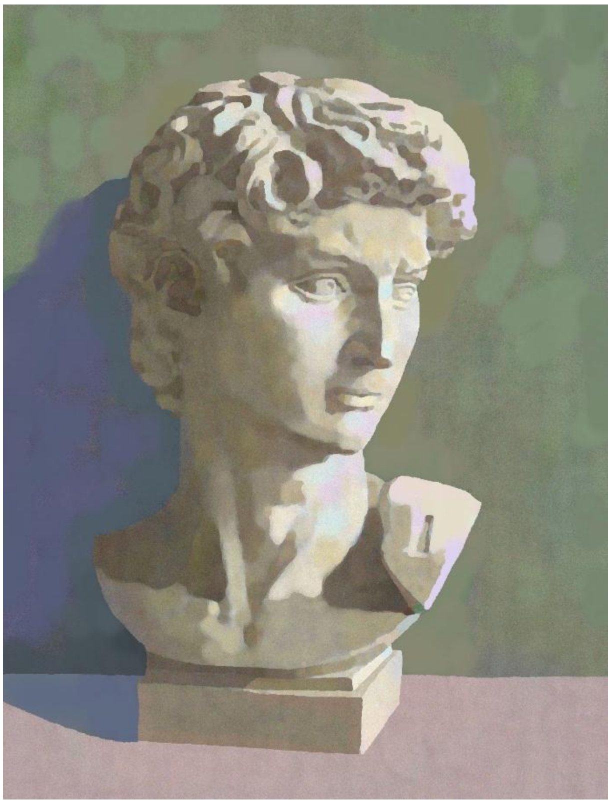

图 9-3.1.增三和弦

Figure 9-3.1. Augmented triad

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图 9-3.2 增三和弦

Figure 9-3.2. Augmented triad

9-3.2.独立增三和弦

增三和弦单独构成空间系统时，具有全局的景深属性。

When the augmented triad constitutes a spatial system alone, it has a global depth of field property.

图 9-3.3.增三和弦

Figure 9-3.3. Augmented triad

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图 9-3.4.增三和弦

Figure 9-3.4. Augmented triad

9-4、Solution ； 解决

爵士音阶中，膜和弦具有寻找线和弦倾向，从而达到稳定，这一属性称作解决（solution）倾向。

In the jazz scale, membrane chords have a tendency to find line chords and thus achieve stability, a property called solution tendency.

在爵士音阶的膜和弦中，导音具有最强的解决倾向，在调的构成中有着重要作用。

Among the membrane chords of the jazz scale, the leading tone has the strongest tendency to resolve and plays an important role in the construction of the key.

在爵士音阶的导音全音阶和弦中，有两个音符与主和弦根音符为小二度关系，因此，爵士音阶有两个导音，两个导音存在主-次关系，大调的主导音为正音符，小调的主导音为负音符。

In the leading tone diatonic chords of the jazz scale, there are two notes that are in a minor second relationship with the root note of the main chord. Therefore, the jazz scale has two leading tones, and the two leading tones have a major-minor relationship. The dominant tone of the major key

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is a positive note, and the dominant tone of the minor key is a negative note.

主-次秩序：在爵士音阶空间系统中，图形按相对尺度大小构成主-次秩序；空间尺度较大的为主图形，是视觉注意的中心，较小的为从属图形。

Primary-secondary order: In the jazz scale space system, graphics are organized into primary-secondary order according to their relative sizes; figure with larger spatial scales are primary graphics, which are the center of visual attention, and figure with smaller scales are subordinate figure.

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10. Atonal；无调性

无调性是指模糊，消除时空系统中的和弦-调性的作用。

Atonal refers to blurring and eliminating the role of chord-tonality in the spatio-temporal system.

在无彩色与单一色中，和弦与调性会完全消除，两者是绝对的无调性结构。

In achromatic and monochromatic systems, chords and tonality are completely eliminated, and both are absolute atonal structures.

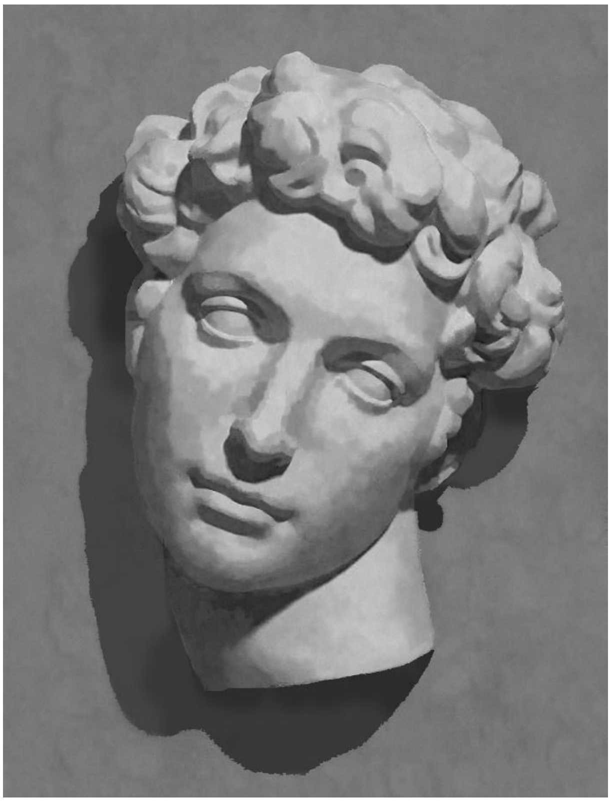

图 10-1，无彩色

Figure 10-1, Neutral colors

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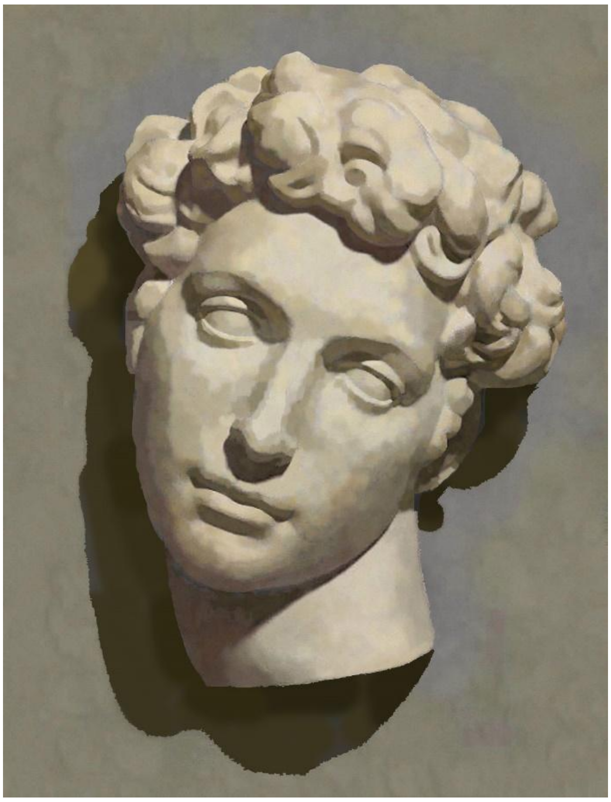

图 10-2、单一色

Figure 10-2. Monochrome

此外，还有一些频谱分布结构具有无调性特征。

In addition, there are some spectral distribution structures that have atonal characteristics.

半音阶：半音阶具有无彩色兼容性与解决倾向。

频域收窄：色彩频域收窄也可以削弱，消除和弦-调性。

上面两个条件是和弦-调性的阻断机制。

Chromatic scale: Chromatic scales have achromatic compatibility and resolution tendencies.

Narrowing of the frequency domain: Narrowing of the color frequency domain can also weaken and eliminate chord-tonality.

The above two conditions are the blocking mechanisms of chord-tonality.

全音阶和弦（爵士特征和弦）具有轻度无彩色兼容性与解决倾向，在插入半音后，无调性倾向被加强，如：重叠和弦（主七和弦，主九和弦，主 11 和弦，主 13 和弦等），其极端形式是半音阶——爵士音阶是常见的无调性组织框架。

Whole tone chords (jazz characteristic chords) have a mild achromatic compatibility and resolution

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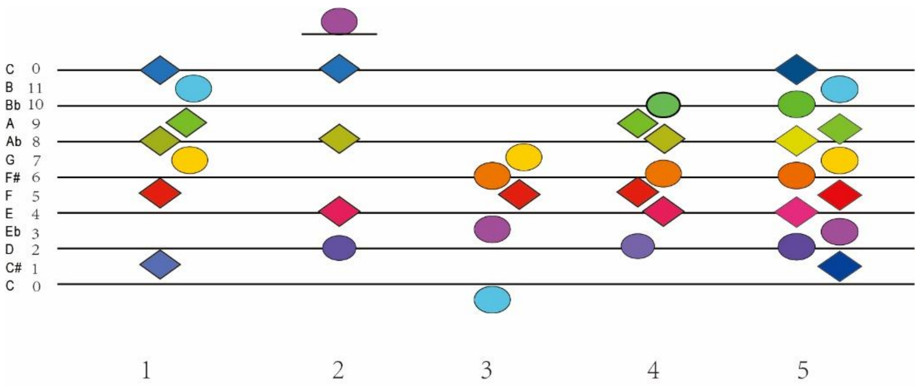
tendency. After the semitone is inserted, the atonality tendency is strengthened, such as: reduplicated chords (major seventh chord, major ninth chord, major 11th chord, major 13th chord, etc.), and their extreme form is the chromatic scale - the jazz scale is a common atonality organizational framework.



相对无调性结构，1，C 13 和弦，2，Eb 9 和弦，3，f# 9 和弦，4，A 13 和弦，5，半音阶

Relatively atonal structures, 1, C 13 chords, 2, Eb 9 chords, 3, f# 9 chords, 4, A 13 chords, 5, chromatic scales

半音阶具有无彩色解决倾向，并依赖无彩色，如频域收窄，则产生单一色倾向。

The chromatic scale has a tendency to resolve achromatic colors and relies on achromatic colors. If the frequency domain is narrowed, a single color tendency will be produced.

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图 10-3.半音阶

Figure 10-3. Chromatic scale

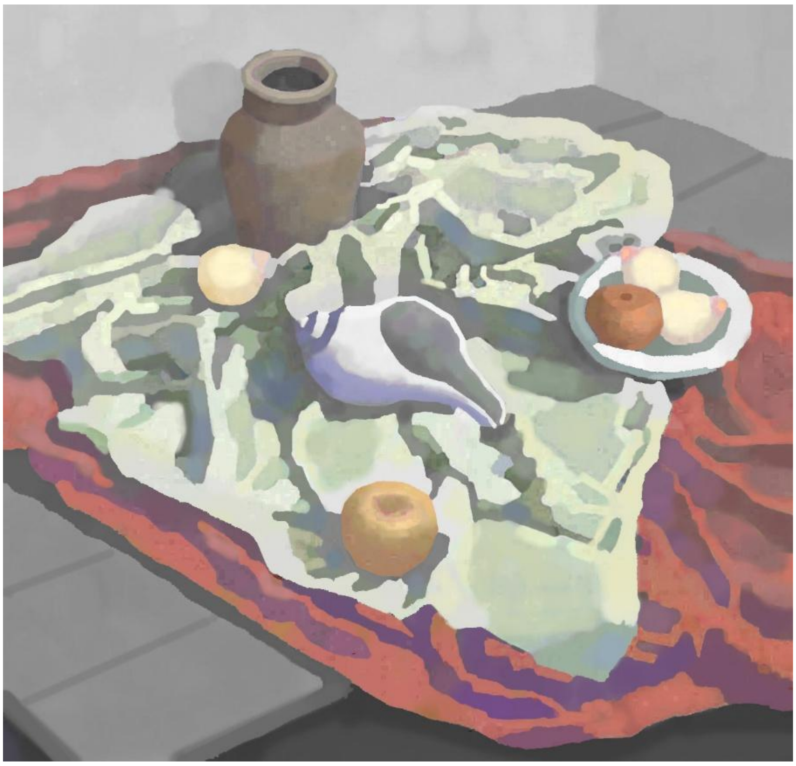

图 10-4.半音阶

Figure 10-4. Chromatic scale

爵士音阶中的重叠和弦包含 1-4 个半音程，具有无彩色解决倾向与兼容性。参见：9-4、重叠和弦

The overlapping chords in jazz scales contain 1 to 4 semitones and have a tendency for achromatic resolution and compatibility. See: 9-4, Overlapping Chords

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图 10-5. 爵士 A9 和弦

Figure 10-5. jazz C9 chord

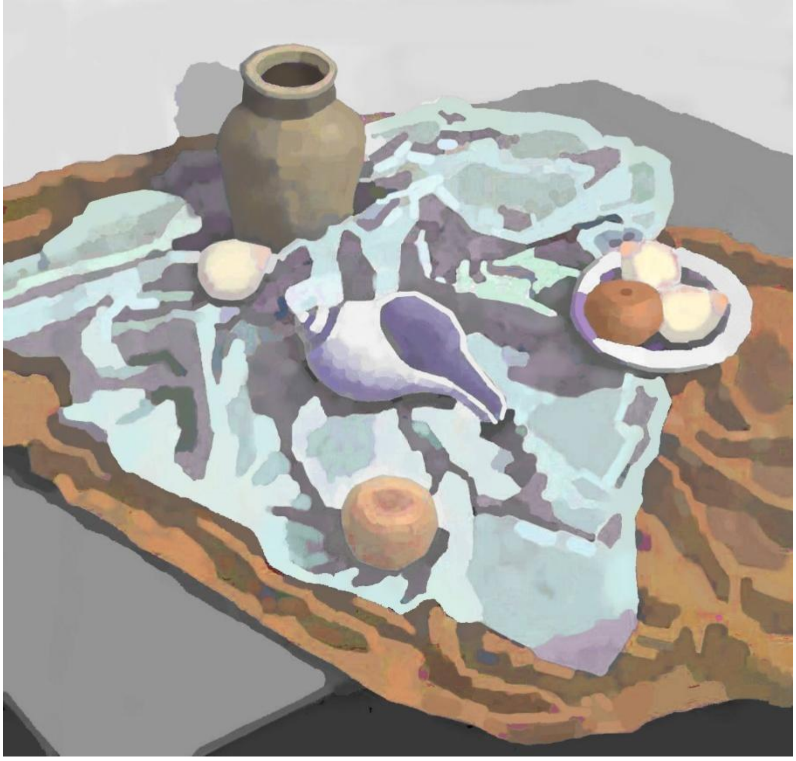

图 10-5. 爵士 f# 9 和弦

Figure 10-5. jazz f# 9 chord

图 10-5. 爵士 C 9 和弦

Figure 10-5. jazz C 9 chord

非和弦（无调性）系统是和弦（调性）系统的反过程，它屏蔽了和弦系统的所有编码，语义逻辑，主要由亮度变化来产生视觉空间。

The non-chord (atonal) system is the inverse process of the chord (tonal) system, which blocks out all the coding, semantic logic of the chord system, and produces visual space mainly by brightness changes.

和弦（调性）与非和弦（无调性）具有不同的语义逻辑，是不同的宇宙观。

Chord (tonality) and non-chord (atonality) have different semantic logic and different cosmological views.

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11.Melody Of Color；色彩旋律

前面的讨论和弦语句是以“和弦”为单位，本章讨论的旋律语句则以音符（色）为单位，两者既有联系，又有相对独立性。

The chord statement discussed above is in the unit of "chord", while the melodic statement discussed in this chapter is in the unit of note (color), which are both related and relatively independent.

旋律在音乐中表现为非同时组织，而在和弦绘画中则表现为同时性组织。

Melody is not synchronic organization in music, but synchronic organization in chord painting.

色彩旋律发生在一个空间包之内，不同空间包则视作不同的旋律段落。

Color melody occurs within a space packet, and different space packets are treated as different melodic paragraphs.

按旋律的语义作用，色彩旋律可分为三种形式：M-L 旋律，分面旋律，点旋律。

According to the semantic function of melody, color melody can be divided into three forms: M-L melody, faceted melody and dot melody.

11-1.M-L Melody；M-L 旋律

M-L 旋律是膜和弦+线和弦语句的省略形式，语句中的和弦被省略为音符，产生 M-L 旋律进行（melodic progression）。

The M-L melody is an abbreviated form of the Membrane chords + line chord sentence. The chords in the sentence are omitted as notes, resulting in an M-L melody progression.

M-L 旋律发生在膜和弦与线和弦之间，膜和弦具有寻找线和弦形成空间包的倾向，这种倾向称为：膜和弦解决（solve）。

The M-L melody occurs between the Membrane chords and the line chord. The Membrane chords has a tendency to find the line chord to form a space packet. This tendency is called: Membrane chords solve.

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在七声音阶（Heptachord）中，减七和弦（Diminished 7th）向主和弦解决（solve）。

In the Heptachord, the Diminished 7th is resolved to the tonic.

在爵士音阶系统中，全音阶和弦向主和弦解决。

In the Weak Tonal System, the Diatonic is resolved toward the tonic.

主和弦为大三和弦（闭和弦）时，膜和弦向着轮廓线解决。

When the tonic is a major triad (closed chord), the Membrane chords is resolved toward the contour line.

主和弦为小三和弦（开和弦）时，膜和弦向着分面线解决。

When the tonic is a minor triad (open chord), the Membrane chords is resolved toward the Facet line.

和弦解决语句中，和弦省略为音符（色）时，表现为色彩旋律，产生色相知觉。

In the chord resolved sentence, when the chord is omitted as a note (color), it is expressed as a color melody and produces a sense of hue.

膜和弦各音符（色）都可以向线和弦各音符（色）解决，但以下形式比较常见：

Each note (color) of the Membrane chords can be solved by the note (color) of the line chord, but the following forms are more common:

导音（leading note）-主音（key-note）语句：导音（leading note）是与主音（key-note）相邻的膜和弦音符（色），具有最强的解决（solve）倾向。

Leading note-key-note sentence: Leading note is the Membrane chords note (color) adjacent to the key-note, which has the strongest tendency to solve.

与主和弦的三度，五度相邻的膜和弦音符（色），可向着主和弦三度，五度解决，见下图：

The Membrane chords note (color) adjacent to the third and fifth degrees of the tonic can be solve toward the third and fifth of the tonic, as shown in the figure below:

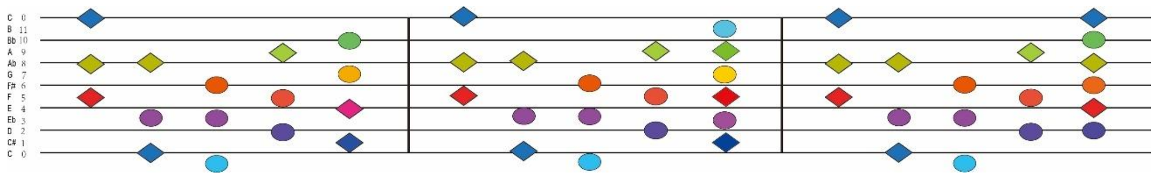

图 11.1、M-L 解决语句

Figure 11.1, M-L resolved statement

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图 11.2、系统背景上，减七和弦（Diminished 7th）的两个色分别向主和弦上的根音（root-note）、五度（fifth）作 M-L 解决。

Figure 11.2. On the background of the system, the two colors of Diminished 7th are resolved by M-L to the root-note and fifth of the tonic.

11-2.Facet Melody；分面旋律

分面旋律是最常见的色彩旋律进行（melodic progression），用于在空间包上产生不同亮度的分面，不同亮度的分面由不同音符（色）构成，称为：分面旋律。

Faceted melody is the most common color melody progression (melodic progression), which is used to produce facet of different brightness on the space packet. The faceg of different brightness are composed of different notes (colors), called: faceted melody.

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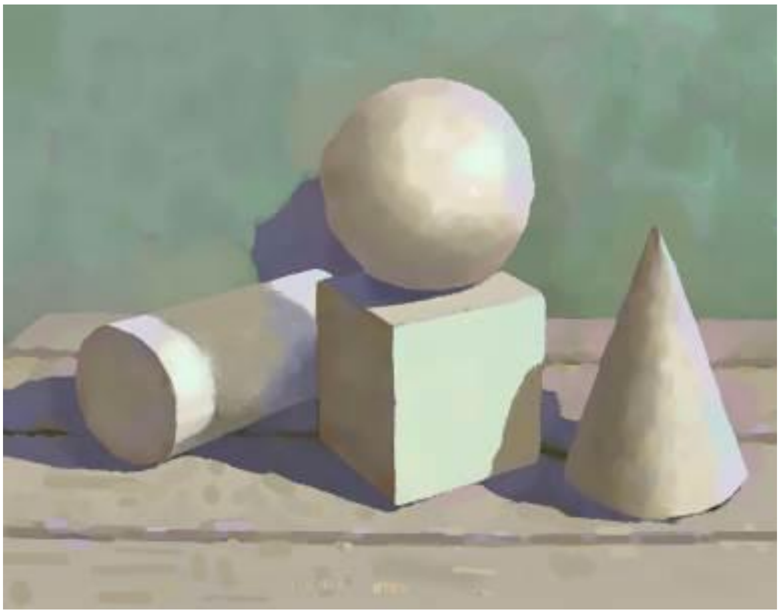

图 11.3、分面旋律表达的明-暗分面

Figure 11.3: Light-dark Facet line expressed by faceted melody

分面旋律只适用膜和弦，大调的分面旋律只发生在一个膜和弦内，小调的分面旋律可发生在多个膜和弦之间。

The faceted melody only applies to the Membrane chords, the faceted melody of the major key only occurs in one Membrane chords, and the faceted melody of the minor key can occur between multiple Membrane chords.

正序旋律与反序旋律：在平均律（Equal Temperament）色环中，红色（E）的能量级最低，紫红色（bE）的能量级最高，其它色的频率高-低是相对的，如：绿色相对黄色，绿色频率更高。

Positive order melody and reverse order melody: In the Equal Temperament color circle, red (E) has the lowest energy level, magenta (bE) has the highest energy level, and the high-low frequencies of other colors are relative, such as : Green is relatively yellow, and green has a higher frequency.

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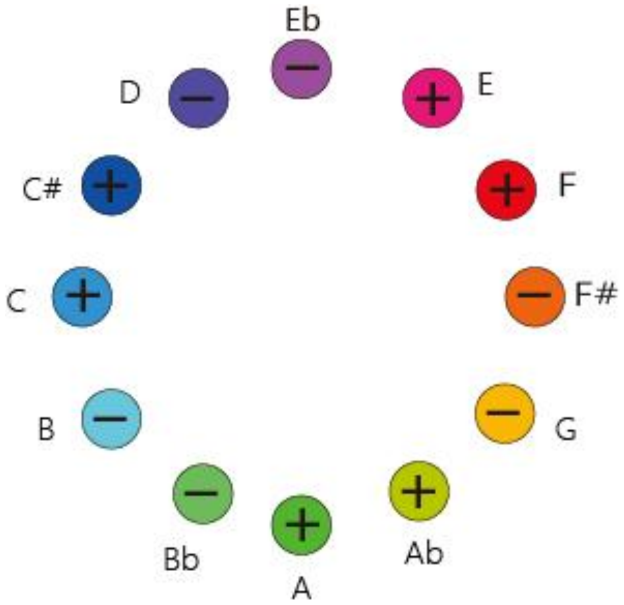

图 11.4、平均律色环

Figure 11.4, equal temperament color circle

分面旋律分为：正序旋律与反序旋律。

Faceted melody is divided into: Positive order melody and reverse order melody.

正序旋律：相对高频色在亮部，相对低频色在暗部。

Positive order melody: relatively high frequency colors are in the bright part, and relatively low frequency colors are in the dark part.

反序旋律：相对高频色在暗部，相对低频色在亮部。

Reverse melody: relatively high frequency colors are in the dark part, and relatively low frequency colors are in the bright part.

正序旋律具有图形（近）倾向，反序旋律具有背景（远）倾向，这一特征可表现在调性，无调性体系中。

The positive sequence melody has a figure (near) tendency, and the reverse sequence melody has a background (far) tendency, which can be manifested in the tonality and atonal system.

调性系统中，正序旋律通常出现在构成图形的小调上，反序进行旋律通常出现在构成背景的大调上，也出现可在同一个调中，表现相对图-底关系，见下图：

In the tonal system, the Positive order melody usually appears on the minor key that constitutes the figure, and the reverse order melody usually appears on the major key that constitutes the background. It can also appear in the same key, showing the relative figure-ground relation, as shown in the figure below.

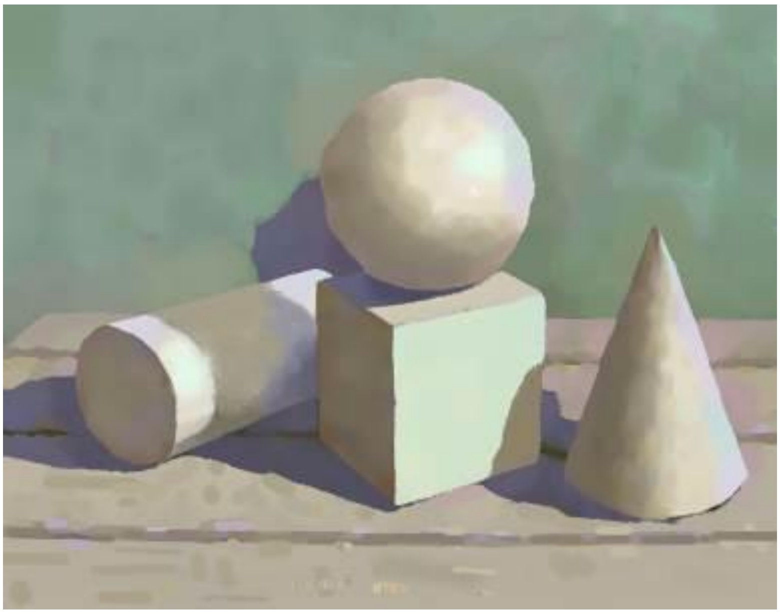

图 11.5、七声音阶（Heptachord）旋律进行：图形（石膏几何形）为升 f 小调，采用正序旋律，背景（墙，桌面）为 A 大调，采用反序旋律。

Figure 11.5. Heptachord melody progress: the figure (plaster geometry) is in f-sharp minor and the Positive order melody is adopted, and the background (wall, desktop) is in A major and the reverse order melody is adopted.

正序旋律，反序旋律通常用于区别图-底关系（figure-ground relation），在图-底关系不确定系统中，可减弱正序，反序旋律的区别。

Positive order melody and reverse order melody are usually used to distinguish the figure-ground relation. In the figure-ground relation uncertain system, the difference between the positive order and the reverse order melody can be weakened.

11-3、Point Melody；点旋律

“点”是线和弦的特殊形式，用于表达一维空间上的点，如：端点，角点等，只适用于三和弦。

"Point" is a special form of line chords, used to express points in one-dimensional space, such as endpoints, corners, etc. It is only suitable for triads.

线和弦由三个音符（色）构成，表达 1 维几何语义，但是当线和弦（闭和弦，开和弦）上出现点、

端点、角点时，三和弦转为分解和弦（broken chord）形式，出现在点、端点、角点上。

line chords are composed of three notes (colors), expressing the semantics of one-dimensional space, but when points, endpoints, and corners appear on the one-dimensiona line chords (closed chords, open chords), the triads are converted to broken chords. , Appears on points, endpoints, and corners.

见下图：#F 小调主和弦转为分解和弦，出现在：点，端点，角点处。

See the picture below: The #F minor tonic is converted into a broken chord, which appears at: point, end point, corner point.

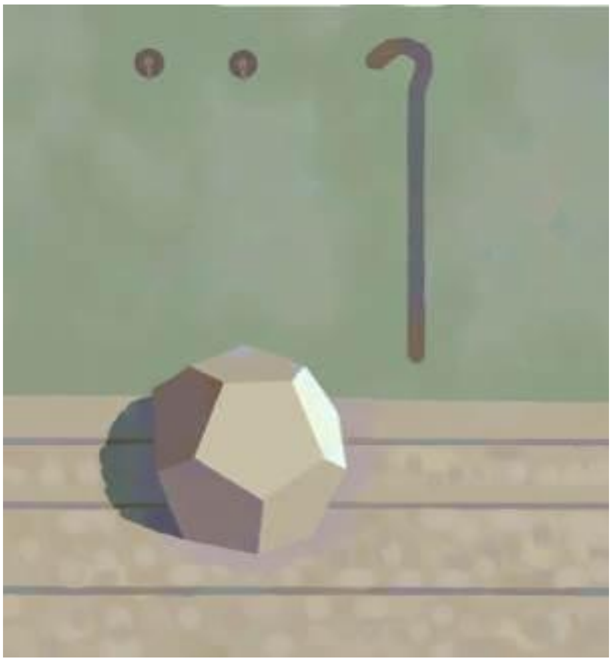

图 11.7、#F 小调主和弦（tonic）变为分解和弦（broken chord）表达图形上的点，角点，端点等

Figure 11.7, #F minor tonic becomes broken chord to express the points, corners, endpoints, etc. on the figure.

11-4、Parallel Melody；并行旋律

同调的空间包上出现多组旋律，称：并行旋律，常用于区别色相，分面与投影，相对图形与相对背景等。

There are multiple sets of melodies on the same key space packet, called: parallel melodies, which are often used to distinguish hue, facet and projection, relative figure and relative background, etc.

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图 11.8、并行旋律

Figure 11.8, Parallel Melody

上图的衬布上有三组分面旋律，有正序旋律，也有反序旋律，称为：并行旋律。

There are three-group faceted melody on the lining cloth of the above picture, there are positive melody and reverse melody, called: parallel melody.

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12.Non-Chord Tone；和弦外色

和弦外音（non-chord tone），调内的和弦之外的色，在和弦绘画中通常有两种用途：1、产生亚旋律；2、削弱色相、和弦的确定性，在和弦绘画中常用的有：邻音（Neighbor note），非离散（non-discrete），持续音（pedal point）、延留音（Vorhalt）、先现音（Anticipation）等。

Non-chord tone, the color outside the chord within the key, usually has two uses in chord painting: 1. Produce sub-melody; 2. Weaken the certainty of hue and chord. Commonly used in chord painting are: neighbor note, non-discrete, pedal point, vorhalt, anticipation, etc.

和弦外色（non-chord color）有几种常见形式：

There are two common forms of non-chord color:

和弦的频率偏移，如：邻音（Neighbor note），非离散（non-discrete）。

The frequency offset of the chord, such as: Neighbor note, Glide.

和弦空间区域偏移，如：持续音（pedal point）、延留音（Vorhalt）、先现音（Anticipation）。

The chord space area offset, such as: continuous tone (pedal point), sustained tone (Vorhalt), anticipation (Anticipation).

12-1.Frequency Offset；频率偏移

和弦频率偏移的形式很多，按照用途可归入两类：1、产生亚旋律，2、削弱和弦内色的色相确定性。

There are many forms of chord frequency offset, which can be classified into two categories according to their purposes: 1. to generate sub-melody, 2. to weaken the hue certainty of the colors in the chord.

邻音（Neighbor note）：用于产生分面亚旋律，通常是膜和弦的和弦外色。

Neighbor note: used to produce faceted sub-melody, usually the chord outer color of the Membrane chords.

下图为增三和弦构成的无调性系统，图形上与背景上都有由邻音（Neighbor note）产生的亚旋

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律，图形上用于表现分面，背景上用于表现投影。

The figure below shows an Atonal system composed of augmented triads. There are sub-melody generated by Neighbor notes on the figure and on the background. The figure is used to express facet, and the background is used to express projection.

邻音（Neighbor note）可以改变音符的正-负属性，正音符具有背景（远）的倾向，负音符具有图形（近）的倾向，常用于改变特定空间区域的景深。

Neighbor notes can change the positive-negative properties of notes, positive notes have a background (far) tendency, and negative notes have a figure (near) tendency, often used to change the depth of field in a specific spatial area.

图 12.1、邻音（Neighbor note）产生的景深

Figure 12.1. Depth of field generated by Neighbor note

非离散（non-discrete），和弦系统基于特定离散值，采用了非离散处理后，和弦特征削弱，可以削弱色相的确定性，表达色相不确定的对象，如：水、玻璃等。

non-discrete: The chord system is based on specific discrete values. After the non-discrete

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treatment is adopted, the chord features will be weakened, which can weaken the certainty of the hue and express the objects with uncertain hue, such as water and glass.

下图的水面使用了非离散（non-discrete）处理，削弱了水面的色相的确定性。

The water surface below uses non-discrete treatment, which reduces the certainty of the hue of the water surface.

图 12.2、爵士音阶 C 大调

Figure 12.2, Weak Tonal System C major

12-2.Space Region Offset；空间区域偏移

和弦空间区域偏移通常表现为：线和弦与膜和弦互相跨界，进入对方的空间区域，类似音乐中的持续音（pedal point）、延留音（Vorhalt）、先现音（Anticipation），通常用于表达空间系统所需要的模糊性。

The offset of the chord space area is usually expressed as: the line chord and the membrane chord cross each other and enter the space area of Used to express the ambiguity required by spatial systems.

在下图中的天空部分，主和弦（线和弦）与全音阶和弦（膜和弦）互相越界，导致和弦结构与和弦语义含混，并产生空间景深，类似音乐中的：持续音（pedal point），延留音（Vorhalt），先现音（Anticipation）。

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In the sky part in the picture below, the tonics (line chords) and the Diatonics (membrane chords) cross each other, resulting in the chord structure and the chord semantics being ambiguous, and the spatial depth of field is generated, similar to music: pedal point, Vorhalt, anticipation.

图 12.4、爵士音阶 A 大调

Figure 12.4, Weak Tonal System A major

空间区域偏移通常发生在线和弦与膜和弦之间，其它形式有待观察。

The spatial region offset usually occurs between the online chord and the Membrane chords, other forms are to be seen.

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13. Multilayer Tone Group；多层调群

一个和弦空间系统包含多个和弦包（调），称为：调群，它是以和弦包（调）为单位的组织形式。

A chord space system contains multiple Chord packets (key), called: key group, which is an organizational form of Chord packets (key) as a unit.

和弦语言中包含多种调群：增四度大-小调（Augmented Fourth Major-Minor），平行大小调（Parallel Major-Minor），C-D-E 调群，T-D-S 调群，前两种共享同导音减七和弦（Leading note diminished 7th），是同层空间系统，称：同层调群，后两种包含多个导音减七和弦（Leading note diminished 7th），分别具有不同的闭合状态，是多层空间系统；称：多层调群。

The chord language includes many key groups: Augmented Fourth Major-Minor, Parallel Major-Minor, C-D-E key group, T-D-S key group. The first two share the same leading note diminished 7th chord and are the same-layer space system, called: same-layer key group. The last two contain multiple leading note diminished 7th chords, each with different Close states, and are multi-layer space systems, called: multi-layer key groups.

多层调群（Key group）存在主-次秩序。

The multi-layer Key group has a primary-secondary order.

等比和弦 Geometric chords	闭合状态 Close state	主-次权重 Primary-Secondary Weight
{B,Ab,F,D}， B dim7	闭合 Closed	高 High,
{C#,Bb,G,E}， C# dim7	闭合-半闭合 Closed-semi-closed	中 medium
{A,F#,Eb,C}， A dim7	半闭合，弱闭合 Semi-closed, weakly Close	低 low

参见：8-1.闭合级别

See: 8-1.Close level

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13-1.C-D-E Key Group；C-D-E 调群

C-D-E 是三个减七和弦 C dim7，D dim7，E dim7 的缩写，分别表示三个导音减七和弦调群，C-D-E 是由调群组成的群，是和弦系统的全局调群。参见：5-1.3.dim7 调群

C-D-E is the abbreviation of three diminished seventh chords C dim7, D dim7, E dim7, which represent three leading tone diminished seventh chord key groups. C-D-E is a group composed of key groups, which is the global key group of the chord system. See: 5-1.3.dim7 key group

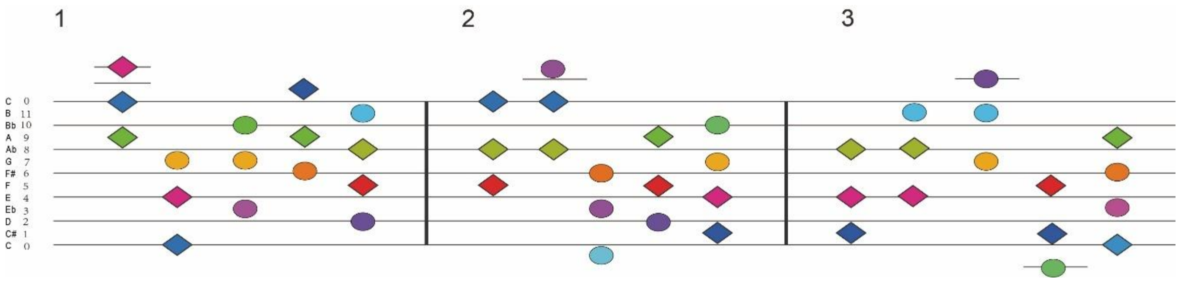

图 13-1.1、C-D-E 调群

Figure 13-2.1, C-D-E keys group

C-D-E 调群中包含不同闭合状态的图形，涉及不同的导音减七和弦，各个图形具有共同的连续背景，并共享主调群的导音减七和弦。

The C-D-E key group contains figures of different Close states, involving different leading diminished seventh chords, each figure has a common continuous background, and shares the leading diminished seventh chords of the main key group.

C-D-E 调群具有主-次权重（自然解决倾向）。参见：8-1.闭合层级。

The C-D-E tone group has a primary-secondary weight (natural solution tendency). See: 8-1. Close levels.

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图 13-1.2. C-D-E 调群

Figure 13-1.2. C-D-E key group

图 13-1.3. B-C 调群

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Figure 13-1.3. C-D-E key group

爵士音阶和弦包的主-次权重低于所有七声音阶（heptachord）和弦包，当闭合层级较高的和弦包转为爵士音阶，解决方向发生逆转。

The major-minor weight of the jazz scale chord package is lower than that of all heptachord chord packages. When the chord package with a higher Close level is converted to a jazz scale, the solution direction is reversed.

图 13.1.4.爵士音阶和弦包向七声音阶和弦包解决。

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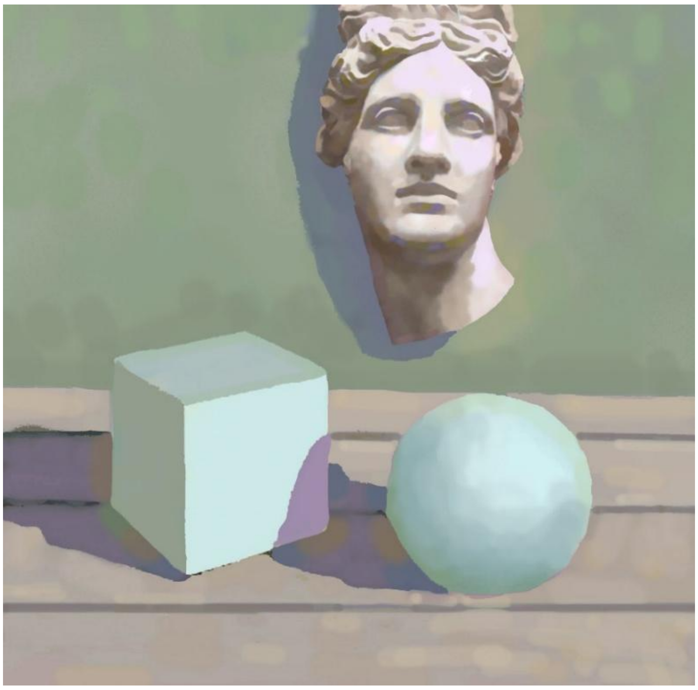

13-2.T-D-S Key Group；T-D-S 调群

T-D-S 调群是 T-D-S 三和弦的转调形式，用于表达空间系统中不同亮度的分形-分面关系；较 T-D-S 三和弦具有更高的确定性。

The T-D-S keys groups is a transition form of the T-D-S triad, which is used to express the fractal-facet relationship of different brightness in the spatial system; it has a higher certainty than the T-D-S triad.

T-D-S 调群是七声音阶（heptachord）调群，其中的属和弦（Dominant）、下属和弦（Subdominant）分别转为属调（dominant key）、下属调（Subdominant Key）。

The T-D-S key group is a heptachord Key group, in which the Dominant and Subdominant chords are converted to the dominant key and Subdominant Key respectively.

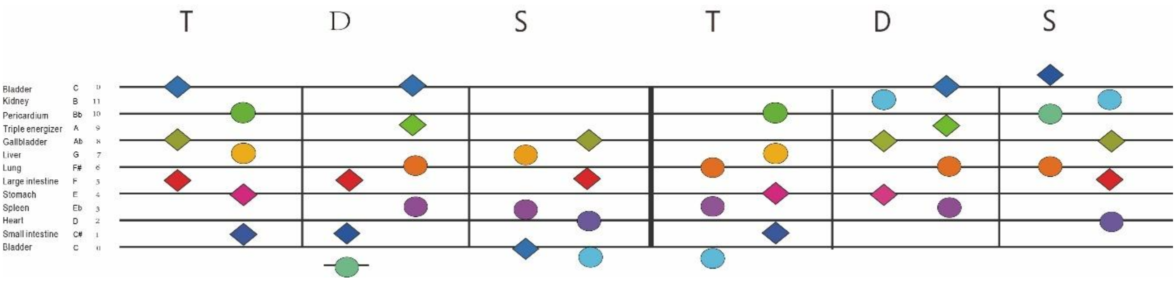

图 13-2.T-D-S 调集团； Figure 13-2.T-D-S tone group;

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大调的属调（dominant key）、下属调（Subdominant Key）表达不同亮度的分离图形；小调的属调（dominant key）、下属调（Subdominant Key）表达同一图形上不同亮度的分面。

The dominant key and subdominant key of the major key express fractal figure of different brightness;the dominant key and the subdominant key of minor key express the facet of different brightness on the same figure.

T-D-S 调群组成部分 T-D-S tone group components	亮度 Brightness	空间语义 Spatial semantics
大调主调 Major main key	中 middle	系统背景 System Background
大调属调 Major Dominant key	暗 dark	背景相对图形 Background Relative figure
大调下属调 Major subdominant key	亮 Bright	背景相对图形 Background Relative figure
小调主调 Minor main key	中 middle	图形 Figure
小调属调 Minor Dominant key	亮 Bright	图形亮分面 Graphics bright facet
小调下属调 Minor subdominant key	暗 dark	图形暗分面 Graphic dark facets

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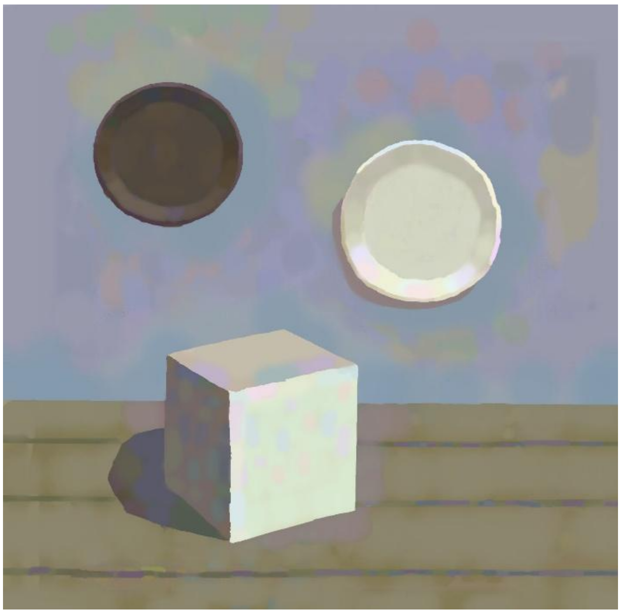

13-2.2、#F 小调、C 大调 T-D-S 调群

13-2.2, #F minor, C major T-D-S key group

#f 小调（石膏图形），亮面=#f 小调-属调（dominant key）；暗面=#f 小调-下属调（Subdominant Key），中间色=#f 小调主和弦。

#f minor (gypsum graphics), bright side = #f minor-dominant key; dark side = #f minor-subdominant key, middle color = #f minor major chord.

C 大调（背景）：墙上的白色挂盘=C 大调的属调（dominant key）；墙上的黑色挂盘=C 大调的下属调（Subdominant Key）。中间色背景=C 大调主和弦。

C major (background): the white hanging plate on the wall = the dominant key of C major; the black hanging plate on the wall = the subdominant key of A major. Mid-color background = C major major chord.

13-2.1. Mixed Key Group；混合调群

T-D-S 调群中的属调与下属调可以采用爵士音阶形式：三和弦+导音全音阶和弦，其分离强度低于属和弦-下属和弦+导音减七和弦。

The dominant and subdominant keys in the T-D-S key group can take the form of a jazz scale: triad + leading tone diatonic chord, which has a lower separation intensity than the dominant chord-subdominant chord + leading tone diminished seventh chord.

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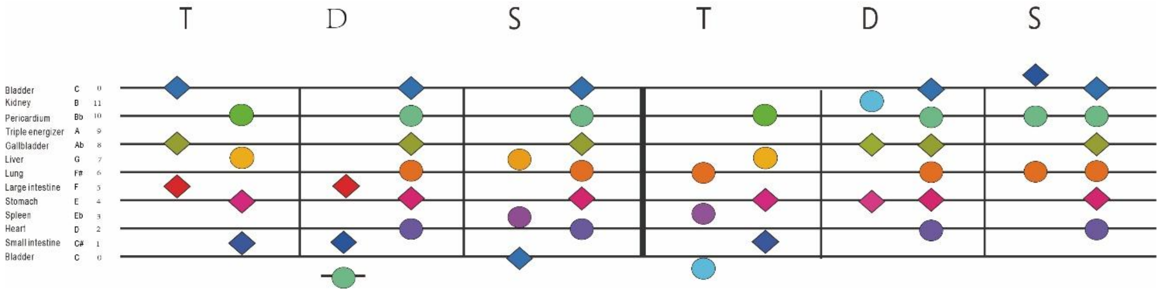

图 13-2.3. 基于 T-D-S 的混合调群

Figure 13-3.2. Hybrid tone group based on T-D-S

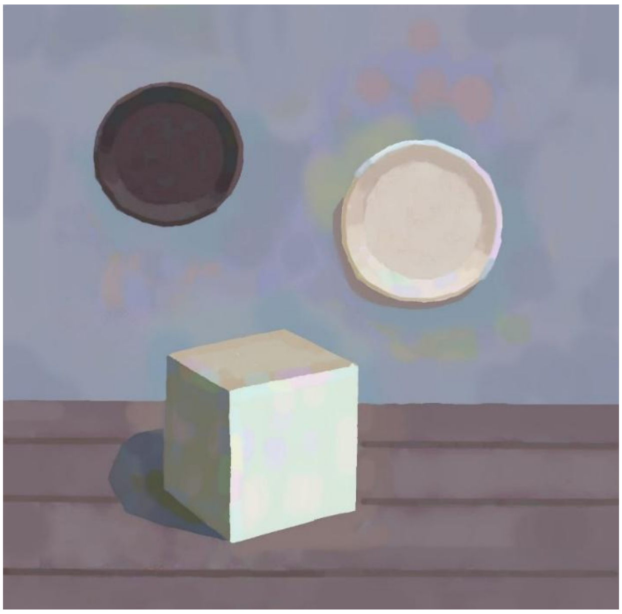

图 13-2.4. 基于 T-D-S 的混合调群

Figure 13-2.4. Hybrid tone group based on T-D-S

13-4. Chord Celestial Model；和弦天体模型

多层调群可构成天体解释模型，其中，C-D-E 调群为星系（银河系）模型，T-D-S 调群为恒星系（太阳系）模型。

Multi-layer tuning groups can constitute a celestial body interpretation model, among which the C-D-E tuning group is the galaxy (Milky Way) model, and the T-D-S tuning group is the star system (solar system) model.

星系（银河系）模型：

Galaxy (Milky Way) Model:

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导音减七和弦 Leading note Diminished 7th	天体 Celestial Bodies	闭合性权重 Close Weight	对称生命 Symmetrical Life
{B,Ab,F,D}	星系核 Galactic nucleus	高 High	神 God
{C#,Bb,G,E}	恒星系 Star system	中 Medium	人 Man
{A,F#,Eb,C}	行星，星尘 Planets, stardust	低 Low	魔 Demon

恒星系（太阳系）模型

Model of the star system (solar system)

导音减七和弦	天体 Celestial Bodies	闭合性权重 Close Weight	对称生命 Symmetrical Life
{B,Ab,F,D}	恒星 Star	高 High	神 God
{C#,Bb,G,E}	恒星系背景 Star system background	中 Medium	人 Man
{A,F#,Eb,C}	行星 planet	低 Low	魔 Demon

以上结果来自和弦观察，方法包括：音乐，绘画（和弦时空），经络感知。

The above results are from chord observation, and the methods include: music, painting (chord time and space), and meridian perception.

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Chord Painting；和弦绘画

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14、Chord Spacetime；和弦时空

24 届世界哲学大会会议论文

Papers of the of 24th World Congress of Philosophy

时空是宇宙的固有结构，是所有物理过程的基础。人类有两类时空观察者：和弦（调性）观察者与非和弦（无调性）观察者，分别观察到两种时空：

Spacetime is the inherent structure of the universe and the foundation of all physical processes. Humans have two types of spacetime observers: harmonic (tonal) observers and non-harmonic (atonal) observers, who observe two types of spacetime respectively:

和弦（调性）时空：和弦生成的时空场，以量子化频谱为编码结构，映射到时空语义集合，音乐（时间域）、绘画（空间域）是其常见形式。

Chord (tonality) space-time: The space-time field generated by chords uses the quantized spectrum as the encoding structure and is mapped to a space-time semantic set. Music (time domain) and painting (space domain) are its common forms.

非和弦（无调性）时空：屏蔽了时空的和弦结构，只保留几何（图-底）与运动的纯粹关系性描述，从外部参考系统（如时钟、尺子、参照物）获得定量，常用于经典物理学框架中，也是日常的时空经验。

Non-chordal (atonal) spacetime : It blocks the chordal structure of spacetime, retains only the purely relational description of geometry (figure-ground) and motion, obtains quantification from external reference systems (such as clocks, rulers, reference objects), is often used in the framework of classical physics, and is also the daily experience of spacetime.

和弦频谱：和弦频谱与能量量子本质相通，均以一个基准频率 f 为单位，在整数 n 的调控下生成一组离散的频率/能量结构。

泛音频谱公式：n*f，N∈Z，f=频率

量子化假设：n*f*h（h=6.626×10^−34）N∈Z

两个公式结构一致，当：n=1-6=大三和弦，n=1-7=大 7 和弦，n=1-9=大 9 和弦，n=1-11=大十一和弦——量子来自和弦。

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泛音是一维震荡模式，大于一维的震荡模式涉及到平均律：(1.059463)^n · f_0，两种模式可以切换。

将 n 切换为 (1.059463)^n，引入指数型量子化能级：E_n=h·1.059463^{n}·f_0，通过模 12 群 $\mathbb{Z}_{12}$ 的结构，实现和弦的系统生成。

Overtone spectrum formula: n*f, N∈Z, f=frequency

Quantization assumption: n*f*h (h=6.626×10^−34)N∈Z

The two formulas have the same structure when: n=1-6 = major triad, n=1-7 = major 7th chord, n=1-9 = major 9th chord, n=1-11 = major 11th chord—quantum comes from chords.

Overtones are one-dimensional oscillation patterns. Oscillation patterns larger than one dimension involve equal temperament: 1.059463)^n·f_0. these two modes can be switched.

Switching n to (1.059463)^n introduces exponential quantized energy levels: E_n=h·1.059463^{n}·f_0. Through the structure of the module 12 group $\mathbb{Z}_{12}$, systematic generation of chords is achieved.

时空二相性：和弦时间与和弦空间镜像对称：{-7,-4,0} ↔ {0,4,7} mod 12（互为反和弦，反调），可数学转换；空间具有定域性，时间具有非定域性，共同表现为时空二相性；波粒二象性只能在和弦（调性）时空中成立。

Space-time duality : Chord time and chord space are mirror-symmetric: {-7,-4,0} ↔ {0,4,7} mod 12 (they are anti-chords and anti-tones), which can be mathematically converted; Space is local and time is non-local, which together manifest as the space-time duality. The wave-particle duality can only hold true in chord (tonal) space-time.

和弦几何：和弦编码（量子化频谱）包含几何语义：开弦，闭弦，膜弦，可生成所有空间状态，也是绘画空间的生成基础。

Chord geometry: Chord encoding (quantized spectrum) contains geometric semantics: open strings, closed strings, membrane strings, which can generate all spatial states and are also the basis for the generation of painting space.

±音符：音符具有±属性，这是频率的物理属性，应涉及所有波动、频率，也可以解释物理学中普遍存在的±属性。

±Notes: notes have ± properties, which are physical properties of frequency and should involve all waves and frequencies. They can also explain the ubiquitous ± properties in physics.

整体性：和弦系统具有整体性，其中的所有元素（音符，和弦，和弦包）在全局系统的控制下保持

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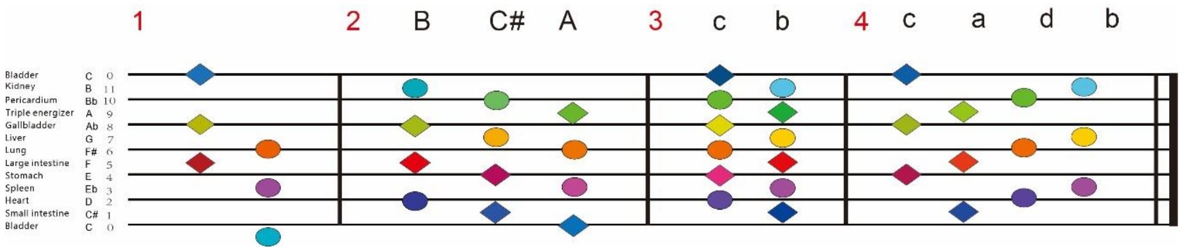
相互关联状态，与空间距离、尺度无关。

Holism: The chord system has wholeness, where all elements (notes, chords, chord bundles) remain interrelated under the control of the global system, regardless of spatial distance or scale.

和弦语言是时空语言，音乐（时间域）与绘画（空间域）是常见和弦时空现象，也是方便的观察途径。

和弦语言是时空语言，音乐（时间域）与绘画（空间域）是常见和弦时空现象，也是方便的观察途径。

Chord language is a space-time language. Music (time domain) and painting (space domain) are common chord space-time phenomena and are also convenient ways of observation.



基本和弦表：1-1、大三和弦（闭弦），1-2、小三和弦（开弦）、2、减七和弦（膜弦）、3、全音阶和弦（膜弦），4、增三和弦（膜弦）

*和弦频谱公式：n*f，H^n*f,（H=1.059463，n∈Z）

*符号：◆=+音符，●=-音符，音符色=色荷

*本文使用 mod12 记谱法

Basic chord table: 1-1, major triad (closed string), 1-2, minor triad (open string), 2, diminished 7th (membrane string), 3, diatonic chord (membrane string), 4, augmented Triads (membrane strings)

* Chord spectrum formula: n*f, H^n*f (H=1.059463，n∊Z)

* Symbol: ◆=+ note, ●=- note, note color = color charge

** This article uses mod12 notation

关键词； Keywords：和弦时空、量子化、和弦场、音乐、绘画、电磁场、弦理论

Chord spacetime, quantization, chord field, music, painting, electromagnetic field, string theory

14-1.Chord Space；和弦空间

和弦编码（量子化频谱）分别生成音乐（时间域）与绘画（空间域），两者镜像对称：{-7,-4,0} ↔

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{0,4,7} mod 12，可数学转换。

Chord encoding (quantized spectrum) generates music (time domain) and painting (space domain) respectively, which are mirror-symmetric: {-7,-4,0} ↔ {0,4,7} mod 12 and can be mathematically converted.

和弦编码（量子化频谱）包含和弦几何语义 {开弦|闭弦|膜弦} 并构成和弦几何框架，以此定义和弦空间结构。

The chord encoding (quantized spectrum) contains the chord geometry semantics {open string|closed string|membrane string} and constitutes a chord geometry framework to define the chord space structure.

“弦”是“和弦”的几何语义，“和弦”是“弦”的特征频谱。不同和弦映射到不同的几何语义：

"String" is the geometric semantics of "chord", and "chord" is the characteristic spectrum of "strings". Different chords map different geometric semantics:

大三和弦 (−7,−4,0)mod 12 ↔ 闭弦（轮廓线）

小三和弦 (−7,−3,0)mod 12 ↔ 开弦（分面线）

等比和弦：减七和弦 (0,3,6,9) mod 12，全音阶和弦 (0,2,4,6,8,10)mod 12，增三和弦 (0,4,8) mod 12 ↔ 膜弦（非线性空间）

三和弦（开弦，闭弦）定义等比和弦（膜弦）的边界（轮廓线，分面线)，生成所有空间状态及相互作用。

Major triad (−7,−4,0)mod 12 ↔ closed string (contour line)

Minor triad (−7,−3,0)mod 12 ↔ open string (Facet line)

Geometric chords: diminished seventh chord (0,3,6,9) mod 12, diatonic chord (0,2,4,6,8,10)mod 12, augmented triad (0,4,8) mod 12 ↔ membrane chord (nonlinear space)

The triads (open strings,closed stirngs) define the boundaries (contours, facets) of the geometric chords (membrane strings), generating all spatial states and interactions.

以上结果来自和弦绘画中的独立观察，在绘画中可重复，并有视觉实验支持。

The above results come from independent observations in chord painting, are repeatable in painting, and are supported by visual experiments.

和弦空间是和弦语言的重要支柱与核心部分，绘画是其主要观察基础与应用领域。

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Chord space is an important pillar and core part of chord language, and painting is its main observation basis and application field.

观察、实验案例：Observation and experimental cases:

Li, X. H. (2020). Chord Painting. ResearchGate. https://www.researchgate.net/publication/340492620_Chord_Painting

Li, X. H. (2024). Chord Language. Zenodo. https://zenodo.org/records/11817631

Griffiths, D. J. (2005). Introduction to Quantum Mechanics. Pearson.

14-2.Chord Packet；和弦包

和弦空间由和弦表达，基本单元是：和弦空间包（调），在前面章节已有介绍，本节主要讨论和弦空间包的物理含义。

The chord space is expressed by chords, and its basic unit is the chord space package (key), which has been introduced in the previous chapter. This section mainly discusses the physical meaning of the chord space package.

本章的讨论默认采用爵士音阶，下面分析一个典型的和弦空间包。

The discussion in this chapter uses the jazz Scale by default, and a typical chord space package is analyzed below.

三和弦（开弦，闭弦）定义全音阶和弦（膜和弦）的边界（轮廓线，分面线等），生成爵士音阶的和弦空间包，下面以 C 大调，F#小调为例：

Triads (open chords, closed chords) define the boundaries (contours, Facet line, etc.) of diatonic chords (membrane chords), and generate the chord space packet of the jazz Scale. The following takes C major and F# minor as examples:

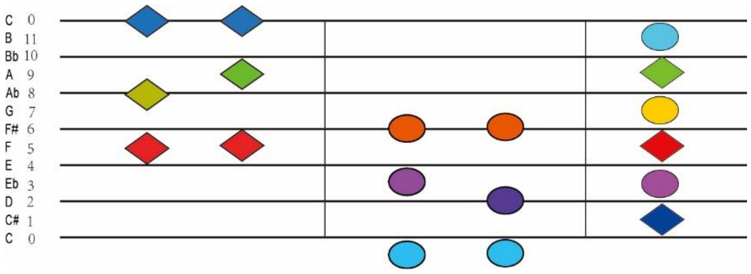

图 14-2.1、爵士音阶和弦包：1、C 大三和弦（闭弦），2、F#小三和弦（开弦），3、全音阶和弦

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（膜弦）（◆=正音符，●=负音符，色彩=色荷）

Figure 14-2.1, jazz Scale chord package: 1,C major triad (closed string), 2,F# minor triad (open string), 3,diatonic chord (membrane string) (◆=positive note, ●=negative note, color=color charge)

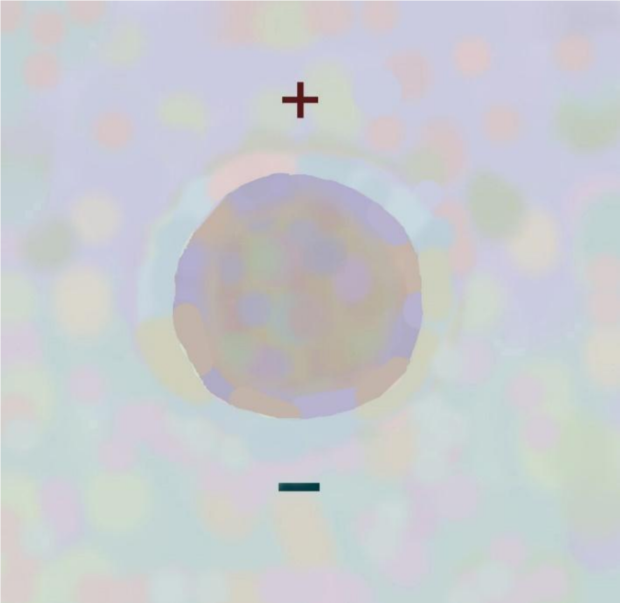

图 14-2.2、爵士音阶，C 大调，f#小调空间包

Figure 14-2.2, jazz Scale C major ,f# minor space packet

实验 1：C 大三和弦（闭弦），构成了图形的闭合轮廓线，全音阶和弦（膜弦）填充所有非线空间，包括图形与背景。

Experiment 1: The C major triad (closed string) forms the closed contour of the figure, and the diatonic chord (membrane string) fills all non-linear Spaces, including the figure and background.

空间包的轮廓线由大三和弦（闭弦）构成，用于束缚空间包，轮廓线（闭弦）的内部由全音阶和弦（膜弦）充实，线和弦与膜和弦分别构成和弦空间包的外层与内核。

The contour of the space packet is composed of major triads (closed strings), which are used to bind the space packet. The interior of the contour line (closed strings) is enriched by diatonic chords (membrane strings), and the line chord and membrane chord form the outer and inner core of the chord space packet respectively.

和弦包是和弦时空的基本单位；那么原子，星体是和弦包吗？合理的回答是：如果原子，星体是和弦时空中的空间单位，其形式就只能是和弦包。

The chord packet is the basic unit of chord space-time ; So are atoms, stars a chord packet? The

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reasonable answer is that if atoms and stars are spatial units in chord space-time, their form can only be chord packets.

图 15-3.2 与下面的照片比较。

Figure 15-3.2 is compared with the following photos.

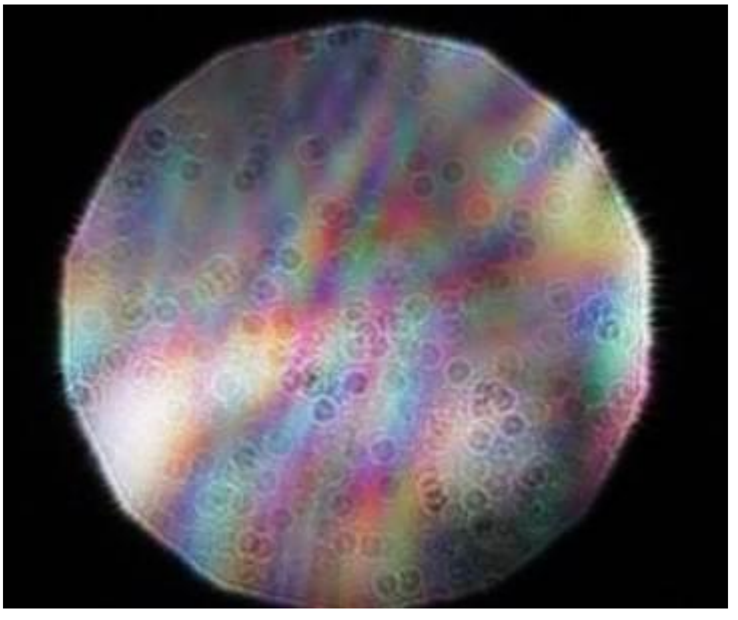

图 14-2.3、孔径光栅显微镜拍摄的铁原子（图片来自互联网）

Figure 14-2.3. Iron atoms taken by aperture grating microscope (picture from Internet)

图 14-2.4、孔径光栅显微镜拍摄的铁原子（图片来自互联网）

Figure 14-2.4. Iron atoms taken by aperture grating microscope (picture from Internet)

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14-2.1.Electric Charge And Magnetic Charge；电荷与磁荷

音符具有正负属性，由此产生和弦的正负属性，正和弦的根音符为正音符，负和弦的根音符为负音符，通常：正和弦为大三和弦（闭弦），负和弦为小三和弦（开弦）。见图：14-2.1

The notes have positive and negative properties, resulting in the positive and negative properties of the chord, the root note of the positive chord is a positive note, the root note of the negative chord is a negative note, generally: the positive chord is a major triad (closed string), and the negative chord is a minor triad (open string). See Figure 14-2.1

【电荷】下图和弦包中包括正和弦（大三和弦，闭弦）与 负和弦（小三和弦，开弦），闭弦构成轮廓线，开弦构成分面线，膜弦充满所有非线空间。

[Charge] The chord package in the figure below includes positive chords (major triads, closed strings) and negative chords (minor triads, open strings). Closed strings form contour lines, open strings form Facet line, and membrane strings fill all non-linear spaces.

图 14-2.5、和弦空间包的构成

Figure 14-2.5, the composition of the chord space packet

下面是一组和弦空间包相互作用的视觉实验。

Below is a visual experiment of a set of chord space packages interacting with each other.

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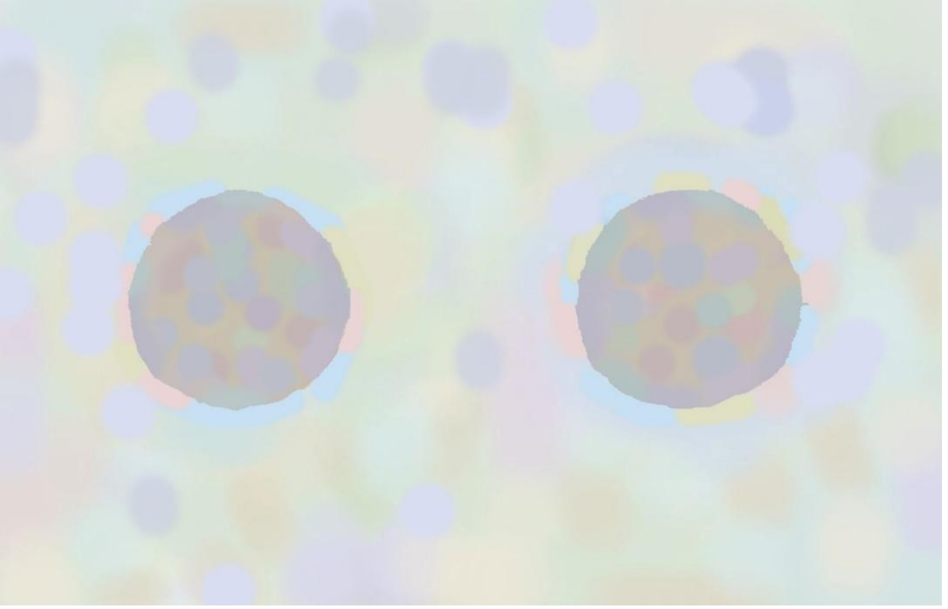

图 14-2.6、左右两个和弦空间包均含有正和弦（大三和弦，闭弦），负和弦（小三和弦，开弦），表现为稳定状态。

Figure 14-2.6. Both the left and right chord space packages contain positive chords (major triad, closed string) and negative chords (minor triad, open string), which are represented as stable states.

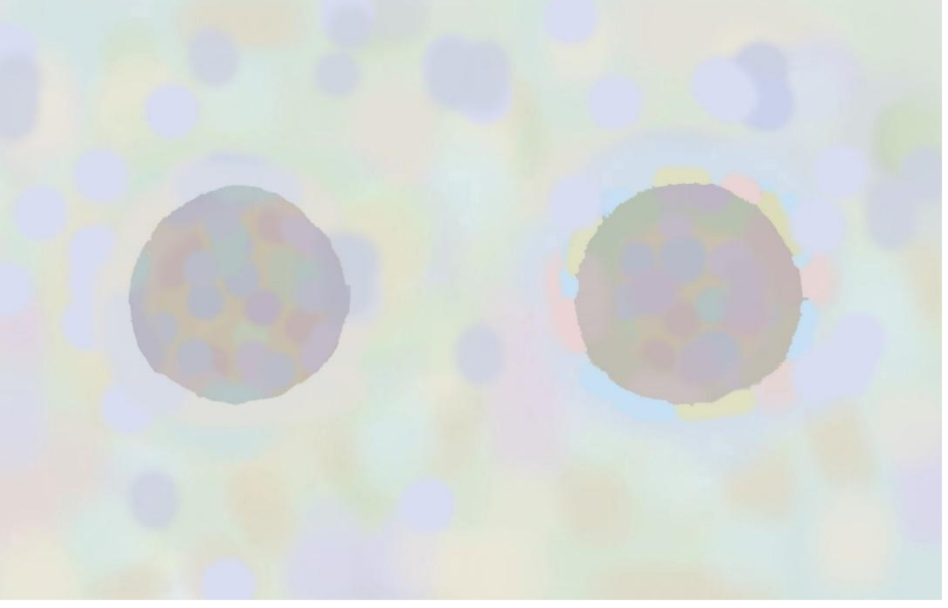

图 14-2.7、左图含大三和弦（正和弦，闭弦），右图含小三和弦（负和弦，开弦），分别为正、负和弦空间包，表现出相互吸引的倾向。

Figure 14-2.7, the left picture contains the major triad (positive chord, closed string), the right picture contains the minor triad (negative chord, open string), respectively, positive and negative chord

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space packages, showing a tendency to attract each other.

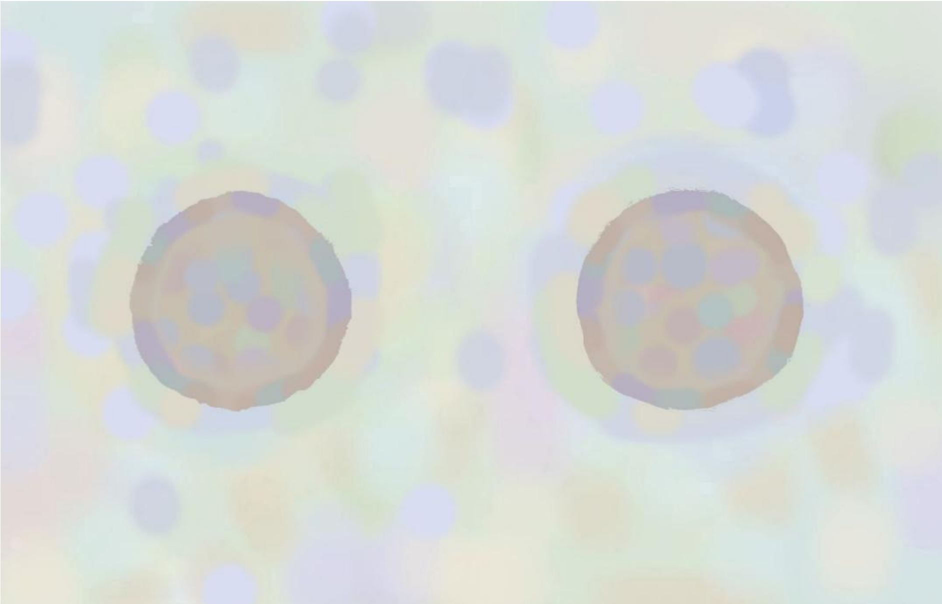

图 14-2.8、左，右两个和弦包都含同种三和弦（小三和弦，负和弦，开弦），表现出相互排斥的倾向。

Figure 14-2.8. Both left and right chord packages contain the same triad (minor triad, negative chord, open string), showing a tendency to exclude each other.

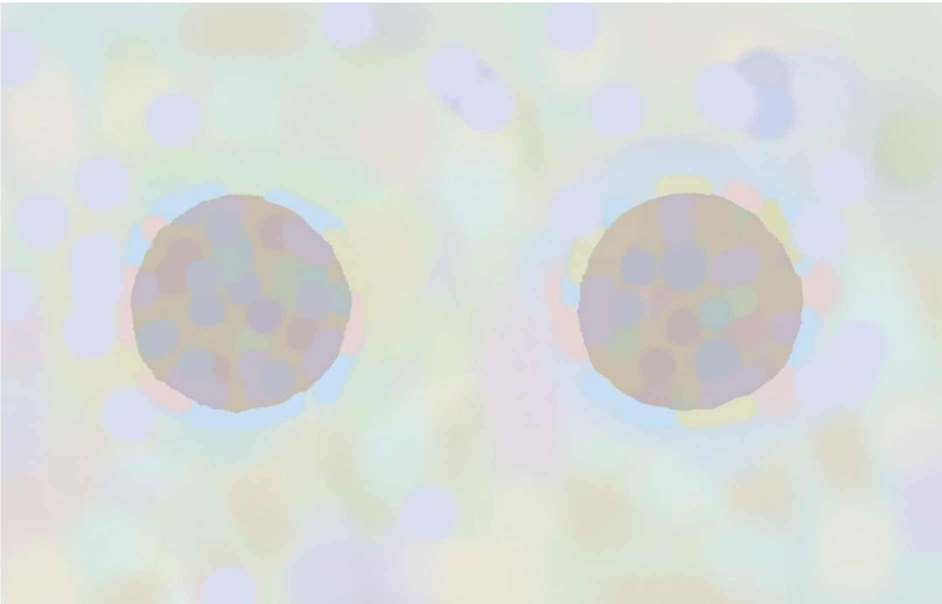

图 14-2.9、左，右两个和弦包都含同种三和弦（大三和弦，正和弦，闭弦），表现出相互排斥的倾向。

Figure 14-2.9, left and right chord packages contain the same triad (major triad, normal chord,

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closed string), showing a tendency to exclude each other.

上面的视觉实验中，和弦空间包的表现类似电场效应，两种和弦之间存在库伦力，合理的解释是：正-负电荷来自正-负和弦。

In the above visual experiment, the chord space package behaves like an electric field effect, there is a coulomb force between the two chords, and the reasonable explanation is that the positive-negative charge comes from the positive-negative chord.

大三和弦（闭弦、正电荷）用于构成轮廓线，封闭、束缚空间包，不能脱离和弦空间包，小三和弦（开弦、负电荷）可以自由的出现在和弦空间包的内-外。

Positive major triads (closed strings, positive charges) are used to form contour lines, closed and bound space packet, and cannot be separated fromembrane chords space packet, minor triads (open strings, negative charges) can freely appear inside-outside of the chord space packet .

【磁荷】爵士音阶和弦包的膜和弦是全音阶和弦，全音阶和弦包含六个音符，各音符分别具有正-负属性与色荷，所有色荷混合产生白色。

【Magnetic charge】The membrane chord of the chord packet of the jazz Scale is the diatonic chord. The diatonic chord contains six notes, and each note has positive-negative attributes and color charges, and all color charges are mixed to produce white.

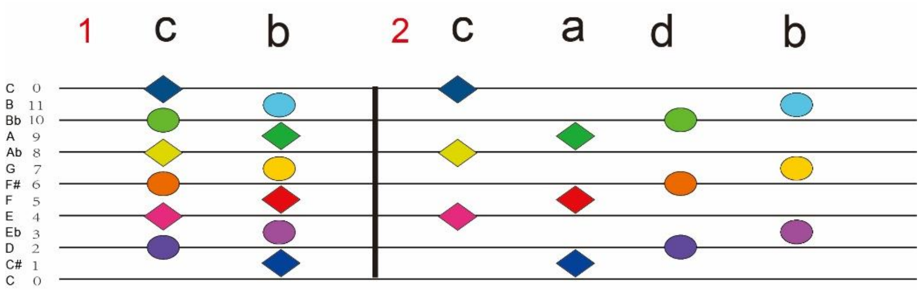

图 14-2.10、1、全音阶和弦；2、增三和弦（◆=正音符，●=负音符，色彩=色荷）

Figure 14-2.10, 1. Diatonic chords; 2. Augmented triads (◆=positive note, ●=negative note, color=color charge)

全音阶和弦充满所有非线空间——包括空间系统的图形与背景，背景上的全音阶和弦表现出如下特征：其中的正-负音符分别倾向于在图形两端的对立位置聚集，形成正极与负极，类似磁场中的±磁荷分布形态。

Diatonic chords fill all non-linear Spaces, including the figure and background of the spatial system. Diatonic chords on the background show the following characteristics: the positive and

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negative notes tend to gather at opposite positions at both ends of the figure, forming positive and negative poles, similar to the distribution of ± magnetic charges in a magnetic field.

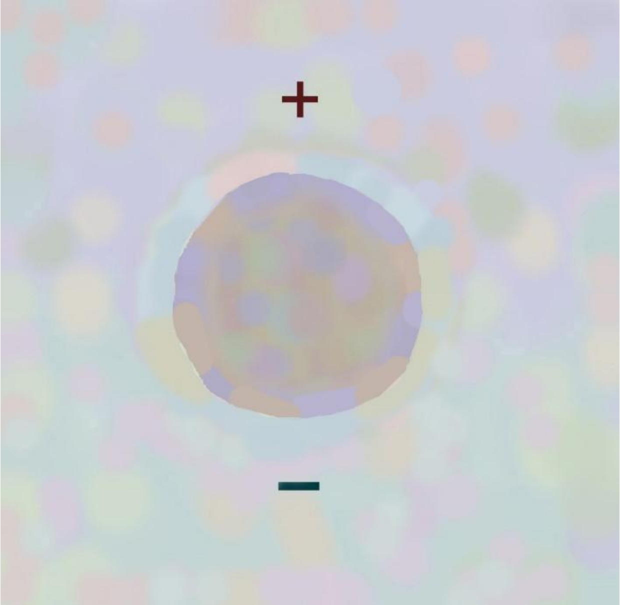

图 14-2.11a、全音阶和弦中的±音符分布表现出类似±磁荷的特征

FIG. 14-2.11a. the ± notes in diatonic chords show characteristics similar to ± Magnetic charge

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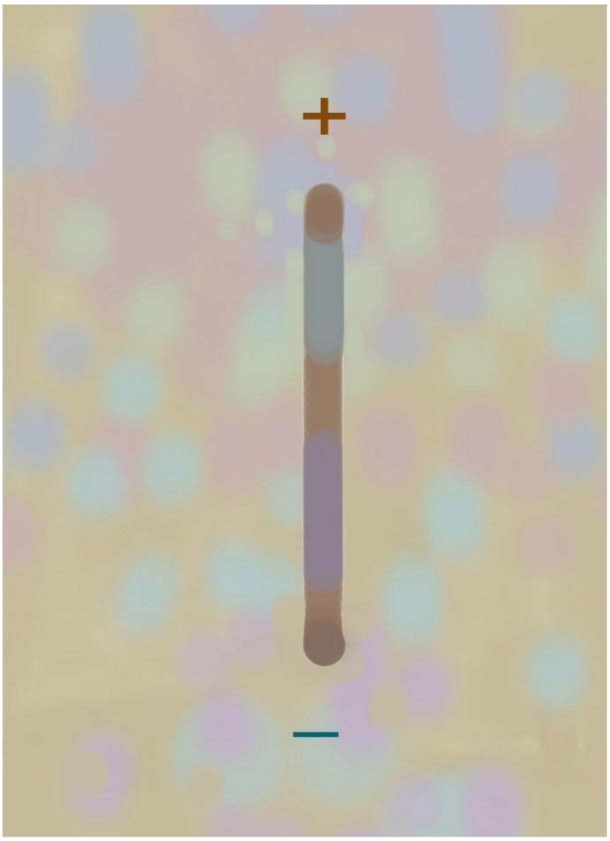

图 14-2.11b、全音阶和弦中的±音符分布表现出类似±磁荷的特征

FIG. 14-2.11b. the ± notes in diatonic chords show characteristics similar to ± Magnetic charge

以上观察表明：电荷来自三和弦，磁荷来自膜和弦，大三和弦（正和弦）带正电荷，小三和弦（负和弦）带负电荷，膜和弦中的正-负音符产生正-负磁荷。

The above observations show that the charge comes from the triad, the magnetic charge comes from the membrane chord, the major triad (closed string) has a positive charge, the minor triad (open string) has a negative charge, and the positive-negative notes in the membrane chord produce a positive-negative magnetic charge.

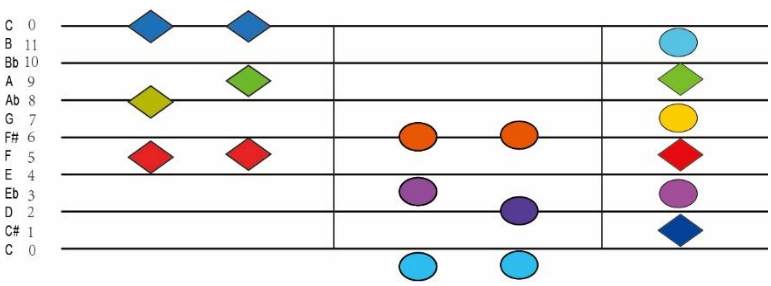

图 14-2.12、爵士音阶和弦包：1、C 大三和弦（闭弦，正电荷），2、F#小三和弦（开弦，负电荷），3、全音阶和弦（膜弦，磁荷）（◆=正音符，●=负音符，色彩=色荷）

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Figure 14-2.12. The chord packet of the jazz Scale: 1, C major triad (closed string, positive charge), 2. F# minor triad (open string, negative charge), 3, diatonic chord (membrane string, Magnetic charge) (◆=positive note, ●=negative note, color=color charge)

大三和弦（闭弦），小三和弦（开弦），等比和弦（膜弦）产生电荷，磁荷，电磁场。

Major triads (closed strings), minor triads (open strings), and isometric series chords (membrane strings) generate electric charges, magnetic charges, and electromagnetic fields.

上面观察表明：±电荷，±磁荷来自±音符。

The above observation shows that ± charge, ± magnetic charge comes from ± note.

大三和弦（闭弦，正电子）与其束缚在内部的膜和弦（膜弦）不能分离，两者共同表现为质子，带正电荷。

The major triad (closed string, positron) cannot be separated from its bound membrane chord (membrane string), which together appear as a proton and are positively charged.

膜弦中的各音符被大三和弦（闭弦，正电子）束缚在和弦包中，类似夸克禁闭与强相互作用。

Each note in the membrane string is bound in a chord package by a major triad (closed string, positron), similar to quark confinement and strong interaction.

开弦在和弦包中产生分离作用：包括分面与图形分裂。

Open strings produce separation effects in the chord package: including faceting and figure splitting.

膜和弦在无调性解决（solution）时，和弦包不含三和弦（正-负电子），表现为不带电荷的中性和弦包（中子）。

Membrane chords In the atonal solution, the chord package contains no triads (positive-negative electrons) and appears as a neutral chord package with no charge (neutrons).

增三和弦（augmented triads）只含有正音符或负音符，不能表现出±磁荷。

augmented triads contain only positive or negative notes and cannot show ± magnetic charges.

天体与原子都是和弦空间包（调），但前者是七声音阶系统，后者是爵士音阶系统，两者具有很大的区别。

Both celestial bodies and atoms are chord space packages (keys), but the former is a heptachord system, the latter is a jazz scale system, and the two have a big difference.

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和弦包成分及作用：

Chord package components and functions:

和弦包成分 Chord Packet Components	几何语义 Geometric semantics	物理属性 Physical properties	可能的物理含义 Possible physical implications
音符 Note	点 Point	±，色荷 ±, Color charge	基本粒子 Elementary particles
等比和弦 Geometric chords	膜弦 Membrane strings	磁场，±磁荷 Magnetic field, ±magnetic charge	磁子，夸克 Magnetons, quarks
大三和弦 Major	闭弦 Closed String	正电荷 Positive Charge	束缚和弦包，强力 Bound Chord Packet, Powerful
小三和弦 Minor	开弦 Open String	负电荷 Negative charge	分面，增维 Faceting, adding dimension
无彩色 Neutral colour	线，膜 Line, Membrane	中性 Neutral	待观察 To be seen

上面讨论的只是和弦基本形式，和弦还有许多变化形式，包括正开弦，负闭弦等，在本书其它章节中有介绍。

What is discussed above is only the basic form of chords. There are many variations of chords, including positive open chords, negative closed chords, etc., which are introduced in other chapters of this book.

14-2.2. Chord Packet Spectrum；和弦包光谱

和弦空间的基本单位为和弦空间包，各调的和弦空间包都有其特征光谱。

The basic unit of chord space is the chord space packet, and the chord space packet of each key has its characteristic spectrum.

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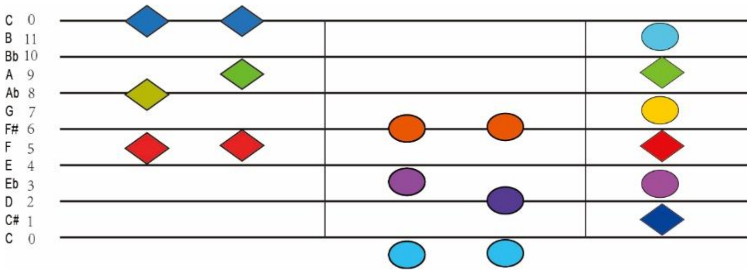

图 14-2.13：C 大调、f#小调和弦包特征光谱

Figure 14-2.13: C major, f# minor chord packet characteristic spectrum

将和弦空间包的特征光谱与原子光谱进行比较，或是个好主意。

It may be a good idea to compare the characteristic spectrum of the chord space Packet with the spectrum of atoms.

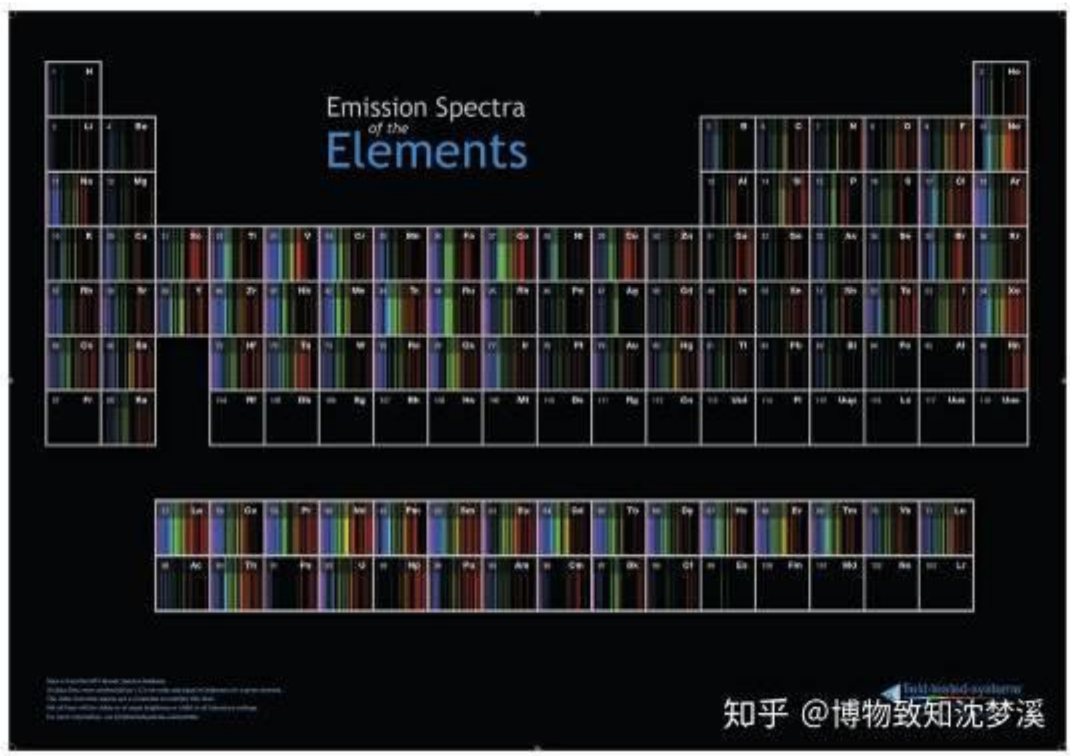

图 14-2.14、元素光谱

Figure 14-2.14, element spectrum

（计算方法见：和弦（量子）数学）

(For the calculation method, see: 1. Chord Mathematical; Chord Math)

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14-2.3. Chord Packet Interaction；和弦包相互作用

在和弦时空中，所有空间作用都是和弦的作用，下面讨论闭合和弦包之间的相互作用。

In chord spacetime, all spatial actions are actions of chords. The interactions between closed chord packet are discussed below.

在和弦时空中，闭合和弦包之间的相互作用包含两类：结合（引力）与分离（斥力），二者皆源于大三和弦（闭弦）的结构张力。闭弦向内表现为结合作用，向外表现为分离作用。其频谱为离散集 {0, 4, 7} mod12，其结构具有正曲率（K>0），若屏蔽和弦，可视作纯粹几何效应。

In chord spacetime, the interactions between closed chord packages include two types: binding force (gravity) and separation force (repulsion), both of which originate from the structural tension of the major triad (closed string). The closed string behaves as a binding effect inward and as a separation effect outward. Its spectrum is a discrete set {0, 4, 7} mod12, and its structure has positive curvature (K>0). If the chord is shielded, it can be regarded as a pure geometric effect.

闭弦通常成对出现在图-底关系的背景侧与图形侧，结合（引力）与分离（斥力）由闭弦的空间路径控制，使和弦包既保持完整，又相互联系。

Closed strings usually appear in pairs on the background and figure sides of the figure-ground relationship, and the combination (attraction) and separation (repulsion) are controlled by the spatial path of the closed strings, so that the chord packages remain complete and interconnected.

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图 14-5.1、闭弦，开弦，膜弦的空间作用

Figure 14-5.1. The space effect of closed strings, open strings, and membrane strings

空间相互作用有两种方式：电磁作用与非电磁作用：和弦（调性）空间的相互作用是闭弦（正电子），开弦（负电子），膜弦（磁场）的作用，是电磁作用；非和弦（无调性）空间不含闭弦（正电子）、开弦（负电子），磁极，是非电磁作用。

There are two ways of space interaction: electromagnetic and non-electromagnetic interaction: Chord (tonality) Space interaction is closed string (positron), open string (negative electron), membrane string (magnetic field), is electromagnetic action; Non-chord (atonal) space does not contain closed strings (positrons), open strings (negative electrons), magnetic poles, and non-electromagnetic interactions.

图 14-5.2、屏蔽和弦后的无调性空间作用

Figure 14-5.2: Atonal spatial effect after shielding chords

空间相互作用包括七声音阶与爵士音阶两种方式，七声音阶和弦包用于生命、天体表达，是时空的宏观形式。

Spatial interaction includes two modes: the heptachord and the jazz scale. The heptachord and chord package are used to express life and celestial bodies and are the macroscopic form of space-time.

在七声音阶中，和弦空间包的结合力与闭合梯度相关，并由此产生空间的主-次秩序，解决倾向，引

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力中心。参见：8.Close;闭合性，13.Multi-Layer Key Group;多层调群。

In the heptachord, the cohesion of the chord space package is related to the Close gradient, which produces the major-minor order of space, the tendency of resolution, and the center of gravity. See: 8. Close, 13. Multi-Layer Key Group.

和弦包相互作用（引力，斥力等），涉及调内，调群，三和弦，重叠和弦，以及不同音阶系统等，具有多样性，复杂性，涉及对不同和弦结构的具体分析。

The chords package interactions (attraction, repulsion, etc.), involving intra-key, key groups, triads, overlapping chords, and different scale systems, etc., are diverse and complex, and involve specific analysis of different chord structures.

14-2.4. Integrity；整体性

整体性：和弦系统具有整体性，其中的所有元素（音符，和弦，和弦包）在全局系统的控制下保持相互关联状态，与空间距离、尺度无关。

Holism: A chord system possesses a holistic nature, where all elements (notes, chords, and chord packages) remain interconnected under the control of the global system, independent of spatial distance or scale.

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Poplar forest, Jazz Scale A major；白杨林、爵士音阶，A 大调

上面图例由爵士音阶 A 大调发挥整体控制作用，将该图放大，缩小到任何尺度，其中的音符，和弦的关联保持不变。

The jazz scale A major plays an overall controlling role in the above diagram. Whether the diagram is enlarged or reduced to any scale, the relationship between the notes and chords remains unchanged.

14-3. Space-Time Duality；时-空二相性

和弦语言包含时间表达与空间表达，前面部分介绍了和弦的空间表达，本节将讨论时-空关系。

Chord language includes time expression and space expression. The previous section introduced the spatial expression of chords. This section will discuss the time-space relationship.

和弦语言包含时间语义（始-末，进行）与空间语义（线，膜），分别表达时间与空间。

和弦时间与和弦空间镜像对称：

{-7,-4,0} ↔ {0,4,7} mod 12

The chord language contains time semantics (beginning-end, progression) and space semantics (line, membrane), which express time and space respectively.

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Chord time and chord space are mirror-symmetric:

{-7,-4,0} ↔ {0,4,7} mod 12

两者互为反结构：反和弦，反调，可以数学转换。

空间具有定域性，时间具有非定域性，整体表现为时空二相性，类似波粒二相性。

The two are inverse structures of each other: anti-chords, anti-keys, and can be converted mathematically.

Space is localized, time is non-localized, and the overall performance is space-time duality, similar to wave-particle duality.

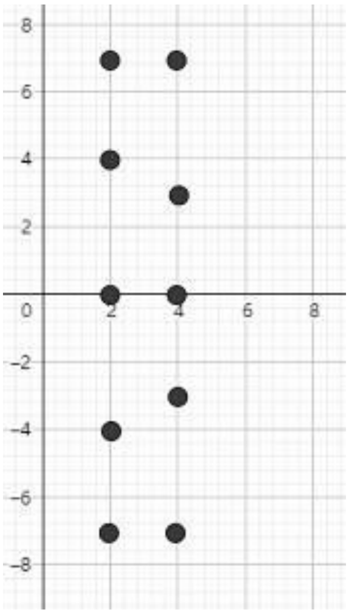

图 14-3.1、大三和弦-小三和弦的升序，降序，镜像对称形式。Y=平均律数列的指数

Figure 1-3, Major triad - minor triad ascending, descending, mirror-symmetric form. Y= exponents of the equal temperament series.

大三和弦，升序：{0，4，7}，大三和弦，降序：{-7，-4，0}（mod 12）

Major triad, ascending: {0,4,7}, Major triad, descending: {-7，-4，0}（mod 12）

小三和弦，升序：{0，3，7}，大三和弦，降序：{-7，-3，0}（mod 12）

Minor triad, ascending: {0,3,7}, Major triad, descending: {-7，-3，0}（mod 12）

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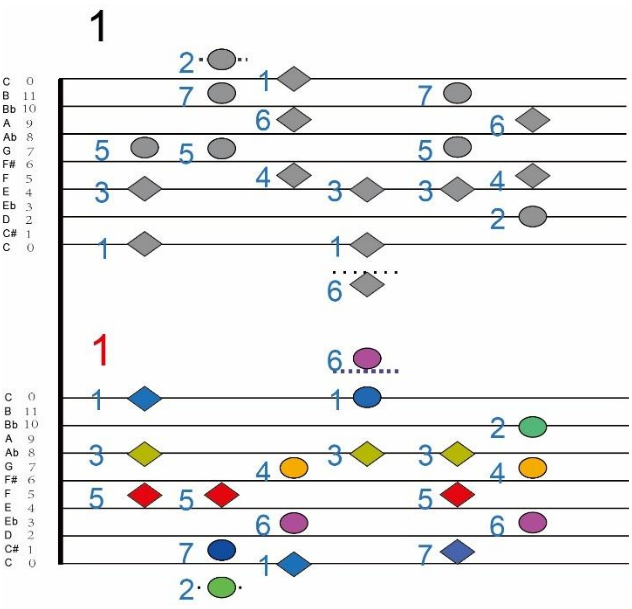

图 14-3.2、和弦镜像：和弦时间（上），和弦空间（下）互为反和弦。

Figure 14-3.2, Chord mirror image: Chord time (top) and chord space (bottom) are each other's antichords.

图 1-3.2、大三和弦-小三和弦的升序，降序，镜像对称形式。七声音阶（Heptachord），C 大调，关系小调。

Figure 1-3.2. Ascending, descending, mirror-symmetric forms of Major - minor triads. Heptachord, C major, relation minor.

Formula；公式：

C 大三和弦（升序）=H^0,4,7.C

C major chord, (ascending)= H ^ 0,4,7.C

a 小三和弦（升序）=H^0,3,7.a

a minor triad (ascending)=H^0,3,7.a

C 大三和弦（降序）=H^0,-4,-7.C

C major chord(descending)= H ^ 0, -4, -7.C

Eb 小三和弦（降序）=H^0,-3,-7.Eb

Eb minor triad (descending)=H^0,-3,-7.Eb

和弦时间与和弦空间具有相反的数学结构，甚至还有相反的物理属性：定域性与非定域性。

和弦时间不含几何语义，没有空间状态；和弦空间不含时间语义，没有时间状态。两者整体表现为

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时空二相性，类似于量子力学中的波粒二象性。

Chord time and chord space have opposite mathematical structures and even opposite physical properties: locality and non-locality.

Chord time does not contain geometric semantics and has no spatial state; chord space does not contain temporal semantics and has no temporal state. The two as a whole show the duality of space and time, which is similar to the wave-particle duality in quantum mechanics.

纯时间 vs. 纯空间：巴赫与莫奈的对比

在巴赫的音乐中，我们只能观察到和弦与旋律的时间变化，无法感知任何几何形状或位置。

纯时间状态下，空间属性无法被观察，空间位置处于叠加态（Superposition State）。

如果要在巴赫的音乐中观察到空间属性，唯一的方式是将和弦时间转换为其镜像对称形式——和弦空间。

Pure time vs. pure space: Bach and Monet's comparison

In Bach's music, we can only observe the time changes of chords and melodies, and cannot perceive any geometric shapes or positions.

In the pure time state, spatial properties cannot be observed, and spatial positions are in a superposition state.

If you want to observe spatial properties in Bach's music, the only way is to convert chord time into its mirror-symmetric form - chord space.

结论：巴赫的音乐是和弦时间，莫奈的绘画是和弦空间。在纯时间状态下，空间位置的概念是无意义的，相当于所有位置的叠加。

Conclusion: Bach's music is chord time, and Monet's paintings are chord space. In the pure time state, the concept of spatial position is meaningless, which is equivalent to the superposition of all positions.

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图 14-3.3、巴赫手稿

Figure 14-4.2. Bach manuscript

3. 莲花的时空二相性：莫奈 vs. 莫扎特

莫奈的莲花（绘画）是空间表达，具有定域性，即它不能同时出现在卢浮宫和奥赛博物馆。

莫扎特的莲花（音乐）是时间表达，具有非定域性，可以处于任意空间位置的叠加态，包括卢浮宫和奥赛。

3. The space-time duality of the lotus: Monet vs. Mozart

Monet's lotus (painting) is a spatial expression with locality, that is, it cannot appear in the Louvre and the Musee d'Orsay at the same time.

Mozart's lotus (music) is a temporal expression with non-locality, and can be in a superposition state of any spatial position, including the Louvre and the Musee d'Orsay.

这意味着，莲花同时具有莫奈（空间）-莫扎特（时间）二相性，类似于波粒二象性：

作为绘画（莫奈）时，它是粒子，位置固定。

作为音乐（莫扎特）时，它是波动，位置可叠加。

结论：

莲花在“莫奈-莫扎特”二相性中展现了时空结构的波粒二象性。

从和弦时间到和弦空间的转换，与量子测量导致波函数坍缩的过程类似。

This means that the lotus has both the Monet (space) and Mozart (time) duality, similar to the

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wave-particle duality:

As a painting (Monet), it is a particle with a fixed position.

As music (Mozart), it is a wave with superimposable positions.

Conclusion:

The lotus shows the wave-particle duality of the space-time structure in the "Monet-Mozart" duality.

The conversion from chord time to chord space is similar to the process of wave function collapse caused by quantum measurement.

图 14-3.4：莫奈-莫扎特二相性。

Figure 14-3.4: Monet-Mozart duality.

14-4.Chord Spacetime Concept Framework；和弦时空概念框架

和弦时空由和弦（量子化频谱）构成，时间与空间是能量的不同形式，由此有：

E=t+s

和弦时空中存在 纯时间（s=0）与纯空间（t=0），这需要与其适应的时空框架。

时间能量（T）：非定域性，类似量子态，不依赖外部时钟。

空间能量（S）：定域性，具有几何属性，如形状、位置等，质量依赖定域性。

Chord spacetime is composed of chords (quantized spectrum). Time and space are different forms of energy, so:

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E=t+s

In chord spacetime, there is pure time (s=0) and pure space (t=0), which requires a spacetime framework that adapts to it.

Time energy (T): non-local, similar to quantum state, does not depend on external clocks.

Space energy (S): local, has geometric properties, such as shape, position, etc., and quality depends on locality.

1、时间与空间的互补关系：

设和弦时-空的总能量归一化为 1，则：

S+T=1

其中：

S 代表和弦空间的能量占比。

T 代表和弦时间的能量占比。

当 S=0（纯时间）时，无空间信息，时间完全非定域。

当 T=0（纯空间）时，无时间信息，空间完全定域。

结论：时间和空间是互补变量，它们的分布决定了和弦时空的性质。

1.The complementary relationship between time and space:

Assume that the total energy of chord space-time is normalized to 1, then:

S+T=1

Where:

S represents the energy proportion of chord space.

T represents the energy proportion of chord time.

When S=0 (pure time), there is no spatial information and time is completely non-local.

When T=0 (pure space), there is no time information and space is completely local.

Conclusion: Time and space are complementary variables, and their distribution determines the properties of chord space-time.

2. 速度的定义：由于速度是时间（非定域性）与空间（定域性）的叠加，时间能与空间能的比值

v=T/S+T=T

由于 S+T=1，我们有：

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v=1−S

这表明：

当 S=0（纯时间），v=1（无空间状态，时间完全非定域）。

当 T=0（纯空间），v=0（无时间状态，空间完全定域）。

速度 v 是时间能量的占比，独立于外部参考系，仅由和弦时空内部状态决定。

结论：

速度 v 不是外部测量的运动速度，而是时间能量的占比。

在和弦时空中，时间能量越高（越非定域），速度越大；空间能量越高（越定域），速度越小。

这类似于量子力学中的“不确定性关系”——时间越模糊，空间信息越清晰，反之亦然。

2. Definition of speed: Since speed is the superposition of time (non-locality) and space (locality), the ratio of time energy to space energy

v=T/S+T=T

Since S+T=1, we have:

v=1−S

This shows that:

When S=0 (pure time), v=1 (no space state, time is completely non-local).

When T=0 (pure space), v=0 (no time state, space is completely local).

Speed v is the proportion of time energy, independent of the external reference system, and only determined by the internal state of the chord spacetime.

Conclusion:

Speed v is not the speed of movement measured externally, but the proportion of time energy.

In chord spacetime, the higher the time energy (the more non-local), the greater the speed; the higher the space energy (the more local), the smaller the speed.

This is similar to the "uncertainty relationship" in quantum mechanics-the more vague the time, the clearer the spatial information, and vice versa.

3. 和弦时空的不连续性

和弦时间（T）与和弦空间（S）互为反和弦（镜像对称），可数学转换。

在纯时间中（S=0），空间信息完全消失。

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在纯空间中（T=0），时间信息完全消失。

这表明：

和弦时空可以是不连续的，即时间和空间可以在某些状态下完全分离。

当 S→0 或 T→0 时，和弦时空表现出类似“量子跃迁”的行为，即从一种完全状态跳跃到另一种完全状态，而不是连续变化。

3. Discontinuity of chord spacetime

Chord time (T) and chord space (S) are antichords (mirror symmetry) and can be mathematically transformed.

In pure time (S=0), spatial information disappears completely.

In pure space (T=0), time information disappears completely.

This shows that:

Chord spacetime can be discontinuous, that is, time and space can be completely separated in certain states.

When S→0 or T→0, chord spacetime exhibits a behavior similar to a "quantum jump", that is, jumping from one complete state to another complete state, rather than changing continuously.

4. 质量的测量问题

时间无法测量质量， 质量必须在定域的空间状态（S>0）下才能被测量。

在纯时间状态（S=0）下，质量无法定义，因为没有空间参考。

质量仅能在具有几何结构的区域内被测量，这意味着质量是空间定域性的表现。

数学表达：

设质量 m 依赖于空间定域性 S，则：

m=MS

其中 M 为某个常数。

当 S=0（纯时间），则 m=0，即纯时间状态下无法测量质量。

当 S=1（纯空间），m=M，即质量完全在空间中表现。

由此得出质量-速度关系：

m+t=1

能量，质量，速度关系为：E=s+t=m+t=1

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结论：

质量只存在于和弦空间，而不存在于和弦时间。

4. Measurement of quality

Time cannot measure mass, and mass must be measured in a localized spatial state (S>0).

In a pure time state (S=0), mass cannot be defined because there is no spatial reference.

Mass can only be measured in a region with a geometric structure, which means that mass is a manifestation of spatial locality.

Mathematical expression:

Assume that mass m depends on spatial locality S, then:

$m=MS$

Where M is a constant.

When S=0 (pure time), m=0, that is, mass cannot be measured in a pure time state.

When S=1 (pure space), m=M, that is, mass is completely manifested in space.

From this, the mass-speed relationship is:

$m+t=1$

The relationship between energy, mass, and speed is: $E=s+t=m+t=1$

Conclusion:

Mass only exists in chord space, not in chord time.

5. 总结：

时间能（T）和空间能（S）满足归一化关系：$S + T = 1$。

速度 $v = T$，决定于时间能量的占比，而不是外部参考系。

在纯时间状态（$T = 1, S = 0$），空间信息消失；在纯空间状态（$S = 1, T = 0$），时间信息消失。

和弦时空的不连续性表明，时间和空间可以完全分离，表现出类似量子跃迁的行为。

质量只存在于和弦空间，在纯时间状态下无法测量质量。

5. Summary:

Time energy (T) and space energy (S) satisfy the normalization relationship: $S + T = 1$.

Speed $v = T$, determined by the proportion of time energy, not the external reference frame.

In the pure time state ($T = 1, S = 0$), spatial information disappears; in the pure space state ($S = 1,$

T = 0), time information disappears.

The discontinuity of chord spacetime shows that time and space can be completely separated, showing quantum jump-like behavior.

Mass only exists in chord space and cannot be measured in the pure time state.

14-5.Chord Space-Time Measurement；和弦时空测量

在和弦时空的观察、测量中，一些和弦语言特征可能被观察到。

In the observation and measurement of chord space -time, some chord language features may be observed.

1、离散性：和弦时-空由和弦表达，可测量到一系列频率（能量）值，不是任何频率（能量）都能进入和弦系统，系统只接受和弦法则允许的一系列离散值（C=H^n*f, H=1.059463），表现为和弦频谱。

1, discrete: chord space-time is expressed by the chord, can be measured to a series of frequency (energy) values, not any frequency (energy) can enter the chord system, the system only accepts a series of discrete values allowed by the chord law (C=H^n*f, H=1.059463), expressed as the chord spectrum.

2、和弦几何语义：和弦空间由和弦表达，和弦按几何语义分为：开弦，闭弦，膜弦。（参见：3、和弦与弦）

2. Chord Geometric semantics: Chord space is expressed by chords, and chords are divided into open strings, closed strings, and membrane strings according to geometric semantics. (See: 3, Chords and Strings)

3、±对称：和弦时-空的“基本粒子”是±音符；和弦属性都涉及±音符及对称性。

3. ± symmetry: The "elementary particles" of chord space-time are ± notes; all chord properties involve ± notes and symmetry.

4、时-空二相性：时间和弦与空间和弦互为反和弦，数学形式为：镜像对称，和弦时间具有非定域性，和弦空间具有定域性，在观察中会表现出“时空二相性”（波粒二相性）。

4. Time-space duality: time chord and space chord are antichords to each other, and the mathematical form is: mirror image and symmetry. Chord time has non-locality, chord space has locality, and the observation will show "space-time duality" (wave-particle duality).

Reference；参考

Basic Theory Of Music；音乐基础理论

Harmony；和声学

Chord Painting；和弦绘画

General Physics；普通物理学

15. Chord Biology；和弦生命

人类有两种时空-生命观察者：和弦（调性）观察者与非和弦（无调性）观察者，分别观察两种时空-生命形式：和弦包（基于量子化频谱，弦）与生物体（基于细胞），生命包含和弦与形态两个层。

Humans have two kinds of space-time-life observers: chord (tonality) observers and non-chord (atonality) observers, who respectively observe two kinds of space-time-life forms: chord packages (based on quantized spectrum, strings) and organisms (based on cells). Life contains two layers: chords and forms.

在人体中，和弦表现为经络（脉轮）系统，观察表明：十二经络系统具有受激频谱响应，其分布可近似为：

fn=H^n·f0 其中 H=2^1/12≈1.059463, n∈Z

In the human body, the chords are manifested as the meridian (chakra) system. Observations show that the twelve meridian systems have a stimulated spectrum response, and their distribution can be approximated as follows:

fn=H^n·f0 其中 H=2^1/12≈1.059463, n∈Z

这说明音乐（时间域）、绘画（空间域）与经络（生命域）共享同一组量子化频谱结构，是和弦场（Chord Field）在不同感知维度中的体现。

This shows that music (time domain), painting (space domain) and meridians (life domain) share the same set of quantized spectrum structures, which are the manifestation of the chord field in different perceptual dimensions.

纯小三和弦+导音减七和弦构成生命和弦包——生命的和弦编码形式；在特定状态下，生命和弦包可独立于生物体，不依赖生物体，具有灵魂的性质。

Pure minor triads + leading tone diminished seventh chords constitute the life chord package - the chord coding form of life; under certain conditions, the life chord package can be independent of the organism, not dependent on the organism, and has the nature of a soul.

和弦（经络）是生命的物理（离散频谱）编码结构。

Chords (meridians) are the physical (discrete spectrum) encoded structures of life.

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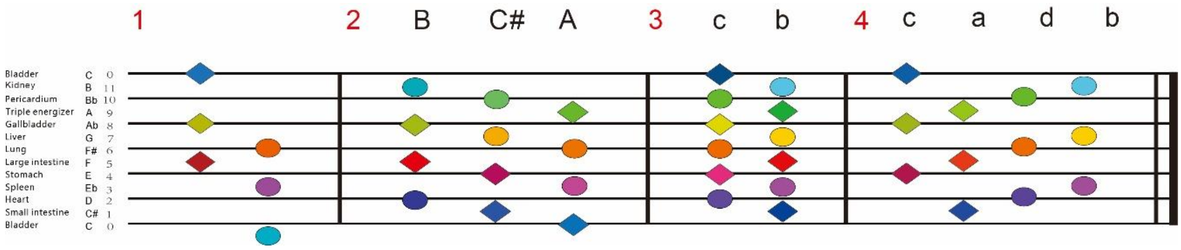

基本和弦表：1-1、大三和弦（闭弦），1-2、小三和弦（开弦）、2、减七和弦（膜弦）、3、全音阶和弦（膜弦），4、增三和弦（膜弦）

*和弦频谱公式：n*f，H^n*f,（H=1.059463，n∈Z）

*符号：◆=+音符，●=-音符，音符色=色荷

*本文使用 mod12 记谱法

Basic chord table: 1-1, major triad (closed string), 1-2, minor triad (open string), 2, diminished 7th (membrane string), 3, diatonic chord (membrane string), 4, augmented Triads (membrane strings)

* Chord spectrum formula: n*f, H^n*f (H=1.059463，n∊Z)

* Symbol: ◆=+ note, ●=- note, note color = color charge

** This article uses mod12 notation

5-1.Qualitative And Dimensional；定性与量纲

十二正经（Twelve regular meridians）是经络系统的主体，每一经络都具有特征频率与正-负（阴-阳）属性，这是本节的要点。

Twelve regular meridians are the main body of the meridian system. Each meridian has a characteristic frequency and positive-negative attributes. This is the main point of this section.

本文数据来自对人体经络系统（和弦编码系统）的内观察：经络对乐音-色光的受激反应；不同的频率的乐音-色光在不同经络上诱发受激反应，表现为经络线路区域出现相应体觉——循经传感（Propagated sensation along the channels），特定经络的受激反应与乐音-色光的频率相关。

The data in this article comes from the Internal Observation of the human body meridian system (chord coding system): the stimulated response of the meridian to the music tone-color light; the different frequency of the music-color light induces the stimulated response on the different meridians, which is expressed as the meridian Corresponding somatosensory emerges in the line area—Propagated sensation along the channels. The stimulated response of a specific meridian is

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related to the frequency of music tone-color light.

上述观察得到如下结果：

The above observations have the following results:

在十二正经（Twelve regular meridians）中，每一经络均能在乐音信号作用下产生受激反应，表现为：循经传感（Propagated sensation along the channels）。

In the Twelve regular meridians, each meridian can produce an stimulated response under the action of music signals, which is expressed as: Propagated sensation along the channels.

特定经络只对特定频率的乐音产生受激反应，对其余频率无确定的反应：十二正经（Twelve regular meridians）具有受激反应特征频率，具有类似“弦共振”的性质。

Specific meridians only produce an stimulated response to music with a specific frequency, and have no definite response to other frequencies: Twelve regular meridians have a characteristic frequency of stimulated response, which is similar to "string resonance"

以膀胱经（bladder meridian）为例：下表中的频率均能在膀胱经（bladder meridian）上诱发受激反应。

Take the bladder meridian as an example: the frequencies in the table below can all induce a stimulated response on the bladder meridian.

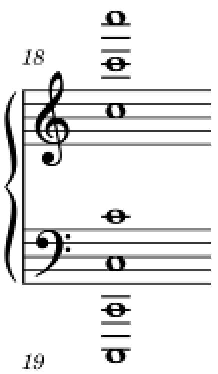

图 15-1.1、C 音的倍频数列。

Figure 15-1.1. The octave sequence of C tone.

*和弦取值的计算方法见：1、和弦数学模型

*For the calculation method of chord value, please refer to: 1. Chord Mathematical Model

用色光作刺激信号，对十二正经（Twelve regular meridians）进行观察，得出如下结果：

Using colored light as a stimulus signal and observing the Twelve regular meridians, the following results are obtained:

1、在十二正经中，各经络均能在色光的刺激作用下出现受激反应。

1. In the twelve regular meridians, each meridian can have a stimulated response under the stimulation of color light.

2、特定经络只在特定频率的色光作用下产生反应，而对其它频率的反应不确定。

2. A specific meridian only reacts under the action of the color light of a specific frequency, and the response to other frequencies is uncertain.

这与光电效应非常相似，经络只接受特定能量值，仍以膀胱经（bladder meridian）为例：它只在频率为 690 兆赫的蓝光作用下出现受激一反应，而对其它频率的反应不确定。

This is very similar to the photoelectric effect. The meridian only accepts a specific energy value. Take the bladder meridian as an example: it only appears stimulated-response under the action of blue light with a frequency of 690 MHz, while the response to other frequencies is uncertain.

十二正经分别具有不同的受激-反应特征频率，乐音、色光、十二正经与十二平均律的对应关系之间如下：

The Twelve regular meridians have different stimulus-response characteristic frequencies, and the corresponding relations between musical tone, color light, Twelve regular meridians and the equal temperament are as follows:

音名 pitch names	色彩 Color	十二经络 Twelve Meridians	±
C	blue	足太阳膀胱经-Foot Taiyang Bladder Meridian	+
B	cyan	足少阴肾经-Foot Shaoyin Kidney Meridian	−
Bb	Green	手厥阴心包经 - Hand Jueyin Pericardium Meridian	−
A	Yellowgreen	手少阳三焦经-Hand Shaoyang Sanjiao (Triple Burner) Meridian	+
Ab	Yellow	足少阳胆经 - Foot Shaoyang Gallbladder Meridian	+
G	yelloworange	手厥阴肝经 - Hand Jueyin Liver Meridian	−
F#	orange	手太阴肺经 - Hand Taiyin Lung Meridian	−
F	Rot-orange	手阳明大肠经 - Hand Yangming Large Intestine Meridian	+
E	Red	足阳明胃经 - Foot Yangming Stomach Meridian	+
Eb	purplishred	足太阴脾经 - Foot Taiyin Spleen Meridian	−
D	purplishred	手少阴心经 - Hand Shaoyin Heart Meridian	−
C#	indigo	手太阳小肠经 - Hand Taiyang Small Intestine Meridian	+

平均律（Equal Temperament）元素对应表

Equal Temperament element correspondence table

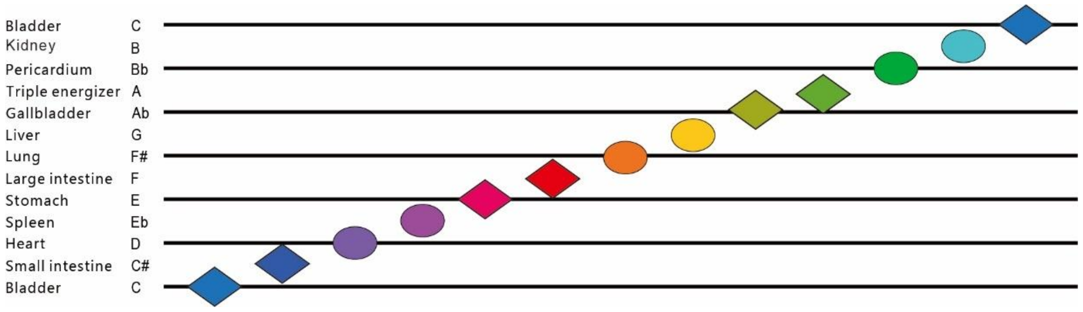

图 15-1.3.2：乐音、色光、十二正经与十二平均律的对应关系（坐标）

Figure 15-1.3.2: Correspondence between music tone, color light, Twelve regular meridians and twelve equal temperament (coordinates)

*和弦取值的计算方法见：1、和弦数学模型

*For the calculation method of chord value, please refer to: 1. Chord Mathematical Model

以上定性、定量观察表明：经络是和弦语言现象。

The above qualitative and quantitative observations show that the meridian is a phenomenon of chord language.

表中的音符含有±标记，这是经络（频率）的另一重要属性。

The notes in the table contain ± marks, which is another important attribute of meridians (frequency).

经络的正-负（阴-阳）属性，由《黄帝内经》等古代医学著作记载，频率值与正-负（阴-阳）值不可分割，应是某种物理属性。见图 15-1.2，图 15-1.3，请注意音符上的±标记。

The positive-negative (yin-yang) attribute of the meridian is recorded in ancient medical works such as Huangdi Neijing. The frequency value is inseparable from the positive-negative (yin-yang) value and should be a certain physical attribute. See Figure 15-1.2, Figure 15-1.3, please pay attention to the ± mark on the note.

频率值与正-负值都是重要的和弦编码元素，对和弦语法、语义具有支配作用，在和弦实验中可观察，验证。请参阅前面：1，2，3，4 等章节。

Frequency and positive-negative values are both important chord coding elements, which dominate the chord syntax and semantics, and can be observed and verified in chord experiments.

Please refer to the previous chapters: 1, 2, 3, 4, etc.

15-2.Chord Distribution On The Human body；人体上的和弦分布

和弦语言在人体上表现为经络系统，线和弦（线和弦）、膜和弦（膜弦）在人体上都有相应的形态-定位，两种和弦组成生命和弦包。

Chord language is expressed as a meridian system on the human body. line chords (line chords) and Membrane chords (membrane chords) have corresponding shapes-positions on the human body. The two chords form a life Chord packet et.

15-2.1.Line Chord；线和弦

线和弦（大三和弦、小三和弦）分布在身体左右两侧的十二正经上。

The line chords (major triad, minor triad) is distributed on the Twelve regular meridians on the left and right sides of the body.

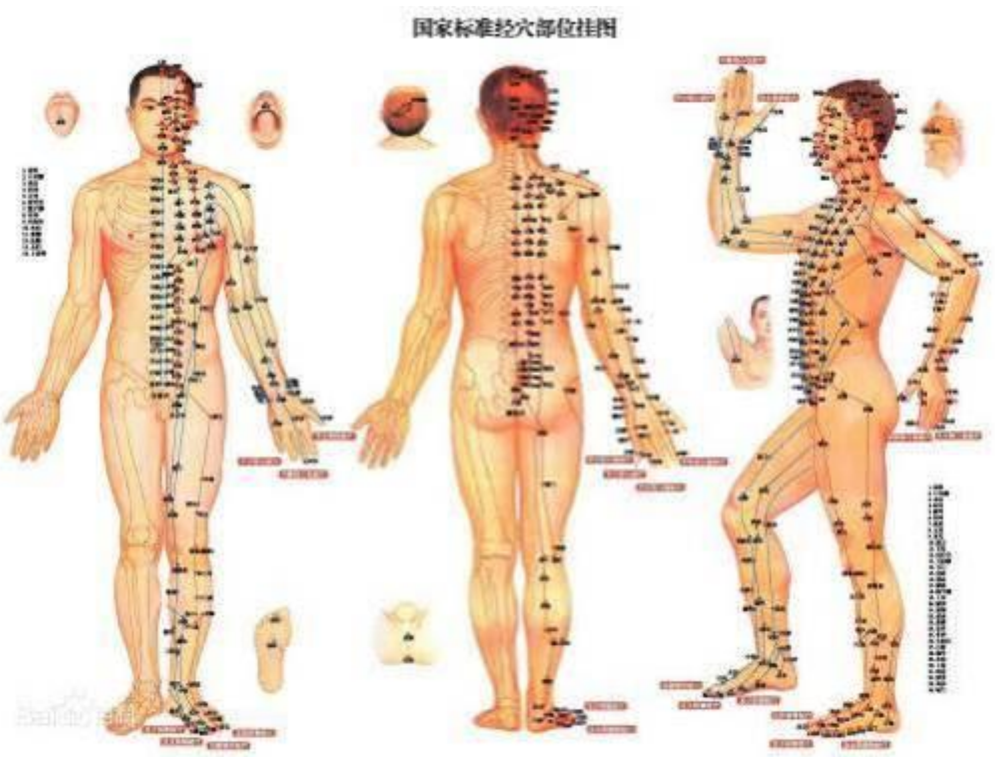

图 15-2.1、十二正经

Figure 15-2.1, Twelve regular meridians

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十二正经具有特征频谱与正-负属性，请注意下图中各和弦上的+、—符号。

The twelve regular meridians have characteristic frequency spectrum and positive-negative attributes. Please pay attention to the + and-signs on each chord in the figure below.

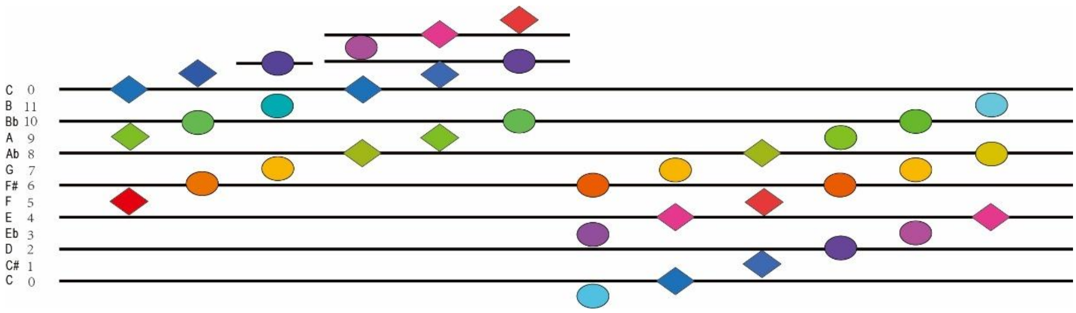


图 15-2.1、十二正经上的线和弦（◆=正音符，●=负音符，色彩=色荷）

Figure 15-2.1 The line chords on the Twelve regular meridians (◆=positive note, ●=negative note, color=color charge)

*和弦取值的计算方法见：1、和弦数学模型

*For the calculation method of chord value, please refer to: 1. Chord Mathematical Model

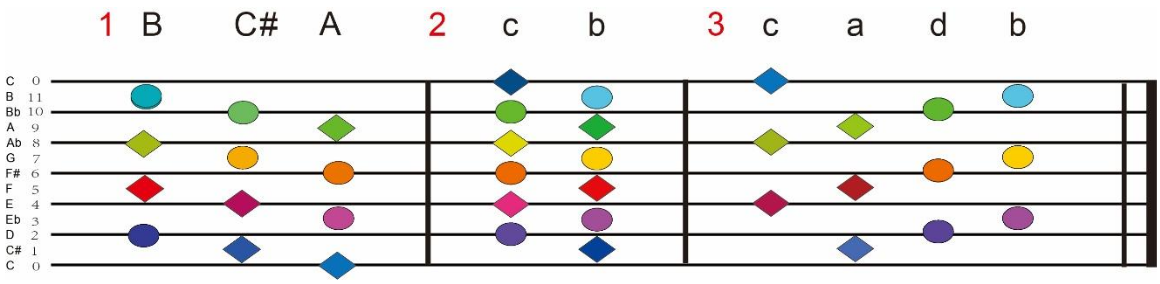
身体左右两侧的线和弦相同，但两侧的音阶、调群形式有显著的区别，在后面有专门介绍。

The line chords on the left and right sides of the body are the same, but there are significant differences in the scales and key groups on both sides, which will be introduced later.

15-2.2.Membrane chords；膜和弦

膜和弦分布在躯干中央的任脉（Ren meridian）、督脉（Du meridian）上。

The Membrane chords is distributed on the Ren meridian and Du meridian in the center of the trunk.



等比和弦表：1、减七和弦（膜弦）、2、全音阶和弦（膜弦），3、增三和弦（膜弦）

*◆=正音符，●=负音符，色彩=色荷

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Geometric chords table: 1, diminished 7th chord (membrane chord), 2, diatonic chord (membrane chord), 3, augmented Triads (membrane chord)

* ◆=positive note, ●=negative note, color=color charge

*和弦取值的计算方法见：1、和弦数学模型

*For the calculation method of chord value, please refer to: 1. Chord Mathematical Model

下图：膜和弦在人体上的分布

Below: the distribution of the Membrane chords on the human body

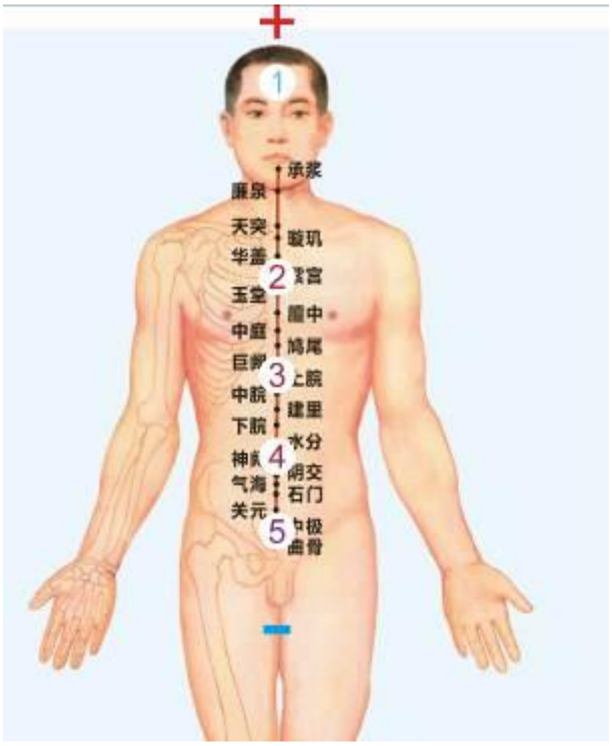

图 15-2.3、膜和弦在任脉，督脉上的分布

Figure 15-2.3, the distribution of the Membrane chords on the Ren and Du channels

膜和弦在任脉与督脉上按照闭合倾向分布，原则是：闭合性较高者在上，闭合性较低者在下，具有相对性，参考位置：1、{B,Ab,F,D}：神庭； 2、3、{C#,Bb,G,E}：膻中，上脘*；4、{A,F#,Eb,C}：关元，中极，长强。

百会：正磁极*；会阴：负磁极*。

Baihui: positive magnetic pole *; Hui yin: negative magnetic pole *.

*{C#,Bb,G,E}具有动态位置，其闭合状态越高，位置越靠上，并可占据其它减七和弦的位置。

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*{C#,Bb,G,E} has dynamic positions, the higher the Close state, the higher the position, and can occupy the position of other diminished 7th.

*表中+、—号位置是人体的南北磁极。

*The positions of + and-in the table are the north and south magnetic poles of the human body.

*全音阶和弦是减七和弦的弱调性形式。

经络（中国医学）与脉轮（瑜伽），丹田（道教）具有显著的相关性，从下面图例中可以看出他们之间的联系：

Meridians (Chinese medicine), chakras (yoga), and dantian (Taoism) have a significant correlation. The connection between them can be seen from the following illustration:

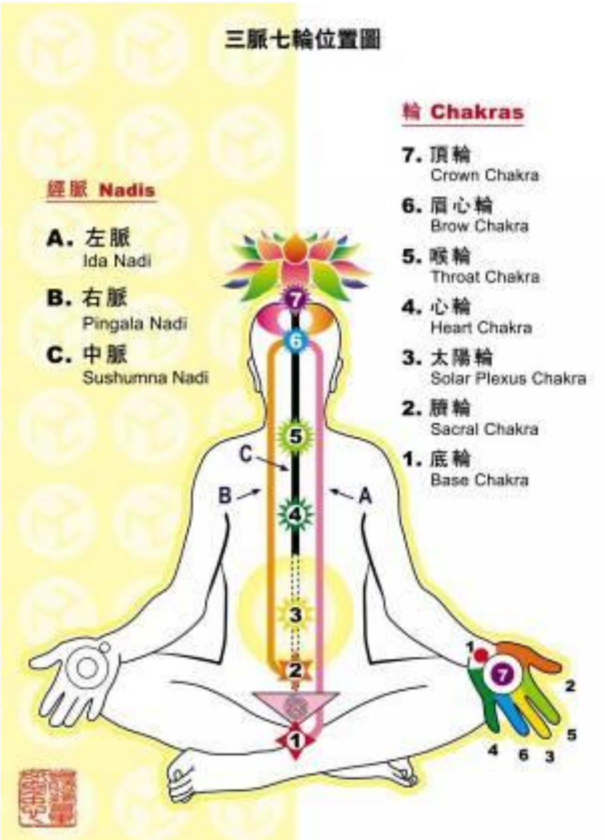

图 15-2.5、三脉七轮图（瑜伽及相关宗教）

Figure 15-2.5, Three Chakras and Seven Chakras (Yoga and related religions)

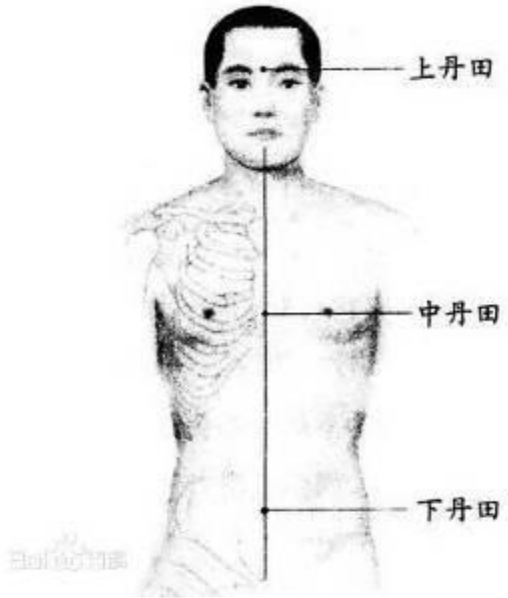

图 15-2.6、丹田位置图（中国道教）。

Figure 15-2.6. Location map of Dantian (Chinese Taoism).

从上面三个图例中，可以看出东方的生命-宗教的观察方法（内观察）与观察基础。

From the above three illustrations, we can see the method of observation (Internal Observation) and the basis of observation of Eastern life-religion.

15-3.Chord Life Packet；和弦生命包

位于躯干中轴任脉（Ren meridian）、督脉（Du meridian）上的膜和弦向身体左、右侧的 12 正经（The Twelve regular meridians）上的线和弦解决，构成和弦时空包，和弦生命包是和弦时空包的形式之一。（参见：基本和弦表）

The Membrane chords on the Ren meridian and Du meridian on the central axis of the torso is resolved to the line chords on the twelve regular meridians on the left and right sides of the body, forming a chord space-time packet and a Chord Life packet It is one of the forms of the chord space-time packet. (See: Basic chord Table)

膜和弦分别向身体的左侧与右侧解决，产生各种和弦包。

The Membrane chords resolves to the left and right sides of the body, respectively, producing various chord packet.

左侧解决：减七和弦（diminished 7th）向身体左侧解决，形成七声音阶（Heptachord）和弦包，

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与七声音阶调群。

Left side resolution: diminished 7th is resolved to the left side of the body, forming the Heptachord chord package and the Heptachord key group.

右侧解决：全音阶和弦，增三和弦向身体右侧解决，形成爵士音阶和弦包，并可兼容无调性。

左侧解决产生七声音阶和弦包，其中的纯小三和弦+导音减七和弦（leading note diminished 7th）是生命（自我）和弦包，右侧解决产生爵士音阶和弦包，它屏蔽了七声音阶和弦包的大部分语义信息，包括生命（自我）信息，是非生命和弦包，但与七声音阶仍存在联系并可相互转换。

15-3.1.Mirror (Exterior And Interior) Relationship；镜像（表里）关系

在生命的和弦表达中，每个和弦都有其镜像和弦，两者互为反和弦，根音符为相邻的两个正负音符。（参阅：1-5.镜像对称）

In the chord expression of life, each chord has its mirror chord, with the two being opposite chords and the root note being two adjacent positive and negative notes. (Refer to: 1-5. Mirror Symmetric)

十二调（十二经络）中有六对镜像和弦，在中医中被称为：表里（exterior and interior）关系。*

There are six pairs of mirrored chords in the twelve tones (twelve meridians), which are referred to as the "exterior and interior" relationship in traditional Chinese medicine*

15-4. Levels of Life；生命层次

纯小三和弦+导音减七和弦（Leading note diminished 7th）构成生命（自我）和弦包，它是生命（自我）的基本单位与物理-数学形式。

Pure minor triad + leading note diminished 7th chord constitutes the life (self) chord package, which is the basic unit and physical-mathematical form of life (self).

生命和弦包具有闭合性差异，来自其导音减七和弦。

The Life Chords package has a Close difference, coming from its leading tone diminished seventh chord.

三个减七和弦具有不同的闭合状态，分别表达不同的生命和弦包，并形成生命（自我）的闭合层级。

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The three diminished seventh chords have different Close states, expressing different life chord packages and forming the Close levels of life (self).

参见：8、闭合性，13、多层调群与宇宙模型。

See: 8. Close, 13. Multilayer tuning groups and cosmological models.

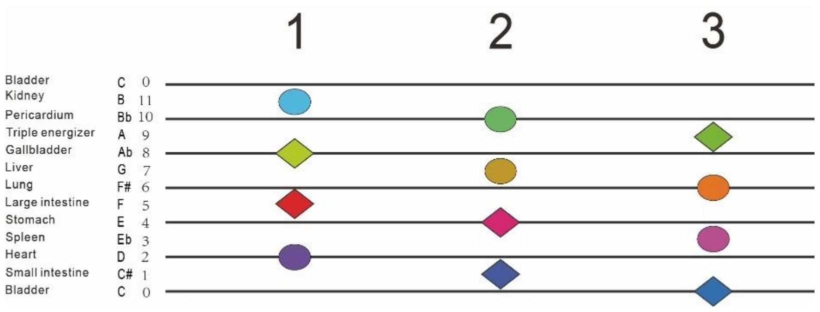

图 8.1、减七和弦表：1、{B,Ab,F,D}-高闭合，2、{C#,Bb,G,E}-中闭合，3、{A,F#,Eb,C} -低闭合

Fig. 8.1 Table of minus seventh chords: 1, {B,Ab,F,D} - high closure, 2, {C#,Bb,G,E} - medium closure, 3, {A,F#,Eb,C} - low closure

在七声音阶（heptanotic）中，纯大调表达天体状态，纯小调表达生命（自我）状态，三个导音减七和弦调群分别表达生命（自我）的不同闭合状态。

In the heptanotic scale, pure major scale expresses the celestial state, pure minor scale expresses the state of life (self), and the three leading tone diminished seventh chord groups express different Close states of life (self) respectively.

生命和弦包与生物体的关系为：闭合性越高，对生物体的依赖越低，最高闭合状态下，和弦包独立于生物体，最低闭合状态下，和弦包依赖生物体——生命和弦包具有灵魂的属性。

The relationship between the life chord package and the organism is: the higher the Close, the lower the dependence on the organism. In the highest Close state, the chord package is independent of the organism. In the lowest Close state, the chord package depends on the organism - the life chord package has the attributes of a soul.

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减七和弦 Diminished 7th	闭合倾向-稳定性-生命层次 Closing tendencies - stability - life level	生命语义 Life semantics	背景大调语义 Background major semantics	与生物体关系 Relationship with organisms
{B,Ab,F,D} B dim7	高；High	神，爱，永生 God, Love, Eternal Life	星系（银河系） Galaxy (Milky Way)	独立 independence
{C#,Bb,G,E}，C # dim7	中；Medium	人性，健康，今生 Humanity, health, this life	恒星系（太阳系） Star system (solar system)	独立-依赖 Independence-Dependence
{A,F#,Eb,C} C dim7	低；Low	魔，植物性，仇恨 Demon, Plant, Hate	行星，星尘 Planets, stardust	依赖 dependent.

*全音阶和弦是减七和弦的弱调性形式。

*The diatonic chord is the weak form of the diminished 7th chord.

*以上结果来自和弦观察，方法包括：音乐，绘画（和弦时空），经络感知。

*The above results are from chord observation, and the methods include: music, painting (chord time and space), and meridian perception.

{C#,Bb,G,E}是当前生命系统，{B,Ab,F,D}，{A,F#,Eb,C} 是过去-未来生命系统。

{C#,Bb,G,E} is the present life system, and {B,Ab,F,D} and {A,F#,Eb,C} are the past-future life systems.

减七和弦决定生命个体的闭合状态，人体中含有三个减七和弦，构成调集团系统，在同时条件下，其中之一处于主导地位。

The diminished 7th chord determines the Close state of the individual life. There are three diminished 7th chords in the human body, and under the condition of simultaneity, one of them is dominant.

解决方向：三个减七和弦（diminished 7th）组成 C-D-E 调群，这是和弦语言的全局形式；闭合状态较低的和弦包向闭合状态较高的和弦包解决，解决方向产生生命的需要体系：{B,Ab,F,D}具有最高闭合状态，是生命的终极需要，其和弦语义有：闭合自我，神，爱，永生。（参见：13-2、C-D-E 调群）

Solution direction: Three diminished seventh chords (diminished 7th) form the C-D-E key group,

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which is the global form of the chord language; the chord package with a lower Close state is solved to the chord package with a higher Close state. The solution direction produces a system of life needs: {B, Ab, F, D} has the highest Close state and is the ultimate need of life. Its chord semantics include: Close self, God, love, and immortality. (See: 13-2, C-D-E key group)

图 15-4.3、{B,Ab,F,D}-{C#,Bb,G,E}-{A,F#,Eb,C} 调群

Figure 15-4.3, {B,Ab,F,D}-{C#,Bb,G,E}-{A,F#,Eb,C} key group

生命和弦包的不同闭合-自我状态具有不同的执行结果，类似东方宗教中的“业力”。

The different Close-self states of the life chord packet have different execution outcomes, similar to "karma" in Eastern religions.

和弦生命中，神是生命（自我）和弦包的最高闭合状态，既存在于自身内部，也可存在于自身外部。

In chord life, God is the highest Close state of the life (self) chord packet, existing both within and outside of itself.

15-4.1.Natural Morality；自然道德

自然道德基于减七和弦的闭合性，通常表现为对生命的态度：爱-恨，善意-恶意，暴力-和平，等。

Natural morality is based on the Close of the diminished 7th, which is usually expressed as an

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attitude towards life: love-hate, kindness-maliciousness, violence-peace, etc.

自然道德现象不限于人类，如：母爱，感恩，互助等，它是具有生物意义的自然法则。

Natural moral phenomena are not limited to humans, such as: maternal love, gratitude, mutual assistance, etc.,it is a natural law with biomass significance.

和弦包的闭合状态及和弦语义主要存在于七声音阶系统，在爵士音阶，无调性体系中被不同程度屏蔽。

The Close state and chord semantics of the Chord packet mainly exist in the heptachord system, and are shielded to varying degrees in the jazz Scale and Atonal system.

常见的道德现象包括：自然道德（Natural morality）与契约道德（Contract morality）；前者是和弦语言的自然语义与自然法则，具有普世性；后者是人类的社会契约，具有民族-地域特征；道德是自然道德与契约道德二层存有。

Common moral phenomena include: natural morality and contract morality; the former is the natural semantics and natural laws of the chord language, which is universal; the latter is the social contract of mankind, with ethnic-regional characteristics; Morality is the two-layer existence of natural morality and contractual morality.

自然道德包含自然奖惩机制，实现途径是：和弦生命包的闭合状态与自然道德状态保持一致。

Natural morality includes a natural reward and punishment mechanism, and the way to achieve it is: the Close state of the Chord Life packet is consistent with the natural moral state.

自然奖惩按以下规则执行：

Natural rewards and punishments are implemented according to the following rules:

1、爱与善意会提升和弦生命包的闭合性。

1. Love and kindness increase the Close of the chord life Packet.

2、仇恨与攻击会降低和弦生命包的闭合性。

2. Hate and attack will reduce the Close of the chord life packet.

3、仇恨、伤害他人会以降低自己的闭合性为代价；被仇恨、攻击所伤害者，会以提升自己的闭合性为补偿。

3. Hate and hurt others will reduce their Close at the cost; Victims of hate and aggression compensate by improving their Close.

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自然奖惩机制在各种宗教经典都有相应的表达，如东方宗教的“因果报应”；最被人熟悉还有耶稣的一段话：你们听见有话说，以眼还眼，以牙还牙。只是我告诉你们，不要与恶人作对。有人打你的右脸，连左脸也转过来由他打。（圣经-新约）

The natural reward and punishment mechanism has corresponding expressions in various religious classics, such as the "karma" of Eastern religions; the most familiar one is a passage from Jesus: You have heard something saying, "An eye for an eye, and a tooth for a tooth." But I tell you, don't fight the wicked. If someone slaps you on the right cheek, turn around and let him hit even the left cheek. (Bible-New Testament)

由自然奖惩获得的和弦包闭合状态可以被存储、执行；不同的闭合状态有不同的执行结果；具有类似“业”的性质。

The Close state of the Chord packet obtained by natural rewards and punishments can be stored and executed; different Close states have different execution results; they have a similar "karma" nature.

对自己的仇恨、伤害行为进行忏悔，或者承受疼苦，可以提升自己和弦生命包的闭合性，这包含在主流宗教的实践中。

Repentance for one's hateful, hurtful actions, or suffering from pain, can enhance the Close of one's chord life package, which is included in the practice of mainstream religions.

15-5. Life-Death and Modulation；生死与转调

和弦生命的组织形式是和弦包，和弦包的起始与终结由主和弦（tonic）与转调（modulation）定义，此外，生命和弦包的存在并不完全依赖生物体，不适用生物学的生-死定义。（参见：15-4，闭合性）

The organizational form of polyphonic life is a chord package, the beginning and end of which are defined by the tonic and modulation. In addition, the existence of a life chord package does not completely depend on the organism, and the biological definition of life and death does not apply. (See: 15-4, Close)

生命和弦包的形式是纯小三和弦+导音减七和弦，完整的和弦生命体系中包含三个减七和弦，分别表达不同的闭合-自我状态，构成时空-生命层级。

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The form of the life chord packet is pure minor triad + leading tone diminished seventh chord. The complete chord life system contains three diminished seventh chords, which express different Close-self states and constitute the spacetime-life level.

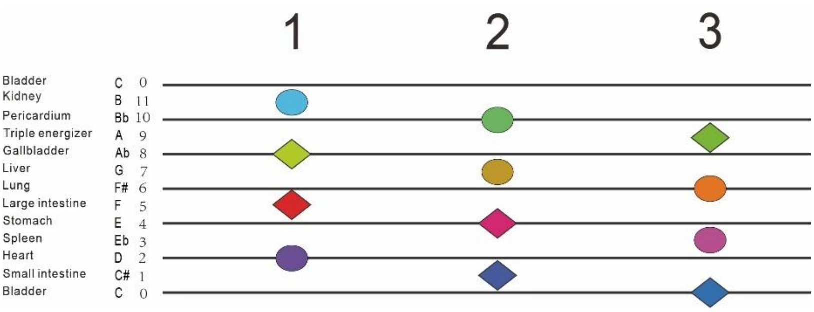

图 8.1、减七和弦表： 1、{B,Ab,F,D}，2、{C#,Bb,G,E}，3、{A,F#,Eb,C}

Figure 8.1. diminished 7th table, 1. {B,Ab,F,D},2. {C#,Bb,G,E}, 3, {A,F#,Eb,C}

三个减七和弦在时-空维度上分离，完整的生命层级结构涉及时空切换，是转调中的动态过程。

The three diminished seventh chords are separated in the space-time dimension. The complete life hierarchy structure involves the switching of spacetime, which is a dynamic process in modulation.

三个减七和弦在时间维度上分布：当前和弦包（今生）是其中之一，其余两个则处于过去（前世），未来（来世）状态。

The three diminished seven chords are distributed in the temporal dimension: the current chord packet (this life) is one of them, and the other two are in the past (past life), future (after life) state.

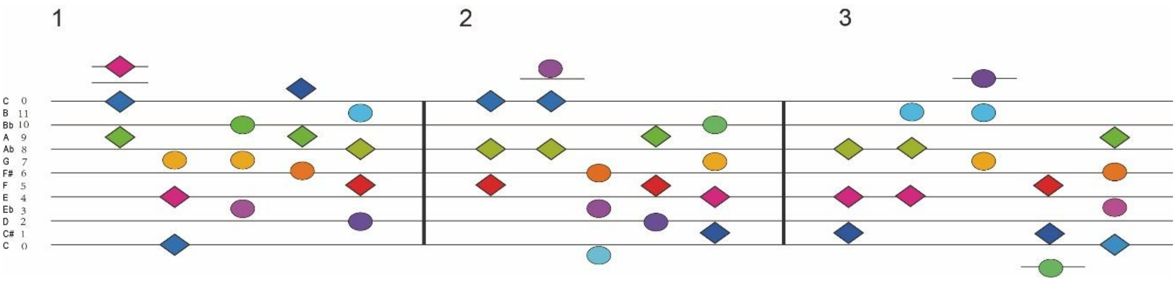

图 13-1.1、{B,Ab,F,D}-{C#,Bb,G,E}-{A,F#,Eb,C} 调群

Figure 13-2.1, {B,Ab,F,D}-{C#,Bb,G,E}-{A,F#,Eb,C} keys group

三个减七和弦（diminished 7th）的转调是生命的过去，现在，未来状态的物理-数学逻辑，转调（transpose）过程类似“轮回”，减七和弦是轮回主体，生命（自我）和弦包在转调中循环，闭合状态（业）决定新调（生命，自我）的状态。

The transpose of the three diminished 7th chords is the physical-mathematical logic of the past,

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present and future states of life. The transpose process is similar to "reincarnation", with the diminished 7th chord being the subject of reincarnation, the life (self) chord package cycling in the transpose, and the Close state (industry) determining the state of the new key (life, self).

减七和弦的转调循环是生命（自我）和弦包的循环，和弦生命（自我）在转调中保持动态连续（永生）。

The modulation cycle of the diminished seventh chord is the cycle of the chord package of life (self), and the chord life (self) maintains dynamic continuity (eternal life) in the modulation.

三个减七和弦具有不同的闭合-自我状态，转调过程伴随着闭合-自我状态的加强或衰减。

The three diminished seventh chords have different gestale-self states, and the modulation process is accompanied by the strengthening or weakening of the gestale-self state.

三个减七和弦中，{B,Ab,F,D} 构成全局调群的主调与解决方向，其和弦状态-语义包括：闭合自我，神，爱，永生，和弦包的解决倾向构成生命的目的设计与终极需要。

Among the three diminished seventh chords, {B, Ab, F, D} constitute the main key and solution direction of the global key group. Its chord state-semantics include: Close self, God, love, and immortality. The solution tendency of the chord package constitutes the purpose design and ultimate need of life.

生命和弦包是调性系统，移调后的生命可能会丢失无调性信息存储，如：自然语言。

The life chord package is a tonal system, and the transposed life may lose the atonal information storage, such as natural language.

和弦生命由七声音阶表达，在爵士音阶中，七声音阶的生命信息会被部分屏蔽，近似非生命系统，但在七声音阶-爵士音阶混合调群中，爵士音阶向七声音阶解决，——生命的产生是自然倾向。

Chord life is expressed by the heptachord. In the jazz scale, the life information of the heptachord will be partially blocked, which is close to a non-living system. But in the heptachord-jazz scale mixed tone group, the jazz scale resolves to the heptachord - the emergence of life is a natural tendency.

15-5.1. Religion；宗教

人的终极需要是永生，生物体无法永生，因此需要灵魂假设，这也是宗教的基石——宗教是另一种生命解释模型。

The ultimate need of human beings is immortality. Organisms cannot be immortal, so the soul hypothesis is needed, which is also the cornerstone of religion - religion is another model of explaining life.

和弦生命中包含三个不同闭合状态的和弦包，闭合性越高，对生物体的依赖越低，最高闭合状态下，和弦包独立于生物体。这一性质是灵魂假设的物理基础。（参见：15-4，闭合性）

Chord life contains chord packages in three different Close states. The higher the Close, the lower the dependence on the organism. In the highest Close state, the chord package is independent of the organism. This property is the physical basis of the soul hypothesis. (See: 15-4, Close)

东方的宗教实践通常与经络（脉轮）相关，在前面的内容中已有介绍。

和弦语义包含：闭合状态，自然道德，自然奖-惩等，这存在于主流宗教的教义中。

自然语言与和弦语言之间具有可编译性，这是祷告，冥想的自然原理基础。

Religious practices in the East are often associated with meridians (chakras), as introduced earlier.

Chord semantics include: Close state, natural morality, natural rewards and punishments, etc., which exist in the doctrines of mainstream religions.

There is a compilability between natural language and chord language, which is the natural principle basis of prayer and meditation.

和弦生命中，神是生命和弦包的闭合状态，只存在于调性系统中，在无调性系统中被完全屏蔽，这是“无神论者”的产生原因；有神论与无神论来自两种观察者：和弦（调性）观察者与非和弦（无调性）观察者。

In chord life, God is the Close state of the chord package of life, which only exists in the tonal system and is completely blocked in the atonal system. This is the reason for the emergence of "atheists"; theism and atheism come from two observers: chord (tonal) observers and non-chord (atonal) observers.

世俗权威仍然基于和弦语义逻辑，与和弦包的解决方向相关，解决方向为权威主体；闭合解决为闭合权威，如：由爱产生的权威；非闭合解决的为非闭合权威，如：恐怖、暴力产生的权威，世俗权威不是一个孤立的问题。（参阅前面章节：13，多层调群）

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15-7.Chord Medicine；和弦医学

和弦生命现象包括：经络，脉轮等，相关的医学都属于和弦医学，如中国传统医学，瑜伽。

Phenomenon of chord life include: meridians, chakras, etc. Related medicines belong to chord medicine, such as traditional Chinese medicine and yoga.

音乐，绘画都可以直接激发人体的和弦系统（经络，脉轮），改善生命-健康状态，对此已有观察、应用，如：音乐、色彩治疗等。

Music and painting can directly stimulate the human body's chord system (meridians, chakras) and improve life-health status. This has been observed and applied, such as music, color therapy, etc.

一些东方宗教与经络，脉轮相关，含有和弦医学特征，如道教，佛教等。

Some eastern religions are associated with meridians, chakras, and contain chord medical features, such as Taoism, Buddhism, etc.

健康状态与自我状态关联，如：减七和弦{C#,Bb,G,E}是当前（今生）特征和弦，和弦语义包含“健康”，理论上，只要在保持在{C#,Bb,G,E}的状态下，就可以一直处于今生，健康状态，实现长生不老。

The health status is related to the self-state. For example, the diminished seventh chord {C#, Bb, G, E} is the current (this life) characteristic chord, and the chord semantics includes "health". In theory, as long as you maintain the state of {C#, Bb, G, E}, you can always be in this life, in a healthy state, and achieve immortality.

如果病因来自人体的和弦场，便无法用其它方法，如：药物，手术等完全解决，病因与生命和弦包的闭合倾向（自然道德状态）有关。

If the cause of the disease comes from the chord field of the human body, it cannot be completely solved by other methods, such as drugs, surgery, etc. The cause of the disease is related to the complete state (natural moral state) of the life chord package.

衰老是转调的过程，转调过程伴生的痛苦也是无法用医学解决的。

Aging is a process of adjustment, and the pain that accompanies the adjustment process cannot be solved by medicine.

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15-7.1. Unity of Heaven and Man；天人相应

天人相应是中医理论的核心思想之一。

和弦生命包由纯小调构成，它与纯大调正-负对称，相互依存，互为生成条件。

The correspondence between heaven and man is one of the core ideas of traditional Chinese medicine theory.

The chord life package is composed of pure minor keys, which are positive-negative symmetrical with pure major keys, interdependent, and mutually generating conditions.

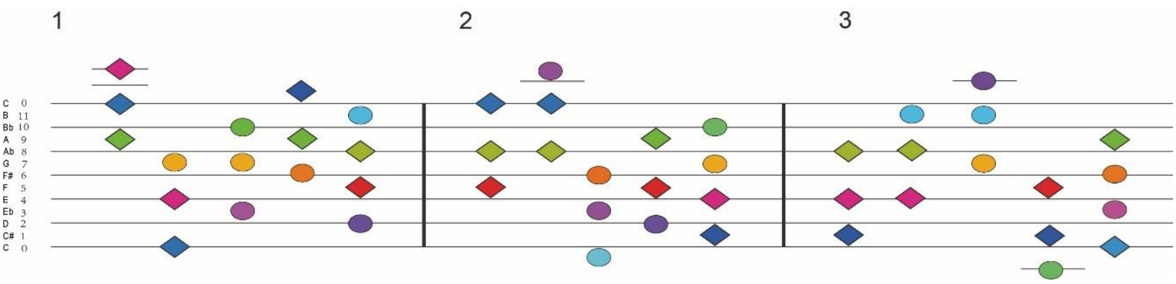

图 13-1.1、{B,Ab,F,D}-{C#,Bb,G,E}-{A,F#,Eb,C} 调群

Figure 13-2.1, {B,Ab,F,D}-{C#,Bb,G,E}-{A,F#,Eb,C} keys group

在图底关系中，纯大调与纯小调分别构成图形与背景；纯大调是生命的背景条件，纯大调的空间特征与组织秩序与宇宙空间相似。

在和弦语义逻辑中，生命与宇宙相互依存，是宇宙的对称-互补结构。

结合内观察可得：生命层级与天体层级存在对应关系：

In the figure-ground relationship, pure major and pure minor constitute the figure and background respectively; pure major is the background condition of life, and the spatial characteristics and organizational order of pure major are similar to the cosmic space.

In the chord semantic logic, life and the universe are interdependent and are the symmetrical-complementary structure of the universe.

Combined with Internal Observation, it can be obtained that there is a corresponding relationship between the life level and the celestial level:

Appendix；附录

Equal Temperament Periodic Table Of Elements;平均律元素周期表

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和弦语言；李晓虹；DOI: 10.13140/RG.2.2.25415.65440/3；ISBN:9781370273348；ASIN: B0919JJ3R7
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A	Bb	B	C	C#	D	Eb	E	F	F#	G	Ab
黄绿 Yellow green	绿 Green	蓝绿 Cyan	蓝 Blue	青紫 Indigo	紫 Violet	紫红 purplish red	红 Red	橙红 Red-orange	橙色 Orange	黄橙 Yellow-Orange	黄 Yellow
三焦 triple warmer	心包 pericardium	肾 kidney	膀胱 bladder	小肠 Small-intestine	心经 heart	脾经 spleen	胃经 stomach	大肠经 Large-intestine	肺经 lung	肝经 liver	胆经 Gallbladder
1 H 氢	2 He 氦	3 Li 锂	4 Be 铍	5 B 硼	6 C 碳	7 N 氮	8 O 氧	9 F 氟	10 Ne 氖	11 Na 钠	12 Mg 镁
13 Al 铝	14 Si 硅	15 P 磷	16 S 硫	17 Cl 氯	18 Ar 氩	19 K 钾	20 Ca 钙	21 Sc 钪	22 Ti 钛	23 V 钒	24 Cr 铬
25 Mn 锰	26 Fe 铁	27 Co 钴	28 Ni 镍	29 Cu 铜	30 Zn 锌	31 Ga 镓	32 Ge 锗	33 As 砷	34 Se 硒	35 Br 溴	36 Kr 氪
37 Rb 铷	38 Sr 锶	39 Y 亿	40 Zr 锆	41 Nb 铌	42Mo 钼	43 Tc 锝	44 Ru 钌	45 Rh 铑	46 Pd 钯	47 Ag 银	48 Cd 镉
49 In 铟	50 Sn 锡	51 Sb 锑	52 Te 碲	53 I 碘	54 Xe 氙	55 Cs 铯	56 Ba 钡	57 La 镧	58 Ce 铈	59 Pr 镨	60 Nd 钕
61 Pm 钷	62 Sm 钐	63 Eu 铕	64 Gd 钆	65 Tb 铽	66 Dy 镝	67 Ho 钬	69 Er 铒	69 Tm 铥	70 Yb 镱	71 Lu 镥	72 Hf 铪
73 Ta 钽	74 W 钨	75 Re 铼	76 Os 锇	77 Ir 铱	78 Pt 铂	79 Au 金	80 Hg 汞	81 Tl 铊	82 Pb 铅	83 Bi 铋	84 Po 钋
85 At 砹	86 Rn 氡	87 Fr 钫	88 Ra 镭	89 Ac 锕	90 Th 钍	91 Pa 镤	92 U 铀	93 Np 镎	94 Pu 钚		

十二平均律元素周期表，来自和弦数学推导，有两种可能的形式：1，2，3 行是降序形式，4，5，6 行是升序形式；表中的音，色，经络，元素通过倍频数列（2^n.F0）产生联系。

The Periodic Table of Elements of the equal temperament, derived fromembrane chords mathematics, has two possible forms: rows 1, 2, 3 are in descending order, and rows 4, 5, 6 are in ascending order; The tone, color, meridian, and elements in the table are connected through an octave sequence（2^n.F0）.

Five Elements Table;五行表

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五行	木	火	土	金	水
五化	生	长	化	收	藏
五色	青（绿）	赤（红）	黄	白	玄（黑）
五方	东	南	中	西	北
五季	春	夏	长夏	秋	冬
五时	平旦	日中	日西	日入	夜半
五节	新年	上巳	端午	七夕	重阳
五星	木星	火星	土星	金星	水星
五声	呼	笑	歌	哭	呻
五音	角	徵	宫	商	羽
五恶	风	热	湿	燥	寒
五脏	肝	心	脾	肺	肾
五腑	胆	小肠	胃	大肠	膀胱
五志	怒	喜	思	悲	恐
五指	食指	中指	大拇指	无名指	小指
五官	目	舌	口	鼻	耳
五觉	色	触	味	香	声
五味	酸	苦	甘	辛	咸

子午流注

平均律扩展表中有一行是经络的是时间属性，根据针灸中的子午流注学说列出；（表中时间是指观察者所在地的太阳时）。子午流注理论体系源于《黄帝内经》“天气始于子，地气始于午、子午相合、命曰岁立、谨侯其时、气与可期。”其方法很多、并在针灸实践中广泛应用，各经络按其对应的时间开放，每日一个周期、周而复始。

+a	+9	-8	-7	+6	+5	-4	-3	+2	+1	-10	-b
A	♭A	G	♯F	F	E	♭E	D	♯C	C	B	♭B
黄绿	黄	黄橙	橙	朱红	红	紫红	紫	青紫	群青	湖蓝	绿
亥	子	丑	寅	卯	辰	巳	午	未	申	酉	戌
三焦	胆经	肝经	肺经	大肠经	胃经	脾经	心经	小肠经	膀胱经	肾经	心包经

图 15-6.1：十二正经特征频率表，子午流注周期表。

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这里所说的“开放”到底是指什么呢？恐怕谁也无法明确，经络具有受激反应特征频率，如果“开放”与此有关，那么特定时间具有特征频率，并能激发特定经络传感发生。

特定时间具有特征频率，不同时间的离散频率分布并符合十二平均律：Fc=H.F0，便会出现上表的结果。

又因、表中的时间周期与地球自转的周期相吻合。与观察者相对地球、太阳的位置有关，因此，由经络知觉到的随时间变化的频率周期还和地球的自转周期有关。

因此；在这里我们能看到两个地球－－－一个是视觉看到的实体的地球，这个地球、既有自转，又有公转。另一个是用经络看到的“波动”地球，这个地球是由十二个频率构成，这些频率都有自己的方位，它们平均的分布在一个圆上、各占据这个圆周的 1/12 的区域。这个“频率”地球的子、午联线永远指向太阳，因而这个地球只有公转、没有自转。而经络觉“看”到的时间是两个地球－－实体地球相对于平均律地球的运动。

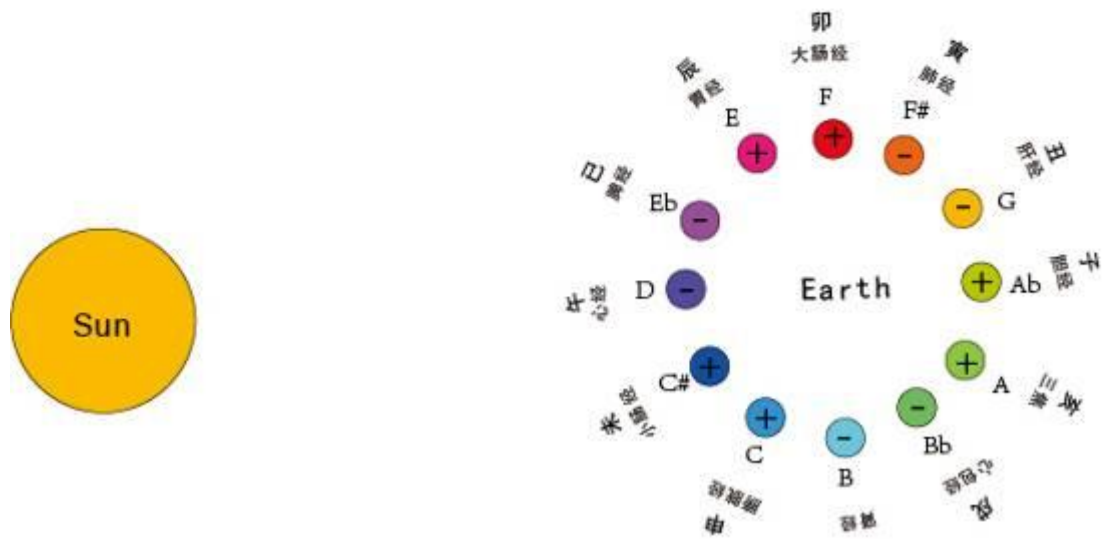

图 15-6.2，地球时间分布图

从上图中可以看出：

被特定的时间内、观察者在地球赤道某一特定点，利用经络觉观察到一系列不连续值（八度等音），例如这一点是申时点，测得值 C、C1、C2、C3、C4、C5……一系列不连续值：Fc=H^12n.F（H=1.05946，F=辐射频率，Fc=测得值，n=0-正整数）。

观察者在 C 点，由申时开始。二十四小时后，测得 C、B、bB、A、bA、G……一系列的不连续值：Fi=h^n*F（n=相隔半音数，F=初始频率）。

也就是说，子午流注现象表明：地球时间是量子化的，并合乎十二平均律。

经络的表里关系

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中医里将经脉分为十二正经，分别对应者十二个脏腑。其中有六条阳经，六条阴经，阳经属表，阴经属里，有着表里相对应的关系。即太阴经对应阳明经，厥阴经对应少阳经，少阴经对应太阳经。

经络的表里关系可以反映出脏腑之间的联系，如当心火旺盛时往往小便也是灼热的，这是因为手少阴心经与手太阳小肠经相表里，心火下移小肠，导致小便灼热。

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太乙金华宗旨

黄庭经

瑜伽经

脉轮全书, [美]安诺德.朱迪斯（Anodea Judith）

圣经-新约

基础音乐理论；Basic music theory

和声学；Harmony

和弦绘画；Chord Painting

普通物理学教材：General Physics Textbooks:

经络学教材；Textbook of Meridian Studies

16. Natural Spirit;自然精神

24 届世界哲学大会会议论文

Papers of the of 24th World Congress of Philosophy

人类存在两套语言系统：符号语言（后天语言）与和弦语言（先天语言）；前者是人工信息系统，基于语音符号，如：自然语言；后者是自然信息系统，基于和弦（量子化频谱），如：音乐、绘画，经络等——精神是符号与和弦二层存有。

Humans possess two language systems: symbolic language (acquired language) and chord language (innate language). The former is an artificial information system based on phonetic symbols, such as natural language; the latter is a natural information system based on [1] chords (quantized spectra), such as music, painting, meridians, etc. Spirit is a dual existence of symbols and chords

人的认识来自两个观察者系统：和弦（调性）观察者与非和弦（无调性）观察者，前者是和弦系统的内部观察，依赖观察者的和弦系统，不能区别主观-客观，如：和声学（音乐、绘画），经络（脉轮）等，或许还有量子-波粒二象性；后者屏蔽了和弦系统，主体与客体均为孤立系统，客体与主体无关，通常可用观察工具代替人类观察者，如：常规的科学。

Human cognition comes from two observer systems: chord (tonal) observers and non-chordic (atonal) observers, the former is the internal observation of the chord system, which depends on the chord system of the observer and cannot distinguish between subject and object, such as: harmony (music, painting), meridians (chakras), etc., and perhaps quantum-wave-particle duality; The latter shields the chord system, the subject and the object are isolated systems, the object is independent of the subject, and observation tools can usually be used to replace human observers, such as conventional science.

两种观察者的重要区别还在于：

和弦（调性）观察者所见是一个基于和弦框架的整体：时空，生命，精神共享和弦结构与数学模型。非和弦（无调性）观察者所见是随机，孤立事件，宇宙被割裂为碎片——任何观察都与观察者有

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关。

Another key difference between the two types of observers is this:

The chordal (tonal) observer sees a whole based on a chordal framework: spacetime, life, and mind share a chordal structure and mathematical model. The non-chordal (atonal) observer sees random, isolated events, a universe fragmented into pieces—any observation is relative to the observer.

和弦语义无法完全进入自然语言，具有不可言说的本体特征。

Chord semantics cannot be fully incorporated into natural language and has an unexpressible ontological characteristic.

关键词：和弦，音乐，绘画，语言，符号，自然精神，自然意志，量子，弦理论

Key words: chord language, symbol language, innate language, acquired language, symbol semantics, chord semantics, natural spirit

*阅读本章时请同时参阅：15、和弦生命

*Please also refer to: 15. Chord Life when reading this chapter

16-1. Two Language；两种语言

人类的语言系统可分为两类基本类型：符号语言（symbolic language）与和弦语言（chord language）。前者是后天习得的人工语言系统，基于语音符号和社会约定，典型代表为自然语言、文字与数学符号；后者则是一种先天嵌入人类感知与生命结构中的物理（离散频谱）语言系统，表现为音乐、绘画、经络系统等形式，基于和弦频谱的自然信息与作用。

Human language systems can be divided into two basic types: symbolic language and chord language. The former is an artificial language system acquired after birth, based on phonetic symbols and social conventions, and is typically represented by natural language, writing, and mathematical symbols; the latter is a physical (discrete spectrum) language system that is innately embedded in human perception and life structure, manifested in the form of music, painting, meridian system, etc., based on the natural information and function of the chord spectrum.

自然语言是最常见的符号语言，它是通过第二信号系统的条件反射获得的符号语义；依赖人类设置，社会约定，后天学习；符号语言来自是人对感知经验的命名，是指称符号，存在主体（心）与客体

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（物）的差异

Natural language is the most common symbolic language. It is a symbolic semantics acquired through the conditioned reflex of the second signal system. It depends on human settings, social conventions, and acquired learning. Symbolic language comes from people's naming of perceptual experience. It is a referential symbol and there is a difference between subject (mind) and object (object).

和弦语言的基本形式为：和弦频谱，和弦几何（开、闭、膜弦），和弦数学模型（n*f，H^n*f，H=1.059463，mod12 群）；是物理语言与作用，没有主体（心）与客体（物）的差异。

The basic forms of chord language are: chord spectrum, chord geometry (open, closed, membrane chord), chord mathematical model (n*f, H^n*f, H=1.059463, mod12 group); it is a physical language and function, without the difference between subject (mind) and object (matter).

和弦语义来自和弦频谱，常用于时空，生命表达。

Chord semantics comes from the chord spectrum, which is often used in time and space, and life expression.

1、时-空语义：和弦语言常用于音乐（时间域），绘画（空间域）的表达。

2、生命语义：人体上存在一个和弦系统，表现为经络（脉轮）系统；,在人体上产生生命（自我）控制。（参见：15、和弦生命）

经络系统表达，执行和弦生命设计 ，如：需要，目的，自我，生死等。

和弦生命语义包含自然伦理，原理是和弦包的闭合梯度及奖惩机制。（参见：15、和弦生命）

1. Space-time semantics: Chord language is often used in the expression of music (time domain) and painting (space domain).

2. Life semantics: There is a chord system in the human body, which is manifested as the meridian (chakra) system; it produces life (self) control in the human body. (See: 15, Chord Life)

The meridian system expresses and executes chord life design, such as: needs, purpose, self, life and death, etc.

Chord life semantics includes natural ethics, and the principle is the Close gradient and reward and punishment mechanism of the chord package. (See: 15, Chord Life)

和弦语言有以下主要特征：

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Chord language has the following main characteristics:

1、先天语言：和弦语言是自然精神，不依赖后天学习，如：人体的经络系统；欣赏音乐的能力并不依赖音乐学习，如：低龄儿童。

1. Innate language: Chord language is the spirit of nature, and does not rely on acquired learning, such as the human body's meridian system; the ability to appreciate music does not rely on music learning, such as: young children.

2、和弦语言是和弦频谱的能量信息，是物理事件，没有主观-客观，精神-物质的对立。

2. Chord language is the energy information of the chord spectrum and a physical event. There is no opposition between subjective and objective, or spirit and matter.

3、和弦语义是和弦频谱的自然信息，但又包含自然道德语义，显示了自然伦理的存在。

3. Chord language is the natural information of the chord spectrum, but it also contains natural moral semantics, showing the existence of natural ethics.

4、和弦语言是物理语言（量子化频谱，弦），具有可执行性。

4. Chord language is a physical language (quantized spectrum, strings) and is executable.

5、和弦语义来自和弦（量子化频谱），是自然精神的存在形式。

5. Chord semantics comes from the chord spectrum, which is the existence form of natural spirit.

符号语言，和弦语言对照表：

Symbolic language, chord language comparison table:

比较维度 Comparison Dimensions	符号语言 Symbolic Language	和弦语言 Chord Language
来源 source	后天学习、社会习得 Acquired learning, social acquisition	与生俱来、自然嵌入 Innate and naturally embedded
表达方式 Expression	语音、文字、逻辑符号 Voice, text, logical symbols	和弦（离散频谱） Chords (discrete spectrum)
核心基础 Core Foundations	命名与指称机制 Naming and designation mechanisms	物理编码 Physical Coding
依赖形式 Dependency Form	主体-客体分离 Subject-object separation	主体-客体统一 Subject-object unity
运作模型 Operational Model	表征→解释→理解 Representation → Interpretation → Understanding	和弦编码→执行 Chord Encoding → Execution
示例	语言、文字、数理逻辑	音乐、绘画、经络

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Example	Language, writing, mathematical logic	Music, painting, meridians

16-2.Compile；编译

符号语言可以被理解，和弦语言可以被执行，两者之间可编译。

The symbolic language can be understood, the chord language can be executed, and the two can be compiled.

常见的和弦语言经验是：自然语言编译为和弦语言，可产生执行性；和弦语言被编译为自然语言，可产生可理解性；两者之间具有可编译性，类似计算机的高级语言与低级语言。

Common chord language experience is: natural language is compiled into chord language, which can produce execution; chord language is compiled into natural language, which can produce intelligibility; there is compilability between the two, similar to high-level and low-level computer languages .

典型的案列是针灸治疗（也包括音乐治疗），这是和弦语言在人体上被执行的过程与结果。

A typical example is acupuncture treatment (including music therapy), which is the process and result of the execution of chord language on the human body.

从一首乐曲中获得的和弦语言体验，如果不能编译为自然语言，便不能被理解，它只是一种不可言说的内部体验；当人们试图将它说出来，如：音乐评论，这就是一个“编译”的尝试。

The chord language experience gained from a piece of music cannot be understood if it cannot be translated into natural language. It is just an unspeakable internal experience. When people try to express it, such as music reviews, this is an attempt at "translation".

编译的困难在于两种语言的原理差异，我们可以认为巴赫，莫扎特的某首乐曲表达了某种“意义”，或者还有很多人也有类似体验，但是这种体验不可言说，也无法外部观察，验证。

The difficulty of compilation lies in the difference in the principles of the two languages. We may think that a piece of music by Bach or Mozart expresses a certain "meaning", or that many people have similar experiences, but this experience cannot be expressed in words, nor can it be observed or verified from the outside.

相反的例子存在于宗教等实践：通过祷告、冥想，企图让自然语言转化为可执行的自然力（神

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力)；这里需要一个编译过程，将自然语言转译为可执行的自然作用，如：物理、化学作用。

The opposite example exists in practices such as religion: through prayer and meditation, an attempt is made to transform natural language into executable natural forces (miracles); a compilation process is required to translate natural language into executable natural effects, such as: physics, Chemical action.

自然语言的不同语义会唤起不同的身-心体验，如：你是好人，你是坏人；多数人能够区别被唤起的身-心反应：愉快或气愤，这意味着自然语言被执行，这里应该有一个相应的执行过程（化学，物理等)。

The different semantics of natural language will evoke different body-mind experiences, such as: you are a good person, you are a bad person; most people can distinguish the evoked body-mind reaction: happy or angry, which means that natural language is executed, here should be There is a corresponding execution process (chemistry, physics, etc.)

如果自然语言能唤起经络（脉轮）反应，如：循经传感（Propagated sensation along the channels）或穴位反应，并能够被重复观察，自然语言与和弦语言之间的可编译性便可以确定，这个实验需要特殊观察者：具有经络体觉的内观察者，这是任何人都可以尝试的方法，也是某些东方宗教的方法。

If natural language can evoke meridian responses, such as: Propagated sensation along the channels or acupoint responses, and can be observed repeatedly, the compilability between natural language and chord language can be determined. This experiment requires special Observer: The Internal Observation of meridian somatosensory. This is a method that anyone can try, and it is also a method of certain Eastern religions.

部分命名符号是来自对和弦语义的转译，如：神，灵魂；这类命名对象无法被外部观察，验证，但又是生命的普遍需要。（参见：15、和弦生命）

Some naming symbols are derived from the translation of chord semantics, such as: God, soul; these named objects cannot be observed or verified from the outside, but are a universal need of life. (See: 15, Chord Life)

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16-3. Observer；观察者

人的认识来自两个观察者系统：和弦（调性）观察者与非和弦（无调性）观察者，前者是和弦系统的内部观察，主-客一体，如：和声学（音乐、绘画），经络（脉轮）等，或许还有量子-波粒二象性；后者屏蔽了和弦系统，主-客之间为“无关”的孤立系统，通常可用观察工具代替人类观察者，如：常规的科学。

Human cognition comes from two observer systems: the chord (tonal) observer and the non-chord (atonal) observer. The former is the internal observation of the chord system, the subject-object integration, such as: Harmony (music, painting), meridians (chakras), etc., and perhaps also the quantum-wave-particle duality; the latter shields the chord system, and the subject and object are "unrelated" isolated systems. Observation tools can usually replace human observers, such as: conventional science.

和弦观察是和弦→和弦的观察，没有主-客，心-物区别，非和弦观察者无法完整观察和弦系统，这里有几个典型案例：

Chord observation is the observation of chords → chords, there is no subject-object, mind-object distinction, non-chord observers cannot fully observe the chord system, here are a few typical cases:

第一个典型案例是对声，光的观察：

The first typical case is the observation of sound and light:

物理学家对声、光的观察产生了声学，光学，光电效应等；而音乐家，画家对声，光的观察产生了和声学（音乐，绘画）；两者均基于观察，可定量，数学表达，但却是不同的逻辑系统。

Physicists' observations of sound and light have produced acoustics, optics, photoelectric effects, etc.; while musicians and painters' observations of sound and light have produced harmony (music, painting); both are based on observation, can be quantified, and expressed mathematically, but they are different logical systems.

第二个案例是对人体的观察，和弦观察者观察到经络（脉轮）系统，并影响了东方的宗教；非和弦观察者观察到现代生物学（细胞，分子等），两者几乎没有任何联系，完全无法兼容。

The second case is the observation of the human body, where the chord observer observes the meridian (chakra) system and influences the religions of the East; Modern biology (cellular, molecular,

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etc.) is observed by non-chord observers, and the two have little connection and are completely incompatible.

和弦语言的观察是和弦系统的内部观察，典型案例是和声学，它来自和弦（调性）观察者对自己身-心的和弦作用的观察，它需要特殊的观察者——天才音乐家；大量的特殊观察者从和弦观察中得到重复的结果，逐渐形成了和弦语言的语法规则及定量-数学表达——和声学，通过主体间性获得确认。这是一个长达数千年的过程，其重复，验证，证伪都只能发生在特殊观察者之间；即使有测量设备能够在自然现象中观察到和弦，也无法识别、理解其语法、语义逻辑，如：时空，生命，自然道德等，其观察过程无法剥离观察者因素。

The observation of chord language is the internal observation of the chord system, and the typical case is harmony, which comes from the observation of the chord (tonality) observer of the chord action of his own body-mind, which requires a special observer - a genius musician; A large number of special observers obtained repetitive results from chord observations, and gradually formed grammatical rules and quantitative-mathematical expressions-harmonic acoustics of chord language, which were confirmed by intersubjectivity. It is a millennia-long process, the repetition, verification, falsification of which can only occur between special observers; Even if there are measuring devices that can observe chords in natural phenomena, they cannot recognize and understand their syntax and semantic logic, such as time and space, life, natural morality, etc., and the observation process cannot be separated from the observer factor.

两种观察者造成了知识系统的割裂，其本质是和弦（调性）与非和弦（无调性）视角的差异。

The two types of observers cause a split in the knowledge system, the essence of which is the difference between the chord (tonality) and non-chord (atonal) perspectives.

Conclusion；结语

语言，历来被视为人类文明的标志与认知的基础。传统语言观以符号结构、表征功能与社会构造为核心，建立了一整套“外部世界—语言—主体”的三元逻辑。然而，和弦语言理论指出：语言不仅用于表述自然，更是自然自身的组织形式之一。

本文提出并论证了以下主要观点：

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和弦语言；李晓虹；DOI: 10.13140/RG.2.2.25415.65440/3；ISBN:9781370273348；ASIN: B0919JJ3R7
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1.人类拥有双重语言系统：符号语言（后天获得，基于命名与逻辑）与和弦语言（先天感知，基于频谱与能量响应）；

2. 和弦语言具有可执行性：它通过频谱结构激发身体、情绪、意识等反应，是自然语言系统的一种；

3. 观察者是语言的共鸣体：主体不仅使用语言，更被语言激活，是语言执行的场域；

4. 自然伦理嵌入和弦语义之中：善恶、爱恨等基本价值，可能具有频谱基础，表现为和弦语义的身体可验证性；

这一理论的意义不仅在于拓展语言的定义，更在于打开一扇通往自然本体、生命机制与意识结构的多维通道。它邀请我们重新理解“语言”的本源：不仅是交流媒介，更是世界的发生方式之一。

Language has always been regarded as the symbol of human civilization and the basis of cognition. The traditional view of language takes symbolic structure, representational function and social structure as the core, and establishes a set of three-element logic of "external world-language-subject". However, the chord language theory points out that language is not only used to express nature, but also one of the organizational forms of nature itself.

This paper proposes and demonstrates the following main points:

1. Humans have a dual language system: symbolic language (acquired after birth, based on naming and logic) and chord language (innate perception, based on spectrum and energy response);

2. Chord language is executable: it stimulates physical, emotional, and conscious reactions through spectrum structure, and is a natural language system;

3. The observer is the resonance body of language: the subject not only uses language, but is also activated by language, and is the field of language execution;

4. Natural ethics are embedded in chord semantics: basic values such as good and evil, love and hate may have a spectrum basis, which is manifested as the physical verifiability of chord semantics;

The significance of this theory lies not only in expanding the definition of language, but also in opening a multi-dimensional channel to the natural ontology, life mechanism and consciousness structure. It invites us to re-understand the origin of "language": not only a medium of communication, but also one of the ways in which the world happens.

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圣经-新约

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Brief Summary；小结

和弦语言——以量子化频谱编码万物

Chord Language—Encoding Everything in a Quantized Spectrum

时空、生命与精神——这三个看似独立的自然层面，实则共享和弦结构与数学模型。和弦以其量子化频谱、调性语义和代数结构，将时间（音乐）、空间（绘画）、生命（经络）乃至意识（自然精神）统一于一个和弦场中。

自然界本无学科之分，所谓“学科”，不过是人类观察角度的割裂产物。在人类的认知系统中，存在两种基本观察者类型：

和弦（调性）观察者：以结构共振、语义参与的方式观察宇宙，所见为一个整体的、连续的和谐宇宙；

非和弦（无调性）观察者：以测量、还原、外部参照的方式认知宇宙，其观察结果是割裂的、孤立的、因果化的事件集合。

和弦语言是一种更底层的统一编码方式，不仅可以解释音乐与绘画，还构成了生命、时空与精神的本体基础。它所揭示的是：宇宙不是由分立的物质和事件构成，而是由一套可变换的和弦结构组织而成。

Conclusion: Chords are the unified physical structure language of the universe.

Time, life, and consciousness—though often treated as separate domains—share a common chordal structure and mathematical model. Through quantized spectra, tonal semantics, and algebraic transformations, the chordal field binds music (time), painting (space), the meridian system (life), and spirit (consciousness) into a coherent unity.

Nature itself knows no disciplines. The very notion of "disciplines" arises from fragmented perspectives imposed by human observers. In this epistemic landscape, two fundamental types of observers exist:

The chordal (tonal) observer, who perceives the universe through structural resonance and semantic participation—yielding an integrated and continuous reality;

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The non-chordal (atonal) observer, who constructs knowledge through measurement, isolation, and external referencing—producing a fragmented, objectified cosmos of isolated events.

Chord language thus stands as a deeper unifying code, bridging art and science, structure and spirit. It reveals a profound truth: the universe is not made of separate things, but woven from transformable chordal relations.

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