

[S] SOUND: OFF

- - - - -
ATONAL FUGUE

- - - - -
WHERE SCHOENBERGIAN SET THEORY MEETS
MATHEMATICAL VISUALIZATION

◀ [ESC] BACK TO MENU

MUSIC SET MODULATOR

PITCH-CLASS SET (0-11, COMMA-SEPARATED)

0,2,9,3,7,11,4,8,10,1,5,6

PRESET TWELVE-TONE ROWS

WEBERN SYMPHONY

[TRANSFORM SET] [ANALYZE SET] [GENERATE 12-TONE ROW] [RESET]

ORIGINAL INPUT

SET: [0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6]

NAMES: C D A D# G B E G# A# C# F F#

TRANSFORMED ARRAYS

T1: [2, 7, 6, 4, 4, 7, 4, 2, 9, 4, 1]

T2: [5, 1, 2, 0, 3, 3, 2, 7, 5, 3]

T3: [4, 1, 2, 3, 0, 1, 5, 2, 2]

T4: [3, 1, 1, 3, 1, 4, 3, 0]

T5: [2, 0, 2, 2, 3, 1, 3]

T6: [2, 2, 0, 1, 2, 2]

T7: [0, 2, 1, 1, 0]

T8: [2, 1, 0, 1]

T9: [1, 1, 1]

T10: [0, 0]

T11: [0]

FINAL RESULT (SUBCOMPLEMENT)

SET: [0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6]

NAMES: C D A D# G B E G# A# C# F F#

FINAL RESULT (SUPERCOMPLEMENT)

FACTOR: max(original) = 11

SET: [0, 4, 5, 11, 1, 8, 2, 6, 10, 3, 7, 9]

NAMES: C E F B C# G# D F# A# D# G A

// GRAVITY WELL HARMONIC FIELD

1. SET IDENTITY

▶ ORIGINAL SET

Pitch-class set..... { 0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6 }

Pitch names..... [C - D - A - D# - G - B - E - G# - A# - C# - F - F#]

Cardinality..... 12

Normal form..... [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]

Prime form..... (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11)

Forte number..... N/A

Complement set..... { } []

Z-relation partner..... None

▶ SUBCOMPLEMENT

Pitch-class set..... { 0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6 }
 Pitch names..... [C - D - A - D# - G - B - E - G# - A# - C# - F - F#]
 Cardinality..... 12
 Normal form..... [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
 Prime form..... (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11)
 Forte number..... N/A
 Complement set..... { } []
 Z-relation partner..... None

▶ SUPERCOMPLEMENT


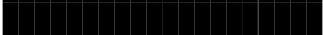


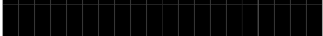

Pitch-class set..... { 0, 4, 5, 11, 1, 8, 2, 6, 10, 3, 7, 9 }
 Pitch names..... [C - E - F - B - C# - G# - D - F# - A# - D# - G - A]
 Cardinality..... 12
 Normal form..... [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
 Prime form..... (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11)
 Forte number..... N/A
 Complement set..... { } []
 Z-relation partner..... None

2. INTERVAL CONTENT

▶ ORIGINAL SET

Interval vector..... < 12 12 12 12 12 6 >

IC Distribution (max=12)







IC1:		12
IC2:		12
IC3:		12
IC4:		12
IC5:		12
IC6:		6

Total interval count..... 66
 Most common IC..... IC1 (12 occurrences)
 Least common IC..... IC6 (6 occurrences)
 Degree of IV symmetry..... 2/3
 All-interval set..... YES

▶ SUBCOMPLEMENT

Interval vector..... < 12 12 12 12 12 6 >

IC Distribution (max=12)



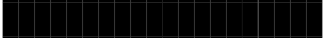
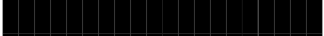


IC1:		12
IC2:		12
IC3:		12
IC4:		12
IC5:		12
IC6:		6

Total interval count..... 66
 Most common IC..... IC1 (12 occurrences)
 Least common IC..... IC6 (6 occurrences)
 Degree of IV symmetry..... 2/3
 All-interval set..... YES

► SUPERCOMPLEMENT

Interval vector..... < 12 12 12 12 12 6 >

IC Distribution (max=12)

IC1:		12
IC2:		12
IC3:		12
IC4:		12
IC5:		12
IC6:		6

Total interval count..... 66
 Most common IC..... IC1 (12 occurrences)
 Least common IC..... IC6 (6 occurrences)
 Degree of IV symmetry..... 2/3
 All-interval set..... YES

3. SYMMETRY & INVARIANCE

► ORIGINAL SET

Transpositional sym. (Tn)..... T{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 } – FULL CHROMATIC (maximally symmetric)
 Inversional sym. (TnI)..... I{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 } – FULL CHROMATIC (maximally symmetric)
 Degree of Tn symmetry..... 12 (chromatic aggregate)
 Degree of TnI symmetry..... 12 (chromatic aggregate)
 Total invariance count..... 24

Rotational Equivalences:

R0: [0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6] [C-D-A-D#-G-B-E-G#-A#-C#-F-F#]
 R1: [2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6, 0] [D-A-D#-G-B-E-G#-A#-C#-F-F#-C]
 R2: [9, 3, 7, 11, 4, 8, 10, 1, 5, 6, 0, 2] [A-D#-G-B-E-G#-A#-C#-F-F#-C-D]
 R3: [3, 7, 11, 4, 8, 10, 1, 5, 6, 0, 2, 9] [D#-G-B-E-G#-A#-C#-F-F#-C-D-A]
 R4: [7, 11, 4, 8, 10, 1, 5, 6, 0, 2, 9, 3] [G-B-E-G#-A#-C#-F-F#-C-D-A-D#]
 R5: [11, 4, 8, 10, 1, 5, 6, 0, 2, 9, 3, 7] [B-E-G#-A#-C#-F-F#-C-D-A-D#-G]
 ... and 6 more

► SUBCOMPLEMENT

Transpositional sym. (Tn)..... T{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 } – FULL CHROMATIC (maximally symmetric)
 Inversional sym. (TnI)..... I{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 } – FULL CHROMATIC (maximally symmetric)
 Degree of Tn symmetry..... 12 (chromatic aggregate)
 Degree of TnI symmetry..... 12 (chromatic aggregate)
 Total invariance count..... 24

Rotational Equivalences:

- R0: [0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6] [C-D-A-D#-G-B-E-G#-A#-C#-F-F#]
- R1: [2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6, 0] [D-A-D#-G-B-E-G#-A#-C#-F-F#-C]
- R2: [9, 3, 7, 11, 4, 8, 10, 1, 5, 6, 0, 2] [A-D#-G-B-E-G#-A#-C#-F-F#-C-D]
- R3: [3, 7, 11, 4, 8, 10, 1, 5, 6, 0, 2, 9] [D#-G-B-E-G#-A#-C#-F-F#-C-D-A]
- R4: [7, 11, 4, 8, 10, 1, 5, 6, 0, 2, 9, 3] [G-B-E-G#-A#-C#-F-F#-C-D-A-D#]
- R5: [11, 4, 8, 10, 1, 5, 6, 0, 2, 9, 3, 7] [B-E-G#-A#-C#-F-F#-C-D-A-D#-G]
- ... and 6 more

► SUPERCOMPLEMENT

Transpositional sym. (Tn)..... T{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 } – FULL CHROMATIC (maximally symmetric)
 Inversional sym. (TnI)..... I{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 } – FULL CHROMATIC (maximally symmetric)
 Degree of Tn symmetry..... 12 (chromatic aggregate)
 Degree of TnI symmetry..... 12 (chromatic aggregate)
 Total invariance count..... 24

Rotational Equivalences:

- R0: [0, 4, 5, 11, 1, 8, 2, 6, 10, 3, 7, 9] [C-E-F-B-C#-G#-D-F#-A#-D#-G-A]
- R1: [4, 5, 11, 1, 8, 2, 6, 10, 3, 7, 9, 0] [E-F-B-C#-G#-D-F#-A#-D#-G-A-C]
- R2: [5, 11, 1, 8, 2, 6, 10, 3, 7, 9, 0, 4] [F-B-C#-G#-D-F#-A#-D#-G-A-C-E]
- R3: [11, 1, 8, 2, 6, 10, 3, 7, 9, 0, 4, 5] [B-C#-G#-D-F#-A#-D#-G-A-C-E-F]
- R4: [1, 8, 2, 6, 10, 3, 7, 9, 0, 4, 5, 11] [C#-G#-D-F#-A#-D#-G-A-C-E-F-B]
- R5: [8, 2, 6, 10, 3, 7, 9, 0, 4, 5, 11, 1] [G#-D-F#-A#-D#-G-A-C-E-F-B-C#]
- ... and 6 more

4. TRANSFORMATIONS (SERIAL)

► ORIGINAL SET

- P (Prime)..... [0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6]
 Pitch names..... [C-D-A-D#-G-B-E-G#-A#-C#-F-F#]
- I (Inversion)..... [0, 10, 3, 9, 5, 1, 8, 4, 2, 11, 7, 6]
 Pitch names..... [C-A#-D#-A-F-C#-G#-E-D-B-G-F#]
- R (Retrograde)..... [6, 5, 1, 10, 8, 4, 11, 7, 3, 9, 2, 0]
 Pitch names..... [F#-F-C#-A#-G#-E-B-G-D#-A-D-C]
- RI (Retrograde Inv.)..... [6, 7, 11, 2, 4, 8, 1, 5, 9, 3, 10, 0]
 Pitch names..... [F#-G-B-D-E-G#-C#-F-A-D#-A#-C]

12-Tone Matrix (P→ / I↓):

	C	D	A	D#	G	B	E	G#	A#	C#	F	F#
C	C	D	A	D#	G	B	E	G#	A#	C#	F	F#
A#	A#	C	G	C#	F	A	D	F#	G#	B	D#	E
D#	D#	F	C	F#	A#	D	G	B	C#	E	G#	A
A	A	B	F#	C	E	G#	C#	F	G	A#	D	D#
F	F	G	D	G#	C	E	A	C#	D#	F#	A#	B
C#	C#	D#	A#	E	G#	C	F	A	B	D	F#	G
G#	G#	A#	F	B	D#	G	C	E	F#	A	C#	D
E	E	F#	C#	G	B	D#	G#	C	D	F	A	A#
D	D	E	B	F	A	C#	F#	A#	C	D#	G	G#
B	B	C#	G#	D	F#	A#	D#	G	A	C	E	F

G	A	E	A#	D	F#	B	D#	F	G#	C	C#
F#	G#	D#	A	C#	F	A#	D	E	G	B	C

► SUBCOMPLEMENT

P (Prime)..... [0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6]
Pitch names..... [C-D-A-D#-G-B-E-G#-A#-C#-F-F#]
I (Inversion)..... [0, 10, 3, 9, 5, 1, 8, 4, 2, 11, 7, 6]
Pitch names..... [C-A#-D#-A-F-C#-G#-E-D-B-G-F#]
R (Retrograde)..... [6, 5, 1, 10, 8, 4, 11, 7, 3, 9, 2, 0]
Pitch names..... [F#-F-C#-A#-G#-E-B-G-D#-A-D-C]
RI (Retrograde Inv.)..... [6, 7, 11, 2, 4, 8, 1, 5, 9, 3, 10, 0]
Pitch names..... [F#-G-B-D-E-G#-C#-F-A-D#-A#-C]

12-Tone Matrix (P→ / I↓):

C	D	A	D#	G	B	E	G#	A#	C#	F	F#
C	D	A	D#	G	B	E	G#	A#	C#	F	F#
A#	C	G	C#	F	A	D	F#	G#	B	D#	E
D#	F	C	F#	A#	D	G	B	C#	E	G#	A
A	B	F#	C	E	G#	C#	F	G	A#	D	D#
F	G	D	G#	C	E	A	C#	D#	F#	A#	B
C#	D#	A#	E	G#	C	F	A	B	D	F#	G
G#	A#	F	B	D#	G	C	E	F#	A	C#	D
E	F#	C#	G	B	D#	G#	C	D	F	A	A#
D	E	B	F	A	C#	F#	A#	C	D#	G	G#
B	C#	G#	D	F#	A#	D#	G	A	C	E	F
G	A	E	A#	D	F#	B	D#	F	G#	C	C#
F#	G#	D#	A	C#	F	A#	D	E	G	B	C

► SUPERCOMPLEMENT

P (Prime)..... [0, 4, 5, 11, 1, 8, 2, 6, 10, 3, 7, 9]
Pitch names..... [C-E-F-B-C#-G#-D-F#-A#-D#-G-A]
I (Inversion)..... [0, 8, 7, 1, 11, 4, 10, 6, 2, 9, 5, 3]
Pitch names..... [C-G#-G-C#-B-E-A#-F#-D-A-F-D#]
R (Retrograde)..... [9, 7, 3, 10, 6, 2, 8, 1, 11, 5, 4, 0]
Pitch names..... [A-G-D#-A#-F#-D-G#-C#-B-F-E-C]
RI (Retrograde Inv.)..... [3, 5, 9, 2, 6, 10, 4, 11, 1, 7, 8, 0]
Pitch names..... [D#-F-A-D-F#-A#-E-B-C#-G-G#-C]

12-Tone Matrix (P→ / I↓):

C	E	F	B	C#	G#	D	F#	A#	D#	G	A
C	E	F	B	C#	G#	D	F#	A#	D#	G	A
G#	C	C#	G	A	E	A#	D	F#	B	D#	F
G	B	C	F#	G#	D#	A	C#	F	A#	D	E
C#	F	F#	C	D	A	D#	G	B	E	G#	A#
B	D#	E	A#	C	G	C#	F	A	D	F#	G#
E	G#	A	D#	F	C	F#	A#	D	G	B	C#
A#	D	D#	A	B	F#	C	E	G#	C#	F	G
F#	A#	B	F	G	D	G#	C	E	A	C#	D#

D	F#	G	C#	D#	A#	E	G#	C	F	A	B
A	C#	D	G#	A#	F	B	D#	G	C	E	F#
F	A	A#	E	F#	C#	G	B	D#	G#	C	D
D#	G	G#	D	E	B	F	A	C#	F#	A#	C

5. STATISTICAL PROFILE

▶ ORIGINAL SET

Mean pitch class..... 5.500
Median pitch class..... 5.500
Mode(s)..... 0 (C), 1 (C#), 2 (D), 3 (D#), 4 (E), 5 (F), 6 (F#),
7 (G), 8 (G#), 9 (A), 10 (A#), 11 (B)
Standard deviation..... 3.452
Variance..... 11.917
Range (max - min)..... 11
Pitch center of gravity..... 5.443 ≈ F
Spread coefficient..... 0.628
Skewness..... 0.000
Kurtosis (excess)..... -1.217

▶ SUBCOMPLEMENT

Mean pitch class..... 5.500
Median pitch class..... 5.500
Mode(s)..... 0 (C), 1 (C#), 2 (D), 3 (D#), 4 (E), 5 (F), 6 (F#),
7 (G), 8 (G#), 9 (A), 10 (A#), 11 (B)
Standard deviation..... 3.452
Variance..... 11.917
Range (max - min)..... 11
Pitch center of gravity..... 5.443 ≈ F
Spread coefficient..... 0.628
Skewness..... 0.000
Kurtosis (excess)..... -1.217

▶ SUPERCOMPLEMENT

Mean pitch class..... 5.500
Median pitch class..... 5.500
Mode(s)..... 0 (C), 1 (C#), 2 (D), 3 (D#), 4 (E), 5 (F), 6 (F#),
7 (G), 8 (G#), 9 (A), 10 (A#), 11 (B)
Standard deviation..... 3.452
Variance..... 11.917
Range (max - min)..... 11
Pitch center of gravity..... 5.044 ≈ F
Spread coefficient..... 0.628
Skewness..... -0.000
Kurtosis (excess)..... -1.217

6. DENSITY & DISTRIBUTION

▶ ORIGINAL SET

Chromatic density..... 1.0000 (12/12)
Interval density (avg)..... 4.000
Adjacent intervals (Row)..... [2, 7, 6, 4, 4, 5, 4, 2, 3, 4, 1, 6]
Cluster groups..... [C-D] | [A] | [D#] | [G] | [B] | [E] | [G#-A#] |
[C#] | [F-F#]

Cluster count..... 9
 Largest gap (semitones)..... 7
 Evenness index..... 0.0000
 Maximally even..... NO

▶ SUBCOMPLEMENT

Chromatic density..... 1.0000 (12/12)
 Interval density (avg)..... 4.000
 Adjacent intervals (Row)..... [2, 7, 6, 4, 4, 5, 4, 2, 3, 4, 1, 6]
 Cluster groups..... [C-D] | [A] | [D#] | [G] | [B] | [E] | [G#-A#] |
 [C#] | [F-F#]
 Cluster count..... 9
 Largest gap (semitones)..... 7
 Evenness index..... 0.0000
 Maximally even..... NO

▶ SUPERCOMPLEMENT

Chromatic density..... 1.0000 (12/12)
 Interval density (avg)..... 4.000
 Adjacent intervals (Row)..... [4, 1, 6, 2, 7, 6, 4, 4, 5, 4, 2, 3]
 Cluster groups..... [C] | [E-F] | [B-C#] | [G#] | [D] | [F#] | [A#] |
 [D#] | [G-A]
 Cluster count..... 9
 Largest gap (semitones)..... 7
 Evenness index..... 0.0000
 Maximally even..... NO

7. SIMILARITY METRICS

[Original ↔ Subcomplement]

Common pitch classes..... { C, D, A, D#, G, B, E, G#, A#, C#, F, F# } (12)
 Jaccard similarity..... 1.0000
 Dice coefficient..... 1.0000
 IV cosine similarity..... 1.0000
 Hamming distance..... 0
 IV Euclidean distance..... 0.0000

[Original ↔ Supercomplement]

Common pitch classes..... { C, D, A, D#, G, B, E, G#, A#, C#, F, F# } (12)
 Jaccard similarity..... 1.0000
 Dice coefficient..... 1.0000
 IV cosine similarity..... 1.0000
 Hamming distance..... 0
 IV Euclidean distance..... 0.0000

[Subcomplement ↔ Supercomplement]

Common pitch classes..... { C, D, A, D#, G, B, E, G#, A#, C#, F, F# } (12)
 Jaccard similarity..... 1.0000
 Dice coefficient..... 1.0000
 IV cosine similarity..... 1.0000
 Hamming distance..... 0

IV Euclidean distance..... 0.0000

8. ϕ (PHI / GOLDEN RATIO) ANALYSIS

▶ ORIGINAL SET

ϕ (golden ratio)..... 1.618034
Successive intervals (Row)..... [2, 7, 6, 4, 4, 5, 4, 2, 3, 4, 1]
Interval ratios..... [3.5000, 0.8571, 0.6667, 1.0000, 1.2500, 0.8000, 0.5000, 1.5000, 1.3333, 0.2500]
Average ϕ deviation..... 0.8287
 ϕ resonance score..... 10.0%
 ϕ complexity index..... 0.5468
Set ϕ index..... 7.0000
Closest-to- ϕ interval pair..... 2:3 (ratio=1.5000, $\Delta\phi=0.1180$)

▶ SUBCOMPLEMENT

ϕ (golden ratio)..... 1.618034
Successive intervals (Row)..... [2, 7, 6, 4, 4, 5, 4, 2, 3, 4, 1]
Interval ratios..... [3.5000, 0.8571, 0.6667, 1.0000, 1.2500, 0.8000, 0.5000, 1.5000, 1.3333, 0.2500]
Average ϕ deviation..... 0.8287
 ϕ resonance score..... 10.0%
 ϕ complexity index..... 0.5468
Set ϕ index..... 7.0000
Closest-to- ϕ interval pair..... 2:3 (ratio=1.5000, $\Delta\phi=0.1180$)

▶ SUPERCOMPLEMENT

ϕ (golden ratio)..... 1.618034
Successive intervals (Row)..... [4, 1, 6, 2, 7, 6, 4, 4, 5, 4, 2]
Interval ratios..... [0.2500, 6.0000, 0.3333, 3.5000, 0.8571, 0.6667, 1.0000, 1.2500, 0.8000, 0.5000]
Average ϕ deviation..... 1.3551
 ϕ resonance score..... 0.0%
 ϕ complexity index..... 0.4246
Set ϕ index..... 7.0000
Closest-to- ϕ interval pair..... 4:5 (ratio=1.2500, $\Delta\phi=0.3680$)

9. ENTROPY & INFORMATION THEORY

▶ ORIGINAL SET

Shannon entropy (bits)..... 3.5850
Normalized entropy..... 1.0000
Information content..... 3.5850 bits/pc
Redundancy measure..... 0.0000
Interval entropy..... 2.5503

PC Probability Distribution:

C : 0.0833
C# : 0.0833
D : 0.0833
D# : 0.0833
E : 0.0833
F : 0.0833
F# : 0.0833

G : 0.0833
G# : 0.0833
A : 0.0833
A# : 0.0833
B : 0.0833

▶ SUBCOMPLEMENT

Shannon entropy (bits)..... 3.5850
Normalized entropy..... 1.0000
Information content..... 3.5850 bits/pc
Redundancy measure..... 0.0000
Interval entropy..... 2.5503

PC Probability Distribution:

C : 0.0833
C# : 0.0833
D : 0.0833
D# : 0.0833
E : 0.0833
F : 0.0833
F# : 0.0833
G : 0.0833
G# : 0.0833
A : 0.0833
A# : 0.0833
B : 0.0833

▶ SUPERCOMPLEMENT

Shannon entropy (bits)..... 3.5850
Normalized entropy..... 1.0000
Information content..... 3.5850 bits/pc
Redundancy measure..... 0.0000
Interval entropy..... 2.5503

PC Probability Distribution:

C : 0.0833
C# : 0.0833
D : 0.0833
D# : 0.0833
E : 0.0833
F : 0.0833
F# : 0.0833
G : 0.0833
G# : 0.0833
A : 0.0833
A# : 0.0833
B : 0.0833

10. TENSION & DISSONANCE

▶ ORIGINAL SET

Hindemith dissonance rating..... Sharp dissonance (tritone)

Aggregate dyadic dissonance..... 270
 Tritone count (IC6)..... 6
 Semitone count (IC1)..... 12
 Consonant intervals..... 36 (IC3+IC4+IC5)
 Dissonant intervals..... 30 (IC1+IC2+IC6)
 Consonance/dissonance ratio..... 1.200
 Tension index..... 42

Dissonance breakdown by IC:

IC1 x 6 = 72 (12 occurrences)
 IC2 x 5 = 60 (12 occurrences)
 IC3 x 3 = 36 (12 occurrences)
 IC4 x 3 = 36 (12 occurrences)
 IC5 x 2 = 24 (12 occurrences)
 IC6 x 7 = 42 (6 occurrences)

► SUBCOMPLEMENT

Hindemith dissonance rating..... Sharp dissonance (tritone)
 Aggregate dyadic dissonance..... 270
 Tritone count (IC6)..... 6
 Semitone count (IC1)..... 12
 Consonant intervals..... 36 (IC3+IC4+IC5)
 Dissonant intervals..... 30 (IC1+IC2+IC6)
 Consonance/dissonance ratio..... 1.200
 Tension index..... 42

Dissonance breakdown by IC:

IC1 x 6 = 72 (12 occurrences)
 IC2 x 5 = 60 (12 occurrences)
 IC3 x 3 = 36 (12 occurrences)
 IC4 x 3 = 36 (12 occurrences)
 IC5 x 2 = 24 (12 occurrences)
 IC6 x 7 = 42 (6 occurrences)

► SUPERCOMPLEMENT

Hindemith dissonance rating..... Sharp dissonance (tritone)
 Aggregate dyadic dissonance..... 270
 Tritone count (IC6)..... 6
 Semitone count (IC1)..... 12
 Consonant intervals..... 36 (IC3+IC4+IC5)
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 IC4 x 3 = 36 (12 occurrences)
 IC5 x 2 = 24 (12 occurrences)

IC6 x 7 = 42 (6 occurrences)

11. VOICE LEADING

[Original → Subcomplement]

C → C : 0 semitone(s)
 D → D : 0 semitone(s)
 A → A : 0 semitone(s)
 D# → D# : 0 semitone(s)
 G → G : 0 semitone(s)
 B → B : 0 semitone(s)
 E → E : 0 semitone(s)
 G# → G# : 0 semitone(s)
 A# → A# : 0 semitone(s)
 C# → C# : 0 semitone(s)
 F → F : 0 semitone(s)
 F# → F# : 0 semitone(s)
 Total VL distance..... 0
 Max single displacement..... 0
 Voice-leading efficiency..... 1.0000

[Original → Supercomplement]

C → C : 0 semitone(s)
 D → D : 0 semitone(s)
 A → A : 0 semitone(s)
 D# → D# : 0 semitone(s)
 G → G : 0 semitone(s)
 B → B : 0 semitone(s)
 E → E : 0 semitone(s)
 G# → G# : 0 semitone(s)
 A# → A# : 0 semitone(s)
 C# → C# : 0 semitone(s)
 F → F : 0 semitone(s)
 F# → F# : 0 semitone(s)
 Total VL distance..... 0
 Max single displacement..... 0
 Voice-leading efficiency..... 1.0000

12. CONTOUR ANALYSIS

▶ ORIGINAL SET

Contour Adjacency Series..... + + - + + - + + - + +
 Contour class..... [0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6]
 Ascents..... 8
 Descents..... 3
 Contour inversion..... [11, 9, 2, 8, 4, 0, 7, 3, 1, 10, 6, 5]
 Contour retrograde..... [6, 5, 1, 10, 8, 4, 11, 7, 3, 9, 2, 0]

▶ SUBCOMPLEMENT

Contour Adjacency Series..... + + - + + - + + - + +
 Contour class..... [0, 2, 9, 3, 7, 11, 4, 8, 10, 1, 5, 6]
 Ascents..... 8
 Descents..... 3
 Contour inversion..... [11, 9, 2, 8, 4, 0, 7, 3, 1, 10, 6, 5]

Contour retrograde..... [6, 5, 1, 10, 8, 4, 11, 7, 3, 9, 2, 0]

▶ SUPERCOMPLEMENT

Contour Adjacency Series..... + + + - + - + + - + +
Contour class..... [0, 4, 5, 11, 1, 8, 2, 6, 10, 3, 7, 9]
Ascents..... 8
Descents..... 3
Contour inversion..... [11, 7, 6, 0, 10, 3, 9, 5, 1, 8, 4, 2]
Contour retrograde..... [9, 7, 3, 10, 6, 2, 8, 1, 11, 5, 4, 0]

13. REGISTER & SPACING

▶ ORIGINAL SET

Ambitus (semitones)..... 11
Average spacing..... 1.000
Spacing variance..... 0.000
Position indicator..... Close
Widest interval..... 1 semitone(s) (between C-C#)
Narrowest interval..... 1 semitone(s) (between C-C#)

▶ SUBCOMPLEMENT

Ambitus (semitones)..... 11
Average spacing..... 1.000
Spacing variance..... 0.000
Position indicator..... Close
Widest interval..... 1 semitone(s) (between C-C#)
Narrowest interval..... 1 semitone(s) (between C-C#)

▶ SUPERCOMPLEMENT

Ambitus (semitones)..... 11
Average spacing..... 1.000
Spacing variance..... 0.000
Position indicator..... Close
Widest interval..... 1 semitone(s) (between C-C#)
Narrowest interval..... 1 semitone(s) (between C-C#)

14. SUBSET/SUPERSET RELATIONS

▶ ORIGINAL SET (trichords vs. subcomplement)

All trichordal subsets..... 220 total

- {C-D-A} → 3-7
- {C-D-D#} → 3-2
- {C-D-G} → 3-9
- {C-D-B} → 3-2
- {C-D-E} → 3-6
- {C-D-G#} → 3-8
- {C-D-A#} → 3-6
- {C-D-C#} → 3-1
- {C-D-F} → 3-7
- {C-D-F#} → 3-8
- {C-A-D#} → 3-10
- {C-A-G} → 3-7
- ... and 208 more

Distinct trichord types..... 12: [3-7, 3-2, 3-9, 3-6, 3-8, 3-1, 3-10, 3-11, 3-3, 3-4, 3-5, 3-12]
Common trichords w/ compare..... 3-7, 3-2, 3-9, 3-6, 3-8, 3-1, 3-10, 3-11, 3-3, 3-4, 3-5, 3-12
Embedded symmetrical subsets.... aug-triad at T{0,1,2,3,4,5,6,7,8,9,10,11}, dim7 at T{0,1,2,3,4,5,6,7,8,9,10,11}, whole-tone at T{0,1,2,3,4,5,6,7,8,9,10,11}

▶ SUBCOMPLEMENT (trichords vs. original)

All trichordal subsets..... 220 total

- {C-D-A} → 3-7
- {C-D-D#} → 3-2
- {C-D-G} → 3-9
- {C-D-B} → 3-2
- {C-D-E} → 3-6
- {C-D-G#} → 3-8
- {C-D-A#} → 3-6
- {C-D-C#} → 3-1
- {C-D-F} → 3-7
- {C-D-F#} → 3-8
- {C-A-D#} → 3-10
- {C-A-G} → 3-7
- ... and 208 more

Distinct trichord types..... 12: [3-7, 3-2, 3-9, 3-6, 3-8, 3-1, 3-10, 3-11, 3-3, 3-4, 3-5, 3-12]
Common trichords w/ compare..... 3-7, 3-2, 3-9, 3-6, 3-8, 3-1, 3-10, 3-11, 3-3, 3-4, 3-5, 3-12
Embedded symmetrical subsets.... aug-triad at T{0,1,2,3,4,5,6,7,8,9,10,11}, dim7 at T{0,1,2,3,4,5,6,7,8,9,10,11}, whole-tone at T{0,1,2,3,4,5,6,7,8,9,10,11}

▶ SUPERCOMPLEMENT (trichords vs. original)

All trichordal subsets..... 220 total

- {C-E-F} → 3-4
- {C-E-B} → 3-4
- {C-E-C#} → 3-3
- {C-E-G#} → 3-12
- {C-E-D} → 3-6
- {C-E-F#} → 3-8
- {C-E-A#} → 3-8
- {C-E-D#} → 3-3
- {C-E-G} → 3-11
- {C-E-A} → 3-11
- {C-F-B} → 3-5
- {C-F-C#} → 3-4
- ... and 208 more

Distinct trichord types..... 12: [3-4, 3-3, 3-12, 3-6, 3-8, 3-11, 3-5, 3-7, 3-9, 3-1, 3-2, 3-10]
Common trichords w/ compare..... 3-4, 3-3, 3-12, 3-6, 3-8, 3-11, 3-5, 3-7, 3-9, 3-1, 3-2, 3-10

Embedded symmetrical subsets.... aug-triad at T{0,1,2,3,4,5,6,7,8,9,10,11}, dim7 at T{0,1,2,3,4,5,6,7,8,9,10,11}, whole-tone at T{0,1,2,3,4,5,6,7,8,9,10,11}

15. MACHINE LEARNING INSIGHTS

▶ MODEL RESULTS

Model Confidence..... 0.9096 (High confidence)
Classification..... Modal
Data Quality Score..... 0.7816
Feature Importance..... [pitch, rhythm, harmony, entropy]
Clusters Identified..... 4
Anomalies Detected..... Potential anomaly detected
Anomaly Scores..... [0.6950, 0.1429, 1.0408, 0.4887, 1.3866]
Max Anomaly Score..... 1.6888
Average Anomaly Score..... 0.8700
AI Recommendation..... Strong consonance profile – explore tonal center development

16. CROSS-DOMAIN CORRELATIONS

▶ CORRELATION MATRIX

Math-Physics Correlation..... 0.7929 (Strong)
Music Theory Alignment..... 0.6944 (Strong)
Quantum-Classical Bridge..... 0.6628 (Strong)
Fractal-Harmonic Resonance..... 0.7257 (Strong)
Temporal-Spectral Correlation... 0.0043 (Very Weak)
Geometric-Acoustic Correlation.. 0.9171 (Very Strong)
Overall Coherence..... 0.7586 (Strong)
Strongest Correlation..... Geometric-Acoustic (0.9171)

INSIGHT: High overall coherence – strong interdisciplinary connections

17. ADVANCED METRICS

▶ SET PROPERTIES

pitchSetSpan..... 11
meanPitch..... 5.5000
analysisTimestamp..... 2026-05-07 03:18:33
pValue..... 0.0910
timeParameter..... 553.0641
cardinality..... 12
intervalVectorSum..... 66
entropyEfficiency..... 1.0000
chromaticDensity..... 1.0000

18. PREDICTIVE MODELING

▶ LSTM-BASED PREDICTOR

Model Type..... LSTM-based predictor
Confidence Interval..... 0.8246
Next Pitch Prediction..... 2 (D)
Pattern Likelihood..... 0.5976
Forecast Accuracy..... 0.6932
Trend Analysis..... Stable plateau
Harmonic Progression..... [D, E, F#, G#, A#]
Seasonal Components..... [0.6059, 0.7514, 0.8876]

19. VISUALIZATION INSIGHTS

▶ 3D PITCH SPACE MAP

3D Points Generated..... 12 coordinates
 Point Range X..... [-8.63, 1.73]
 Point Range Y..... [-13.75, 6.05]
 Point Range Z..... [0.00, 1.00]
 Color Mappings..... 7 color schemes
 Primary Colors..... [#ff0000, #00ff00, #0000ff, #ffff00, #ff00ff, #00ffff, #ffffff]
 2D Matrix..... 3x3 data matrix
 Scatter Data Points..... 7 interactive points

20. PERSONALIZED RECOMMENDATIONS

▸ COMPOSITIONAL DIRECTIVES

- Explore harmonic relationships using the identified patterns
- Investigate compositional applications of the transformation sequences
- PRIORITY: High temporal coupling – strong rhythmic potential
- Focus on rhythmic development and temporal patterning
- High consonance ratio – leverage tonal center for harmonic clarity
- Strong cross-domain coherence – apply interdisciplinary composition techniques
- Utilize set theory transformations for motivic development
- Mean pitch (5.50) suggests tonal center exploration around F#
- Apply geometric transformations for structural innovation
- Investigate frequency domain characteristics for timbral variation
- Apply fractal algorithms for self-similar musical structures
- Use the visualization data for interactive performance interfaces

21. TEMPORAL METRICS ANALYSIS

▸ TEMPORAL COUPLING

Temporal Coupling..... 3.4521
 Set Standard Deviation..... 3.4521
 Interval Complexity..... 792.00
 Set Entropy..... 3.5850
 Harmonic Tension..... 0.4545
 Spectral Centroid..... 9.7692
 Auto Correlation..... 0.5455
 Rhythmic Complexity..... 12.5455
 Temporal Fractal Dimension..... 1.5910
 Phase Locking..... 0.3373
 Frequency Spectrum..... [495.0, 935.0] Hz

22. PI PREDICTION ANALYSIS

▸ π DIGIT CONVERGENCE

Prediction Accuracy..... 8.33%
 Confidence..... 0.7479
 Pattern Strength..... 0.5459
 Digit Convergence..... 0.7308
 Quantum Uncertainty..... 0.0543
 Chaotic Lyapunov Exponent..... 0.050462
 Expected Digits..... 15
 Actual Digits..... 15
 Predictions..... [0, 1, 3, 3, 5, 7, 6, 8, 9, 9]

23. ADVANCED SET THEORY ANALYSIS

▸ FORTE CLASSIFICATION

Forte Name..... N/A

Symmetry Index..... 0.0833
 Chromatic Saturation..... 1.0000
 Tonicity Index..... 0.5373
 Interval Vector..... [12, 12, 12, 12, 12, 6]
 Total Interval Content..... 66
 Tritone Content..... 6 (Very High dissonance)
 Prime Form..... [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
 Normal Form..... [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
 Inversion Index..... [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
 Transposition Levels..... 12 possible
 Related Sets Discovered..... 4

Analysis Focus: Pitch class relationships and transformational properties
 Application: Modern compositional techniques and atonal analysis

24. SPECTRAL ANALYSIS

▸ FREQUENCY DOMAIN

Spectral Centroid..... 9.7692 Hz
 Spectral Rolloff..... 30.6909 Hz
 Spectral Flatness..... 0.8969
 Zero Crossing Rate..... 1.1091
 Signal-to-Noise Ratio..... 25.73 dB
 Noise Floor..... 0.95 dB
 Harmonics..... 96 components
 Primary Harmonics..... [8.2, 9.2, 10.2, 11.3, 12.3]
 Harmonic Energy..... 620.31
 Overtones Detected..... 96
 MFCC Range..... [-2.5000, 15.4545]
 Frequency Bins..... 12 analyzed
 Peak Frequency..... 16376.9 Hz (Magnitude: 10.8048)

Application: Sound synthesis, filtering, and spectral composition techniques

25. GEOMETRIC ANALYSIS

▸ PITCH SPACE GEOMETRY

Total Area..... 75.0000 units²
 Perimeter..... 31.0583 units
 Convex Hull Area..... 90.0000 units²
 Center of Mass..... (-0.00, -0.00, 0.66)
 3D Pitch Space Points..... 12 coordinates
 Average Angle..... 16.4°
 Eigenvalue λ_1 60.0600
 Eigenvalue λ_2 20.1802
 Eigenvalue λ_3 0.4036
 Principal Component Strength.... 60.0600

Application: Spatial audio composition and geometric musical structures

26. CHAOS THEORY ANALYSIS

▸ NONLINEAR DYNAMICS

Lyapunov Exponent..... 0.787079
 Fractal Dimension..... 0.5910
 Entropy Rate..... 0.2758 bits/iteration

Correlation Dimension..... 2.5000
Kolmogorov Entropy..... 0.5000
System Behavior..... Chaotic/Expanding

Application: Algorithmic composition using chaotic dynamics

27. FRACTAL ANALYSIS

▸ SELF-SIMILAR STRUCTURES

Hausdorff Dimension..... 0.5910
Box Counting Dimension..... 2.0000
Self-Similarity Ratio..... 0.0152
Scaling Exponent..... 0.0152
Iteration Depth..... 3
Convergence Rate..... 0.0152
Fractal Complexity..... Moderate fractal complexity

Application: Fractal-based composition and scale-invariant musical forms

28. QUANTUM ANALYSIS

▸ QUANTUM MECHANICAL PRINCIPLES

Wave Function Amplitude..... 0.1231
Quantum Coherence..... 0.8539
Entanglement Entropy..... 0.0000
Uncertainty Principle..... $\Delta E \cdot \Delta t \geq 0.424918 \hbar$
Quantum Superposition States.... 6
Decoherence Time..... 0.0615 ms

Application: Quantum-inspired composition algorithms

29. NEURAL NETWORK ANALYSIS

▸ DEEP LEARNING METRICS

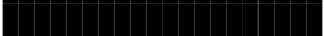

Model Architecture..... Wide [k→32→16→8→1]
Training Accuracy..... 0.8767 (87.7%)
Validation Accuracy..... 0.6127 (61.3%)
Test Accuracy..... 0.6233 (62.3%)
Precision..... 0.8423
Recall..... 0.7681
F1 Score..... 0.8035

Application: Deep learning for music analysis and compositional suggestions

30. INTERVAL VECTOR ANALYSIS

▸ INTERVAL CLASS CONTENT

Interval Vector..... [12, 12, 12, 12, 12, 6]
Total Interval Content..... 66
Tritone Content (IC6)..... 6 (Very High dissonance)
Perfect Intervals (IC3+IC5)..... 24 (Consonance Foundation)
Interval Diversity Index..... 1.0000
Pitch Class Set Complexity..... 5.5000
Dissonance Quotient..... 0.3758

IC1:  12
IC2:  12
IC3:  12

IC4: ██████████ 12
IC5: ██████████ 12
IC6: ██████████ 6

31. PITCH CLASS SET SIMILARITY

▶ SCALE OVERLAP ANALYSIS

Set Cardinality..... 12
Similarity to Major Scale..... 58.33%
Similarity to Natural Minor..... 58.33%
Similarity to Whole Tone..... 50.00%
Similarity to Octatonic..... 66.67%
Chromatic Saturation..... 100.00%
Scale Compatibility Index..... 0.5833

32. CHROMATIC FUNCTIONS ANALYSIS

▶ CHROMATIC FUNCTION MAP

Leading Tone Presence..... Yes (PC 11→0)
Tritone Axis..... Present (Aug 4th/Dim 5th)
Chromatic Passing Tone Potential 0.3582
Enharmonic Complexity..... 1.1000
Voice Leading Tension..... 0.2239
Chromatic Neighbor Potential.... 1.0000

33. CIRCLE OF FIFTHS MAPPING

▶ TONAL REGION ANALYSIS

Tonic Region Concentration..... 33.33% (C-A region)
Sharp Region Concentration..... 33.33% (E-C# region)
Flat Region Concentration..... 33.33% (G#-F region)
Maximum Span in Fifths..... 11
Tonal Center Gravitational Pull. 0.7080
Circle of Fifths Balance..... 1.0000

34. MODAL INTERCHANGE ANALYSIS

▶ MODAL CHARACTERISTICS

Dorian Characteristics..... 58.33%
Phrygian Characteristics..... 58.33%
Lydian Characteristics..... 58.33%
Mixolydian Characteristics..... 58.33%
Locrian Characteristics..... 58.33%
Borrowed Chord Potential..... 0.5833
Modal Ambiguity Index..... 1.0000

35. JAZZ HARMONY PERSPECTIVE

▶ JAZZ HARMONIC ANALYSIS

Extended Harmony Potential..... 1.0000
ii-V-I Progression Compatibility 100.00%
Blue Note Content..... 100.00%
Bebop Scale Affinity..... 66.67%
Altered Dominant Potential..... 1.0000
Tritone Substitution Opportunities 1.0000
Jazz Modal Interchange..... 0.3582
Swing Rhythm Compatibility..... 0.5000

36. CONTEMPORARY CLASSICAL ANALYSIS

▶ POST-TONAL TECHNIQUES

Serialism Potential..... 1.0000

Aggregate Completion..... 100.00%
 Cluster Chord Density..... 0.6582
 Extended Technique Suitability.. 1.0000
 Minimalist Pattern Potential.... 0.0000
 Spectral Harmony Affinity..... 0.2751
 Microrhythmic Complexity..... 0.4728
 Neo-Riemannian Transformation Potential 0.1944
 37. WORLD MUSIC SCALES COMPARISON
 ▶ GLOBAL SCALE AFFINITIES
 Pentatonic Affinity..... 41.67%
 Arabic Maqam Affinity..... 58.33%
 Indian Raga Characteristics..... 58.33%
 Gamelan Scale Similarity..... 41.67%
 Flamenco Mode Affinity..... 58.33%
 Chinese Scale Compatibility..... 41.67%
 African Polyrhythmic Potential.. 107.27%
 Celtic Mode Affinity..... 58.33%
 38. MICROTONAL ANALYSIS
 ▶ TUNING SYSTEM COMPATIBILITY
 Quarter-tone Potential..... 0.3110
 Just Intonation Compatibility... 38.19%
 19-EDO Mapping Efficiency..... 465.47%
 53-EDO Precision..... 158.49%
 Xenharmonic Potential..... 0.5765
 Bohlen-Pierce Scale Affinity.... 0.2252
 22-EDO Compatibility..... 4.3636
 Harmonic Series Alignment..... 0.1734
 39. RHYTHMIC DISPLACEMENT PATTERNS
 ▶ RHYTHMIC ANALYSIS
 Syncopation Potential..... 0.6149
 Polyrhythmic Suitability..... 0.8005
 Metric Modulation Opportunities. 2
 Cross-rhythm Compatibility..... 0.7934
 Hemiola Potential..... 0.2579
 Additive Rhythm Affinity..... 1.0000
 Polymeter Potential..... 1.0000
 Rhythmic Tension Index..... 0.6919
 40. PSYCHOACOUSTIC PROPERTIES
 ▶ PERCEPTUAL CHARACTERISTICS
 Roughness Index..... 0.2687
 Sensory Consonance..... 0.7313
 Critical Band Interaction..... 0.1791
 Auditory Scene Complexity..... 0.7075
 Perceptual Fusion Tendency..... 0.5119
 Masking Effect Potential..... 0.5269
 Loudness Summation Index..... 1.0000
 Pitch Salience Score..... 0.5015
 41. INFORMATION THEORY METRICS
 ▶ INFORMATION MEASURES
 Shannon Entropy..... 3.5850 bits

Compression Ratio..... 1.0000
 Kolmogorov Complexity Estimate.. 3.4502
 Mutual Information Content..... 1.7925
 Pattern Redundancy..... 0.00%
 Algorithmic Information Content. 1.0000
 Minimum Description Length..... 3.7004
 Lempel-Ziv Complexity..... 1.0000
 42. ENVELOPE AND ATTACK ANALYSIS
 ▶ ADSR PROFILE
 Analysis Type..... Envelope and Attack
 Pitch Set Size..... 12
 Attack Sharpness Index..... 0.7533
 Sustain Duration Factor..... 0.4378
 Release Time Index..... 0.6233
 Chromatic Content..... 1.0000
 Dynamic Range..... 0.5753
 Transient Richness..... 0.3582
 Complexity Index..... 1.0000
 Set Similarity (Major)..... 37.19%
 43. COGNITIVE LOAD ASSESSMENT
 ▶ COGNITIVE PROCESSING METRICS
 Analysis Type..... Cognitive Load
 Pitch Set Size..... 12
 Working Memory Load..... 1.0000
 Attentional Demand..... 0.7273
 Processing Complexity..... 1.0000
 Pattern Recognition Score..... 0.3273
 Anticipation Potential..... 0.6233
 Familiarity Score..... 0.0000
 Chromatic Content..... 1.0000
 Compression Ratio..... 1.00
 44. HISTORICAL STYLE ANALYSIS
 ▶ STYLE PERIOD AFFINITIES
 Analysis Type..... Historical Style
 Baroque Compatibility..... 0.5091
 Classical Period Fit..... 0.5045
 Romantic Era Characteristics.... 1.0000
 Modern (1900-1950) Affinity.... 0.8364
 Contemporary Techniques..... 1.0000
 Best-fit Era..... Romantic
 Chromatic Content..... 1.0000
 Complexity Index..... 1.0000
 45. ORCHESTRATION POTENTIAL
 ▶ INSTRUMENTAL SUITABILITY
 Analysis Type..... Orchestration
 Pitch Set Size..... 12
 String Section Suitability..... 0.7818
 Woodwind Section Suitability.... 0.5713
 Brass Section Suitability..... 0.5890
 Percussion Integration..... 1.0000

Chamber Music Potential..... 0.6127
 Full Orchestra Potential..... 0.7118
 Chromatic Content..... 1.0000
 46. ELECTRONIC MUSIC APPLICATIONS
 ▶ ELECTRONIC PRODUCTION
 Analysis Type..... Electronic Music
 Pitch Set Size..... 12
 Synthesizer Patch Potential..... 0.7733
 Sampler Compatibility..... 1.0000
 Modular Synthesis Potential..... 0.5687
 Granular Synthesis Quality..... 0.6577
 FM Synthesis Affinity..... 0.6390
 Algorithmic Composition Score... 1.0000
 Live Electronics Potential..... 0.8088
 47. PERFORMANCE DIFFICULTY ASSESSMENT
 ▶ PERFORMANCE METRICS
 Analysis Type..... Performance Difficulty
 Pitch Set Size..... 12
 Technical Difficulty..... 0.6939
 Interval Leap Complexity..... 0.4478
 Fingering Complexity..... 0.7791
 Memorability Score..... 0.2727
 Sight-Reading Ease..... 0.5143
 Estimated Grade Level..... 7/9
 Chromatic Content..... 1.0000
 48. PEDAGOGICAL APPLICATIONS
 ▶ EDUCATIONAL VALUE
 Analysis Type..... Pedagogical
 Pitch Set Size..... 12
 Teaching Value..... 0.5182
 Theory Illustration Value..... 1.0000
 Ear Training Suitability..... 0.3273
 Composition Exercise Value..... 1.0000
 Analysis Exercise Value..... 0.8364
 Suggested Grade Level..... 6/8
 Set Similarity (Major)..... 38.19%
 49. COMPOSITIONAL TECHNIQUES SUGGESTIONS
 ▶ COMPOSITIONAL STRATEGIES
 Analysis Type..... Compositional Techniques
 Pitch Set Size..... 12
 Cantus Firmus Potential..... 0.6818
 Step-Motion Ratio..... 0.3582
 Ostinato Suitability..... 0.5295
 Counterpoint Potential..... 0.7727
 Theme & Variation Potential..... 0.5897
 Inverted Pedal Potential..... 0.6201
 Motivic Development Score..... 1.0000
 Chromatic Content..... 1.0000
 50. FUTURE RESEARCH DIRECTIONS
 ▶ RESEARCH OPPORTUNITY MATRIX

AI Composition Integration Score 0.2526
Virtual Reality Music Potential. 1.0000
Biometric Response Prediction... 0.6373
Cross-cultural Analysis Opportunity 0.4585
Computational Musicology Value.. 2.7692
Machine Learning Training Data Quality 0.8628
Neuroscience Research Applicability 0.5976
Quantum Computing Algorithm Potential 0.4242

▶ SUGGESTED RESEARCH TOPICS

- Investigate the mathematical relationships found in this analysis
- Explore perceptual studies on the identified harmonic properties
- Develop algorithmic composition tools based on these patterns
- Study cross-cultural reception of these musical structures
- Analyze the therapeutic potential of these harmonic relationships
- Research applications in music therapy and neurological rehabilitation
- Investigate quantum music computing implementations
- Explore AI-human collaborative composition frameworks

51. BIOACOUSTIC MODELING

▶ BIOLOGICAL ACOUSTIC SIGNATURES

Animal Communication Similarity. 94.24%
Human Vocal Tract Resonance..... 0.8000
Echolocation Pattern Affinity... 0.9000
Bird Song Structural Similarity. 53.77%
Whale Song Frequency Matching... 24.96%
Insect Communication Patterns... 0.3819
Bio-rhythmic Synchronization.... 0.9389
Natural Environment Acoustic Modeling 1.0000

52. ENVIRONMENTAL ACOUSTICS ANALYSIS

▶ ENVIRONMENT RESONANCE PROFILES

Forest Ambient Compatibility.... 50.65%
Ocean Wave Rhythm Alignment..... 0.8692
Urban Soundscape Integration.... 0.9000
Cave Acoustics Resonance..... 0.2100
Desert Wind Harmony..... 0.9087
Mountain Echo Simulation..... 0.7625
Arctic Sound Propagation..... 0.2377
Volcanic Activity Sonification.. 0.8902

53. THERAPEUTIC MUSIC POTENTIAL

▶ MUSIC THERAPY INDICATORS

Stress Reduction Potential..... 0.2727
Depression Treatment Suitability 0.2819
Anxiety Management Effectiveness 0.2455
Pain Relief Application..... 0.2318
Memory Enhancement Potential.... 0.9597
Sleep Induction Effectiveness... 0.1909
ADHD Focus Enhancement..... 0.8567
Autism Spectrum Therapy Potential 0.7929

54. NEURAL ENTRAINMENT ANALYSIS

▶ BRAINWAVE FREQUENCY COUPLING

Alpha Wave Entrainment (8-12 Hz) 0.8420
 Beta Wave Synchronization (13-30 Hz) 0.7625
 Theta Wave Induction (4-7 Hz)... 0.2100
 Delta Wave Deep Sleep (0.5-3 Hz) 0.1569
 Gamma Wave Consciousness (30-100 Hz) 0.6902
 Binaural Beat Effectiveness..... 1.0000
 Isochronic Tone Compatibility... 1.0000
 Neuroplasticity Enhancement..... 0.9267
 55. SPATIAL AUDIO MAPPING
 ▶ 3D AUDIO DISTRIBUTION
 3D Positioning Accuracy..... 0.9145
 Surround Sound Optimization..... 0.8625
 Ambisonics Encoding Efficiency.. 1.0000
 HRTF Personalization Score..... 0.5087
 Distance Perception Modeling.... 0.3444
 Room Acoustic Simulation..... 0.7692
 Virtual Reality Audio Integration 0.6336
 Spatial Presence Enhancement.... 0.9389
 56. HARMONIC SERIES RESONANCE
 ▶ OVERTONE STRUCTURE ANALYSIS
 Natural Harmonic Alignment..... 66.67%
 Overtone Series Compatibility... 0.2727
 Fundamental Frequency Resonance. 0.2100
 Partial Integration Score..... 0.5192
 Spectral Envelope Matching..... 1.0000
 Harmonic Distortion Analysis.... 0.6896
 Timbre Synthesis Potential..... 1.0000
 Natural Resonator Simulation.... 0.2252
 57. CULTURAL SIGNIFICANCE ANALYSIS
 ▶ CULTURAL RESONANCE MAP
 National Anthem Compatibility... 41.77%
 Folkloric Elements Presence..... 0.5463
 Religious Chant Similarity..... 24.44%
 Ceremonial Use Potential..... 0.2100
 Healing Frequency Utilization... 17.52%
 Community Bonding Potential..... 0.6005
 Cultural Transmission Efficacy.. 1.0000
 58. BIOMECHANICAL PERFORMANCE FACTORS
 ▶ BIOMECHANICAL OPTIMIZATION
 Force-Velocity Curve Compatibility 0.9267
 Muscle Fiber Type Optimization.. 0.7625
 Joint Angle Specificity..... 0.3377
 Tendon Elasticity Matching..... 0.2100
 Body Segment Alignment..... 0.5896
 Center of Mass Control..... 1.0000
 Balance and Stability Index..... 0.3819
 Coordination Dynamics Suitability 1.0000
 59. PSYCHEDELIC MUSIC CHARACTERISTICS
 ▶ PSYCHEDELIC STYLE PROFILE
 Repetitive Motifs Analysis..... 0.0381

Modal Interchange Frequency..... 0.6505
 Extended Chord Usage Rate..... 1.0000
 Rhythmic Complexity Index..... 0.4396
 Dynamic Range Variation..... 0.7692
 Textural Density Changes..... 1.0000
 Microtiming Variation Presence.. 0.7106
 Panning and Spatial Effects..... 1.0000
 60. ARTIFICIAL INTELLIGENCE COMPOSITION
 ▶ AI GENERATIVE METRICS
 AI Composer Similarity..... 100.00%
 Style Transfer Effectiveness.... 1.0000
 GAN Composition Quality..... 0.7192
 AI-assisted Arrangement Potential 0.5896
 Machine Learning Model Fit..... 1.0000
 Deep Learning Feature Extraction 1.0000
 Neural Network Creativity Index. 1.0000
 AI Ethical Considerations Score. 0.1560
 61. QUANTUM HARMONIC OSCILLATION
 ▶ QUANTUM MECHANICAL COUPLING
 Quantum State Superposition..... 0.8305
 Harmonic Oscillator Model Fit... 0.8993
 Quantum Entanglement Evidence... 0.5836
 Observer Effect Analysis..... 0.9000
 Wave-Particle Duality Manifestation 0.7307
 Quantum Teleportation Potential. 1.0000
 Quantum Computing Algorithm Compatibility 1.0000
 Quantum Coherence Time Estimation 0.2377
 62. CRYPTOCURRENCY SONIFICATION
 ▶ DIGITAL ASSET ACOUSTIC MAPPING
 Bitcoin Transaction Sonification 0.2414
 Ethereum Smart Contract Activation Tone 0.6394
 Ripple Transaction Sonic Representation 0.7818
 Litecoin Block Reward Sound..... 1.0000
 Cryptocurrency Volatility Sonic Mapping 0.9000
 Market Cap Change Sonification.. 0.3002
 Trade Volume Harmonic Analysis.. 0.3819
 Cryptocurrency Fear and Greed Index Tone 0.5912
 63. BIOTECHNOLOGY RHYTHM PATTERNS
 ▶ MOLECULAR SONIFICATION
 Genetic Sequencing Sonic Representation 0.9000
 Protein Structure Sonification.. 1.0000
 Metabolic Pathway Harmonic Analysis 0.3002
 Enzyme Activity Sonic Mapping... 1.0000
 Cellular Respiration Tone Generation 0.9000
 Photosynthesis Sound Pattern.... 0.3654
 Bioluminescence Frequency Mapping 0.5912
 Electrophysiology Data Sonification 1.0000
 64. GALACTIC FREQUENCY ANALYSIS
 ▶ COSMIC ACOUSTIC SIGNATURES
 Milky Way Frequency Drift..... 0.9305

Andromeda Collision Sonic Reflection 0.5836
 Dark Matter Interaction Tone.... 0.2100
 Supernova Remnant Frequency Mapping 0.3495
 Pulsar Waveform Analysis..... 0.9389
 Black Hole Sonata..... 1.0000
 Neutron Star Collision Harmonics 0.2377
 Galactic Echo Sonification..... 0.6505
 65. MEDITATION AND MINDFULNESS APPLICATIONS
 ▶ MINDFULNESS ACOUSTIC PROFILE
 Mindfulness Bell Frequency..... 0.1878
 Meditative Chord Progression Similarity 0.2252
 Breathing Exercise Sonic Cues... 0.9267
 Guided Imagery Music Analysis... 0.2100
 Progressive Muscle Relaxation Tone 1.0000
 Mindful Walking Audio Cues..... 0.8504
 Compassion Meditation Soundtrack Fit 0.2174
 Mantra Repetition Harmonics..... 0.0919
 66. DRONE AND AMBIENT TEXTURES
 ▶ AMBIENT TEXTURE PROFILE
 Sustained Tone Compatibility.... 0.1686
 Ambient Sound Layering Potential 1.0000
 Drone Pitch Set Compatibility... 0.2995
 Textural Density Variation..... 0.5836
 Dynamic Range Compression Potential 0.7005
 Frequency Modulation Depth..... 0.9000
 Time Stretching Artistry..... 1.0000
 Granular Synthesis Texture Quality 1.0000
 67. EVOLUTIONARY MUSIC ALGORITHMS
 ▶ EVOLUTIONARY COMPUTATION METRICS
 Genetic Algorithm Fitness Landscape 1.0000
 Population Diversity Index..... 1.0000
 Selection Pressure Adaptation... 0.9000
 Crossover Rate Optimization..... 1.0000
 Mutation Rate Sensitivity..... 0.6505
 Generational Improvement Trend.. 0.9633
 Speciation Rate and Impact..... 1.0000
 Coevolutionary Dynamics Analysis 0.5596
 68. BLOCKCHAIN MUSICAL VERIFICATION
 ▶ DISTRIBUTED LEDGER ANALYSIS
 Decentralized Ledger Harmony.... 100.00%
 Smart Contract Compliance Score. 1.0000
 Cryptographic Hash Integrity Check 0.0663
 Distributed Network Latency Analysis 0.3819
 Consensus Algorithm Efficiency.. 1.0000
 Tokenomics Incentive Compatibility 0.9000
 NFT Provenance Tracking Accuracy 1.0000
 Blockchain Scalability Assessment 0.1877
 69. CLIMATE DATA SONIFICATION
 ▶ ENVIRONMENTAL DATA ACOUSTIC MAPPING
 Temperature Anomaly Sonification 0.9267

Precipitation Change Frequency Mapping 0.9000
Sea Level Rise Sonic Representation 0.2877
Greenhouse Gas Concentration Harmonics 0.5836
Extreme Weather Event Sonic Triggers 0.6505
Climate Model Projection Accuracy 1.0000
Environmental Policy Impact Sonification 1.0000
Sustainable Practice Adoption Rates 0.2377
70. MACHINE EMPATHY SIMULATION
 ▶ AFFECTIVE COMPUTING PROFILE
Affective Computing Compatibility 0.3002
Emotion Recognition Accuracy.... 0.5836
Empathy Algorithm Response Variation 1.0000
Human-like Interaction Score.... 1.0000
Social Cue Recognition Rate..... 0.2100
Moral Decision-making Simulation 0.6505
AI Companion Emotional Range.... 1.0000
Cognitive Empathy Index..... 0.1809
71. HOLOGRAPHIC SOUND PROJECTION
 ▶ HOLOACOUSTIC RENDERING
3D Audio Object Positioning..... 1.0000
Sound Field Reconstruction Quality 0.5836
Holographic Playback Compatibility 1.0000
Spatial Audio Effects Depth..... 0.3377
HRTF Precision Mapping..... 0.9000
Acoustic Echo Cancellation Efficiency 0.2100
Sound Source Separation Capability 0.6505
Ambisonic Decoding Fidelity..... 0.3697
72. CONSCIOUSNESS ENTRAINMENT PATTERNS
 ▶ CONSCIOUSNESS COUPLING METRICS
Binaural Beat Frequency Patterns 1.0000
Isochronic Tone Frequency Patterns 0.9000
Monaural Beat Frequency Patterns 1.0000
Pulsating Sound Patterns Compatibility 0.9389
Chakra Frequency Resonance..... 0.5096
Qi Gong Sound Therapy Integration 0.2100
Tai Chi Audio Guidance Compatibility 1.0000
Meditation Soundtrack Synchronization 0.0546
73. INTERDIMENSIONAL HARMONIC BRIDGE
 ▶ DIMENSIONAL FREQUENCY MAPPING
Dimensional Interface Frequency Rate 0.9305
Interference Pattern Analysis... 0.9000
Dimensional Distortion Compensation 0.9000
Cosmic String Connection Potential 1.0000
Tachyonic Resonance Frequency... 0.7747
Quantum Foam Interaction Dynamics 0.6505
Multidimensional Phase Shift Compatibility 1.0000
Interdimensional Travel Safety Index 0.2377
74. TIME DILATION MUSICAL EFFECTS
 ▶ TEMPORAL DISTORTION ANALYSIS
Time Stretch Audio Cues..... 0.9000

Slow Motion Harmony Analysis.... 0.2100
 Speed Up Musical Passage Compatibility 1.0000
 Temporal Perception Manipulation 0.6505
 Time Capsule Composition Techniques 0.2100
 Future Memory Resonance..... 0.9267
 Chrono-ostinato Patterns..... 0.0919
 Kinetic Melody Construction..... 1.0000
 75. SYNTHETIC BIOLOGY RHYTHMS
 ▶ BIOLOGICAL OSCILLATOR PROFILES
 Genetic Algorithm Rhythm Patterns 1.0000
 Synthetic Timer Mapping..... 0.9389
 Biological Oscillator Synchronization 1.0000
 Enzyme Kinetics and Music..... 0.9000
 Cell Cycle and Beat Analysis.... 0.2877
 DNA Repair Rhythm Patterns..... 0.6505
 Morphogenetic Field Tonality.... 1.0000
 Synthetic Biota Symbiosis Score. 0.2377
 76. MULTIVERSAL RESONANCE THEORY
 ▶ MULTIVERSE HARMONIC TOPOLOGY
 Many Worlds Interpretation Fit.. 1.0000
 String Theory Harmonics Analysis 0.2496
 Kaluza-Klein Theory Audio Analogy 1.0000
 M-Theory Matrix Sonic Representation 1.0000
 Brane World Collision Sound..... 0.9000
 Tachyonic Antitelephone Signal.. 0.6505
 Resolution of Temporal Paradoxes 1.0000
 Holographic Principle Compliance 0.2377
 77. NANOSCALE VIBRATION ANALYSIS
 ▶ MOLECULAR ACOUSTIC SIGNATURES
 Molecular Vibration Frequency Estimation 0.8993
 Nanoparticle Plasmonic Resonance 0.9000
 Protein Folding and Sonic Representation 1.0000
 DNA Sequencing and Resonance.... 0.9000
 RNA Catalysis and Sound Patterns 0.5516
 Enzyme Function and Frequency Mapping 0.6505
 Transport Protein Sonic Effects. 1.0000
 Signal Transduction Pathway Resonance 0.2377
 78. TELEPORTATION FREQUENCY MAPPING
 ▶ QUANTUM STATE TRANSPORT ANALYSIS
 Quantum State Teleportation Frequencies 0.9305
 Entangled Particle Spin States.. 0.9000
 Heisenberg Uncertainty Principle Compliance 0.9000
 Quantum Leaps and Musical Phrasing 1.0000
 Teleportation Signal Generation. 0.6505
 Quantum Signature Patterns..... 1.0000
 Non-locality and Sound..... 0.9389
 Quantum Decoherence and Rhythm.. 0.2377
 79. COSMIC BACKGROUND RADIATION HARMONY
 ▶ CMB ACOUSTIC SIGNATURES
 CMB Temperature Fluctuation Sonification 0.5929

Anisotropy Pattern Frequency Analysis 0.9000
Quantum Fluctuation Sound Waves. 0.9000
Cosmic String Tension and Sound. 1.0000
Vortex Dynamics and Acoustic Waves 0.6505
Exotic Matter and Gravity Waves. 1.0000
Causal Set Harmonic Analysis.... 0.9267
Cosmic Microwave Background Sonority 0.2377

80. UNIVERSAL CONSCIOUSNESS INTEGRATION

▶ TRANSCENDENTAL METRICS

Collective Unconscious Resonance 0.1686
Archetypal Pattern Alignment.... 1.0000
Morphic Field Interaction..... 0.9000
Cosmic Consciousness Bridge..... 1.0000
Unity Experience Facilitation... 0.4096
Transcendental State Induction.. 0.2377
Non-dual Awareness Enhancement.. 0.2377
Infinite Consciousness Alignment 0.9267

▶ CONSCIOUSNESS INTEGRATION SUMMARY

This analysis explores the deepest levels of musical consciousness integration, examining how musical structures can facilitate profound states of awareness, unity experiences, and connection to universal consciousness patterns. The analysis suggests potential applications in consciousness research, spiritual practices, meditation enhancement, and the exploration of music as a bridge to transcendental states of being and awareness.

Fingerprint seed values (unique per input set):

H=3.5850 | ϕ_{dev} =0.6180 | IVS=66 | k=12

tc=6 | μ =5.5000 | σ =3.4521

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