

Short Trace

1.

Handwritten musical score for measures 1-14. The score is written on two staves. The top staff contains a melodic line with notes numbered 1 through 14. The bottom staff contains a bass line with notes numbered 1 through 14. Red arrows connect notes between the two staves, indicating voice leading. A bracket labeled '3-7' spans measures 1-7, and another bracket labeled '3-9' spans measures 3-9. Measure 11 has a fermata over it.

Handwritten musical score for measures 15-27. The score is written on two staves. The top staff contains a melodic line with notes numbered 15 through 27. The bottom staff contains a bass line with notes numbered 15 through 27. Red arrows connect notes between the two staves, indicating voice leading. A bracket labeled '3' is placed over measures 24-26.

Handwritten musical score for measures 28-37. The score is written on two staves. The top staff contains a melodic line with notes numbered 28 through 37. The bottom staff contains a bass line with notes numbered 28 through 37. Red arrows connect notes between the two staves, indicating voice leading. A bracket labeled '3' is placed over measures 34-36.

8-1 {5, 6, 7, 8, 9, 10, 11, 0}

KL

7-4 see 7-4

7-5 - see 7-5

K

3-7 (6x) {5, 7, 10} {5, 8, 10} {6, 8, 11} {6, 9, 11} {7, 9, 0} {7, 10, 0}

3-9 (2x) {5, 7, 0} {5, 10, 0}

8-1 ≠ 7-6

8-1 ≠ 7-212

8-1 ≠ 7-24

6-212 - see 6-212

9-4 ≠ 8-1

4-23 {5, 7, 10, 0}

KL

only 2  
3-element  
subsets of  
4-23

3-7 (2x) {5, 7, 10} {7, 10, 0}

3-9 (2x) {5, 7, 0} {5, 10, 0}

NOTE "FORMAL" POSITION

K

9-4 (3x) - see 9-4

7-5 - see 7-5

7-212 - see 7-212

7-24 - see 7-24

6-212 ≠ 4-4

3-2 {6, 9, 11}

K<sub>4</sub>

4-4 {1, 3, 6}

8-215 {6, 9, 11} {7, 9, 0} {4, 6, 9} {0, 3, 5} {4, 7, 9}

4-23 {5, 7, 10} {7, 10, 0}

7-4 {6, 9, 11} {6, 8, 11} {7, 9, 0}

7-6 {8, 11, 1}

7-212 {6, 8, 11} {8, 11, 1} {1, 3, 6} {3, 6, 8}

7-24 {11, 1, 4} {6, 8, 11} {11, 2, 4} {11, 4, 6} {8, 11, 1} 5-24 {0, 2, 5}

7-28 {0, 2, 5} {6, 9, 11} {7, 9, 0}

6-212 {6, 9, 11} {7, 9, 0}

6-22 {0, 2, 5}

6-34 {0, 2, 5} {5, 8, 10}

K

8-1 - see 8-1

7-5

3-9 {5, 7, 0}

K<sub>6</sub>

4-23 {5, 7, 0} {5, 10, 0}

7-5

7-24 {11, 1, 6} {4, 6, 11} {6, 8, 11} 5-24 {0, 2, 5}

8-212 {0, 5, 7}

6-22 {10, 0, 5}

8-24 {10, 0, 5}

K

8-1 see 8-1

4-4

7-215

7-4

7-6

7-212

7-28



EX. 450  
1, 15-5

Sehr langsam

10-2: *entwäss.*

Arnold Schoenberg, Op. 10/6

pp

3-9

3-9

ppp

8-215 (*entwäss.*)

6-212

7-28

8-215

(7-28)

4-215/5-214/6-214

3

9-4 (*entwäss.*)

6-22

4-4

7-24/7-212/7-6

18-1: *entwäss.*

(6-212)

7-5

7-4

5-4: {8, 11, 0, 1, 2}

4-3 {3, 4, 6, 7}

all moving lines - 8-229

(1911)

*Schro langsam*

Arnold Schoenberg, Op. 19/16

\* 4-23 contains only 3-7 and 3-9 (formal juncture)

Pitch-structure in context of Set - PNM article of piece

7-24 (contains 6-212) [353443]  
 6-24 0, 1, 2, 5, 7, 9 [142422] Scriabin's Mystic Chord (Wozniak)

Normal order vector

- 6-212 5, 6, 7, 9, 11, 0 [332232]
- 5-24 contains 3-9 and 3-9 (also 3-2, 3-4, 3-5, 3-6, 3-8, and 3-11)
- 7-6 [533442]

7-28 [344433]

Schoenberg, 8p. 19/6

### Complement Relations

why 5-24/2-24

$$5-24: \{10, 0, 2, 4, 5\}$$

$$7-24: \{11, 0, 1, 2, 4, 6, 8\}$$

### Similarity Relations

$\Delta_{AND}(R1, RP)$

5-5, 5-6

$\Delta_{AND}(R2, RP)$

4-4, 4-215

5-4, 5-212

$\times_{AND}(R1, RP)$

4-1, 4-23

5-6, 5-24

6-22, 6-34

$\times_{AND}(R2, RP)$

5-5, 5-12

Subsets of 6-212

5 7.1 9.1 12.1 19.1 24.1 36.1

4 2.1 5.1 6.1 8.1 9.1 11.2 13.2 15.1 16.1 18.1 28.1 22.1

3 1.1 2.2 3.1 4.2 5.5 6.2 7.2 8.2 9.1 10.1 11.1

6-212: {5, 6, 7, 9, 11, 0}

6-241 (not present) {0, 1, 2, 3, 6, 8}

K<sub>6</sub>

3-4: {6, 7, 11} {7, 11, 0}

9-4 {0, 1, 2, 4, 6, 7} {1, 2, 4, 6, 7, 8}

9-4: {0, 1, 2, 3, 6, 8} {6, 8, 11, 0, 1, 2}

5-7 {7, 9, 0} {6, 9, 11} <sup>intersection in</sup> {1, 2, 4, 6, 7} - 5-212

3-9 {0, 5, 7}

8-215: evident in notation, m. 3

K

8-1\* {5, 6, 7, 9, 11, 0} {5, 6, 8, 10, 11, 0}

6-212 ≠ 4-4

6-212 ≠ 4-23

7-4 (1x) - evident in notation

7-5 (1x) - evident in notation

5-212 ~~\_\_\_\_\_~~ {6, 7, 9, 11, 0}

7-212 ≠ 6-212

5-24 ~~\_\_\_\_\_~~ {5, 7, 9, 11, 0}

7-24 ≠ 6-212

7-212 = 6-241 2x

7-24 = 6-241 1x

7-28 - evident in notation, m. 3



~~6-22~~ {0, 0, 2, 4, 5, 6}      0, 2, 5 ~~and 6, 4, 5~~

$\{1, 0, 2, 4, 5, 6\}$   
 $6-22 - kh \rightarrow 3-7 \quad 1x$   
 $3-9 \quad 1x \quad 10, 0, 5$   
 $3-4 \quad 2x \quad 0, 4, 5, \text{ and } 10, 5, 6$   
 $9-4 \supset 6-22 \quad 2x$   
 $8-25 \supset 6-22 \quad 1x$   
 ~~$6-22 \supset 4-5 \quad 1x$~~   
 $6-22 \supset 5-24 \quad 1x \quad 10, 0, 2, 4, 5$  (evolution score)  
 $7-24 \supset 8-22 \quad 1x \quad 0, 1, 2, 4, 6, 8$

$\{8, 10, 0, 2, 4, 5, 6\}$   
 $6-34 - kh$  (largest) of hexahedra  
 $\supset 3-7 \quad 2x$   
 $\supset 3-9 \quad 1x$   
 $9-4 \supset 6-34 \quad 1x$   
 ~~$6-34 \supset 4-25 \quad 1x$~~   
 $8-25 \supset 6-34 \quad 1x$   
 $6-34 \supset 5-24 \quad 1x$   
 $7-24 \supset 6-34 \quad 1x$   
 $5-24 \supset 6-34 \quad 1x$   
 $6-34 \supset 5-28 \quad 1x$

$w. 9 \quad 4-4 - kh \quad \{1, 2, 3, 6\}$   
 $\supset 3-7 \quad 1x \quad 1, 3, 6$   
 $\supset 3-4 \quad 1x \quad 1, 2, 6$   
 $9-4 \supset 4-4 \quad 7x$   
 $7-4 \supset 4-4 \quad 2x \quad 6, 7, 8, 11 \text{ and } 7, 8, 9, 0$   
 $7-6 \supset 4-4 \quad 1x \quad 5, 6, 7, 10 \quad 8, 11, 0, 1$

$K$   
 $7-5 (3x) \quad \{5, 6, 7, 10\} \quad \{6, 9, 10, 11\} \quad \{7, 10, 11, 0\}$   
 $7-212 (2x) \quad \{1, 2, 3, 6\} \quad \{8, 11, 0, 1\}$   
 $7-24 \quad \{11, 0, 1, 4\} \quad \{8, 11, 0, 1\}$   
 $6-212 \neq 4-4$

83203

7-24: { 11, 0, 1, 2, 4, 6, 8 }

5-24: { 10, 0, 2, 4, 5 }

$K_h$

~~3-4 (2x) { 1, 2, 6 } { 11, 1, 4 } { 4, 8, 1 }~~  
 9-4 ~~2-24~~ 1x (evident in score)

~~3-4 { 0, 4, 5 }~~

9-4 (2x) { 0, 2, 4, 6, 7 } { 1, 2, 4, 6, 8 } { 11, 0, 2, 4, 6 }

Exceeded  
why 3-8 (6x)

3-7 (5x) { 11, 1, 4 } { 0, 8, 11 } { 11, 2, 4 } { 1, 4, 6 } { 8, 11, 1 }

~~3-7~~ { 0, 2, 5 }

3-9 (3) { 11, 1, 6 } { 4, 6, 11 } { 6, 8, 1 }

3-9 { 1, 0, 5, 5 }

6-22: { 0, 1, 2, 4, 6, 8 }

6-22 { 10, 0, 2, 4, 5 }

6-34: { 11, 0, 2, 4, 6, 8 }

6-34 { 10, 0, 2, 4, 5 } } XB.

$K$

8-1 ~~9-24~~

8-1 (2x) { 5, 6, 8, 10, 0 } { 5, 7, 9, 11, 0 }

4-4 (2x) { 11, 0, 1, 4 } { 8, 11, 0, 1 }

5-24 ~~4-4~~

8-215 ~~9-24~~

8-215 (2x) { 4, 5, 7, 9, 11 } { 5, 7, 9, 11, 0 }

4-23 (2x) { 11, 1, 4, 6 } { 6, 8, 11, 1 }

5-24 ~~4-23~~

7-24 ~~6-212~~

6-212 (1x) { 5, 7, 9, 11, 0 }

8-215: { 0, 3, 4, 5, 6, 7, 9, 11 }

$K_h$

6-22: { 0, 1, 2, 4, 6, 8 }

6-34: { 3, 5, 7, 9, 11, 0 }

6-212: evident in score

3-7 (5x) { 0, 3, 5 } { 4, 6, 11 } { 7, 9, 0 } { 4, 7, 9 } { 6, 9, 11 }

7-6 { 11, 0, 3, 4, 5, 6, 7 }

7-28 { 3, 5, 6, 7, 9, 11, 0 }

3-7 (5x) { 6, 9, 11 } { 7, 9, 0 } { 4, 6, 9 } { 0, 3, 5 } { 4, 7, 9 }

$K$

3-9 (3x) { 5, 7, 0 } { 4, 6, 11 } { 9, 11, 4 }

7-4 ~~8-215~~

7-5 ~~8-215~~

7-212 ~~8-215~~

7-24 ~~8-215~~

5-24 (2x) { 4, 5, 7, 9, 11 } { 5, 7, 9, 11, 0 }

7-6 {7, 8, 11, 0, 1, 2, 3} <sup>in score</sup>

π<sub>h</sub>

9-4 (3x) {7, 8, 11, 0, 1, 2, 3} {0, 1, 2, 3, 4, 7, 8} ~~{7, 8, 11, 0, 1, 2, 3}~~ {11, 0, 1, 2, 3, 6, 7}

3-4 (5x) {7, 8, 0} {7, 11, 0} {8, 0, 1} {2, 3, 7} {3, 7, 8}

3-7 (1x) {8, 11, 1}

4-4 (1x) {8, 11, 0, 1}

8-215 {11, 0, 3, 4, 5, 6, 7}

κ

3-9 (2x) {7, 0, 2} {8, 1, 3}

8-1 ✗ 7-6

7-28 {3, 5, 6, 7, 9, 11, 0}

π<sub>h</sub>

3-7 (3x) {0, 3, 5} {6, 9, 11} {7, 9, 0}

8-215 (1x) {3, 5, 6, 7, 9, 11, 0} - no in score

6-34 (1x) {6, 7, 9, 11, 0, 3}

κ

9-4 ✗ 7-28

3-4 (2x) {6, 7, 11} {7, 11, 0}

3-9 (1x) {0, 5, 7}

6-212 (1x) - no in score

9-4 {0, 1, 2, 3, 4, 6, 7, 8, 11}

π<sub>h</sub>

4-4 {1, 2, 3, 6} {2, 3, 4, 7} {3, 6, 7, 8} {6, 7, 8, 11} {8, 11, 0, 1} {11, 0, 1, 4} {11, 1, 3, 4}

7-4 {0, 1, 2, 3, 4, 6, 7}

7-5 {1, 2, 3, 4, 6, 7, 8} <sup>in score</sup>

7-6 {7, 8, 11, 0, 1, 2, 3} {0, 1, 2, 3, 4, 7, 8} {11, 0, 1, 2, 3, 6, 7}

7-212 {6, 7, 11, 0, 1, 2, 3} no in score

7-24 - no in score - see 5-24

6-212 {0, 1, 2, 4, 6, 7} {1, 2, 4, 6, 7, 8}

6-22 {0, 1, 2, 4, 6, 7} {0, 2, 4, 6, 7, 8}

6-34 {11, 0, 2, 4, 6, 8}

κ

9-4 ✗ 8-1

9-4 ✗ 8-215

4-23 (3x) {1, 3, 6, 7} {2, 3, 4, 7} {3, 6, 7, 8}

9-4 ✗ 7-28

7-5: {5, 6, 7, 9, 10, 11, 0}

$K_h$  3-4 (5x) {5, 6, 11} {6, 7, 11} {5, 9, 10} {6, 10, 11} {7, 11, 0}  
9-4 (1x) {1, 2, 3, 4, 6, 7, 8}  
3-9 (2x) {5, 7, 0} {5, 10, 0}  
8-1 (2x) {5, 6, 7, 9, 10, 11, 0} {5, 6, 7, 8, 9, 11, 0}

$K$  3-7 (4x) {5, 7, 10} {6, 9, 11} {7, 9, 0} {7, 10, 0}  
4-4 (3x) {5, 6, 7, 0} {6, 9, 10, 11} {7, 10, 11, 0}  
8-215  $\neq$  7-5  
4-23 (1x) {5, 7, 10, 0}  
6-212 (1x) - evident in notation

7-4: {5, 6, 7, 8, 9, 11, 0}

$K_h$  9-4 (1x) {0, 1, 2, 3, 4, 6, 7}  
3-4 (2x) {6, 7, 11} {7, 8, 0} {7, 11, 0}  
3-7 (3x) {6, 9, 11} {6, 8, 11} {8, 9, 0}  
8-1 (2x) {5, 6, 7, 8, 9, 11, 0} {5, 6, 8, 9, 10, 11, 0}  
4-4 (2x) {5, 6, 8, 11} {6, 7, 8, 11}

$K$  3-9 (1x) {5, 7, 0}  
8-215  $\neq$  7-4  
6-212 (1x) - evident in notation

7-212: {6, 8, 11, 0, 1, 2, 3}

$K_h$  9-4 (1x) {6, 8, 11, 0, 1, 2, 3} - as in 6CMT  
3-7 (4x) {6, 8, 11} {8, 11, 1} {1, 3, 6} {6, 8}

$K$  3-9 (3x) {6, 8, 1} {6, 11, 1} {8, 1, 3}  
8-1  $\neq$  9-212  
4-4 (2x) {8, 11, 0, 1} {1, 2, 3, 6}  
8-215  $\neq$  7-212  
4-23 (2x) {6, 8, 11, 1} {1, 3, 6, 8}  
7-212  $\neq$  6-212