



BI-HEXAPHONIC TENSION AND EXPERIENTIAL AFFORDANCES

Mauri Kaipainen, PhD

Overview

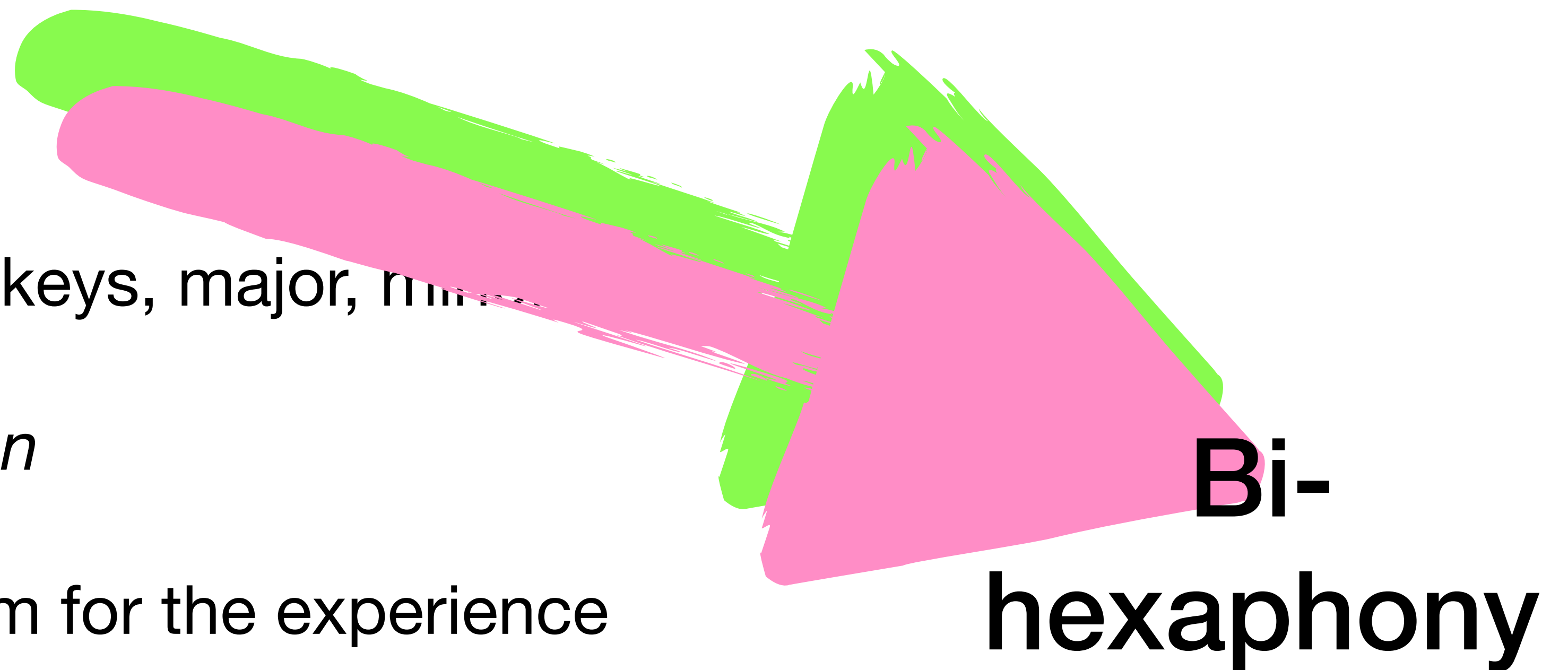
- BI-HEXAPHONY
- POLY-DOMINANCY
- PHENOMENOLOGICAL APPROACH TO MUSIC ANALYSIS
- BI-HEXAPHONIC PITCH ORGANIZATION
- EXPERIENTIAL SENSE-MAKING OF BI-HEXAPHONIC MUSIC PROGRESSION

Motivation

1) Why does Schönberg sound occasionally *diatonic* to me despite his deliberate ambiguity?

2) How to compose:

- Without tonic centers, keys, major, minor
- With *pitch-class tension*
- Ambiguity, leaving room for the experience



Motivation

Introspection of experience

1) Why does Schönberg sound occasionally *diatonic* to me despite his deliberate ambiguity?

2) How to compose:

- Without tonic centers, keys, major, minor
- With *pitch-class tension*
- Ambiguity, leaving room for the experience



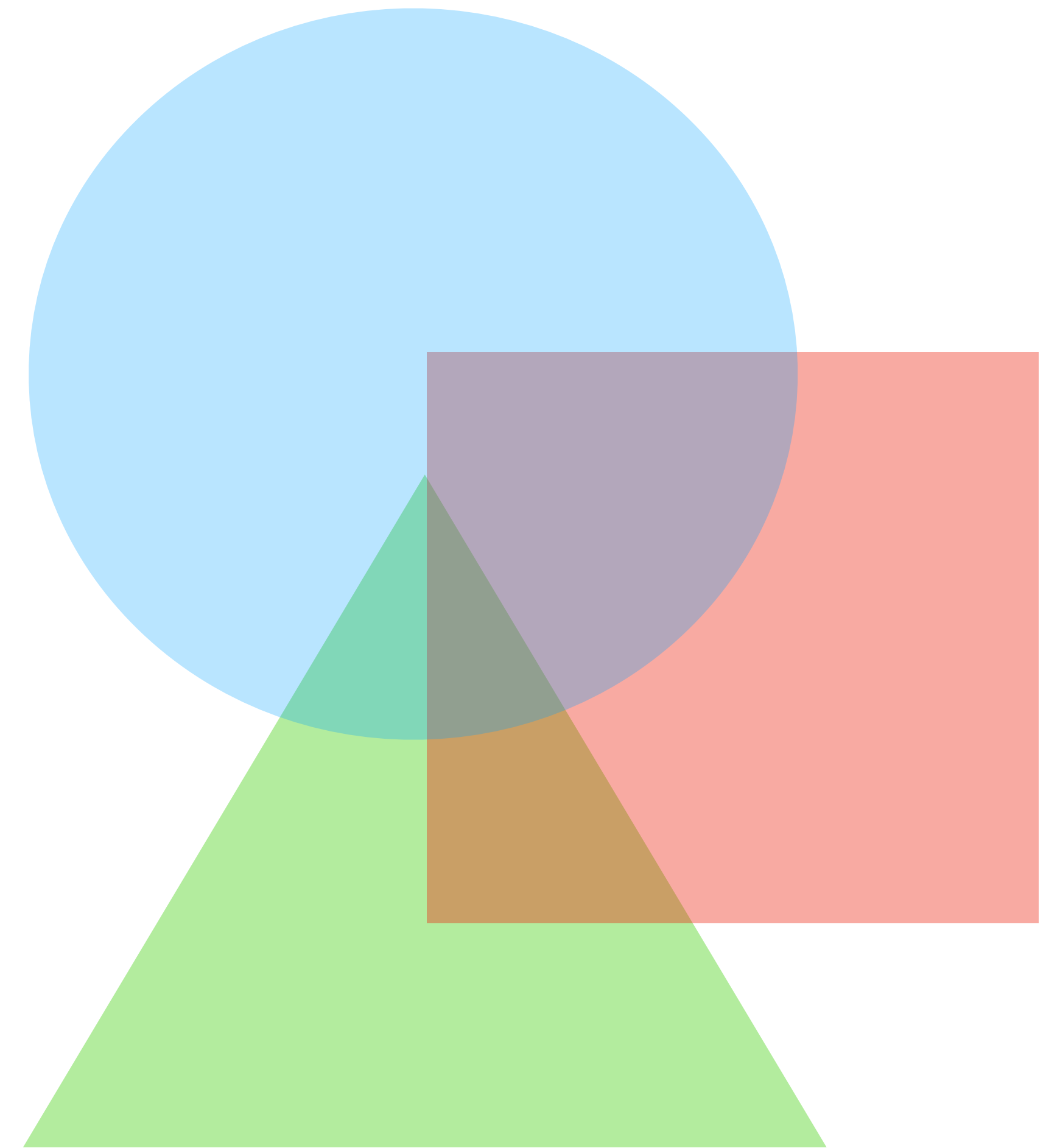
**Bi-
hexaphony**

Three pillar epistemology of experience

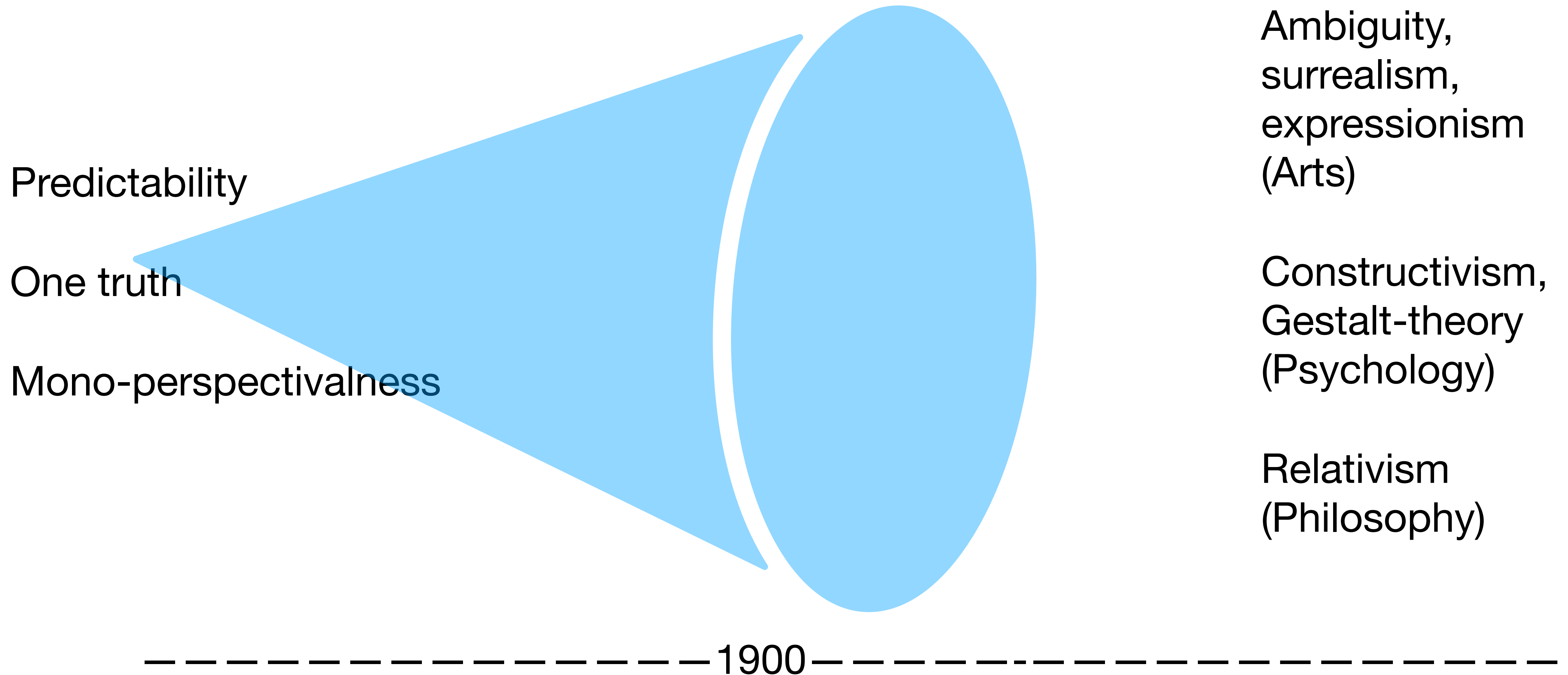
Holistic experience: Individually felt, shared in terms of body and culture

Three-pillar epistemology, studying experience from three angles:

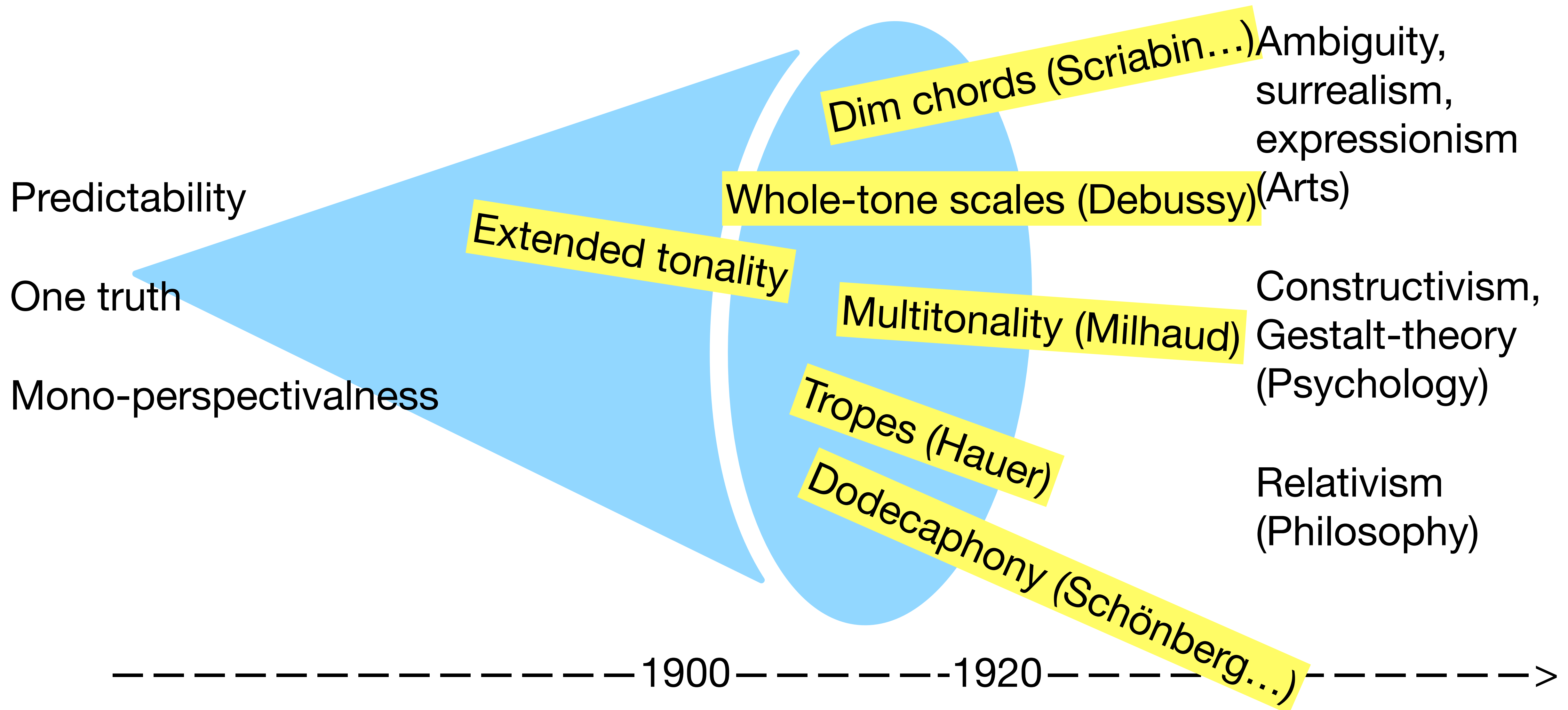
- Introspection
- Psychophysiology
- Shared code: Notation and music analysis



Very short history of ambiguity

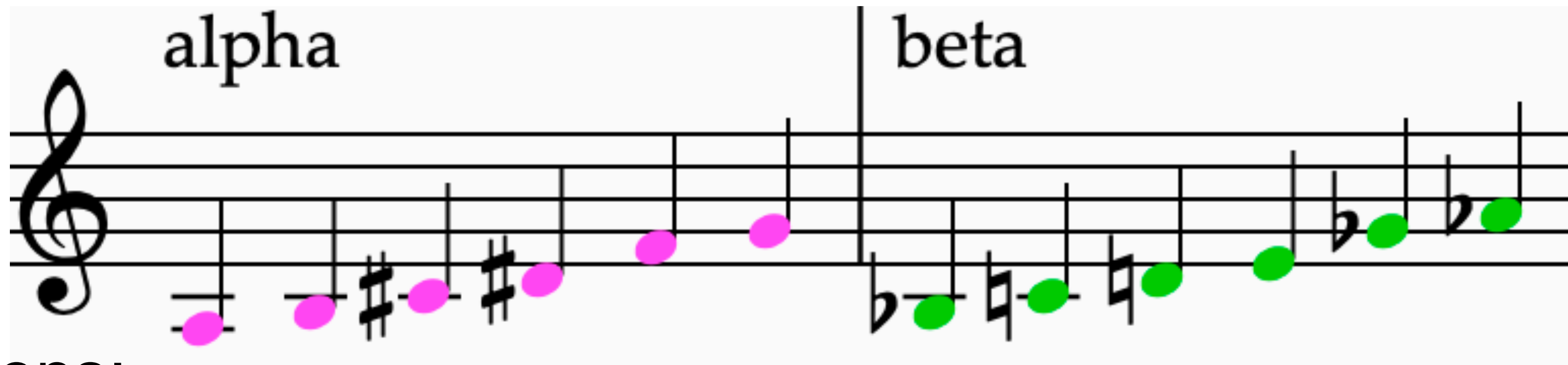


Very short history of ambiguity



BI-HEXAPHONY

Bi-hexaphony



Conventions:

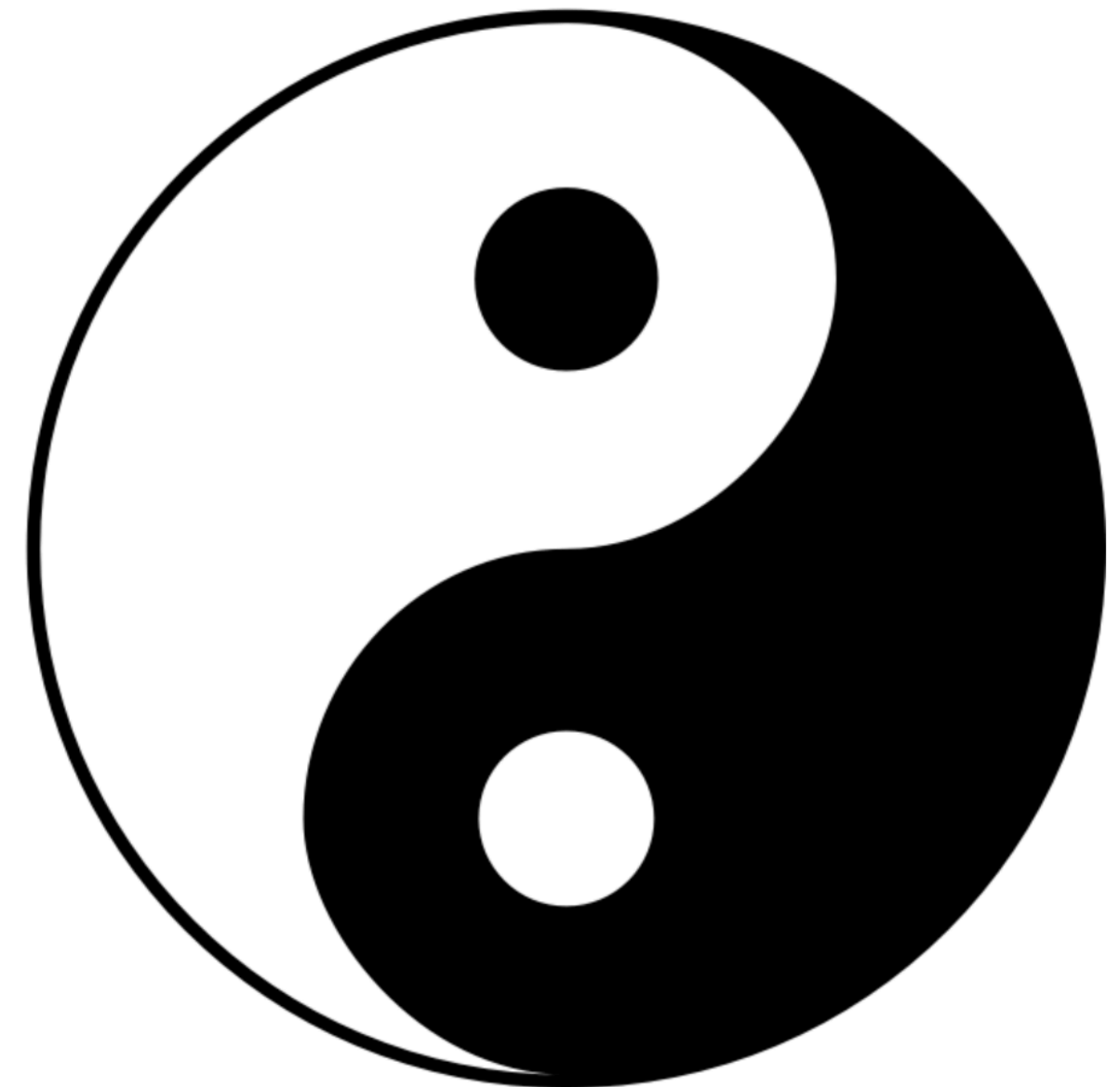
- Alpha: notated with # accidentals
- Beta: notated with b accidentals

=> Enharmonic equivalence

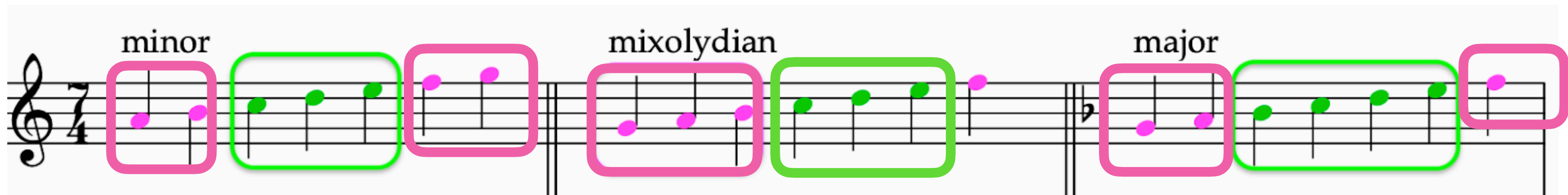
Bi-hexaphony

Two symmetric:

- Sets
- “Keys”
- Harmonic functions
- **Polydominancies** for each other



Omnipresence of bi-hexaphony: Diatonic music



All septatonic scales comprise of alpha and beta cells, *limited by transitions to other hexaphony*

Omnipresence of bi-hexaphony: Dodecaphony

All twelve-tone rows can be broken into hexaphonies.

Wind Quintet, Andante (3rd movement)

Horn

Bassoon *p dolce*

1 2 3 4 5 6 7 8 9 10 11 12

Schönberg 1951, 124

Bi-hexaphonic tension

Hypothesis:

Separation of the two hexaphonies is enough to generate an experiential tension

A musical score for two hexaphonies. The top staff is in treble clef and the bottom staff is in bass clef. The music consists of eighth and sixteenth notes, some of which are highlighted in pink and green. The word "pizz" (pizzicato) is written above the first measure of both staves, and a dynamic marking "p" (piano) is below the first measure of the bottom staff. A yin-yang symbol is overlaid on the score, centered between the two staves in the second measure, and is enclosed in a green rounded rectangle. The symbol is positioned over a pink note on the top staff and a green note on the bottom staff.

Bi-hexaphonic tension

Hypothesis:

Separation of the two hexaphonies is enough to generate an experiential tension

The image shows a musical score with three staves. The top staff is in treble clef and contains a measure with a yin-yang symbol overlaid on it, enclosed in a green rounded rectangle. The yin-yang symbol is positioned between two notes: a green note on the lower staff and a pink note on the upper staff. The word "pizz" is written above the yin-yang symbol, and a dynamic marking "p" is below it. The middle staff is in bass clef and contains a sequence of notes, some pink and some green, with a "pizz" marking above the first measure and a "p" marking below the first measure. The bottom staff is in bass clef and contains a sequence of notes, some pink and some green, with a "pizz" marking below the last measure. The notes are color-coded: pink notes are on the upper staff and green notes are on the lower staff. The yin-yang symbol is a black and white circle with a black dot in the white half and a white dot in the black half.

Bi-hexaphonic tension

Hypothesis:

Separation of the two hexaphonies is enough to create an experiential tension

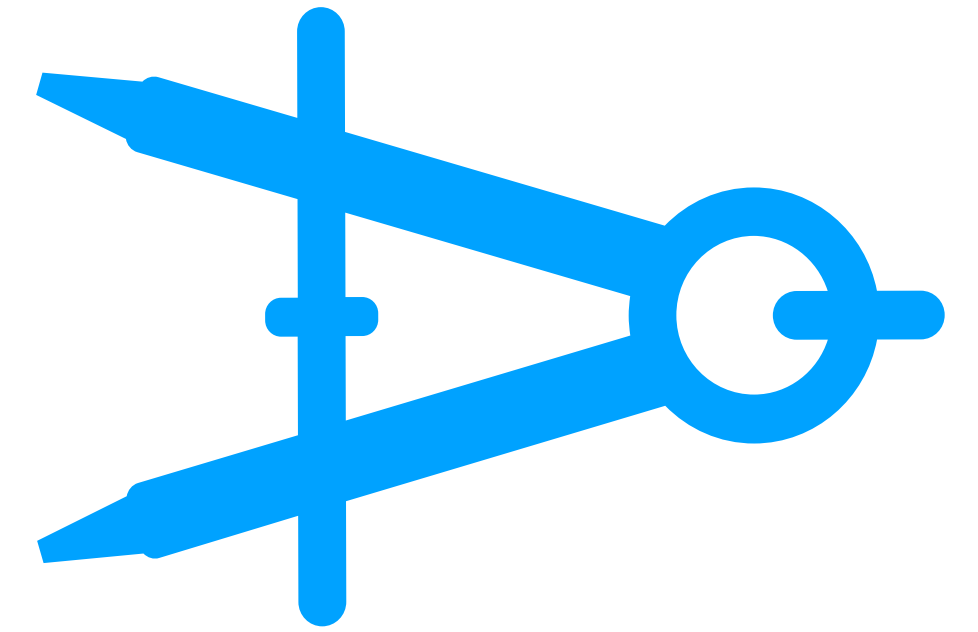
Formula:

$t = \text{maturity} \times \text{ambitus}$

The image shows a musical score with two staves. The top staff is annotated with $a = 4/5$ and $m = 4/6$. A green box highlights a section of the top staff containing notes with green and pink dots, with the annotation $t = 0.533$ below it. The word "pizz" is written above the notes in the highlighted section. The bottom staff also contains notes with pink and green dots, with the word "pizz" written above it. The score is divided into measures by vertical lines.

Cell ambitus

Cell ambitus = the range of expression in number of whole-tones / 5

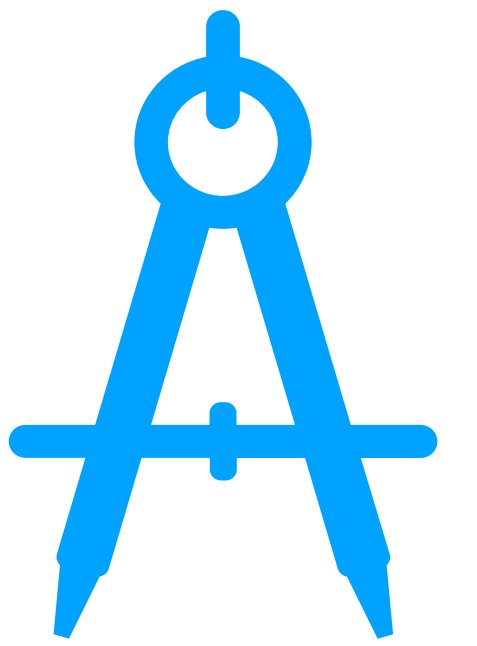


Embodied reference: reaching, stretching...

The diagram illustrates cell ambitus on two musical staves. The top staff is in 8/4 time, and the bottom staff is in 6/4 time. Each staff shows five measures with notes and accidentals enclosed in pink rounded rectangles. Labels 'a= 1/5' through 'a= 5/5' are placed below each measure.

Staff	Measure	Label	Notes and Accidentals
8/4	1	a= 1/5	C4, G4
	2	a= 2/5	C4, F#4
	3	a= 3/5	C4, F#4
	4	a= 4/5	C4, G4
	5	a= 5/5	C4, G4
6/4	1	a= 1/5	C4, G4
	2	a= 2/5	C4, G4
	3	a= 3/5	C4, F#4
	4	a= 4/5	C4, F#4
	5	a= 5/5	C4, G4

Cell maturity



Maturity = the number of tones played out / 6

Embodied reference: Spatial and temporal completeness, readiness, fullness

m= 5/6

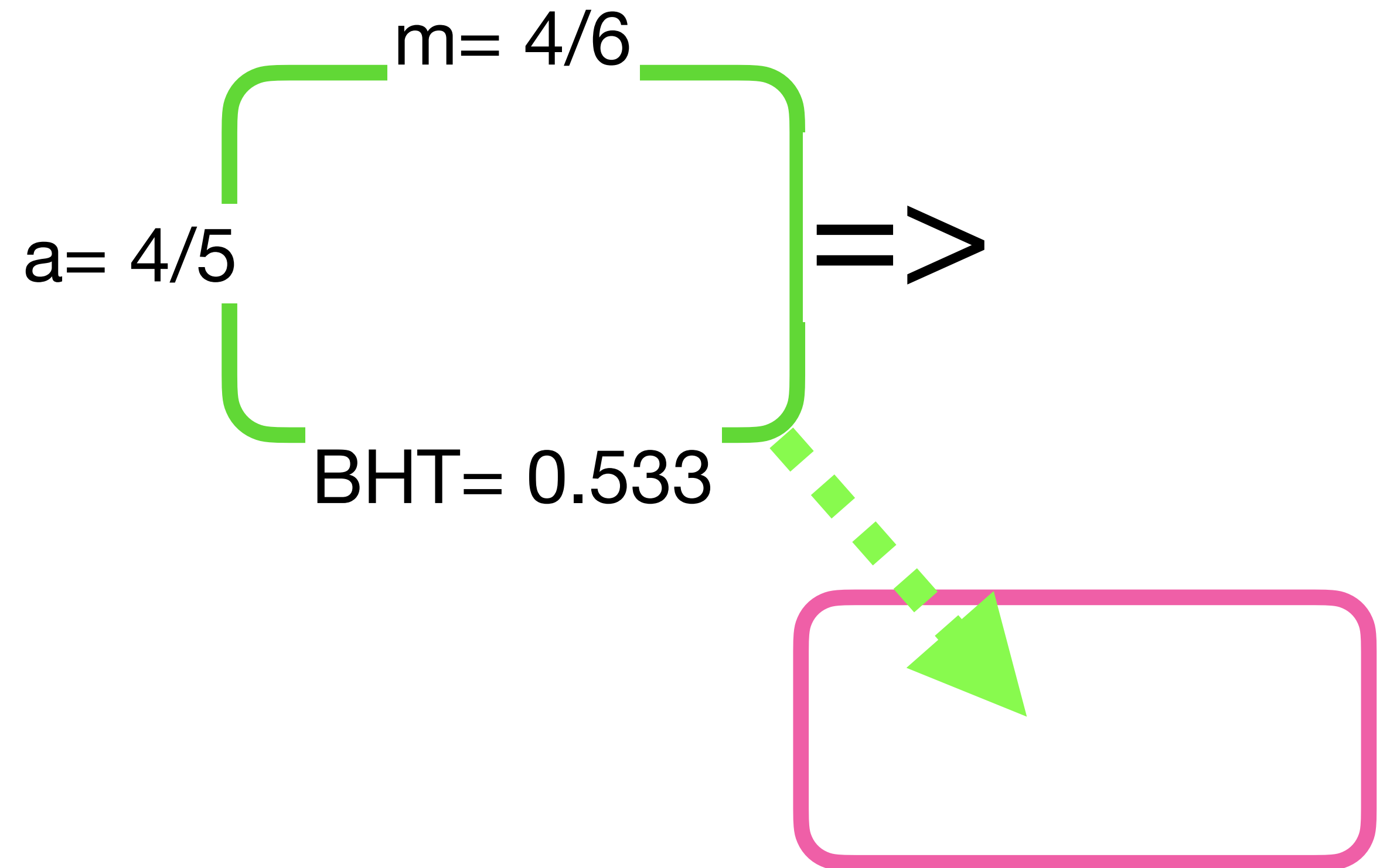
m= 6/6

m= 7/6

Bi-hexaphonic tension

The stronger the tension:

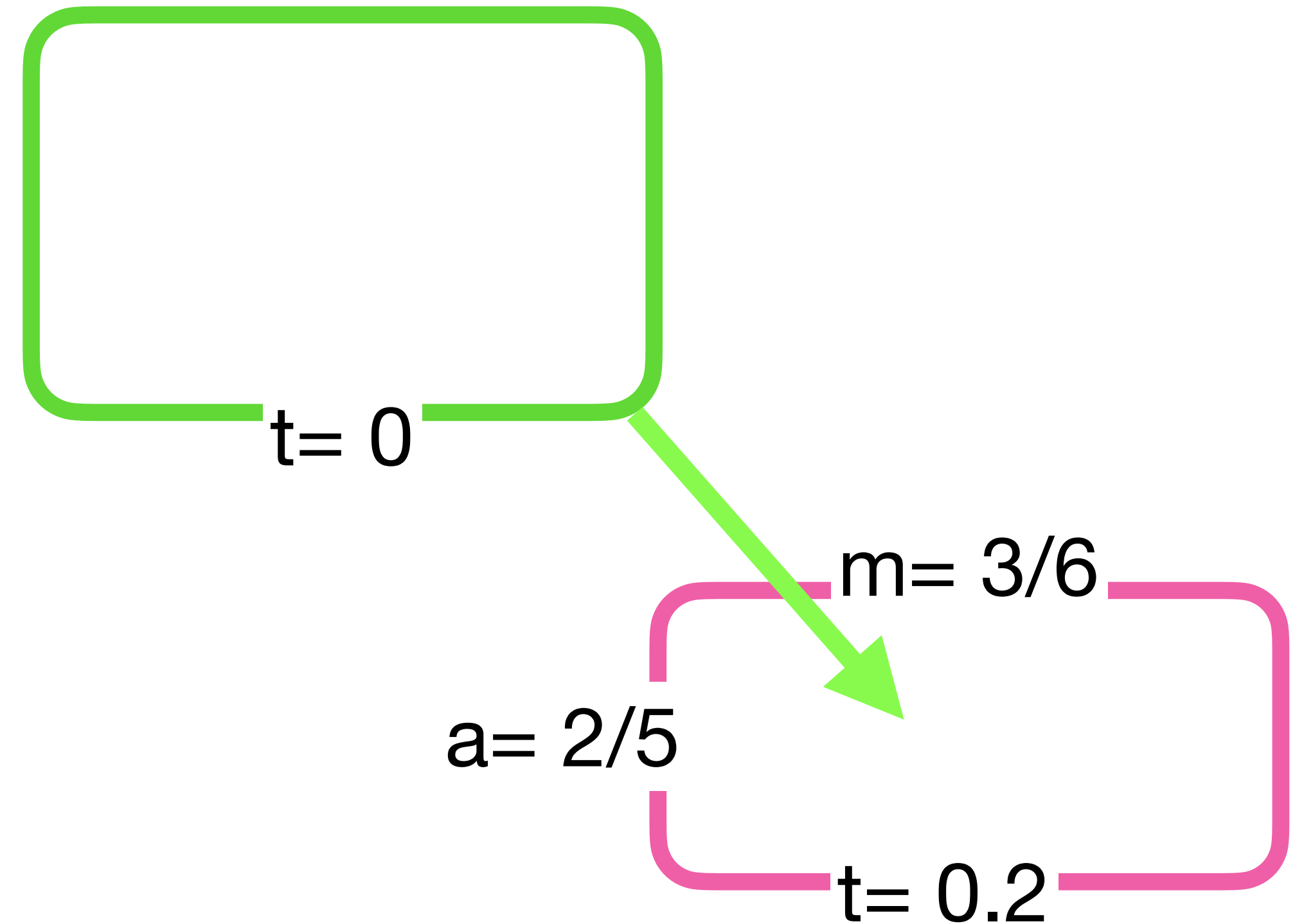
- The more urgent the need for resolution
- The more ambiguous the anticipated resolution



Transition: Tension release

Tension released by transition to other BH

- Via transitive intervals
- Begins to accumulate again
- Not a dominant-tonic release, but...



Transitive intervals

Intervals leading to a given tone in next hexaphony:

- Semitone (leading tone)
- Minor third
- Fourth
- Fifth
- Sixth
- Seventh

Ascending/descending

The diagram illustrates transitive intervals between two hexachords on a five-line staff. The first hexachord, in D major (two sharps), consists of six pink circles on the lines D4, E4, F#4, G4, A4, and B4. The second hexachord, in B-flat major (two flats), consists of six green circles on the lines B3, C4, D4, E4, F4, and G4. Orange arrows show the transitive intervals: the top line of the first hexachord (D4) moves to the top line of the second (B3), the second line (E4) moves to the second line (C4), the third line (F#4) moves to the third line (D4), the fourth line (G4) moves to the fourth line (E4), the fifth line (A4) moves to the fifth line (F4), and the bottom line (B4) moves to the bottom line (G4). A dynamic marking *mf* is placed below the first hexachord, and a wedge-shaped hairpin indicates a crescendo from the first to the second hexachord.

Transitive intervals

Intervals leading to a given tone in next hexaphony:

- Semitone (leading tone)
- Minor third
- Fourth
- Fifth
- Sixth
- Seventh

Ascending/descending
Enharmonic equivalence

The diagram illustrates transitive intervals between two hexachords on a five-line staff. The first hexachord, marked *mf*, is in the key of D major (two sharps) and consists of the notes D4, E4, F#4, G4, A4, and B4, represented by pink circles. The second hexachord is in the key of B-flat major (two flats) and consists of the notes B3, C4, D4, E4, F4, and G4, represented by green circles. Orange arrows show the following transitive intervals: D4 to B3 (semitone), E4 to C4 (minor third), F#4 to D4 (fourth), G4 to E4 (fifth), A4 to F4 (seventh), and B4 to G4 (seventh). A black wedge-shaped symbol below the staff indicates a dynamic change or crescendo.

Transitive intervals

Intervals leading to a given tone in next hexaphony:

- Semitone (leading tone)
- Minor third
- Fourth
- Fifth
- Sixth
- Seventh

Ascending/descending
Enharmonic equivalence

The diagram illustrates transitive intervals between two hexachords on a five-line staff. The first hexachord, marked *mf*, is in the key of D major (two sharps) and consists of the notes D4, E4, F#4, G4, A4, and B4, represented by pink circles. The second hexachord is in the key of B-flat major (two flats) and consists of the notes B3, C4, D4, E4, F4, and G4, represented by green circles. Orange arrows show the following intervallic relationships: D4 to B3 (semitone), E4 to C4 (minor third), F#4 to D4 (fourth), G4 to E4 (fifth), A4 to F4 (seventh), and B4 to G4 (seventh). A black wedge-shaped symbol below the staff indicates a dynamic change or crescendo.

Bi-hexaphonic transition as affordance* for experiential tension resolution



*Gibson, J.J. (1977). The Theory of Affordances

POLYDOMINANCY

Polydominancy

Harmonic ambiguity: Bi-hexaphonic transition can always be interpreted as leading to **multiple alternative paths of dominants.**

- Generic property of bi-hexaphony
- An experiential choice among alternatives
- Not deliberately composed, but inherent in the organisation

Polydominancy

No fifths in a
BH cell:

=> Consider
dyadic
harmonic
implications &
dim sevenths/
augmented
sixths

The diagram shows a musical score with three staves. A yellow vertical bar highlights a central section. A green rounded rectangle encloses the first two staves of this section, labeled 'Beta' at the bottom. A pink rounded rectangle encloses the last two staves, labeled 'Alpha' at the bottom. A pink bar at the bottom of the first staff is labeled 'Beta'. A blue bar at the bottom of the last staff is labeled 'Alpha'. Dotted lines with arrows connect notes between the Beta and Alpha sections: a cyan line from the top staff, a yellow line from the middle staff, a pink line from the middle staff, and a blue line from the bottom staff. A solid blue arrow points from the top staff of the Alpha section to the top staff of the Beta section. A solid yellow arrow points from the middle staff of the Alpha section to the middle staff of the Beta section. A solid pink arrow points from the middle staff of the Alpha section to the middle staff of the Beta section. A solid blue arrow points from the bottom staff of the Alpha section to the bottom staff of the Beta section. The notes are: Beta top staff (F#4, G4), Beta middle staff (G3, G4), Beta bottom staff (F#3, G3), Alpha top staff (G4, G4), Alpha middle staff (G3, G4), Alpha bottom staff (F#3, G3).

Beta

Alpha

Polydominancy

Alpha and beta are polydominants of each other.

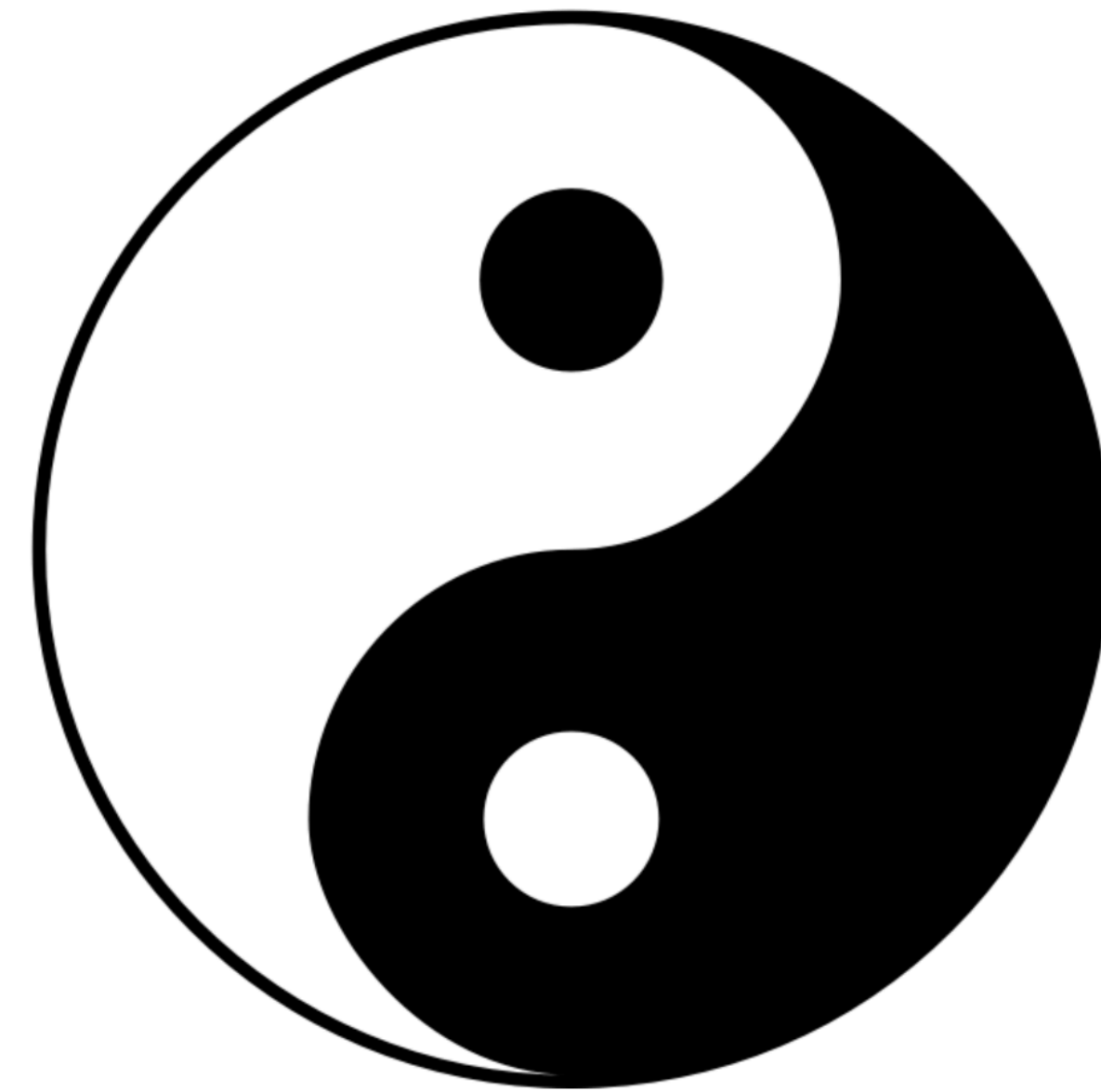
Alpha = D(beta)

Beta = D(alpha)

=> Ambiguity

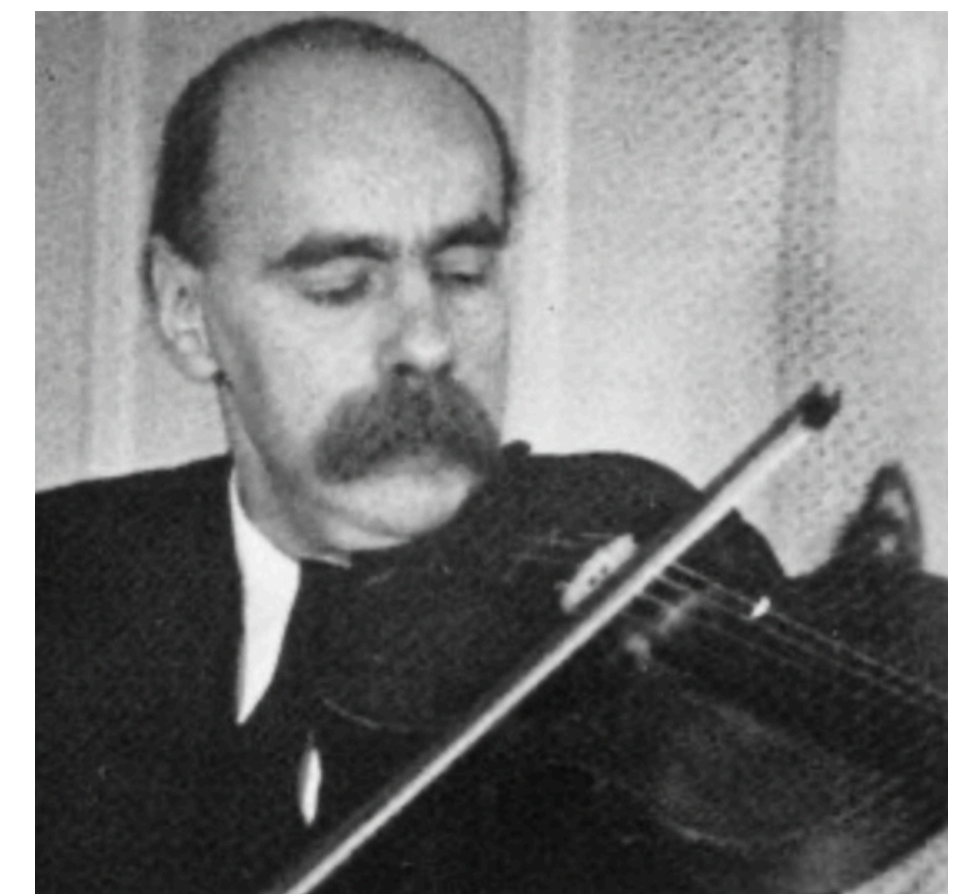
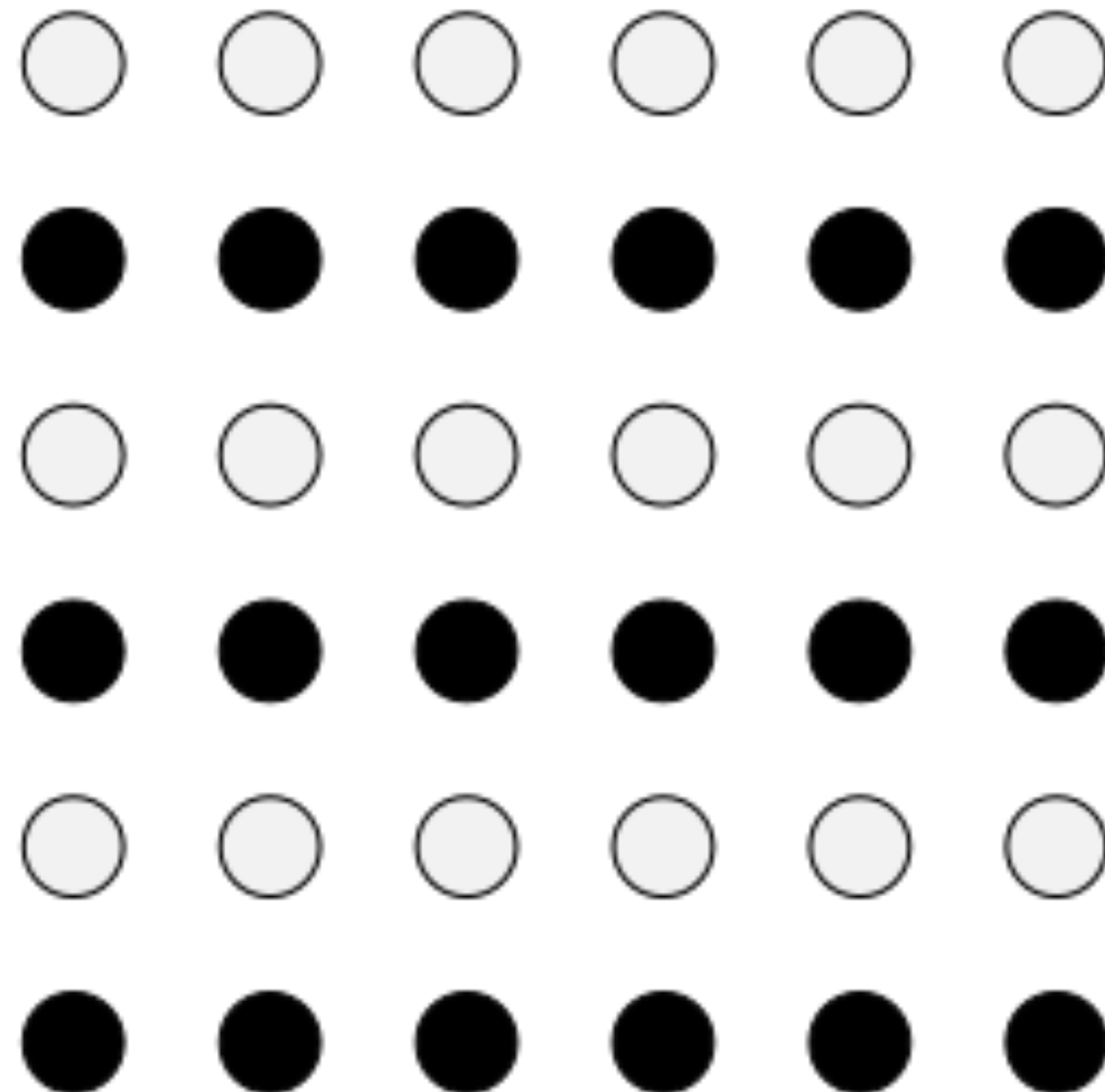
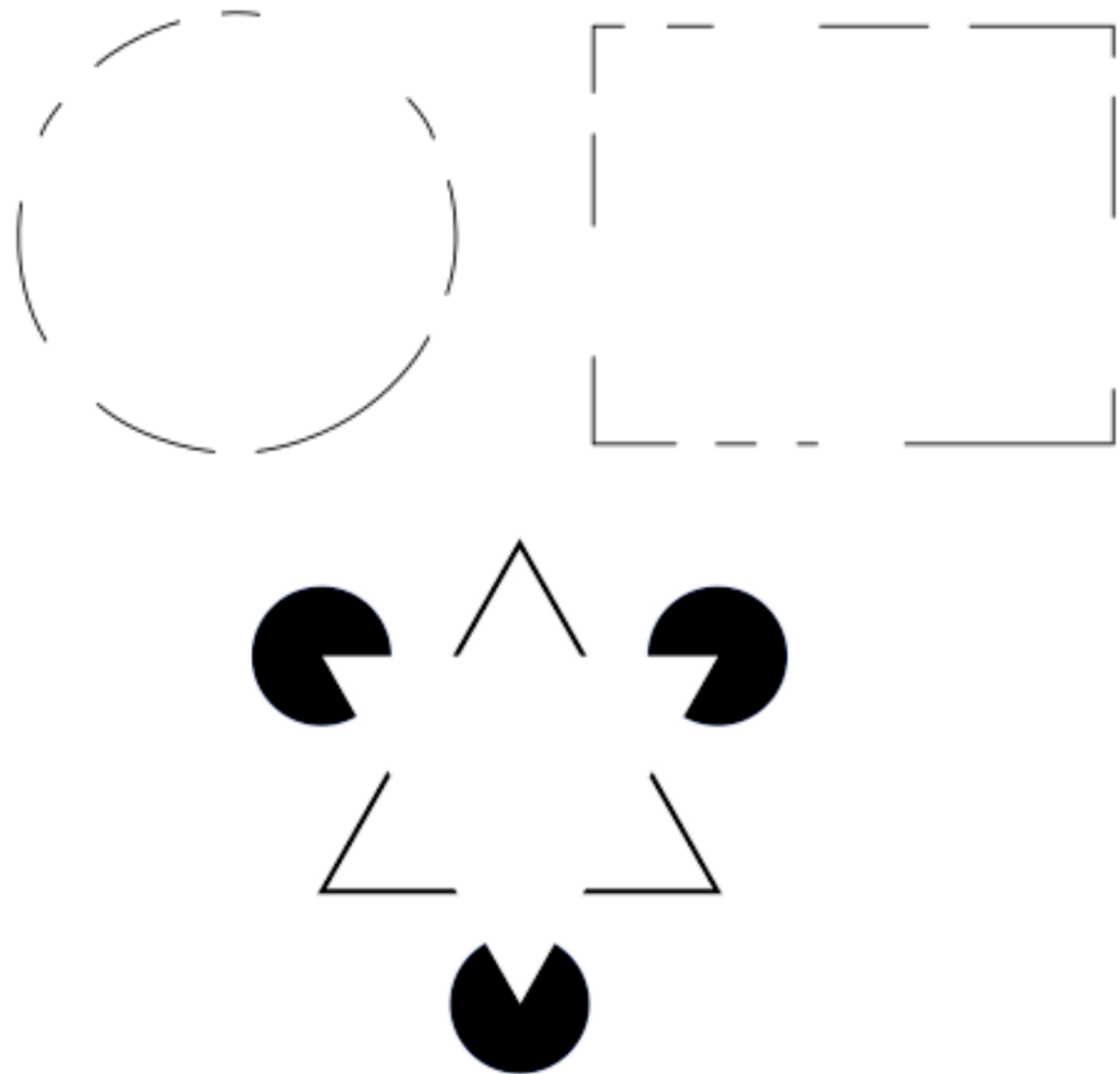
Experiential freedom of experience:

- Connecting dots
- Drawing red threads
- Autonarrating



Polydominancy affords pattern construction

Gestalt -theory: The mind constructs patterns out of hints



Wertheimer, Max
(1912).

"Experimentelle
Studien über das
Sehen von Bewegung"

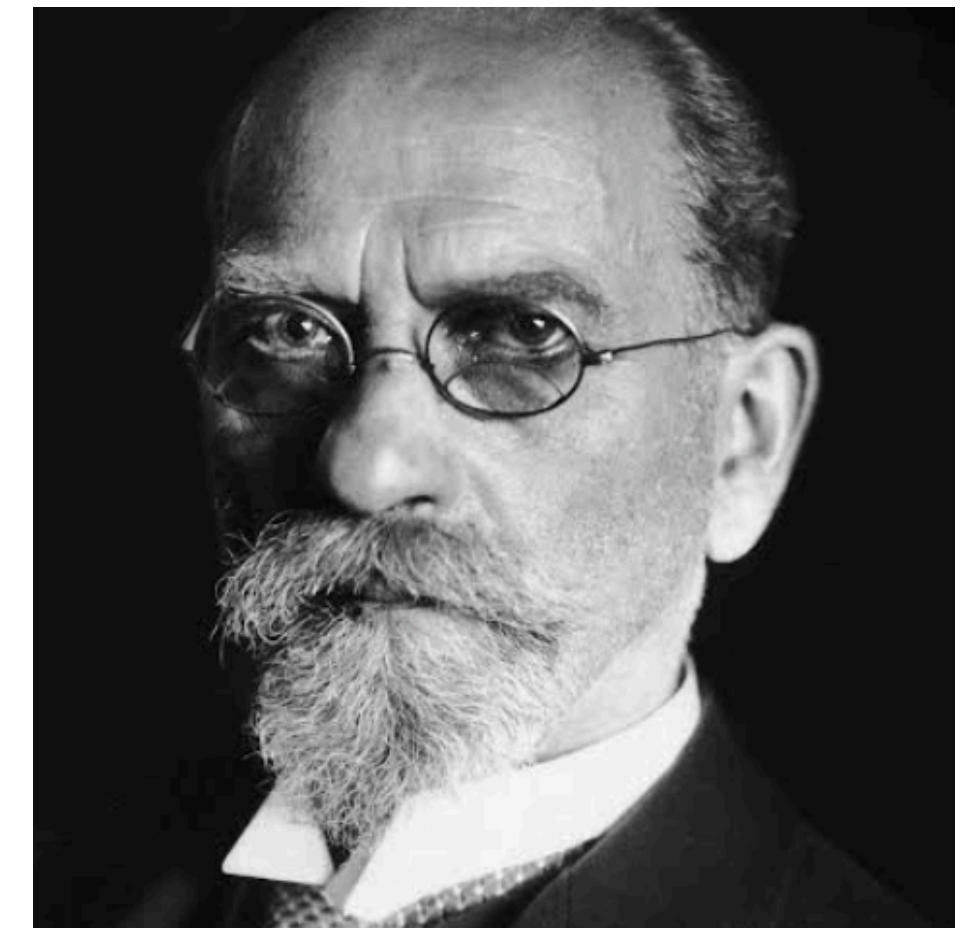
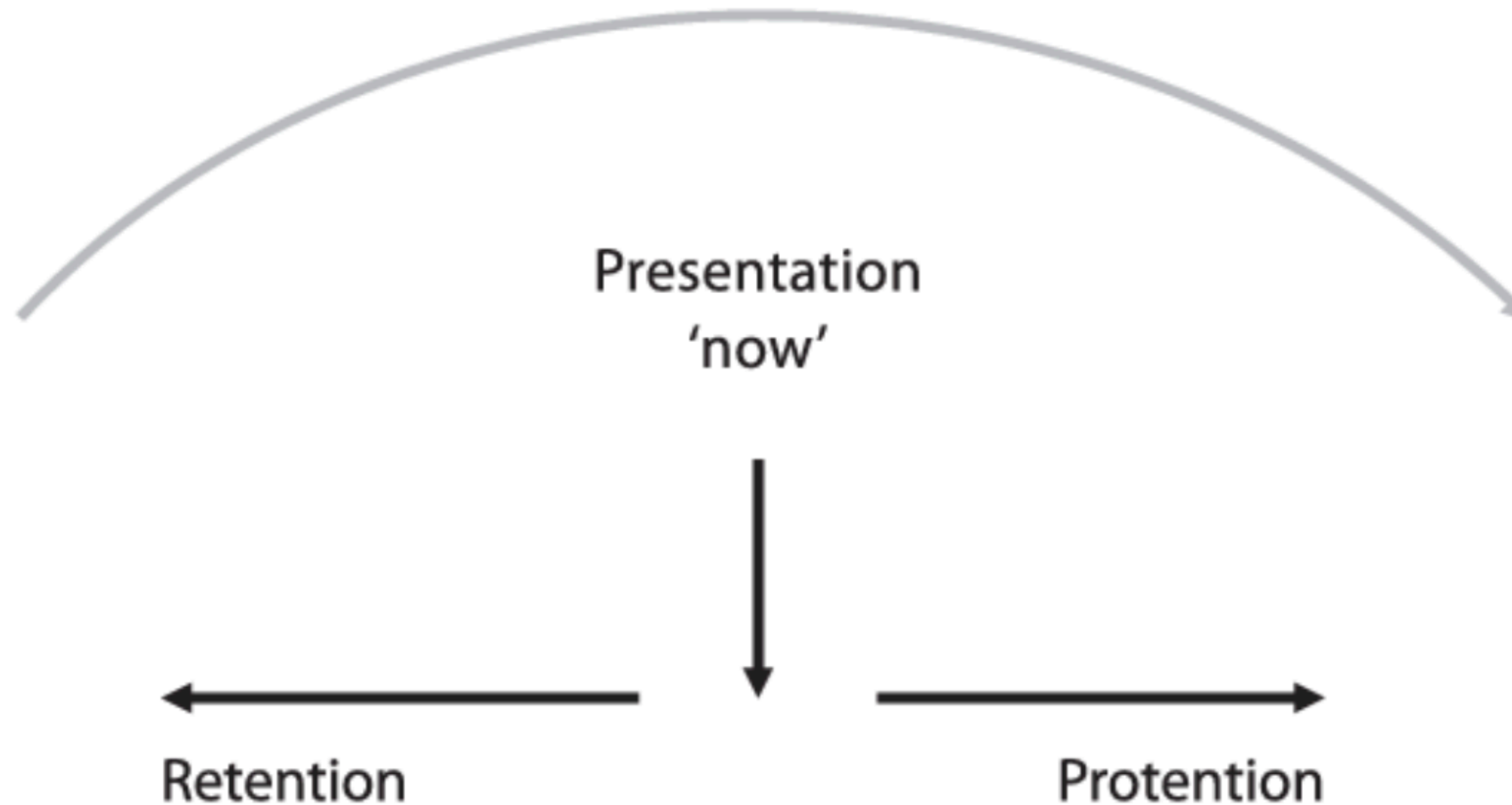
**PHENOMENOLOGICAL
APPROACH TO MUSIC
ANALYSIS**

For myself, I cannot begin to take an interest in the phenomenon of music except insofar as it emanates from the integral man. I mean from a man armed with the resources of his senses, his psychological faculties, and his intellectual equipment.



Stravinsky, Igor. Poetics of music in the form of six lessons. Vol. 66. Harvard University Press, 1970. P. 27

Structure of temporal experience



Edmund Husserl (2012).
On the phenomenology
of the consciousness of
internal time (OR.
1893-1917)

Experience is holistic

- Humans share experiences due to common embodied foundation - already **pre-verbally**
- Cognitions, feelings and experience are aspects of one and the same system

=> Even experience of time is holistic



Maurice Merleau-Ponty.
(1962). Phenomenology of
Perception. (OR. 1949)

Neurophenomenology

- Temporal experience has a systemic structure, develops further Husserl's theory
- Shared experience is observable by means of psychophysiology



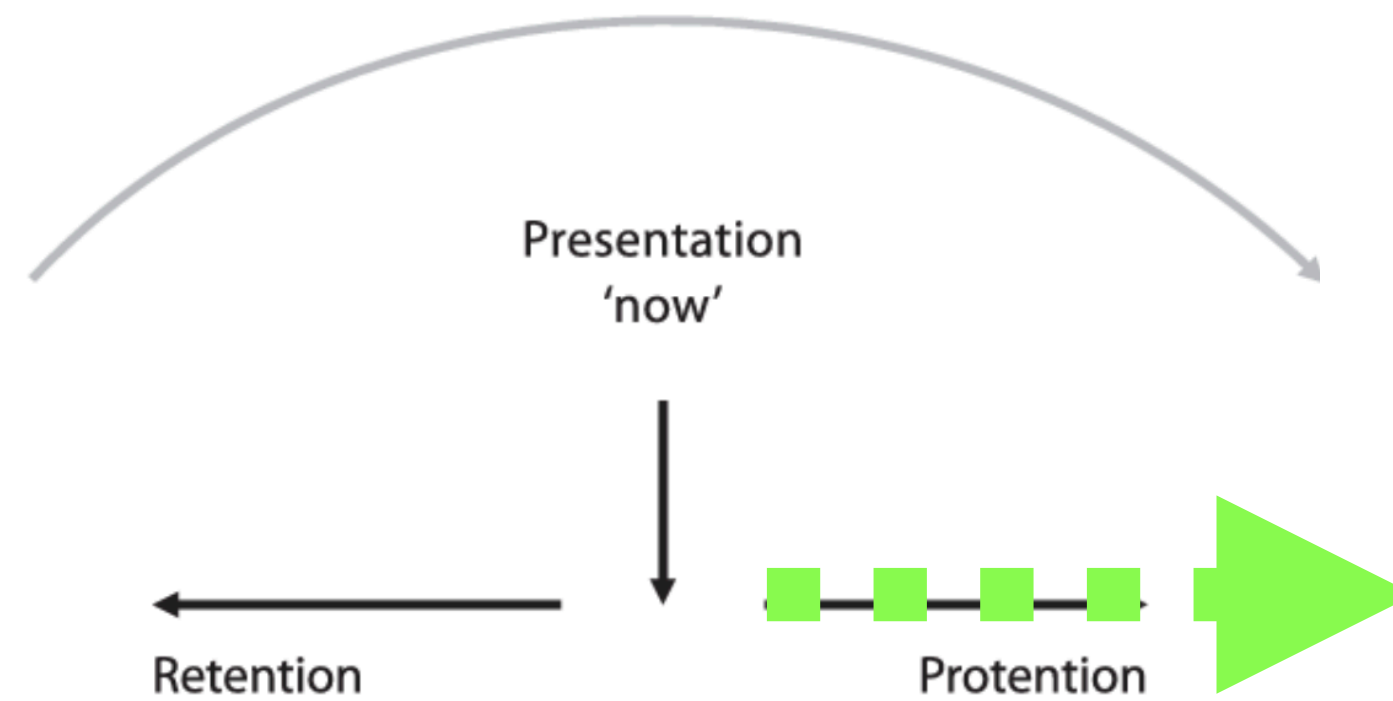
Francisco Varela
(1999). *The Specious Present: A
Neurophenomenology
of Time
Consciousness.*

Protention in general

Holistic anticipation for the coming event:
Embodied anticipates (protends) events to unfold.

Metaphors and potential (hypothetical) simulation
of tension-release:

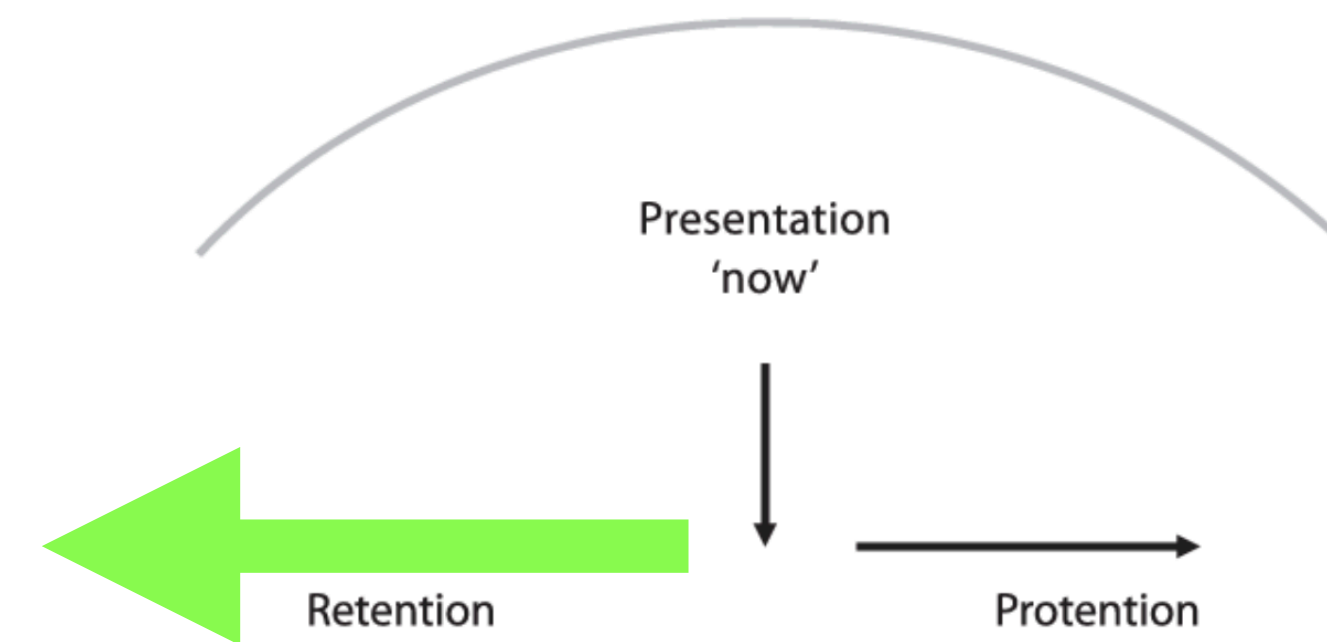
- reaching
- stretching
- leaping
- catching
- Survival strategy
- Solid empirical ground in psychophysiology



Retention in general

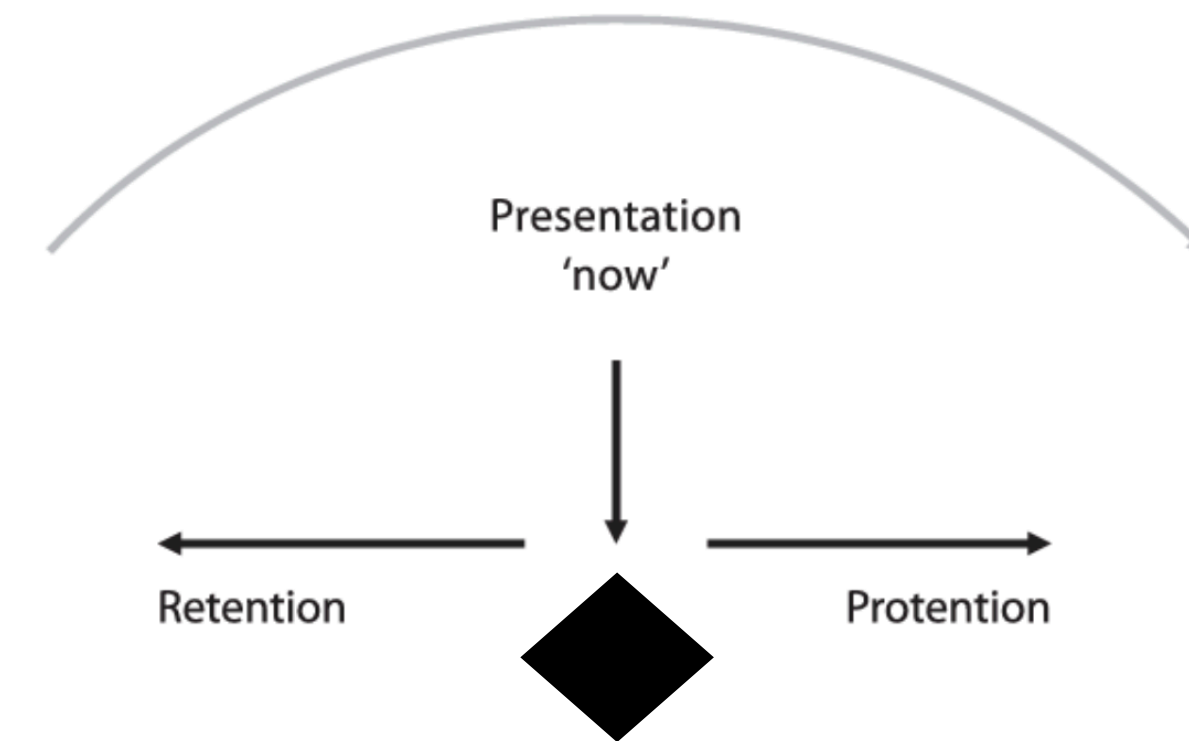
Retrospective sense-making:

- Gestalting, constructing patterns
- Preverbal, perceptual logic
- Serves to learn better protection
- Autonarration (Tikka, Kaipainen, Salmi 2023, Kauttonen et al. 2014)



Presentation now

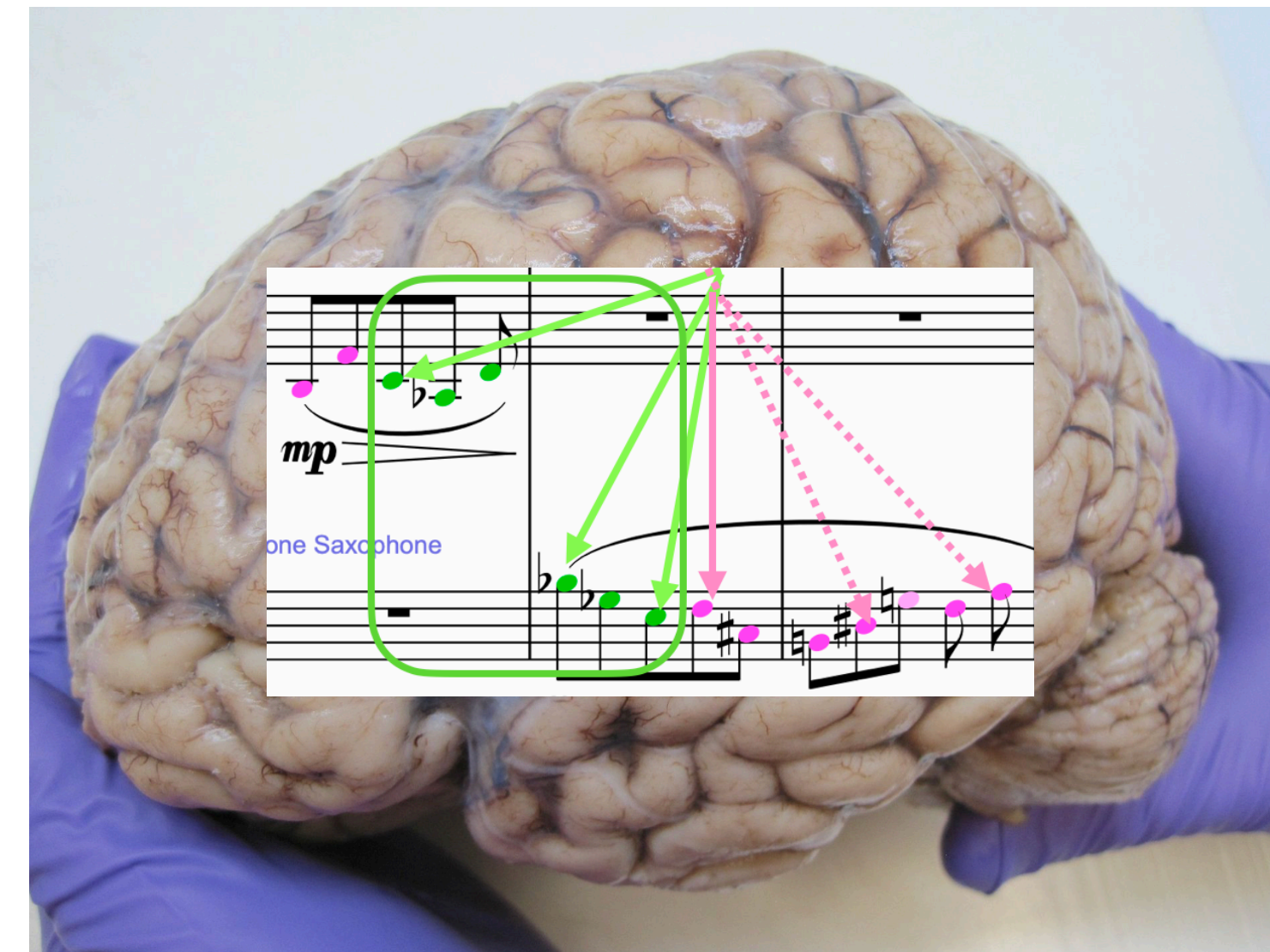
- Moment ofnowness constantly mediating protection and retention, relating to what unfolds in the environment in the present context



Protention and retention in music

Subjective construction sense-making:

- ‘Mental voice-leading’
- ‘Mental harmonization’



=> Particularly interesting with music without obvious and agreed harmony

BI-HEXAPHONIC PITCH ORGANIZATION

Sequential principle

All tones of the current hexaphony (alpha or beta) shall be played out before transition to the other hexaphony in order to form a **mature** cell.

- No order (row) dictated
- All permutations allowed, depend on other consideration

Vertical principle

All simultaneously played tones belong to same hexaphony:

=> Hexachord *consonance*

=> Mixed: hexachord *dissonance*

No vertical tone duplications allowed.

Hexaphonic consonance

Any chord construct of the hexaphony up to clusters of six has the consonant effect.

The image shows a musical score for two pianos, labeled "Piano (a)" and "Piano (b)". The score is written in 7/8 time and consists of two staves. Piano (a) is in the upper staff, and Piano (b) is in the lower staff. The key signature is one sharp (F#), and the time signature is 7/8. The score is divided into six measures by vertical bar lines. The dynamics for Piano (a) are *ff*, *mf*, *ff*, *mf*, *f*, and *ff*. The dynamics for Piano (b) are *f* and *mf*. The score illustrates the concept of hexaphonic consonance by showing various chord constructions in the upper staff and their corresponding accompaniment in the lower staff. The upper staff features chords of six notes, some of which are clusters of six notes. The lower staff features a complex, rhythmic accompaniment consisting of eighth and sixteenth notes, often grouped into beamed pairs or groups of four. The overall effect is one of harmonic richness and complexity.

**Piano
concerto,
Mvt 1:
mark J-K
(before
cadenza)**

The image displays a musical score for the first movement of a piano concerto, specifically marking measures J through K, which occur just before the cadenza. The score is organized into two systems. The first system features staves for Violin I, Violin II, Viola, Cello, and Double Bass, followed by woodwinds (Flute, Clarinet, Bassoon) and the Piano. The second system continues with Violin I, Violin II, Viola, and Cello/Double Bass. The piano part is particularly intricate, showing a dense texture of notes and ornaments. The woodwinds and strings provide harmonic support, with some woodwinds playing melodic lines. The overall arrangement is typical of a full orchestral score for a piano concerto.

Hexaphonic dissonance

Overlapping hexaphonies.

Can be regarded as appoggiaturas or suspensions

Hexaphonic dissonance

Wind Quintet, Andante (3rd movement)

Suspension

Schönberg

Appoggiatura

Andante

Appoggiatura

Suspension

Suspension

Appoggiatura

Suspension

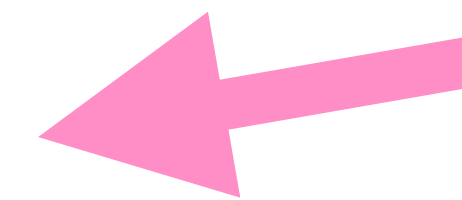
Appoggiatura

EXPERIENTIAL SENSE-MAKING OF BI- HEXAPHONIC MUSIC PROGRESSION

Protention and retention

Mental voice-leading and harmonisation

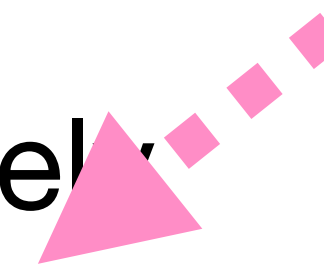
- Protentions are like hypotheses, to be confirmed or falsified
- Retention constructs the red line retrospectively



Protention and retention

Mental voice-leading and harmonisation

- Protentions are like hypotheses, to be confirmed or falsified
- Retention constructs the red line retrospectively



Protentive mental harmonisation

Selection
among
multiple

Dominance
paths
chosen to
anticipate:

D7(F)

The image displays a musical score with three staves. The top staff contains a treble clef, a key signature of one sharp (F#), and a melody consisting of a quarter rest, a quarter note G4, and a half note A4. The middle staff contains a treble clef and a chord progression: a D7 chord (F#, A, C, E) in the first measure, a D7 chord (F#, A, C, E) in the second measure, and a D7 chord (F#, A, C, E) in the third measure. The bottom staff contains a treble clef, a key signature of one sharp (F#), and a melody consisting of a quarter rest, a quarter note G4, and a half note A4. A large green rounded rectangle highlights the first two measures of all three staves. A black diamond is positioned above the second measure of the top staff. A dashed purple arrow points from the right side of the green box to a pink square highlighting the D7 chord in the third measure of the middle staff. Another dashed purple arrow points from the right side of the middle staff to the right edge of the image.

Beta

Alpha

Retentive mental harmonisation

Retrospective explanation:

- Gestalting
- Autonarration

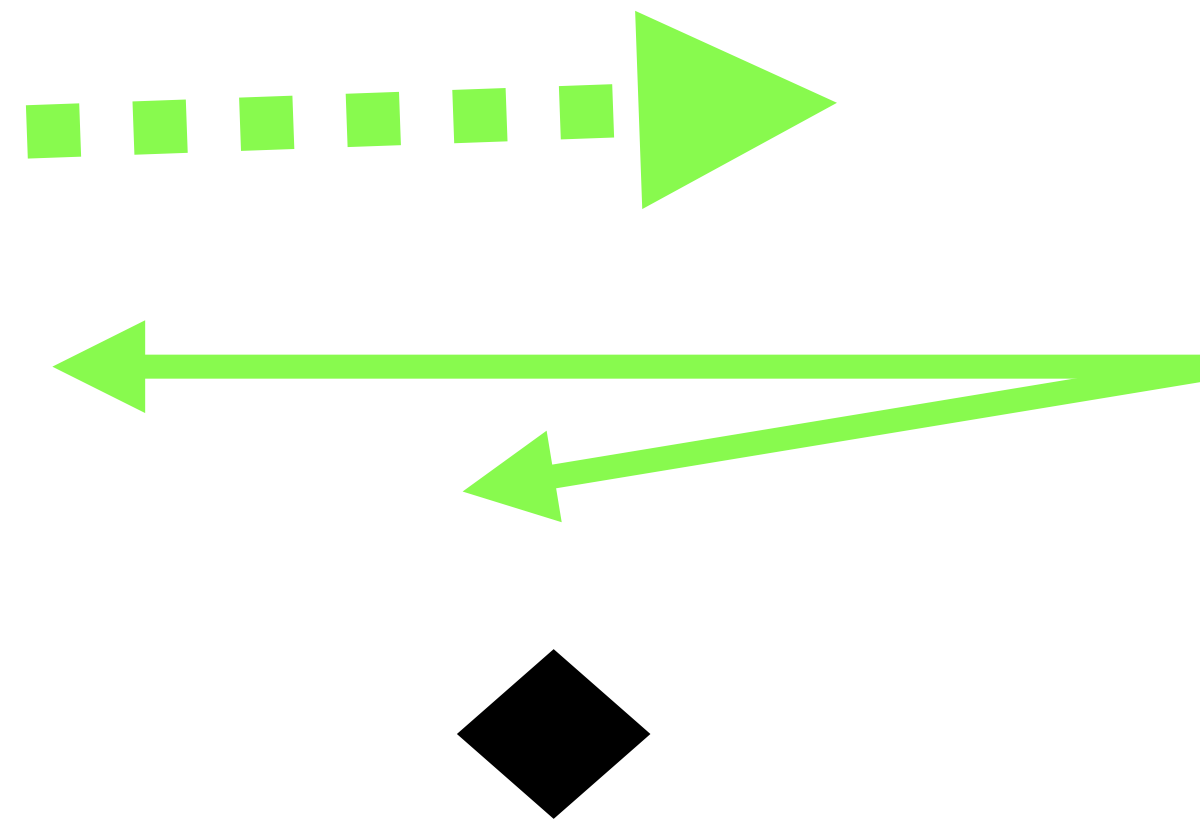
The diagram shows a musical score with three staves. A large green rounded rectangle labeled "Beta" encompasses the first two staves and the first two-thirds of the third staff. A large pink rounded rectangle labeled "Alpha" encompasses the last third of the third staff and the entire fourth staff. A black diamond is positioned above the right side of the Alpha section. A vertical cyan bar highlights a specific area in the fourth staff. Two cyan arrows point from this bar to the first and second staves of the Beta section. The word "Root" is written below the first staff of the Beta section. The text "(Transitory) experience of tonic as reference point" is written to the right of the Alpha section.

Beta

Alpha

(Transitory) experience of tonic as reference point

Protention - retention walkthrough



The image displays a musical score for three saxophone parts: Alto Saxophone, Tenor Saxophone, and Baritone Saxophone. The score is written on three staves. A large white circle with a black border is centered over the first measure of the Alto Saxophone staff, containing the text "V7(F)?" and "T = 0.66". A black diamond symbol is positioned above this circle. A green arrow points from the circle to the first measure of the Tenor Saxophone staff, which is circled in green. A pink arrow points from the circle to the first measure of the Baritone Saxophone staff. The Baritone Saxophone staff features a long melodic line with a slur and a dynamic marking of *mp*. The Tenor Saxophone staff has a dynamic marking of *mp*. The Alto Saxophone staff has a dynamic marking of *mf*. The overall dynamic range is indicated by a hairpin at the bottom, starting with *mp* and ending with *mf*. The score includes various musical notations such as notes, rests, slurs, and dynamic markings.

Alto Saxophone

V7(F)?

T = 0.66

Tenor Saxophone

Baritone Saxophone

mp

mp

mf

mf

f

mp

The image shows a musical score for three saxophone parts: Alto Saxophone, Tenor Saxophone, and Baritone Saxophone. The score is written in treble clef for the Alto and Tenor parts, and bass clef for the Baritone part. The music is in 4/4 time and features a key signature of one flat (B-flat major or D minor). The Alto part starts with a whole rest in the first measure, followed by a half note G4 in the second measure, and a quarter note G4 in the third measure. The Tenor part starts with a quarter note G4 in the first measure, followed by a quarter note F4 in the second measure, and a quarter note E4 in the third measure. The Baritone part starts with a quarter note G2 in the first measure, followed by a quarter note F2 in the second measure, and a quarter note E2 in the third measure. The score includes dynamic markings such as *mp*, *mf*, and *f*. A large black diamond is placed above the second measure. A white circle with a black border is centered over the second measure, containing the text "V7(F)?" and "T = 1" in green. A green oval highlights the notes G4, F4, and E4 in the Tenor part and the notes G2, F2, and E2 in the Baritone part. A pink dotted line with arrows points from the circle to the notes G4, F4, and E4 in the Tenor part and the notes G2, F2, and E2 in the Baritone part. A black arrow points from the circle to the notes G4, F4, and E4 in the Tenor part. A black arrow points from the circle to the notes G2, F2, and E2 in the Baritone part.

Alto Saxophone

V7(F)?

T = 1

Tenor Saxophone

Baritone Saxophone

mp

mf

mp

mf

f

mp

The image shows a musical score for three saxophone parts: Alto Saxophone (top), Tenor Saxophone (middle), and Baritone Saxophone (bottom). The score is written in treble clef for the Alto and Tenor, and bass clef for the Baritone. The music is in 4/4 time. The Alto part starts with a whole rest in the first measure, followed by a quarter note in the second measure, and a half note in the third measure. The Tenor part starts with a quarter note in the first measure, followed by a quarter note in the second measure, and a half note in the third measure. The Baritone part starts with a quarter note in the first measure, followed by a quarter note in the second measure, and a half note in the third measure. The score includes dynamic markings such as *mp*, *mf*, and *f*. A black diamond symbol is located in the top right corner. A speech bubble in the center contains the text "V7(Bb)?" and "T = 1.17". A green box highlights a section of the Tenor and Baritone parts in the first two measures, with green arrows pointing from the Tenor part to the Baritone part. A pink box highlights a section of the Baritone part in the third measure, with pink arrows pointing from the Tenor part to the Baritone part. A dotted pink arrow points from the Tenor part to the Baritone part in the third measure.

Alto Saxophone

Tenor Saxophone

Baritone Saxophone

V7(Bb)?
T = 1.17

mp

mp

mf

mf

f

p

mo

This image shows a musical score for three saxophone parts: Alto, Tenor, and Baritone. The score is written on three staves, each with a treble clef (except for the Baritone which has a bass clef). The Alto Saxophone part is in the top staff, the Tenor Saxophone in the middle, and the Baritone Saxophone in the bottom. The music is in 4/4 time and features various dynamics including *mp* (mezzo-piano), *mf* (mezzo-forte), and *f* (forte). There are several annotations: a black diamond in the top staff, a large dotted circle in the Alto staff, a pink oval in the Baritone staff, and two green arrows pointing from the Baritone staff to the Tenor staff. The score includes notes, rests, and dynamic markings.

Alto Saxophone

Tenor Saxophone

Baritone Saxophone

f

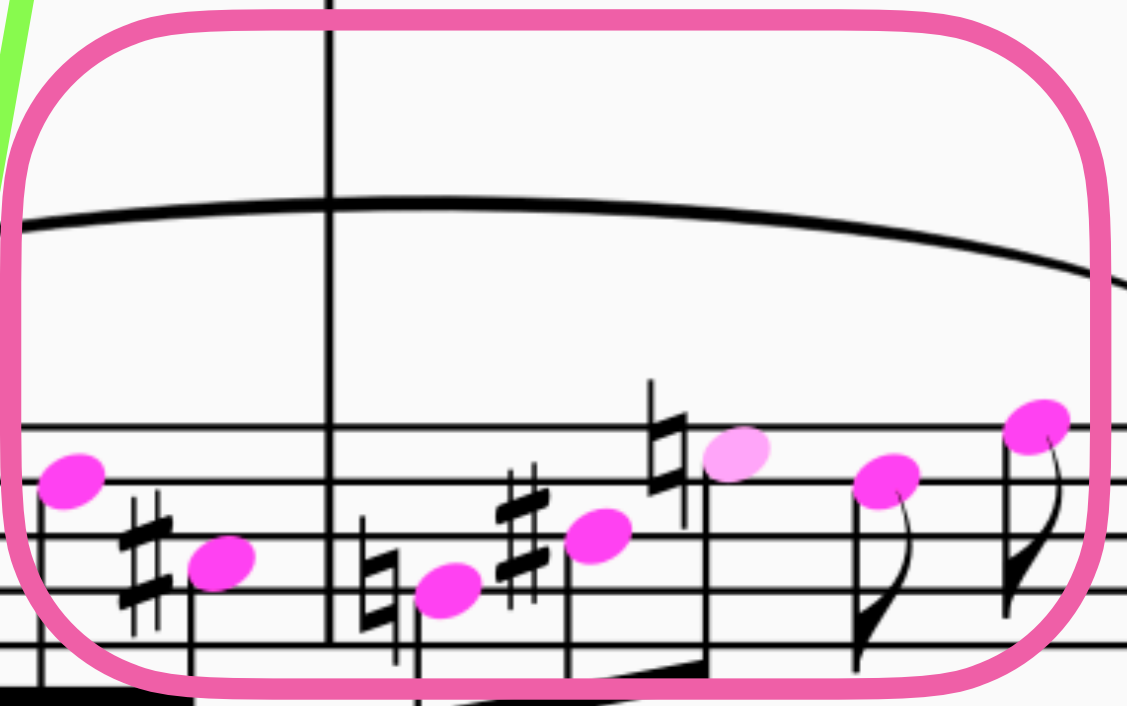
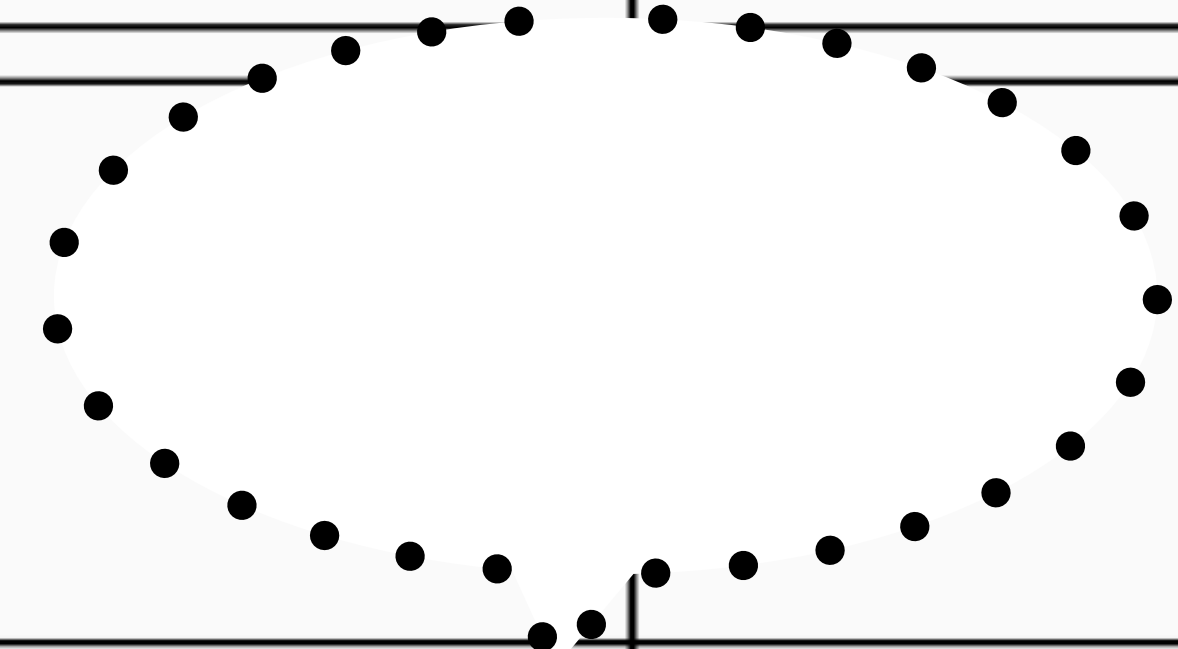
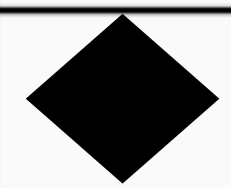
mf

mp

mp

mf

mp



This image shows a musical score for three saxophone parts: Alto, Tenor, and Baritone. The score is annotated with various musical symbols and arrows to highlight specific harmonic and melodic elements.

- Alto Saxophone:** The top staff. It features a diamond-shaped symbol above the first measure. A circled annotation "V(A)?" is placed above the second measure, with a pink arrow pointing to a note in the third measure. A pink triangle points to a note in the fourth measure. The dynamic marking *mf* is present.
- Tenor Saxophone:** The middle staff. It has a dotted-line oval annotation "V7(E)" in the second measure, with a pink arrow pointing to a note in the third measure. A pink triangle points to a note in the fourth measure. The dynamic marking *mp* is present.
- Baritone Saxophone:** The bottom staff. It has a pink triangle pointing to a note in the second measure. The dynamic marking *mp* is present.

Annotations and arrows:

- Green arrows:** Point from notes in the Tenor and Baritone staves to notes in the Alto staff.
- Pink arrows:** Point from notes in the Baritone staff to notes in the Tenor staff.
- Pink dashed arrows:** Point from notes in the Baritone staff to notes in the Tenor staff.
- Pink triangle:** Points to a note in the Alto staff.
- Pink triangle:** Points to a note in the Tenor staff.
- Black diamond:** Located above the first measure of the Alto staff.
- Dynamic markings:** *mp* (mezzo-piano) and *mf* (mezzo-forte) are used throughout the score.
- Other symbols:** A circled "V(A)?", a dotted-line oval "V7(E)", and a black diamond.

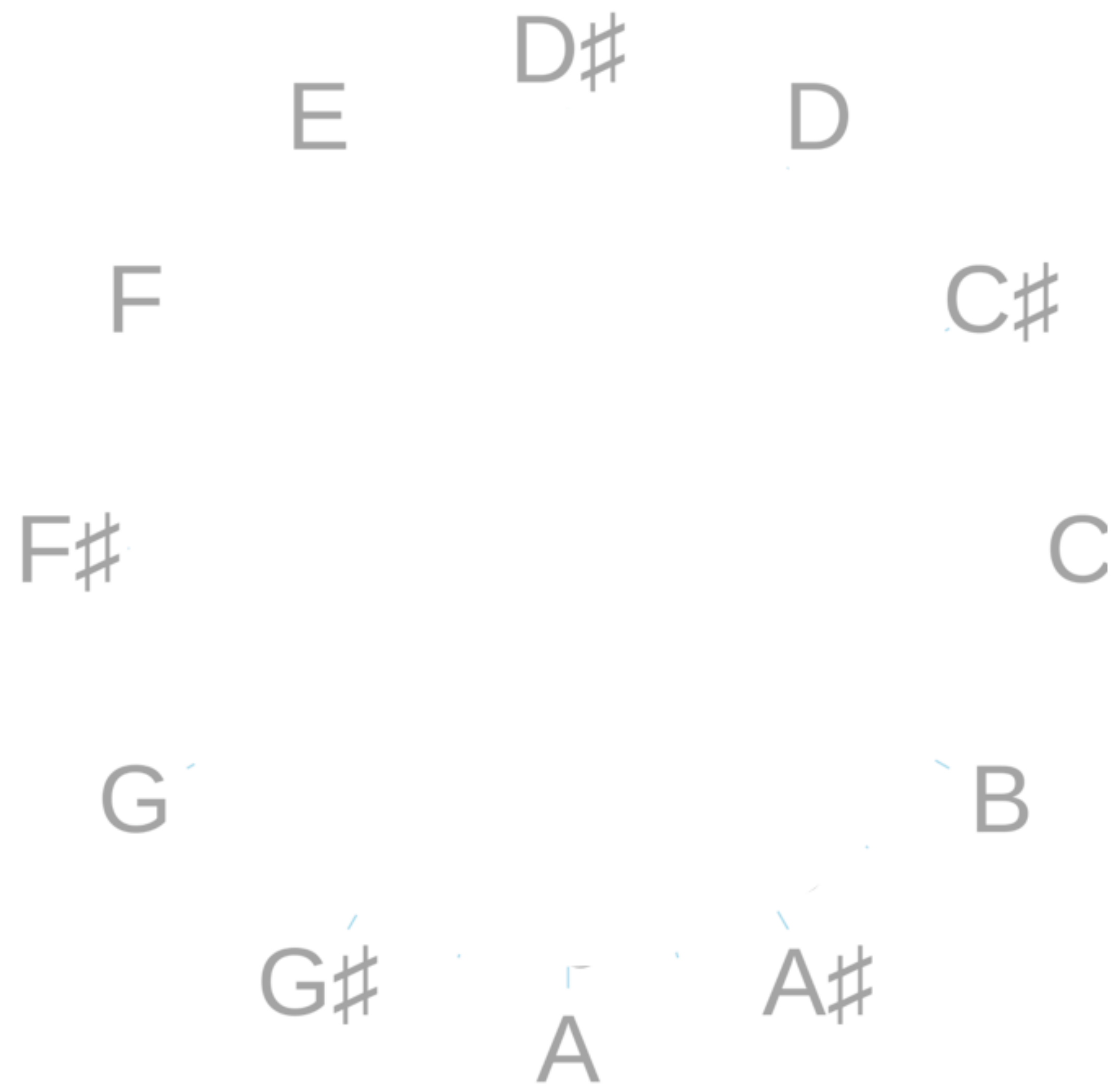
Experiential circle of fifths

- Every BH transition is an implicit $V \rightarrow V$ cadenza.
- A experience of BH music can navigate around circles of fifths

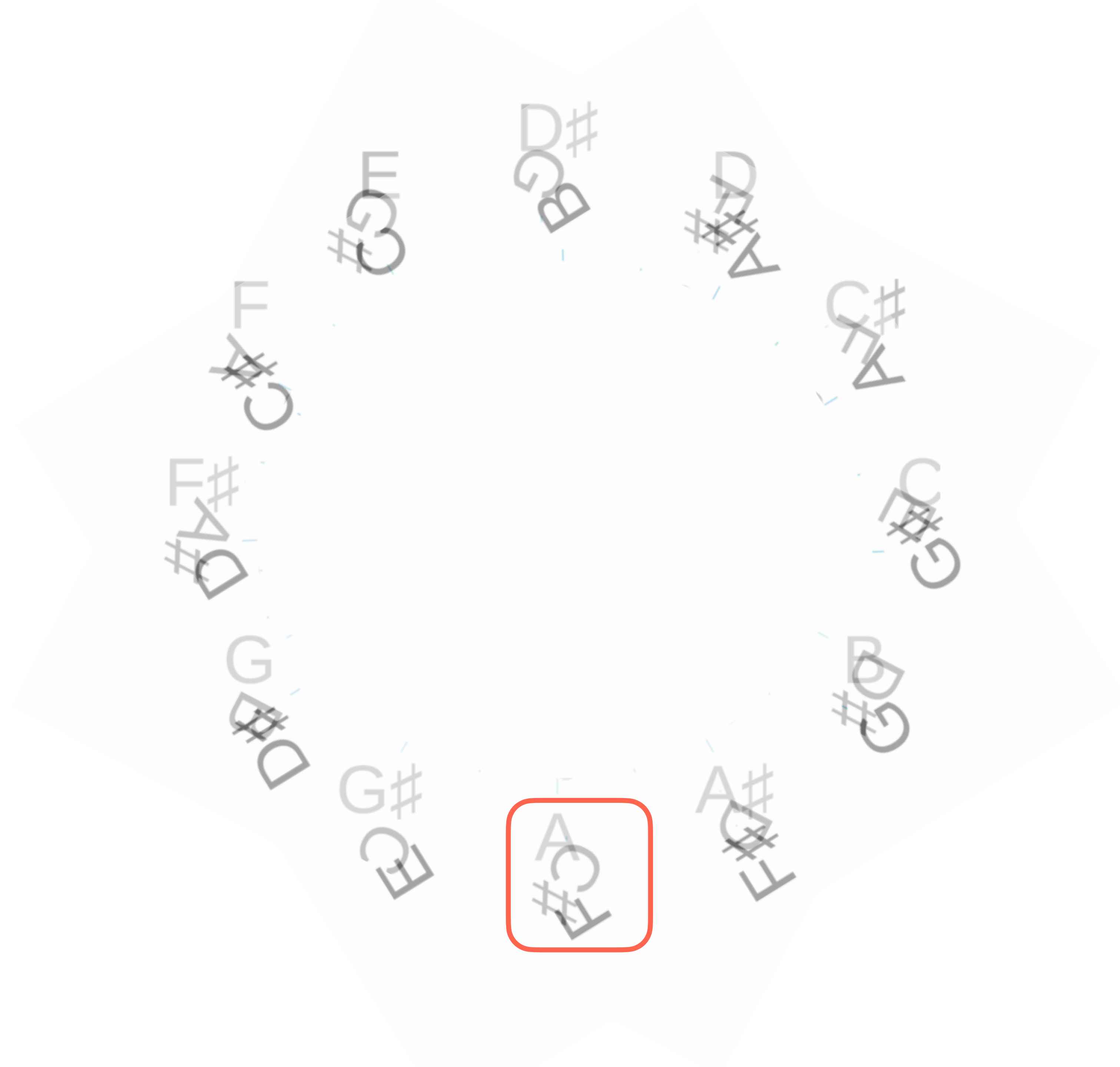
Polycircle of fifths

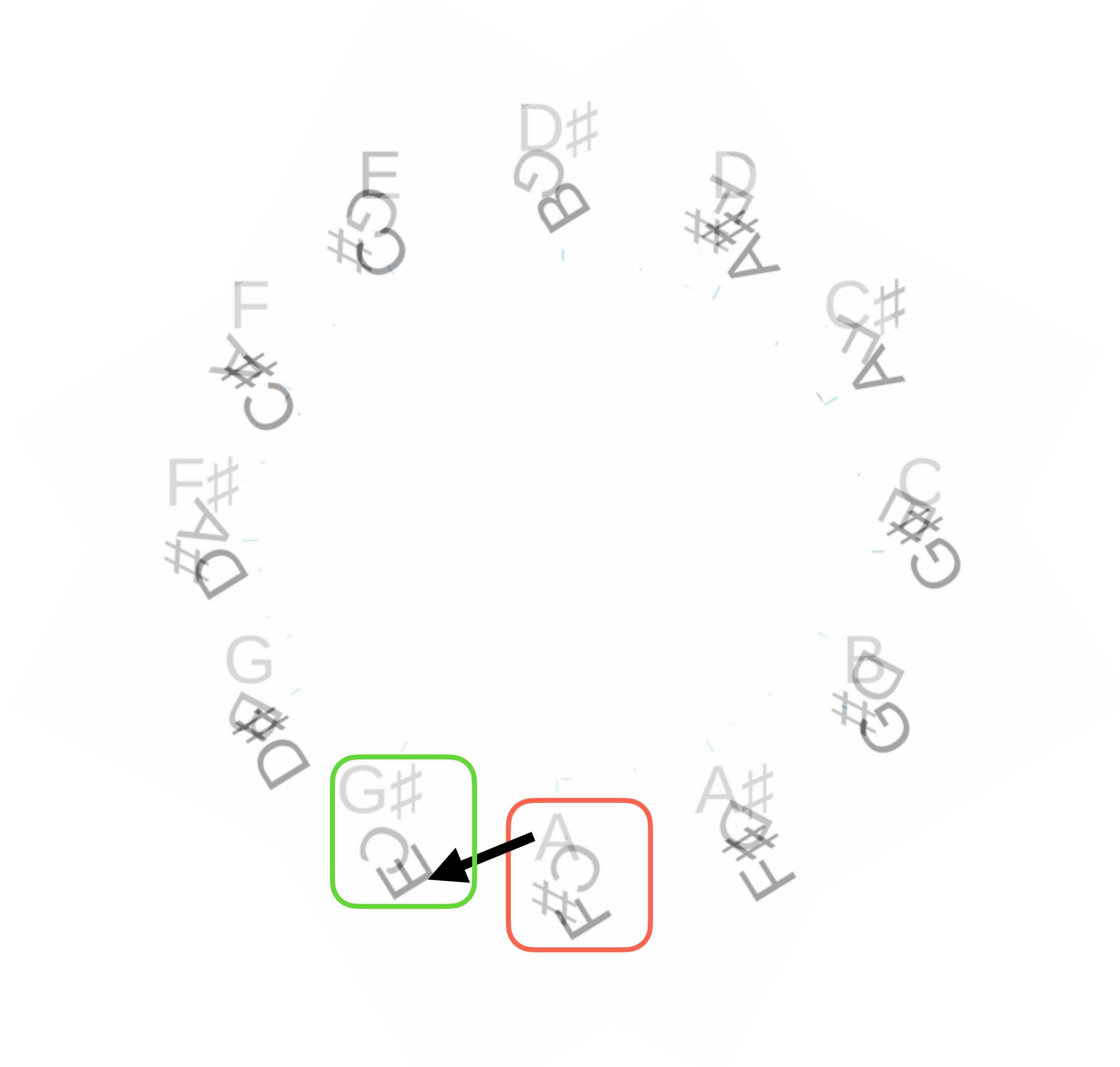
The bi-hexaphonic pitch organisation affords *multiple overlapping circles of fifths*.

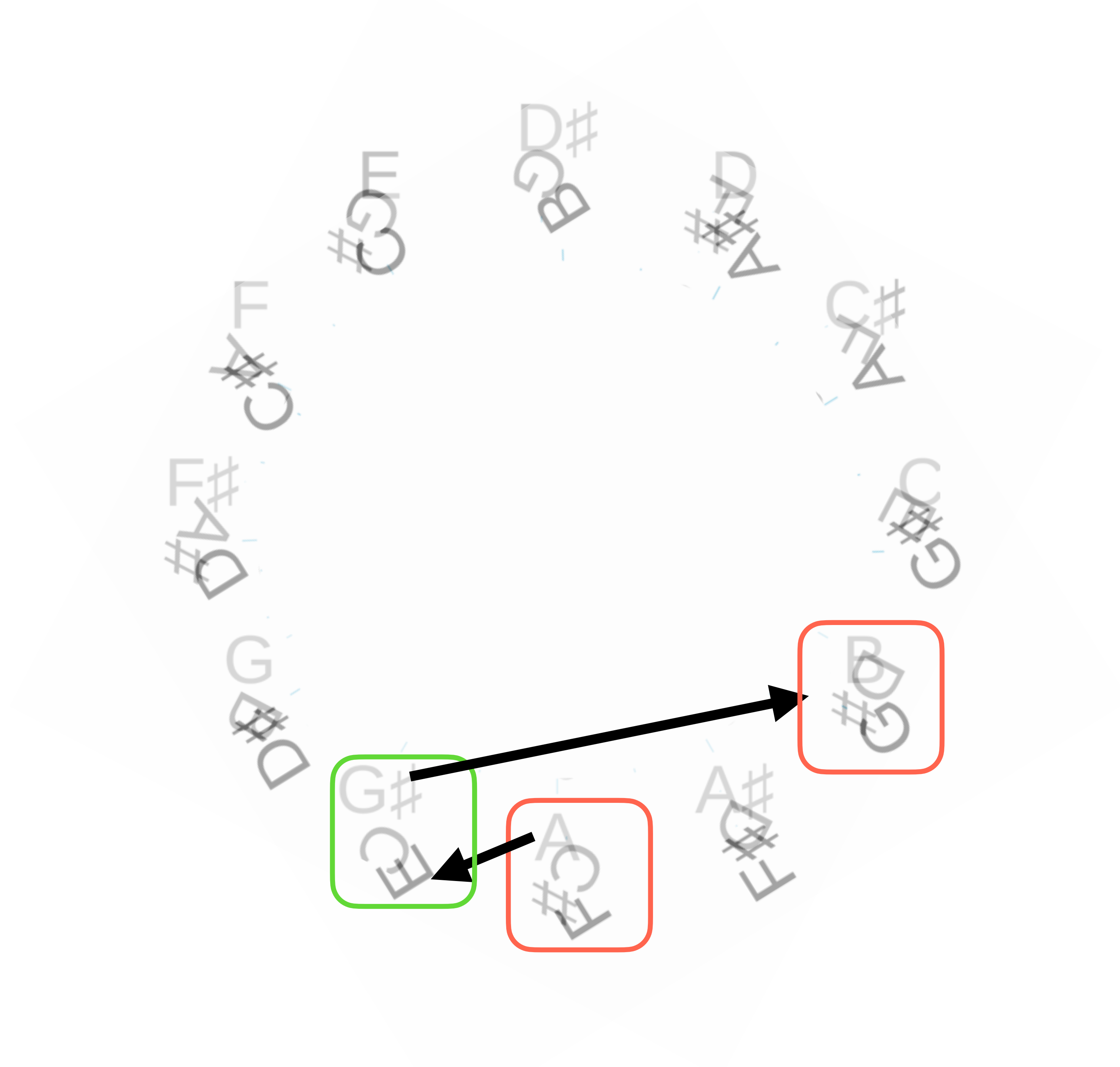
Experiential harmonization branches to alternative dominant implications at every cell.

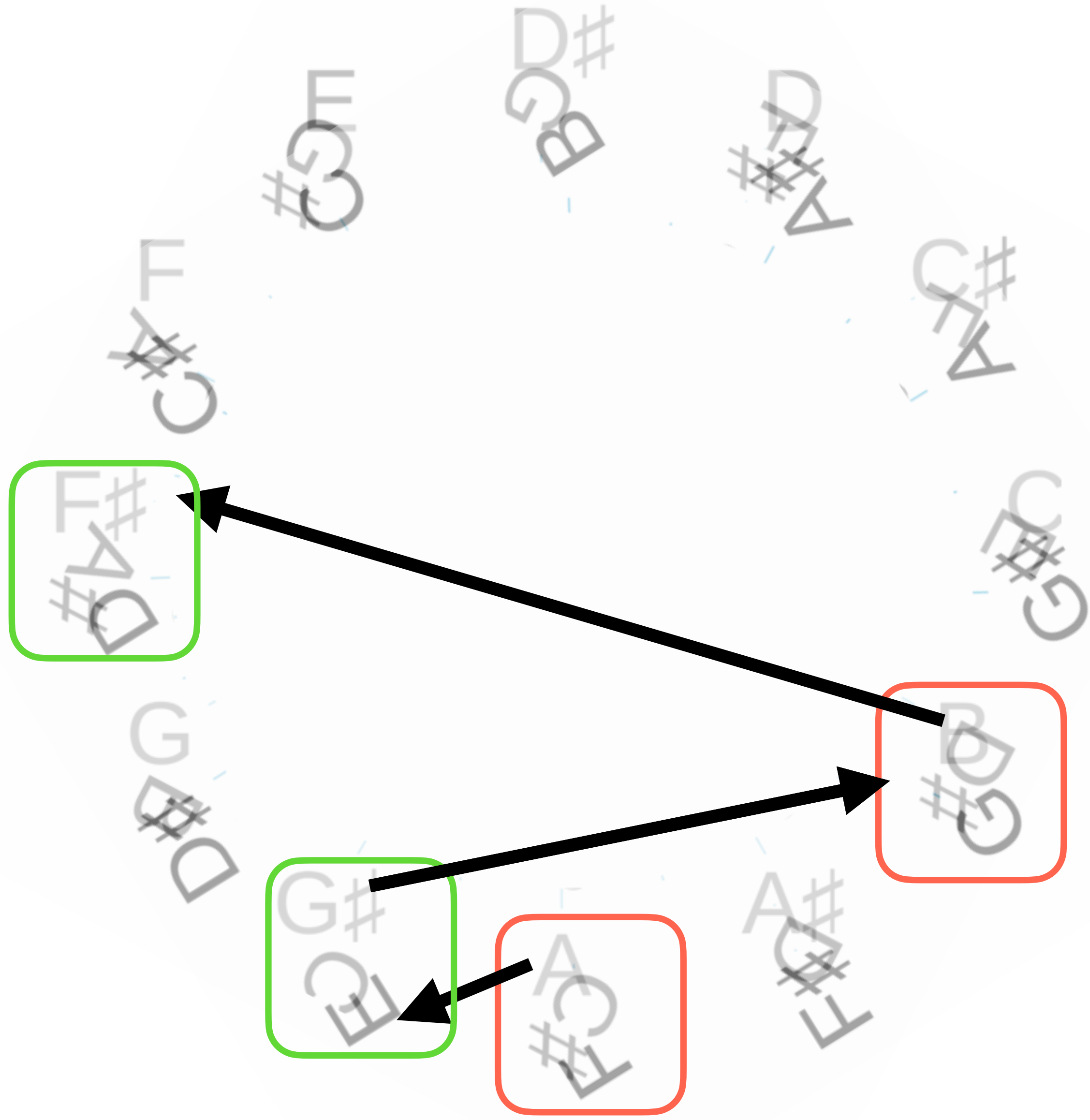












DEMO of poly-dominancy

String Quartet 3

- Andante vivo
- Lento
- **Presto “Perpetuum mobile”, forever looping**

DEMO of poly-dominancy

String Quartet 3

- Andante vivo
- Lento
- **Presto “Perpetuum mobile”, forever looping**

180 **T**

pp

p

subito

Demo d.b.

Schönberg revisited

Why can one sometimes experiential dominant functions in Schönberg?

Why sometimes not?

Schönberg revisited

Wind Quintet, Andante (3rd movement)

Schönberg

Andante

m=5/6 m=6/6 m=6/6 m=6/6

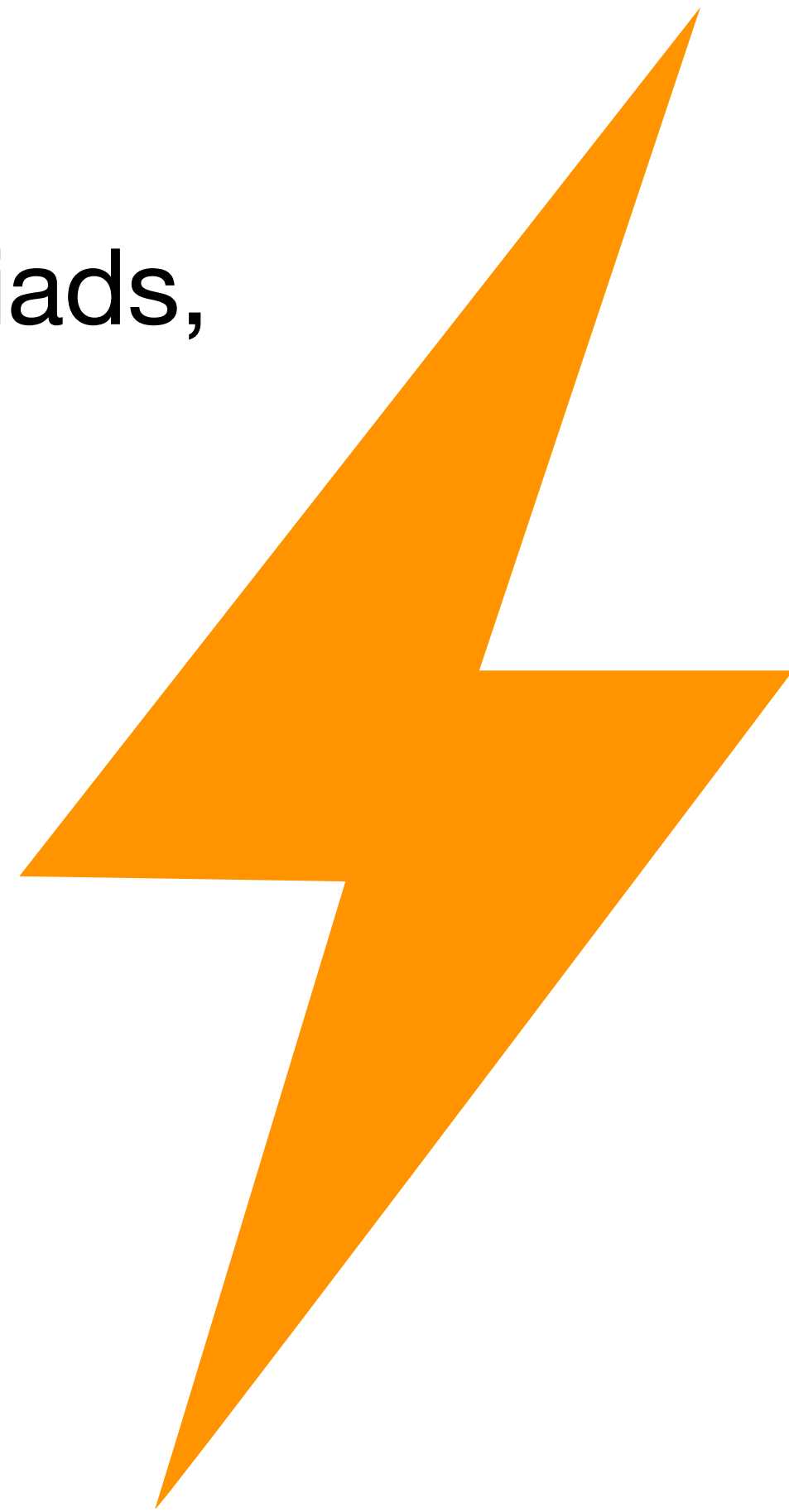
<= Mature hexaphonic cells!

<= BH-dissonance, appoggiature/suspensione

Kaipainen revisited

Why do you experience Kaipainen's music diatonic (do you?), even if there are no:

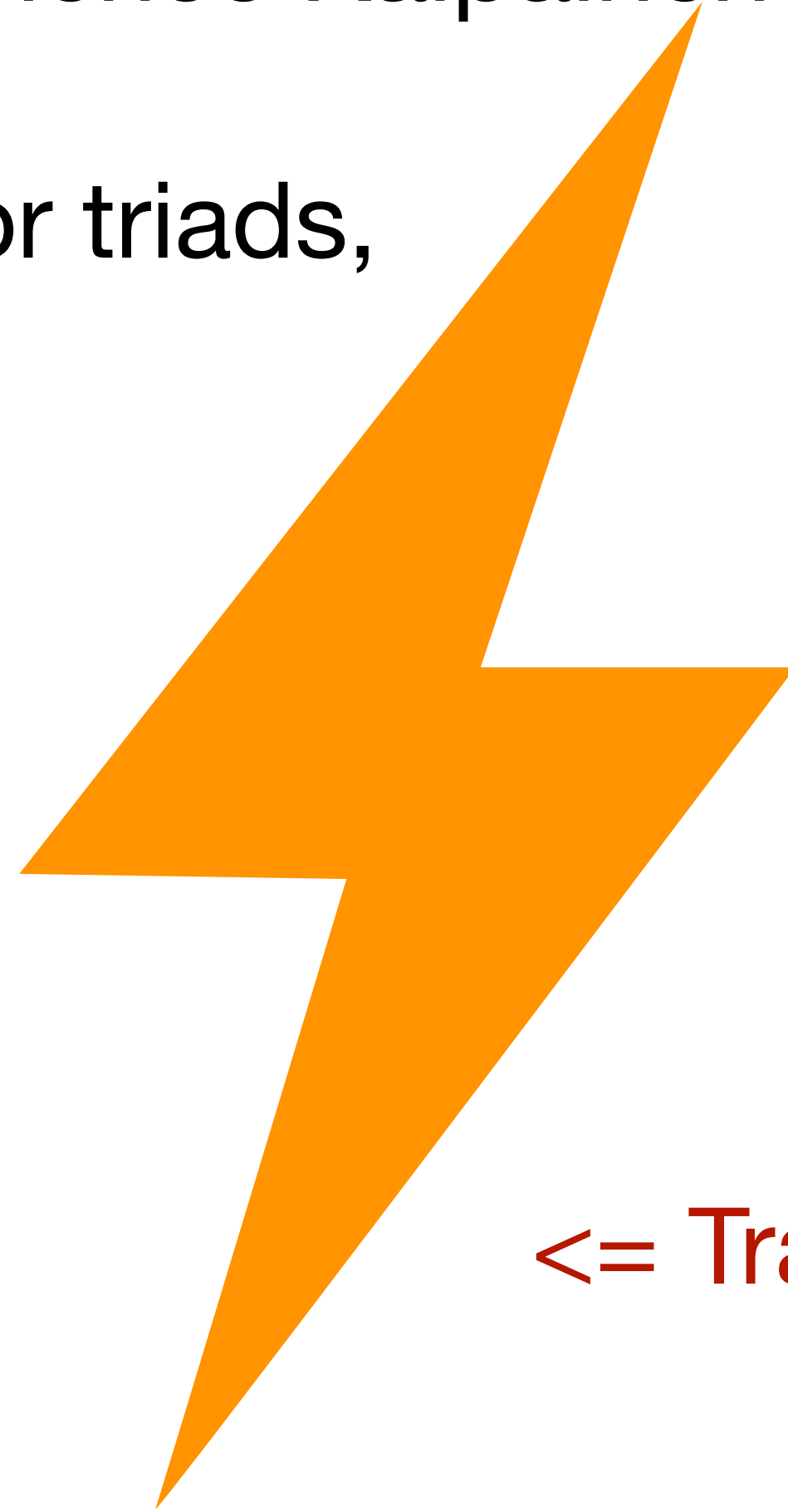
- major or minor triads,
- no keys
- no tonic centres



Kaipainen revisited

Why do you experience Kaipainen diatonic (do you?), even if there are:

- No major or minor triads,
- No keys
- No tonic centres



Maybe because of:

<= The vertical (harmonic) rule?

<= Traditional voice-leading & counterpoint?

Diatonics revisited

The image shows a musical score in 2/4 time, divided into four measures. The notes are: Measure 1: Do (treble), do (bass); Measure 2: twin - kle, so (treble), so (bass); Measure 3: la (treble), la (bass); Measure 4: so (treble), so (bass). The notes are color-coded: Do and do are green, twin - kle, so, so, la, la, so, so, fa, fa, mi, mi, re, re, do are pink. The score is annotated with ambitus (a) and maturity (t) values. The first measure has a=2/5 and m=2/6, t=0.13. The second measure has a=2/5 and m=2/6, t=0.13. The third measure has a=2/5 and m=2/6, t=0.13. The fourth measure has a=5/5 and m=2/6, t=0.33. The score is framed by a dashed green line.

$a=2/5$ kle, twin - kle, $a=2/5$ $a=2/5$ How I $a=5/5$ er what you are.
Do do so so la la so fa fa mi mi re re do

$m=2/6$ $m=2/6$ $m=2/6$ $m=2/6$
 $t=0.13$ $t=0.13$ $t=0.13$ $t=0.33$

- Cells with low BH tension (low ambitus, low maturity)
- II & III, IV & V regarded as one cell (one generalised function?)

Diatonics revisited

The image shows a musical score for 'Ave Maria' in 2/4 time, with two staves (treble and bass). The melody is in the treble clef, and the bass line is in the bass clef. The score is divided into four measures, each with a specific annotation for BH tension. The annotations are: $a=2/5$ for the first measure, $a=2/5$ for the second measure, $a=2/5$ for the third measure, and $a=5/5$ for the fourth measure. The lyrics are: 'Do do', 'twin - kle, so so', 'la la', 'so', 'How I', 'fa fa', 'mi mi', 'er what you re re', 'are. do'. The annotations are: $m=2/6$ for the first measure, $m=2/6$ for the second measure, $m=2/6$ for the third measure, and $m=2/6$ for the fourth measure. The annotations are: $t=0.13$ for the first measure, $t=0.13$ for the second measure, $t=0.13$ for the third measure, and $t=0.33$ for the fourth measure. The annotations are: $a=2/5$ for the first measure, $a=2/5$ for the second measure, $a=2/5$ for the third measure, and $a=5/5$ for the fourth measure. The annotations are: $m=2/6$ for the first measure, $m=2/6$ for the second measure, $m=2/6$ for the third measure, and $m=2/6$ for the fourth measure. The annotations are: $t=0.13$ for the first measure, $t=0.13$ for the second measure, $t=0.13$ for the third measure, and $t=0.33$ for the fourth measure.

- Cells with low BH tension
- II & III, IV & V regarded as one cell

CONCLUSIONS

Conclusions: Bi-hexaphony

- Analysed implications and characteristics of bi-hexaphony
- Claimed omnipresence of BH across septatonic scales, and recognised the challenge of BH analysis and history of BH

Conclusion: Bi-hexaphonic transition as affordance for experiential tension-resolution



Alpha

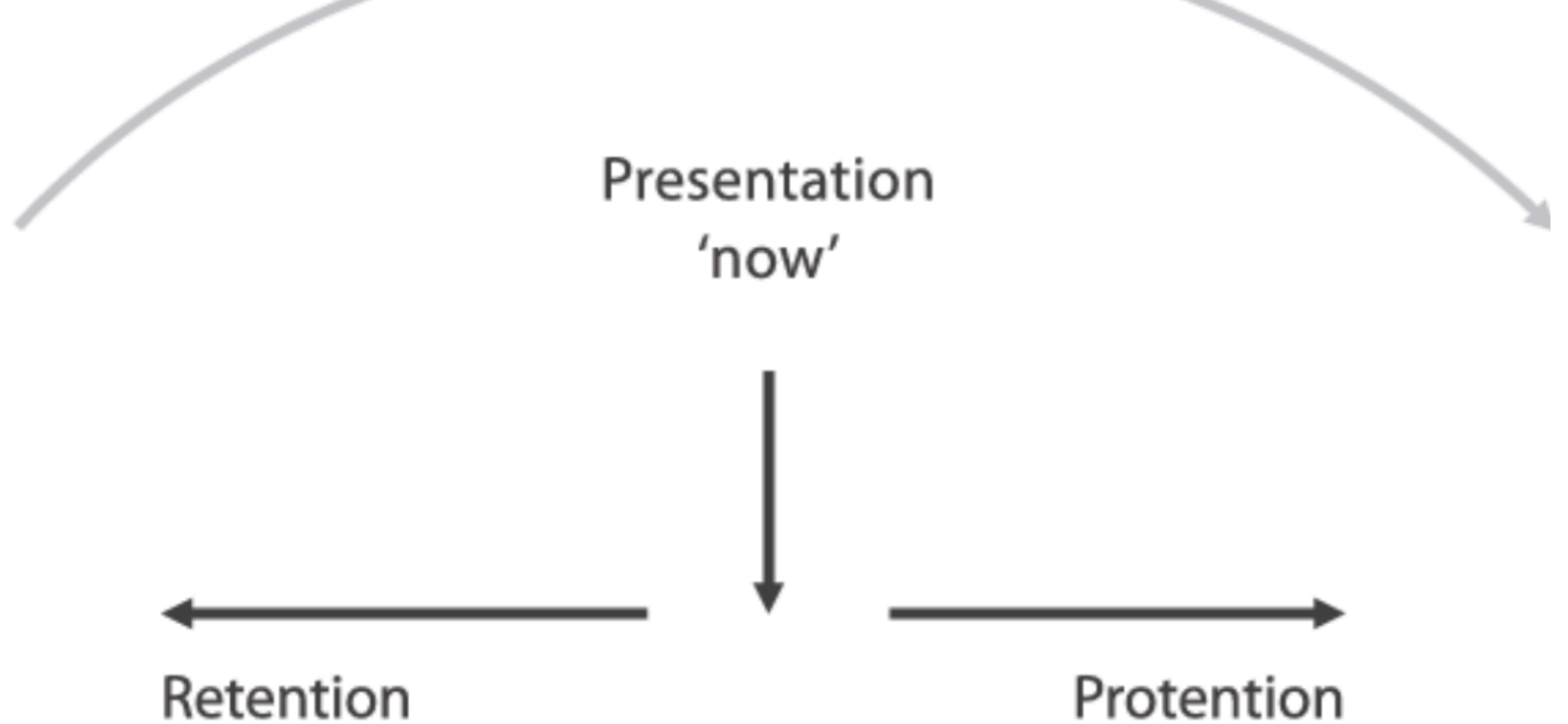


Beta

Conclusion: Experience

I have applied BH
bipolarity to conceptually
superimpose:

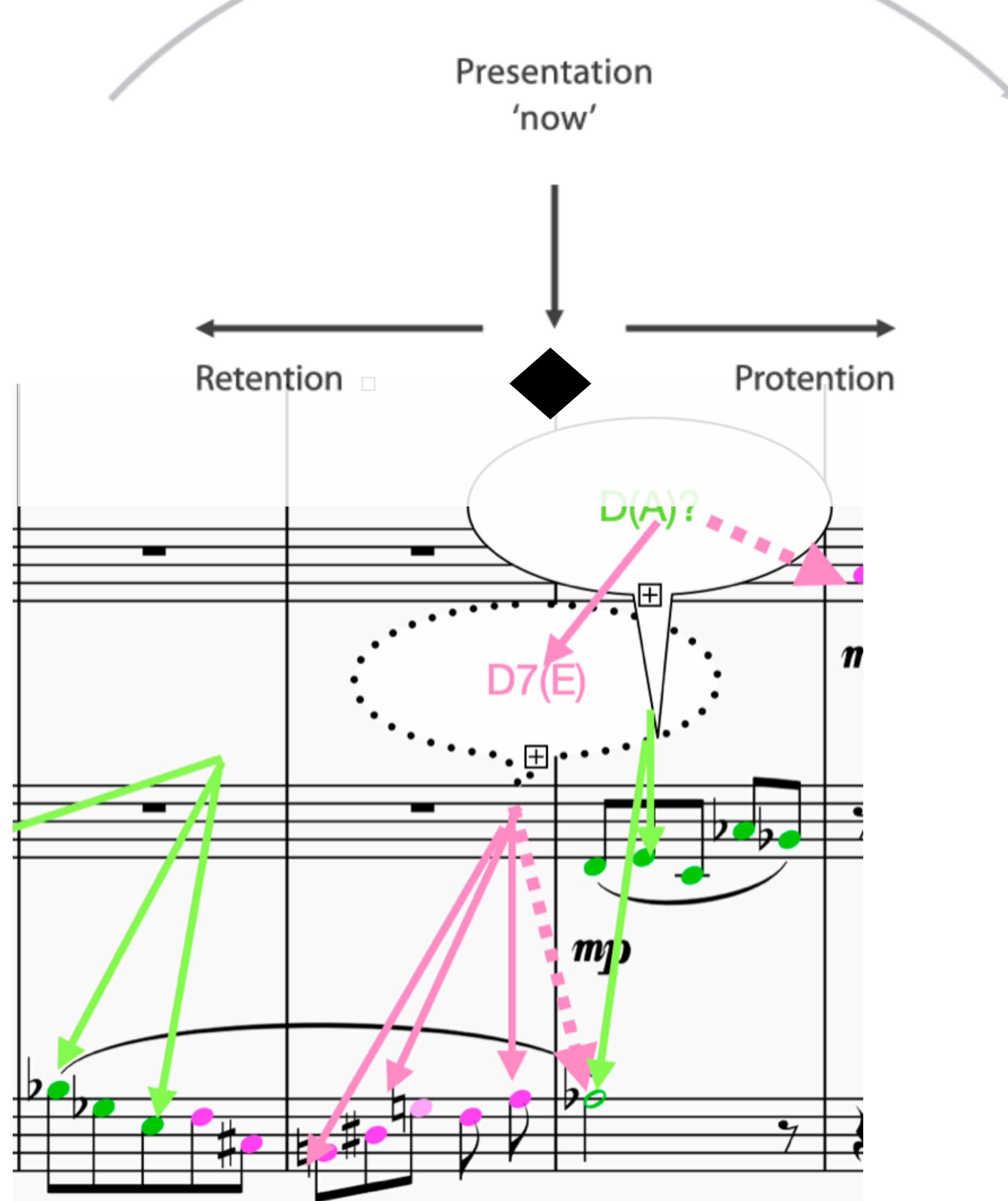
- Experiential protention-
retention structure
- Bi-hexaphonic tension-
release



Conclusion: Experience & BH tension-release

I have applied BH bipolarity to conceptually superimpose:

- Experiential protention-retention
- Bi-hexaphonic tension-release



Conclusions: Bi-hexaphonic pitch organisation

- Introspection: BH allows me an expressive musical syntax for my obsessive composition.
- Allows a introspection laboratory of temporal experience
- Allows a music theoretical laboratory with *polydominance* as one of the core issues.



Conclusions: Bi-hexaphonic pitch organisation

- Introspection: BH allows me an expressive musical syntax for my obsessive composition.
- Allows a introspection laboratory of temporal experience
- Allows a music theoretical laboratory with *polydominance* as one of the core issues.



Conclusion: Diatonics

- Bi-hexaphony is omnipresent and is as old as septatonic scales (since Antiquity?).
- => History of BH tension: A red thread through music history
- => Explanatory value of BH with respect equally to diatonic and post-diatonic music
- => Potential contributions to **experiential music theory**, independent of the diatonic canon.



Conclusion: Diatonics

- Bi-hexaphony is omnipresent and is as old as septatonic scales (since Antiquity?).
- => History of BH tension-release: A red thread through music history
- => Explanatory value of BH with respect equally to diatonic and post-diatonic music
- => Potential contributions to **experiential music theory**, independent of the diatonic canon.

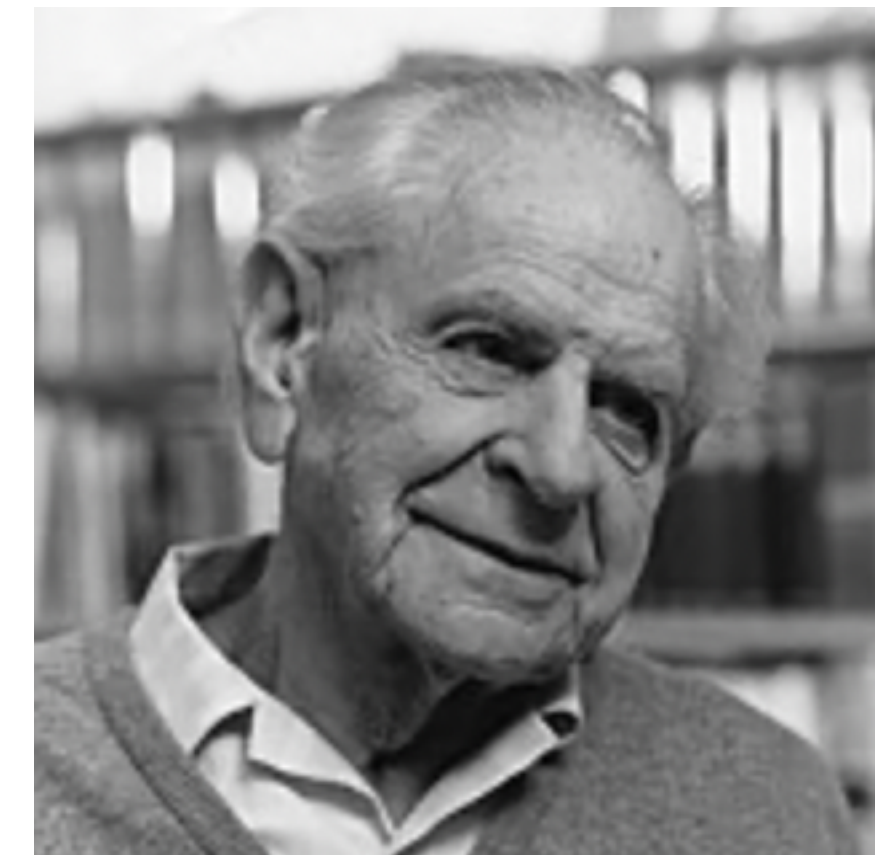


Conclusions: Epistemology

- Is the hypothesis of bi-hexaphonic tension confirmable/falsifiable?
- Individual experience can not be proven, but the shared embodied structure of experience can.
- Psychophysiological experiments may or may not be able to show the accumulation of tension, e.g. based on the paradigm of mismatch negativity (Tervaniemi 2021).

Conclusions: Epistemology

- Popper: For any hypothesis to have credence, it *must be inherently disprovable* before it can become accepted as a scientific hypothesis or theory.
- Is the hypothesis of bi-hexaphonic tension disprovable?
- Individual experience can not be proven, but the shared embodied structure of experience can.
- Psychophysiological experiments may or may not be able to show the accumulation of tension, e.g. based on the paradigm of mismatch negativity (Tervaniemi 2021).
- Humanistic approval: Historical consistency



Popper, Karl [1959]. [*The Logic of Scientific Discovery*](#).

References

- Bharucha, Jamshed J. "Music cognition and perceptual facilitation: A connectionist framework." *Music perception* 5.1 (1987): 1-30.
- Husserl, Edmund (2012). *On the phenomenology of the consciousness of internal time (1893-1917)*. Springer Science & Business Media. Volume 4.
- Gibson, J.J. (1977). *The Theory of Affordances. -Perceiving, Acting, and Knowing*, Eds. Robert Shaw and John Bransford.
- Schoenberg, Arnold (2010). *Style and idea: Selected writings*. Univ of California Press.
- Tikka, Pia, Mauri Kaipainen, and Juha Salmi. "Narrative simulation of social experiences in naturalistic context—a neurocinematic approach." *Neuropsychologia* 188 (2023): 108654.
- Merleau-Ponty, M. (1962). *Phenomenology of Perception* (Trans. Colin Smith). London: Routledge and Kegan Paul.
- Popper, Karl (2002) [1959]. *The Logic of Scientific Discovery*. Abingdon-on-Thames: Routledge.
- Stravinsky, Igor. *Poetics of music in the form of six lessons*. Vol. 66. Harvard University Press, 1970. P. 27
- Tervaniemi, Mari (2022). Mismatch negativity-stimulation paradigms in past and in future. *Frontiers Media SA. Frontiers in Neuroscience*. Volume 16, 1025763. <https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2022.1025763/full>
- Wertheimer, Max (1912). "[Experimentelle Studien über das Sehen von Bewegung](#)" *Zeitschrift für Psychologie* (in German). **61**: 161–265.
- Varela, F. (1999). *The Specious Present: A Neurophenomenology of Time Consciousness*. Petitot, J., F. Varela, B. Pachoud, and J.M. Roy. *Naturalizing Phenomenology. Issues in contemporary phenomenology and cognitive science*. Stanford University Press. 1999.

Musical examples

- Mauri Kaipainen: *Piano concerto* <https://www.dropbox.com/scl/fi/n69q3o3ns96bb5iexkdi8/Piano-Concerto.mp3?rlkey=6y8pef1qg402jjj5id2vbc54o&dl=0>
- Mauri Kaipainen: *Urban prelude and fugue* for saxophone quartet <https://www.dropbox.com/scl/fi/yqmrtlvnbtuu2a11ur5t5/Urban-prelude-and-fugue.mov?rlkey=1hjz25nh8df7cl6win1wxhn5w&dl=0>
- Mauri Kaipainen: String quartet 3: <https://www.dropbox.com/scl/fi/pc28ami2luzp4v2xgtz59/SQ3.mov?rlkey=2h4965smoekav7l9d4f1ohr4f&dl=0>
- Arnold Schönberg: Wind quintet Op. 26 https://youtu.be/VUEj5q43nec?si=v4tXe_yaCG1TnS18

