

MTO 27.3 Examples: Chiu, Macroharmonic Progressions through the Discrete Fourier Transform: An Analysis from Maurice Duruflé's Requiem

(Note: audio, video, and other interactive examples are only available online)

<https://mtosmt.org/issues/mto.21.27.3/mto.21.27.3.chiu.html>

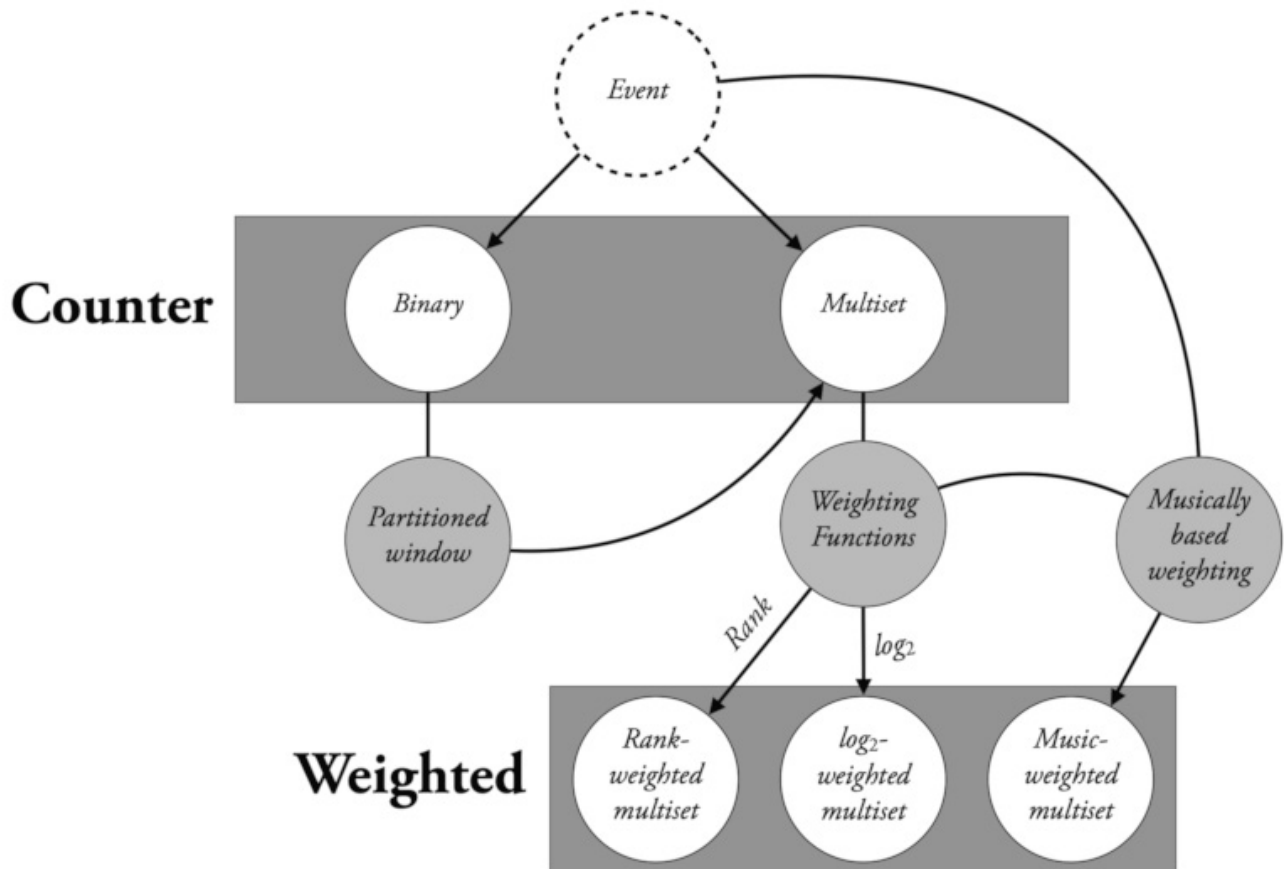
Example 1. Different scales combining to form a macroharmony

Example 2. Requiem: *Domine Jesu*, mm. 31–34

Example 3. DFT macroharmonic qualities

Component	Quality	Description
f_1	<i>Clustered Quality</i>	contains chromatically adjacent PCs
f_2	<i>Dyadicity</i>	contains tritones or fifths
f_3	<i>Hexatonicity</i>	contains triads (augmented or major/minor) or the hexatonic scale (two adjacent augmented triads)
f_4	<i>Octatonicity</i>	contains diminished sevenths or octatonic scales
f_5	<i>Diatonicity</i>	contains a partial fifth cycle
f_6	<i>Whole-tone Quality</i>	contains a whole-tone cycle (partial or complete)

Example 4. Approaches to encoding music



Example 5. *Domine Jesu*, rehearsal 24, binary vs. multiset

binary: {C, E, G} \longrightarrow (1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0)

characteristic
function

multiset: {C, C, C, C, C, C, C, C, C, C, C, C, C, C,
E, E, E, E, E, E, E, E, E, E, E, E, E,
G, G, G, G, G, G, G, G} \longrightarrow (13, 0, 0, 0, 12, 0, 0, 8, 0, 0, 0, 0)

Example 6. *Domine Jesu*, melody at rehearsal 24, overlapping sliding windows

discrete time series

window 0 $[[\{\emptyset\},0],[\{4\},1],[\{4\},1.5],[\{4\},2],[\{4\},3],[\{2\},3.5]]$

windows

window 1 $[[\{4\},1],[\{4\},1.5],[\{4\},2],[\{4\},3],[\{2\},3.5],[\{4\},4]]$

window 2 $[[\{4\},2],[\{4\},3],[\{2\},3.5],[\{4\},4],[\{4\},5],[\{4\},5.5]]$

window 3 $[[\{4\},3],[\{2\},3.5],[\{4\},4],[\{4\},5],[\{4\},5.5],[\{2\},6],[\{4\},6.5]]$

Example 7. *Domine Jesu*, rehearsal 24, different window sizes

33

SOPRANOS

24

li-be-ra e - as de o - re le - o - nis,

A.

et de pro-fun-do la - cu,

TENORS

f

li-be-ra e - as de o - re le - o - nis,

T.

li-be-ra e - as de o - re le - o - nis,

BASSES

f

li-be-ra e - as de o - re le - o - nis,

GR.

subito

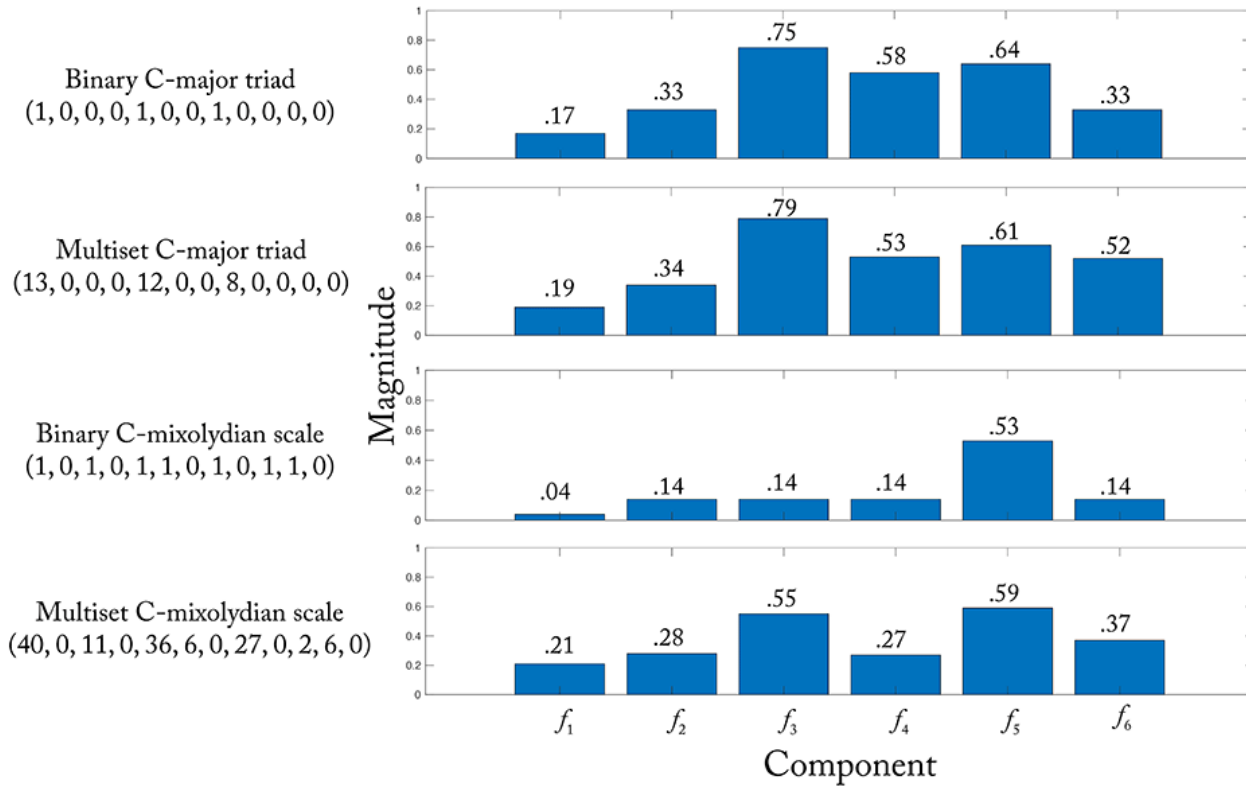
li-be-ra e - as de o - re le - o - nis,

13, 0, 0, 0, 12, 0, 0, 8, 0, 0, 0, 0

40, 0, 11, 0, 36, 6, 0, 27, 0, 2, 6, 0

3

Example 8. DFT calculations on different retrieval processes and window sizes for *Domine Jesu*, rehearsal 24



Example 9. Weight by metric hierarchy

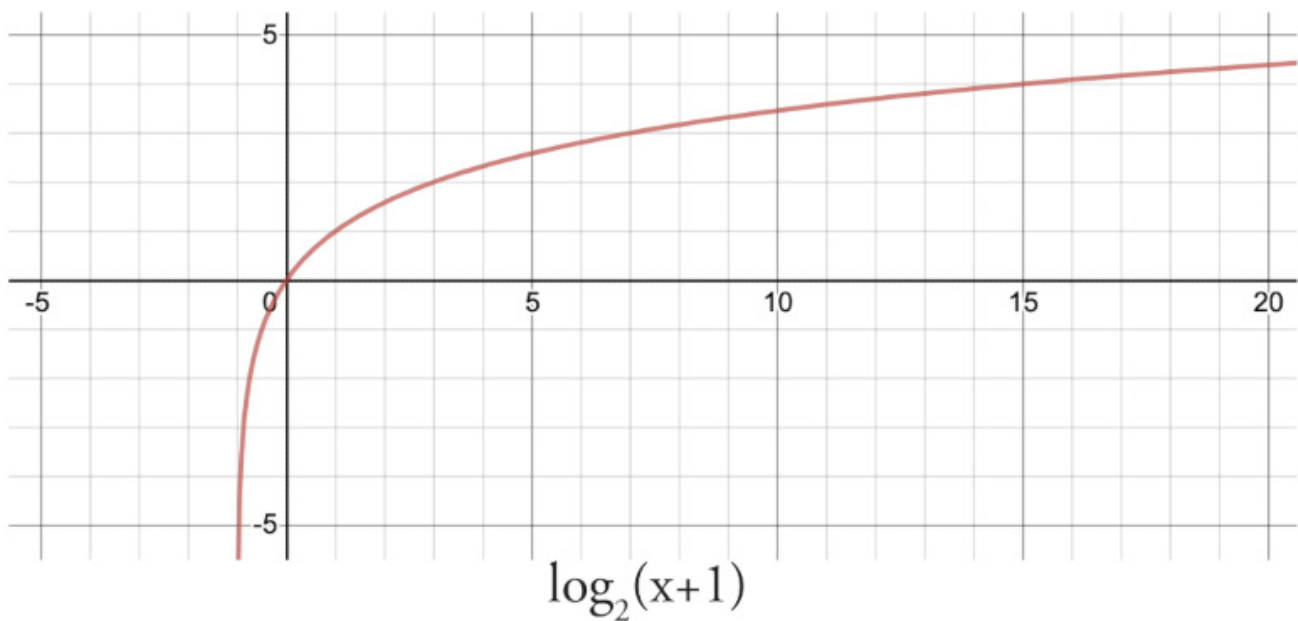
Level 1	♪ : 1(x)
Level 2	♪ : 0.5(x)
Level 3	♪ : 0.25(x)
Level 4	♩ : 0.1667(x)

Example 10. Monotonic weightings of PC-frequency distributions, *Domine Jesu*, rehearsal 24

Retrieval Procedure	PC-Frequency Distribution
multiset	(40, 0, 11, 0, 36, 6, 0, 27, 0, 2, 6, 0)

Retrieval Procedure	Weighted Multiset
metric-weighted multiset	(31, 0, 9, 0, 28.5, 6, 0, 18, 0, 2, 4.5, 0)
rank-weighted multiset	(7, 0, 4, 0, 6, 2, 0, 5, 0, 1, 2, 0)
log ₂ -weighted multiset	(5.4, 0.0, 3.6, 0.0, 5.2, 2.8, 0.0, 4.8, 0.0, 1.6, 2.8, 0.0)

Example 11. log₂(x+1) function



Example 12. *Domine Jesu*, rehearsal 24, partitioned window

33

24

SOPRANOS

TENORS

BASSES

S. et de pro-fun-do

A. la - cu,

T. li-be-ra

B. li-be-ra

24

li-be-ra e - as de o - re le - o - nis,

li-be-ra e - as de o - re le - o - nis,

li-be-ra e - as de o - re le - o - nis,

li-be-ra e - as de o - re le - o - nis,

GR. *f* *subito*

(1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0)

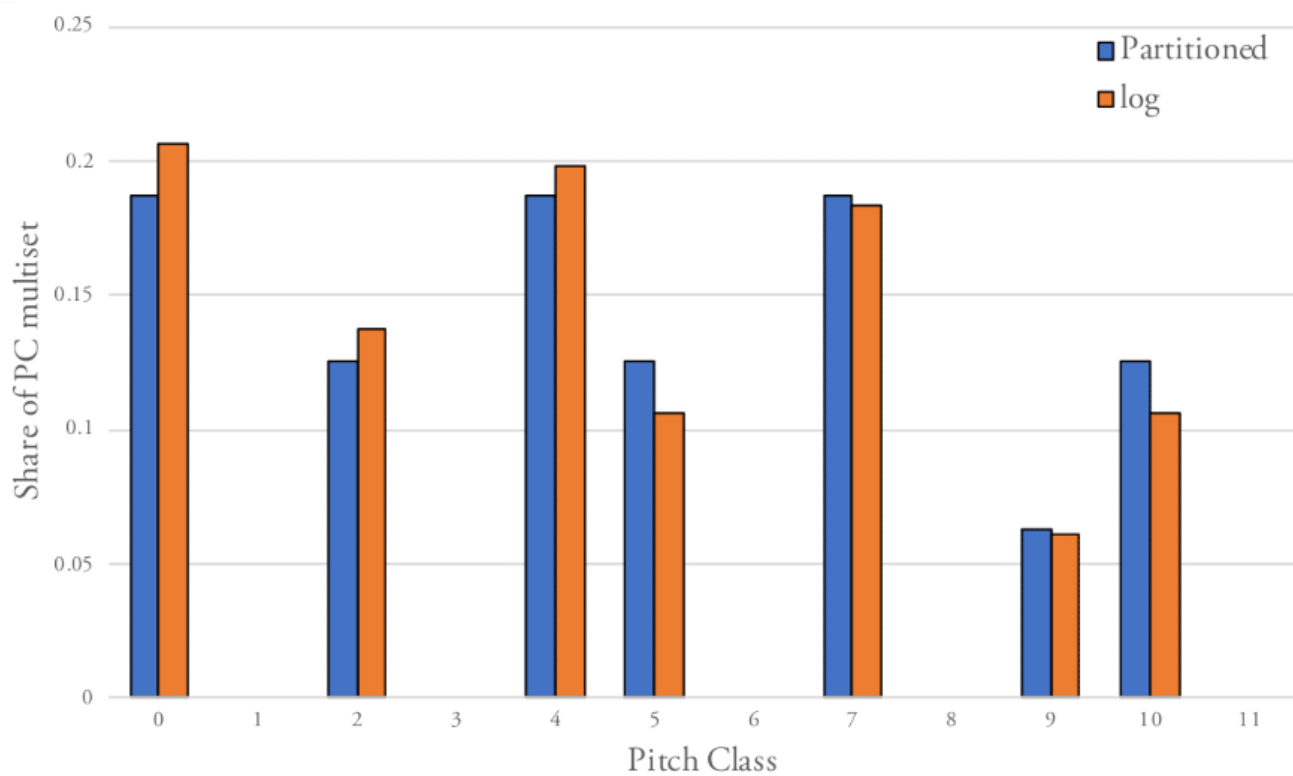
(1, 0, 1, 0, 1, 1, 0, 1, 0, 0, 1, 0)

(1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0)

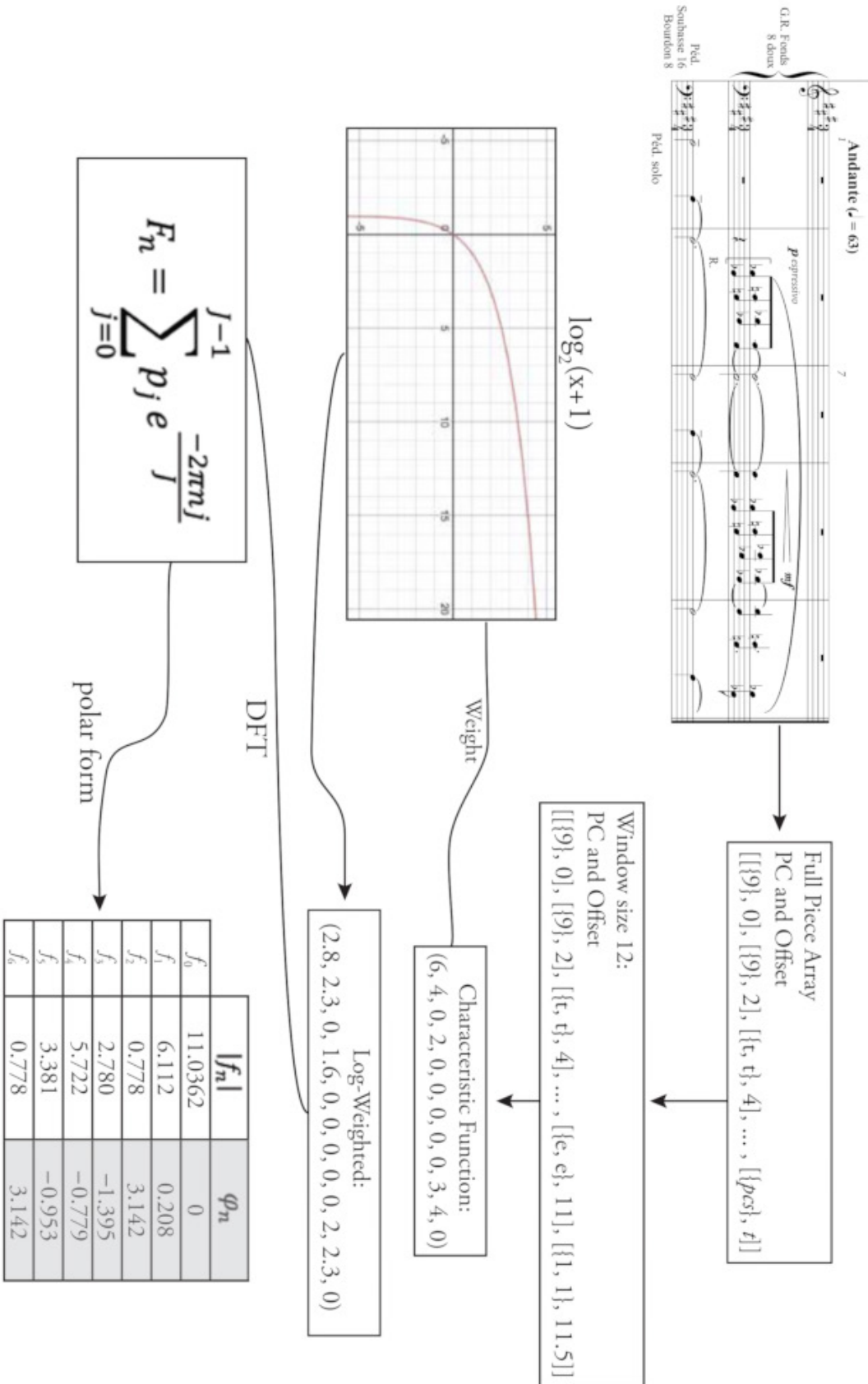
(3, 0, 2, 0, 3, 2, 0, 3, 0, 1, 2, 0)

3

Example 13. *Domine Jesu*, rehearsal 24, partitioned window vs. \log_2



Example 14. Coding procedure flow chart



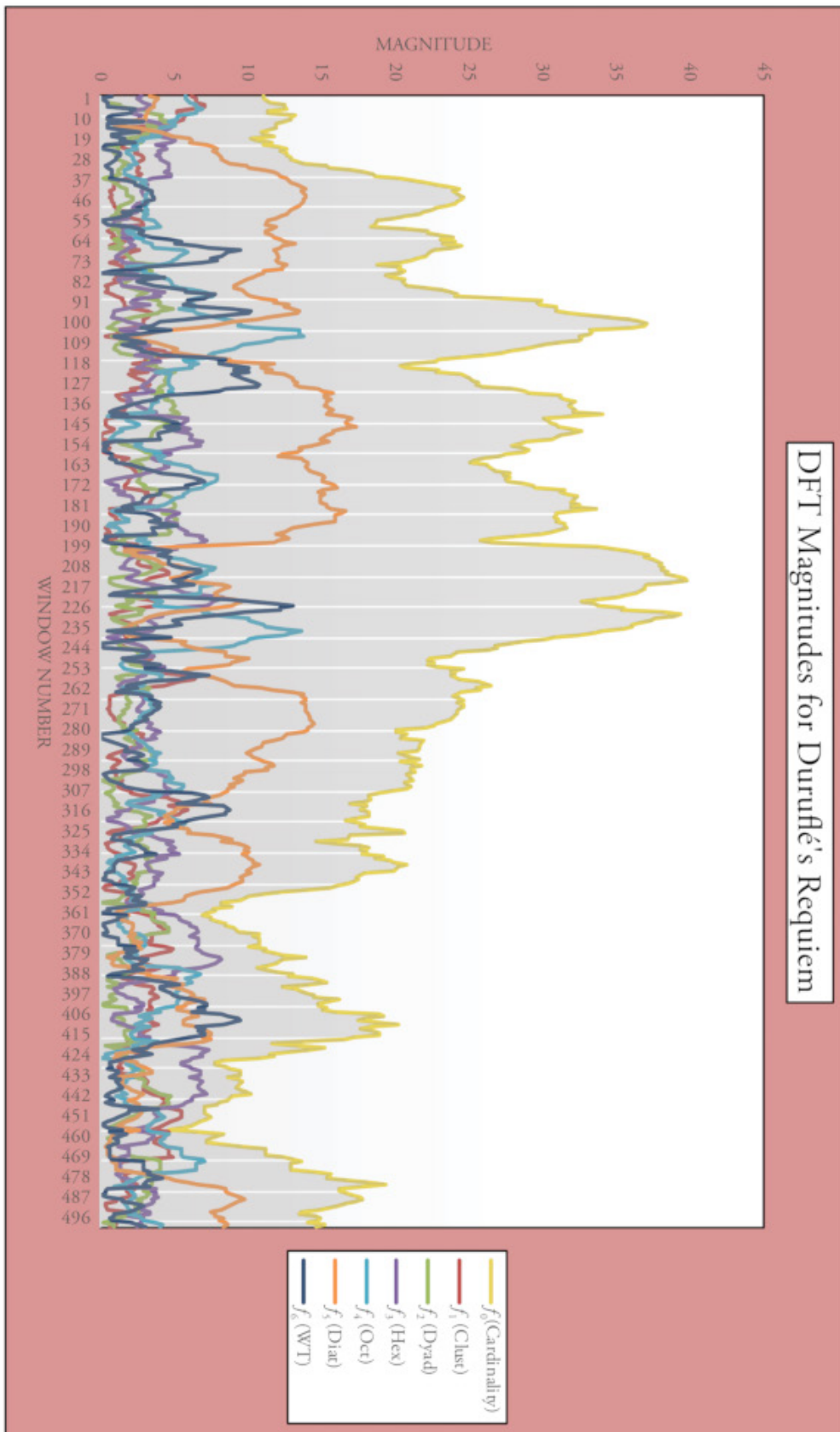
Example 15. *Domine Jesu*, form chart

		A			
	Introduction	a			b
Measure	1	9	35	38	42
Window	1	25	96	106	119
notable musical features	andante / <i>expressivo</i>	thematic entry	tutti		animato with triplets
primary macroharmony	octatonic	diatonic		octatonic	diatonic

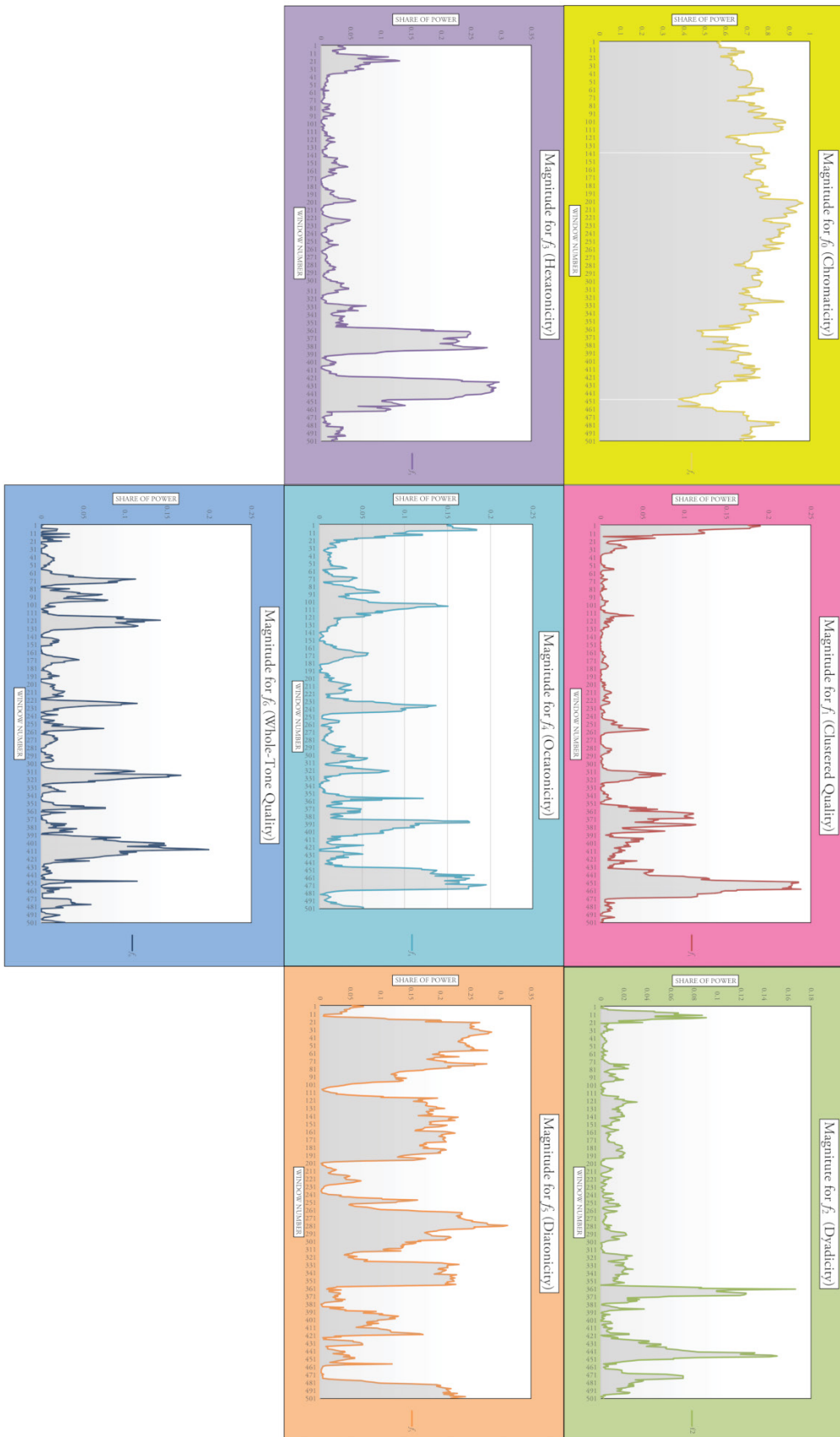
				B		
			a'	c	d	
70	80	85	89	98	117	
210	234	249	265	291	347	
same material, different key		foreshadows B theme	initial a theme	sopranos	sopranos and altos	
	octatonic	diatonic			diatonic	

						d
e						
123	127	145	148	153	159	169
365	378	442	451	466	484	519
crumhorn	baritone solo	crumhorn	baritone		sopranos and altos	end
hexatonic				organ transition	diatonic	

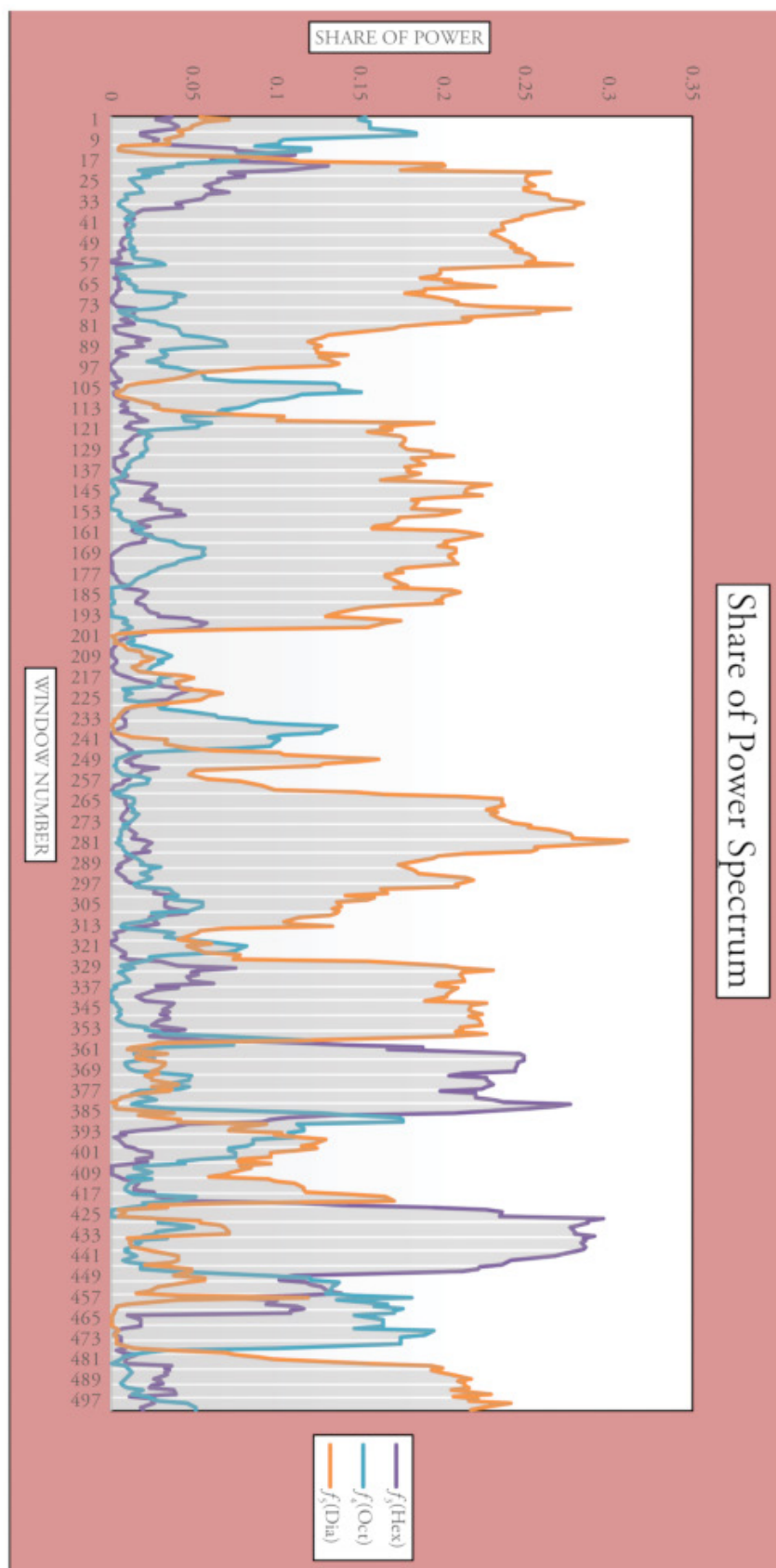
Example 16. *Domine Jesu*, magnitude values



Example 17. *Domine Jesu*, share of power for f_0 - f_6 (separated)



Example 18. *Domine Jesu*, share of power for f_3 , f_4 , and f_5 (compounded)



Example 19. *Domine Jesu*, mm. 1–16 (ww. 1–33)

m. 1
w. 1 **Andante** (♩ = 63) *octatonicity*

G.R. Fonds 8 doux

Péd. Soubasse 16 Bourdon 8

Péd. solo

p espressivo *mf*

R.

m. 6
w. 16 *rall.* *diatonicity* *hexatonicity* **19** **Andantino** (♩ = 72)

Péd. G.R.

dim. *pp*

m. 12
w. 32 **20** G.R.

G.R.

Example 20. *Domine Jesu*, mm. 117–131 (ww. 347–382)

m. 117
w. 347

37 *diatonicity*

SOPRANOS *p*
ALTOS *p*

Quam o - lim A - bra - hac pro - mi - sis - ti, —

Quam o - lim A - bra - hac pro - mi - sis - ti, — et — se - mi - ni — e -

G.R. Fonds 8 doux *p*
R. Gambe, Voix céleste *dim.*

Péd. Soubasse 16 Bourdon 8

m. 122
w. 361

38 *hexatonicity*

pp
jus.

38 *pp*
espressivo

G. Cromorne (ou Clarinette)

Bourdon 8
R. Voix humaine tremblant

m. 127
w. 378

BARYTON SOLO

p

Bar. Solo

Hos - ti - as et pre - ces - ti - bi Do - mi - ne lau - dis of - fe - ri - mus,

Example 21. *Domine Jesu*, mm. 127–136 (ww. 378–400)

m. 127
 w. 378 BARYTON SOLO
p
 Hos-ti-as et pre-ces-ti-bi Do-mi-ne lau-dis of-fe-ri-mus,
hexatonicity
octatonicity

Baritone Solo
 Hos-ti-as et pre-ces-ti-bi Do-mi-ne lau-dis of-fe-ri-mus,
hexatonicity
octatonicity

G.R. Fonds 8 doux
 Péd.
 Soubasse 16
 Bourdon 8
diatonicity

m. 132
 w. 394
 tu sus-ci-pe pro-a-mi-ma-bus il-

m. 132
 w. 394
 tu sus-ci-pe pro-a-mi-ma-bus il-

pp (cresc. R.)
f
 R. + Gambe 8

Ab F_m⁷ D⁰⁷ C⁰⁷ D⁷ F_m⁷

Example 22. *Domine Jesu*, mm. 35–41 (ww. 96–107)

diatonicity

24 m. 35
w. 96

octatonicity

SOPRANOS
li - be - ra e - as de o - re le o - - nis,

ALTOS
li - be - ra e - as de o - re le o - - nis,

TENORS
li - be - ra e - as de o - re le o - - nis,

BASSES
li - be - ra e - as de o - re le - o - - nis,

G.R. Fonds 8 doux
G.R. *f subito*

Péd. Soubasse 16 Bourdon 8

octatonicity

25 m. 38
w. 106

octatonicity

rall.

SOPRANOS
f dim. ne ab - sor - be - at e - as tar - ta - rus, *mf* ne ca - dant in obs - cu -

ALTOS
f dim. ne ab - sor - be - at e - as tar - ta - rus, *mf* ne ca - dant in obs - cu -

TENORS
f dim. ne ab - sor - be - at e - as tar - ta - rus, *mf* ne ca - dant in obs - cu -

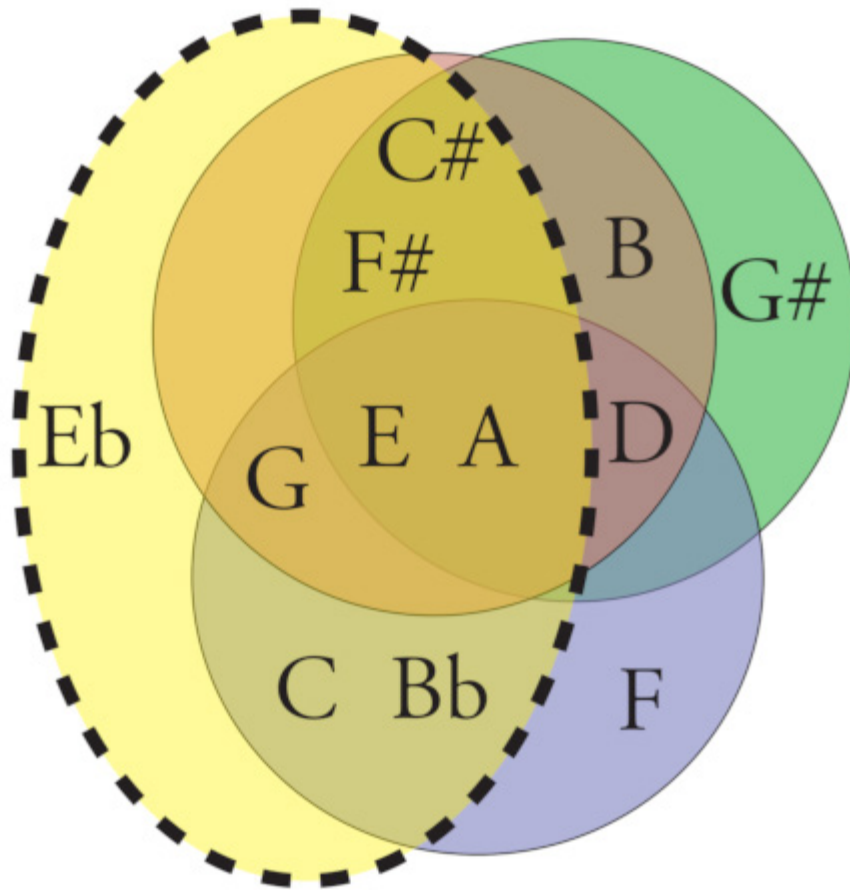
BASSES
f dim. ne ab - sor - be - at e - as tar - ta - rus, *mf* ne ca - dant in obs - cu -

G.R. Fonds 8 doux
dim.

Péd. R.

Example 23. Macroharmonic subset relationships

- A Mixolydian
- C Mixolydian
- F# Aeolian
- Oct₀₋₁



Example 24. *Domine Jesu*, mm. 145–158 (ww. 442–472)

m. 145
 w. 442
 G. R. Cromorne (ou Clarinette)
 8 doux
 R. Gambe
pp
 hexatonicity

m. 147
 w. 448
 BARYTON SOLO
p
 fac e - as, Do - mi - ne, de mor - te tran - si - re ad vi - tam.
poco
p

m. 153
 w. 466
 41
 octatonicity
 R. + Gambe 8
 R. + Flûte 8
f
 R. Flûte

Example 25. *Domine Jesu*, mm. 159–169 (ww. 484–508)

diatonicity

m. 159
w. 484

42

SOPRANOS

ALTOS

G.R. Fonds
8 doux

Péd.
Soubasse 16
Bourdon 8

p

Quam o - lim A - bra - hae pro - mi - sis - ti, et se - mi -

dim.

42 R. Gambe, vois céleste

p

dim.

diatonicity

m. 164
w. 500

pp

rall.

ni e - jus.

G. Fonds 8 doux

rall.

pp