

Tonalities

An application for the collaborative online analytical exploration of digital scores: a demonstration based on secular polyphonic works by Guillaume Dufay

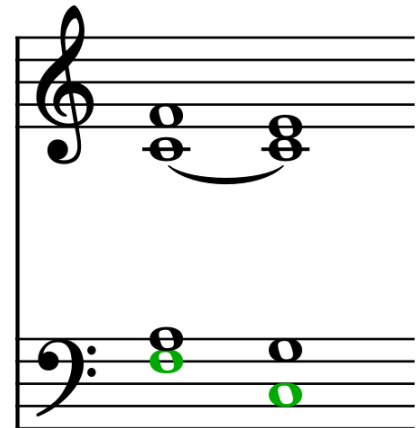
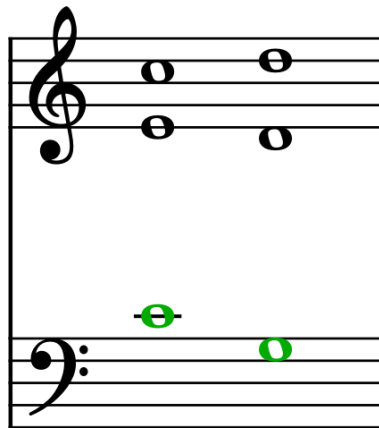
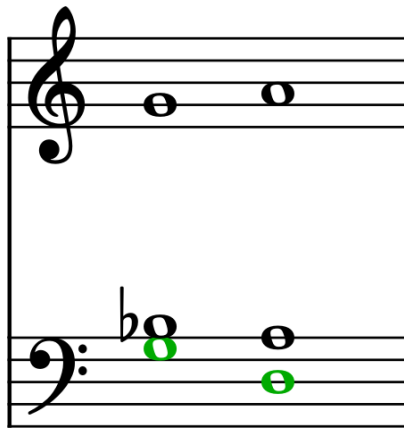
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Thomas Bottini, Philippe Cathé, Achille Davy-Rigaux,
Marco Gurrieri, Félix Pouillet-Pagès

Second international conference on computational and cognitive musicology
Utrecht University, Netherlands, 17 October 2024



Aim of this research

Investigating the origins and contrapuntal logic of cadences with a descending fourth in the lowest voice



Tonalities^{2.1}



This interface leverages web technologies to grasp how distinct theoretical viewpoints bring to light different, sometimes conflicting musical properties; confront different interpretations; and, ultimately, provide documented and authored analyses of musical pieces. To this end, Tonalities (a) makes use of theoretical models, which (b) can be associated with arbitrary selections on the score and (c) lead to critical analyses through collaborative approaches.

The interface addresses the following challenges:

Available scores



My recent work

View recent analytical projects



Anonyme Guillaume Dufay Johann Sebastian Bach
 Jacquet de Mantua Cyprien de Rore Pierre de La Rue
 Alfonso Fontanelli Nicolas Gombert Lupus Hellinck
 Heinrich Isaac Josquin des Prez Leonhard Lechner
 Jean-Baptiste Lully Cristobal de Morales Michael Prætorius
 Philippe Verdelot Adrian Willaert Gioseffo Zarlino

De ma h

1 results



De ma haulte et bonne aventure

Guillaume Dufay



Analytical projects for Contrafactum, textus Rotundelli igno...



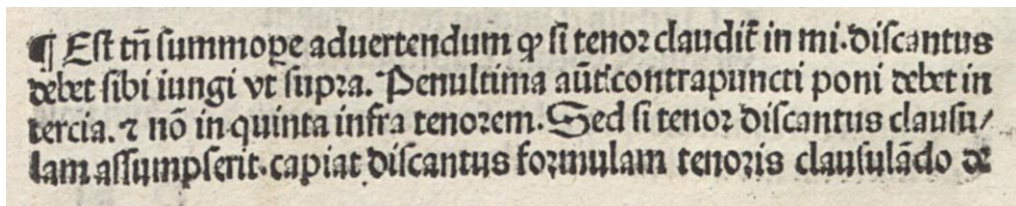
Cadences_CGN

91 annotations

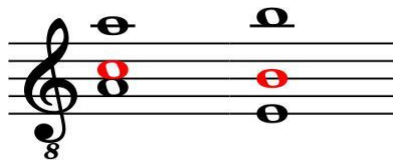


What theory says and what it doesn't

Nicolaus Wollick (Melchior Schanppecher), *Opus aureum*, fol. H4v-5r.



It must, however, be noted most diligently that **if the tenor closes** (clauditur) **on mi**, the discant ought to be joined to it as above, but the penult of the counterpoint [i.e. the bass] ought to be placed a third and not a fifth below the tenor (C. Mutch, *Studies in the History of the Cadence*, p. 94).



What theory says

ti - e, ple - num gra - ti -
ple - num gra - ti -
gra - ti - e, ple - num gra - ti -
gra - ti - e, ple - num gra - ti -

Measure 245 is marked above the first staff.

Josquin des Prez (?),
*In principio erat
verbum,*
ed. M. Just (NJE)

e et ve - ri - ta - tis, et ve - ri - ta - tis.
e et ve - ri - ta - tis, et ve - ri - ta - tis.
e et ve - ri - ta - tis, et ve - ri - ta - tis.
e et ve - ri - ta - tis, et ve - ri - ta - tis.

Measure 250 is marked above the first staff. A red box highlights the final measure (measure 254) of this system, which contains the phrase 'ta - tis'.

“Plagal cadence”

Analytical model

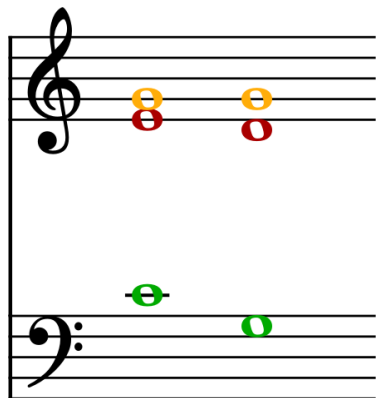
The musical notation shows three voices: Cantizans_C (blue), Tenorizans_T (red), and Bassizans_B (green). The notation is on a single staff with a treble clef and a 3/8 time signature. The notes are arranged in a way that suggests a specific harmonic structure.

Cantizans_C

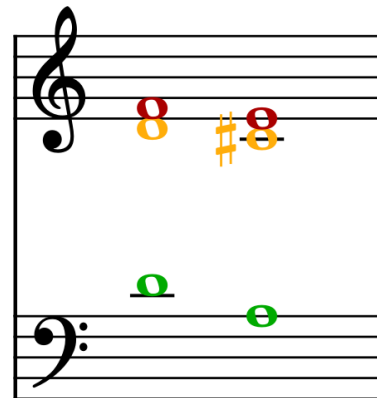
Tenorizans_T

Bassizans_B

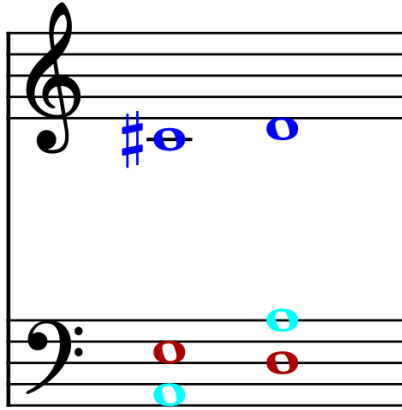
Bassizans_P



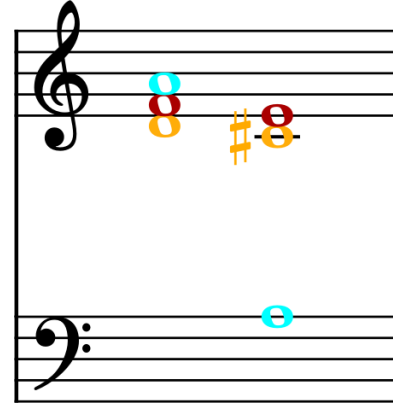
Altizans_A



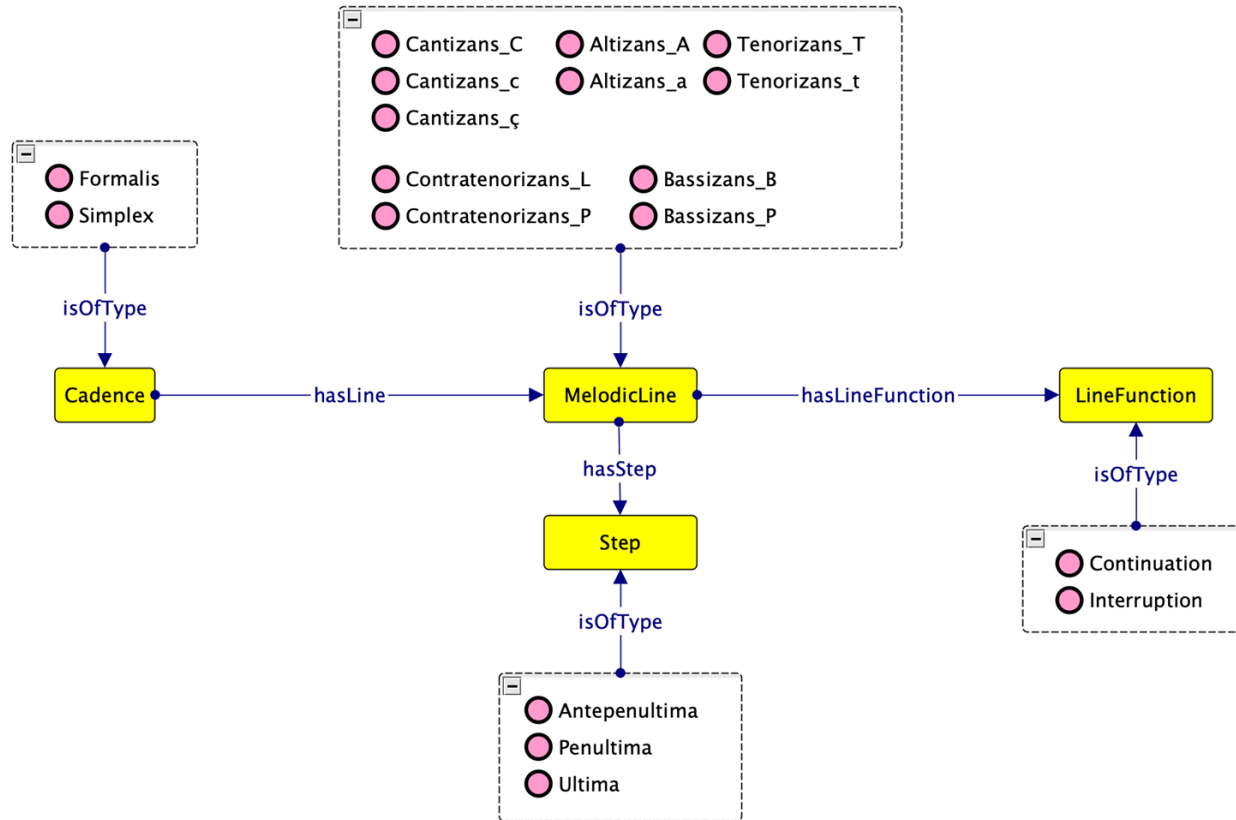
Altizans_a



Contratenorizans_L



Contratenorizans_P



The interface displays a musical score for the song "Mille bonjours je vous presente". The score is in C major and 4/4 time, featuring three staves: [C.] (Clef), C.T. (Clef), and T. (Clef). The score is divided into three systems, with measures 8, 11, and 14 marked. A search bar is located on the left, and a sidebar lists available concepts: Cadence, LineFunction, MelodicLine, StepNote, and Step. A right sidebar shows a list of sub-individuals, each with a CN (Concept Name) label and a date/time stamp. A comment field is at the bottom right.

Left Sidebar:

- Selected score: Mille bonjours je vous presente
- Selected model: Cadences FilaberGuillotelGurrieri 2023
- Search...
- Available concepts: SELECT ALL
- > Cadence
- > LineFunction
- > MelodicLine
- > StepNote
- > Step

Right Sidebar:

- Individual with 7 items
- CN C Simplex (08/04/2024, 22:59)
- Sub-individual (08/04/2024, 23:00) CN C Cantizans_C
- Sub-individual (08/04/2024, 23:00) CN C Tenorizans_T CN C Continuation
- Sub-individual (08/04/2024, 23:00) CN C Bassizans_P
- Comment...

Tonalities annotation interface: <https://data-iremum.huma-num.fr/tonalities/>

Browser address bar: <https://yasgui.triply.cc/#>

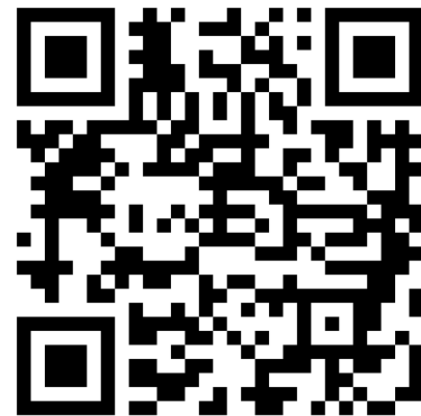
Query: <https://data-iremum.huma-num.fr/sparql/>

```
1 PREFIX cadences: <https://w3id.org/polifonia/ontology/modal-tonal/Cadences_FilaberGuillotelGurrieri_2023/>
2 PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>
3 PREFIX dcterms: <http://purl.org/dc/terms/>
4 PREFIX graph: <http://data-iremum.huma-num.fr/graph/>
5 PREFIX iremus: <http://data-iremum.huma-num.fr/id/>
6 PREFIX sherlock: <http://data-iremum.huma-num.fr/ns/sherlock#>
7
8 SELECT DISTINCT ?project ?concept ?annotation
9
10
11 WHERE {
12   GRAPH graph:tonalities-contributions {
13     ?project crm:P9_consists_of ?E13 .
14     ?E13 sherlock:has_document_context ?docContext.
15     ?E13 crm:P177_assigned_property_of_type crm:P2_has_type.
16     ?E13 crm:P141_assigned cadences:Baseizans_P.
17     ?E13 crm:P141_assigned ?concept.
18     filter( regex(str(?docContext), "Dufay" ))
19   }
20 }
```

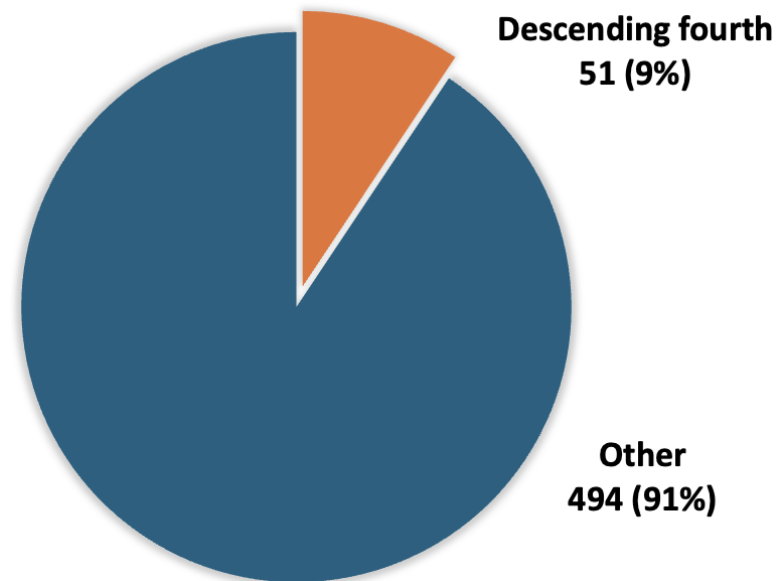
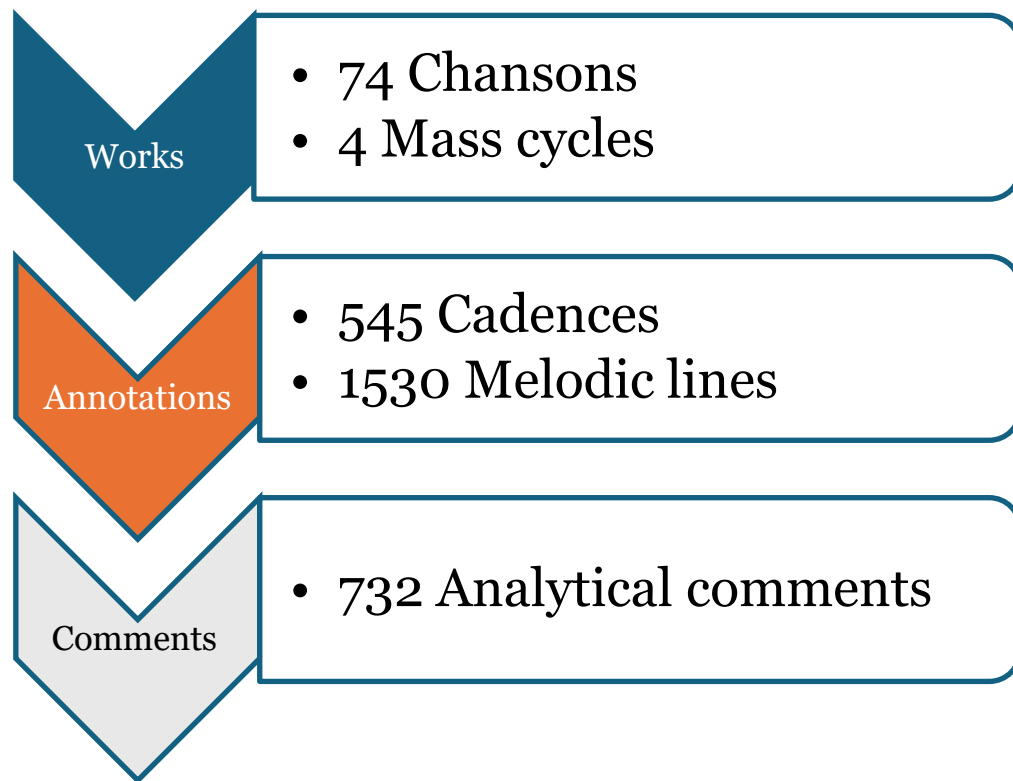
38 results in 1.175 seconds

project	concept
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iremum:1657a5df-0ba3-4673-bf41-e3ffd58ea27c	cadences:Baseizans_P
iremum:f6e11d7fc136-468b-87c1-cb5ba25de0ba	cadences:Baseizans_P
iremum:ce6b82ba3-b8c2-4405-94c0-584fee0b24b2	cadences:Baseizans_P
iremum:5e3683ef-7a0d-4e73-bd9b-4b747a12dee5	cadences:Baseizans_P
iremum:a849e9e8-8c34-41d6-a919-5c0201471eaa	cadences:Baseizans_P
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iremum:5e93c8f5-c441-4e28-bb7c-1b5ff2a16f	cadences:Baseizans_P
iremum:f0156796-52b7-4dd6-976d-03eaca662073	cadences:Baseizans_P
iremum:62409bcf-6f10-4937-b7fe-5ddd493ae260	cadences:Baseizans_P
iremum:f5604b9e-f49a-454b-8cbb-8d88dafdd3e1	cadences:Baseizans_P
iremum:bf0ce9d-fd36-4395-8977-48cc975043d0	cadences:Baseizans_P

Try it yourself ?



Tonalities sparql endpoint: <https://data-iremum.huma-num.fr/sparql/>



Melodic movements

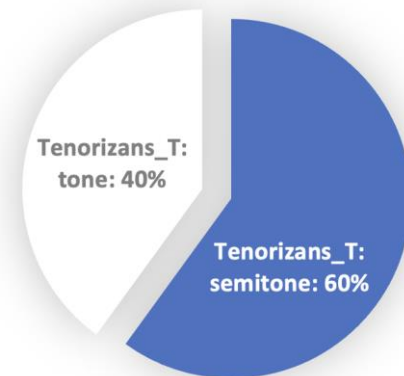
Tenorizans line

descending semitone

[C.]

[T.]

[C.T.]



G. Dufay, *Je me complains*, 5-9.

Melodic movements

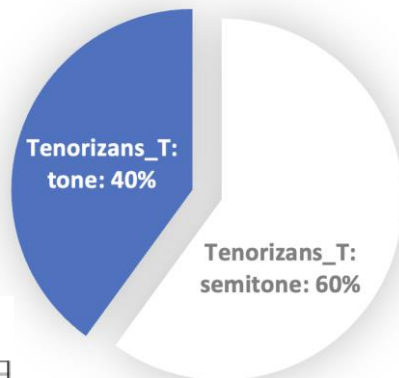
Tenorizans line

24

[C.]

[C.T.]

[T.]



G. Dufay, *Resvelliés vous et faites chiere lye*, 24-30

descending tone

Melodic movements

Altizans line

Mi cadence
and/or
Interrupted cadence ?

The image shows a musical score for the song "The Rose Tree" in 3/8 time, featuring three parts: C (Coprone), C.T. (Coprone Tenor), and T. (Tenor). The score is divided into two systems, starting at measure 42 and 50. The key signature has one flat (B-flat).

System 1 (Measures 42-49):

- Coprone (C.):** The melody starts with a quarter note G4, followed by eighth notes A4, Bb4, and C5. There is a whole rest in measure 45, followed by quarter notes D5, E5, and F5. The final note in measure 49 is G5, which is circled in red.
- Coprone Tenor (C.T.):** The melody starts with a quarter note G4, followed by eighth notes A4, Bb4, and C5. There is a whole rest in measure 45, followed by quarter notes D5, E5, and F5. The final note in measure 49 is G5, which is circled in green.
- Tenor (T.):** The melody starts with a quarter note G4, followed by eighth notes A4, Bb4, and C5. There is a whole rest in measure 45, followed by quarter notes D5, E5, and F5. The final note in measure 49 is G5, which is circled in yellow.

System 2 (Measures 50-57):

- Coprone (C.):** The melody starts with a quarter note G4, followed by eighth notes A4, Bb4, and C5. There is a whole rest in measure 51, followed by quarter notes D5, E5, and F5. The final note in measure 57 is G5, which is circled in red.
- Coprone Tenor (C.T.):** The melody starts with a quarter note G4, followed by eighth notes A4, Bb4, and C5. There is a whole rest in measure 51, followed by quarter notes D5, E5, and F5. The final note in measure 57 is G5, which is circled in green.
- Tenor (T.):** The melody starts with a quarter note G4, followed by eighth notes A4, Bb4, and C5. There is a whole rest in measure 51, followed by quarter notes D5, E5, and F5. The final note in measure 57 is G5, which is circled in yellow.

Annotations:

- Two large blue arrows point from the C.T. part to the T. part in measures 42 and 43, indicating a vocal entry or transition.
- Colored circles (red, green, yellow) highlight specific notes in each part, likely for a singing exercise.
- Colored lines (red, green, yellow) connect the circles to the corresponding parts.

G. Dufay, *Ce jour le doibt*, 42-56

Melodic movements

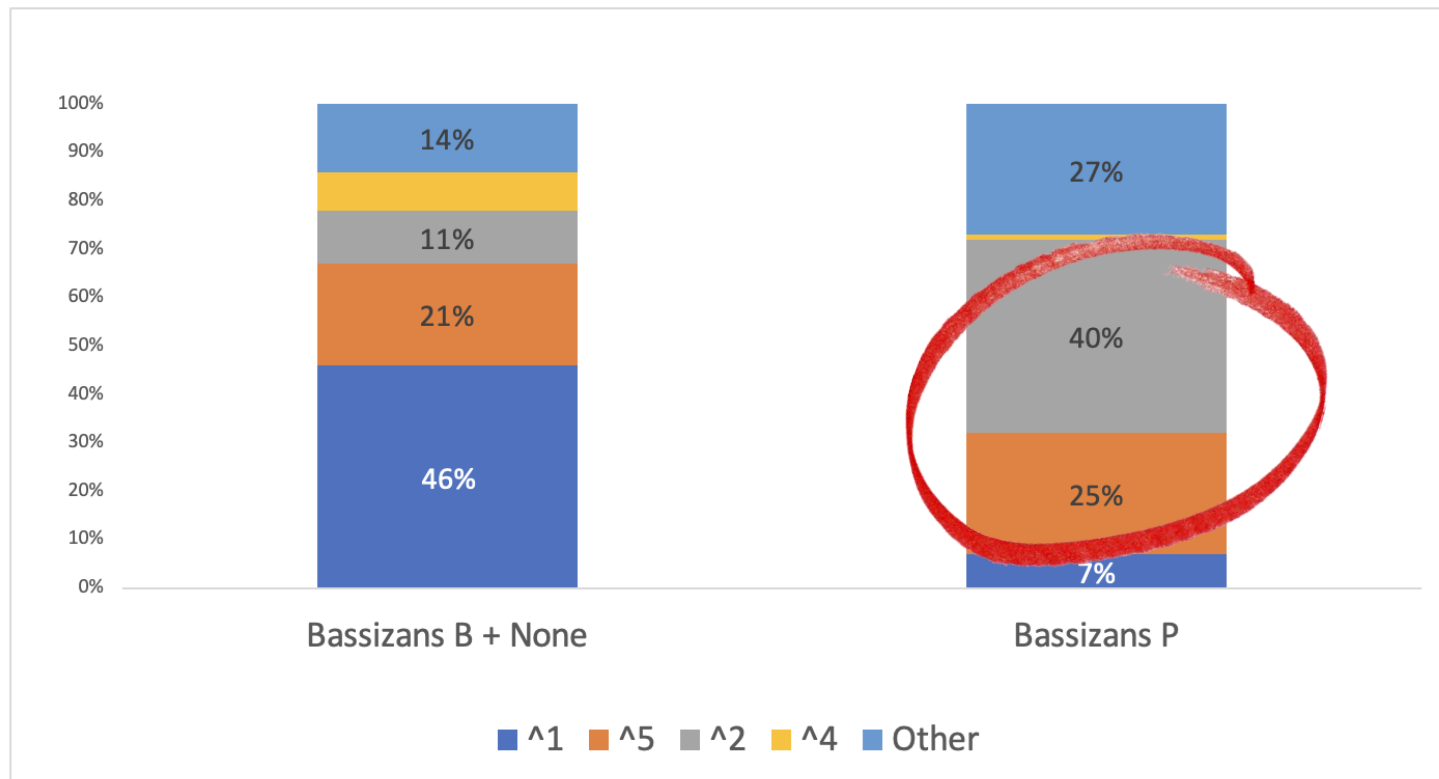
Altizans line

Interrupted cadence !

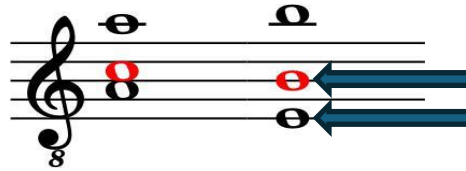
The image displays a musical score for three parts: [C.] (Cantus), C.T. (Cantus Tenor), and T. (Tenor). The score is in G major, indicated by one sharp (F#). The key signature is shown as a flat (b) on the F line of the T. staff. The time signature is 8/8. The score is marked with a '10' at the beginning of the [C.] staff. The [C.] staff has a treble clef and a key signature of one sharp. The C.T. staff has a treble clef and a key signature of one sharp. The T. staff has a treble clef and a key signature of one sharp. The score shows a descending fourth cadence in the Altizans line, which is highlighted by a blue arrow pointing to the cadence. The cadence is marked by a blue circle around the final note of the phrase, which is a G4. The final note of the phrase is a G4, which is circled in blue. The final note of the phrase is a G4, which is circled in blue. The final note of the phrase is a G4, which is circled in blue.

G. Dufay, *J'ay grant (dolour)*, 10-12

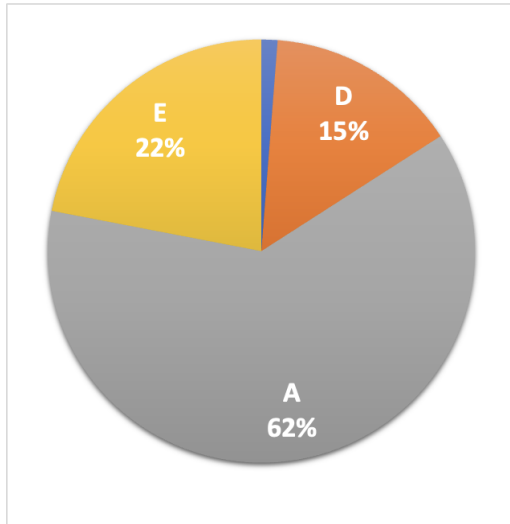
Cadence degrees



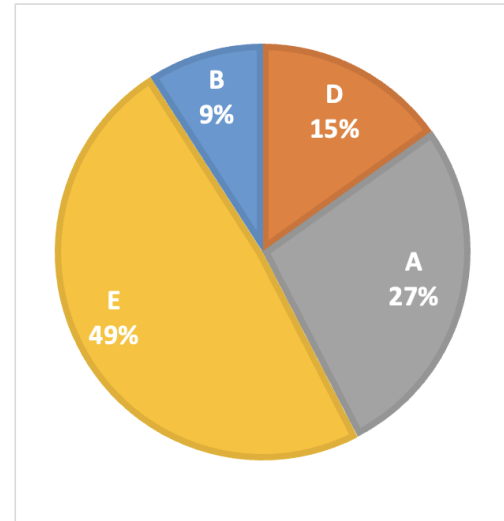
Cadence degrees



What's the target note of a descending fourth cadence ?



Mi cadences without bassizans line
(cadence degrees relate to the tenorizans line)



Mi cadences with bassizans line
(cadence degrees relate to the tenorizans line)

Cadence degrees

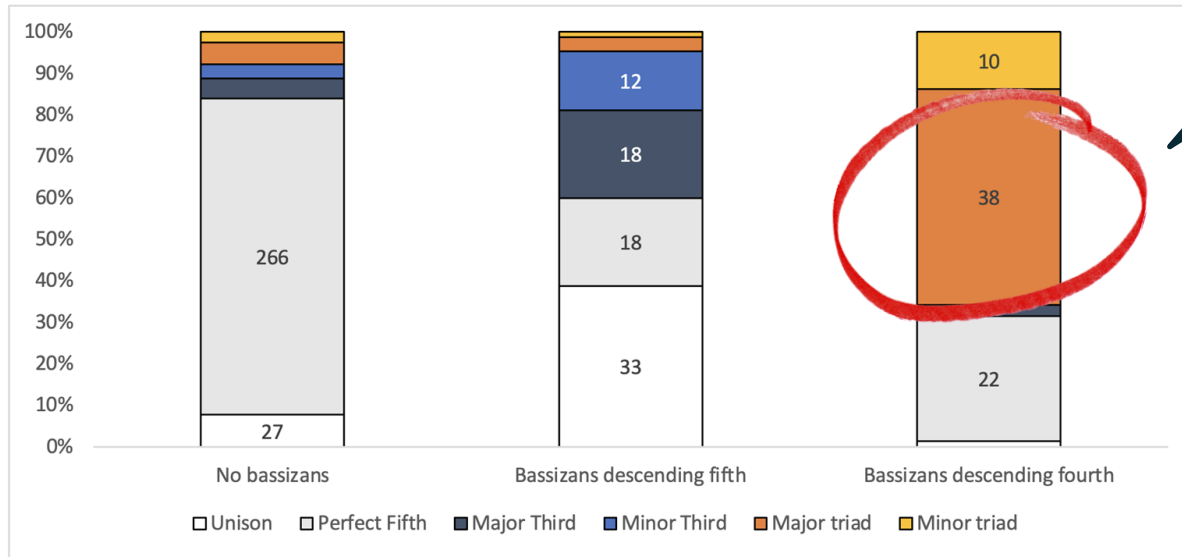
What's the target note of a descending fourth cadence?

The image shows a musical score for three parts: Cn (Cantus), T (Tenor), and Ct (Cello). The score is for measures 21-24 of G. Dufay's 'Malheureux cuer'. The cadence is highlighted with a red box around the final notes of measures 21 and 22. The notes are circled in blue, red, and green to show the descending fourth relationship.

Measure	Cn (Cantus)	T (Tenor)	Ct (Cello)
21	G4	E4	C4
22	F#4	D4	B3
23	E4	C4	A3
24	D4	B3	G3

G. Dufay, *Malheureux cuer, que vieulx tu faire*, m. 21-24

Final sonorities



Complete triads, and especially major triads, predominate in descending fourth cadences !

1. A horizontal and dynamic process: open cadences

a) Alternating 'open' and 'closed' endings

The image displays a musical score for G. Dufay's *Je ne suy plus*, measures 8-15. The score is written for three parts: [C.] (Cantus), [T.] (Tenor), and [C.T.] (Contratenor). The first system (measures 8-11) shows an open ending, with a red box highlighting the final three notes of each part. The second system (measures 12-15) shows a closed ending, with a blue box highlighting the final three notes of each part. A blue arrow points from the red box to the blue box, indicating the transition from the open ending to the closed ending.

G. Dufay, *Je ne suy plus*, 8-15

1. A horizontal and dynamic process: open cadences

b) Interruptions

The image displays a musical score for three parts: [C.] (Cantus), C. T. (Cantus Tenor), and T. (Tenor). The score is in C major and 4/4 time. A red box highlights a section of the music starting at measure 14, where the cadence is interrupted. The notes in this section are marked with blue circles. A red arrow points to the right, indicating the continuation of the music.

G. Dufay, *Je languis en piteux martire*

2. A static and vertical state: plagal cadences

30

Cn

Ct

T

B

di,

di,

mi

na

do

mi

na

The image displays a musical score for four voices: Contratenor (Cn), Contralto (Ct), Tenor (T), and Bass (B). The score is in mensural notation with a common time signature. The lyrics are 'di, di, mi na do mi na'. The final measure (measure 32) features a plagal cadence, indicated by blue circles around the notes. The notes are: Cn (G4), Ct (F4), T (C4), and B (G2). The lyrics 'na do mi na' are written below the Bass staff.

G. Dufay, *Missa Ave Regina celorum*, 30-32

Conclusion

- The notion of cadence is a complex one. Tonalties has proven useful to annotate a large corpus, to confront our analytical viewpoints, and to explore some qualitative hypotheses based on quantitative data.
- Our analyses clarify: the complex links between the mi cadence and the interrupted cadence; the different tonal functions of the descending fourth cadence; and its harmonic implications.

- Seth J. Coluzzi, “Black Sheep: The Phrygian Mode and a Misplaced Madrigal in Marenzio’s Seventh Book (1595)”, *The Journal of Musicology* 30.2 (2013), 129-179
- Caleb Mutch, *Studies in the History of the Cadence*, Ph.D. Columbia University, 2015
- Caleb Mutch, “Blainville’s New Mode, or How the Plagal Cadence Came to be ‘Plagal’”, *Eighteenth-Century Music* 12.1 (2015), 69-90
- Liam Patrick Hynes-Tawa, *How the Phrygian Final Lost Its Finality*, Ph.D. Yale University, 2020
- Megan Kaes Long, “Reassessing the Plagal Cadence in Byrd and Morley”, *Music Theory Online*, 28.3, sept. 2022, <https://mtosmt.org/issues/mto.22.28.3/mto.22.28.3.long.html>
- Richard Freedman, Alexander Morgan, Daniel Russo-Batterham, *Musicologists and Data Scientists Pull out all the Stops: Defining Renaissance Cadences Systematically*, 2023, <https://hcommons.org/deposits/item/hc:59281/>