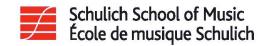
# Revisiting the Origins of the Italian Madrigal: With Machine Learning

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## The origins of the madrigal

#### Current consensus

- The madrigal emerges as a new genre of Italian-texted vocal music in the 1520s
- The Italian-texted works by Verdelot are madrigals
- It originated in Florence (and Rome?) in the 1520s

#### But where did it come from?

- The frottola (Einstein 1949)
- The chanson and motet (Fenlon and Haar 1988)
- Florentine song: carnival song, and improvised solo song (A. Cummings 2004)

# Finding the origins: what happened before Verdelot?

- Verdelot arrived in Florence in 1521
- Earliest sources of the madrigal

New focus: Florence, 1515-1522

## My hypothesis

The madrigal was deliberately created as a

- high-style genre of secular music
- that emulates the style of the sacred motet

#### Why?

- Musical sources
- Texts
- Musical style
- Cultural context (not today)

### What do sources tell us? Madrigals are the first Italian secular genre to be copied and printed in partbooks (previously used only for Masses and motets)

#### **Prints**

- Motetti e Canzone I (Rome, 1520), partbooks
- Pisano, *Musica sopra le Canzone del petrarcha* (Petrucci, Fossombrone, 1520) partbooks

#### Manuscripts

- Florence 164 (c. 1522), partbooks
- Chicago, Newberry Library (c. 1527) partbooks

Madrigals are called *Canzone* in the 1520s

# What do sources tell us? Madrigals (Canzone) and motets are included in the same sources

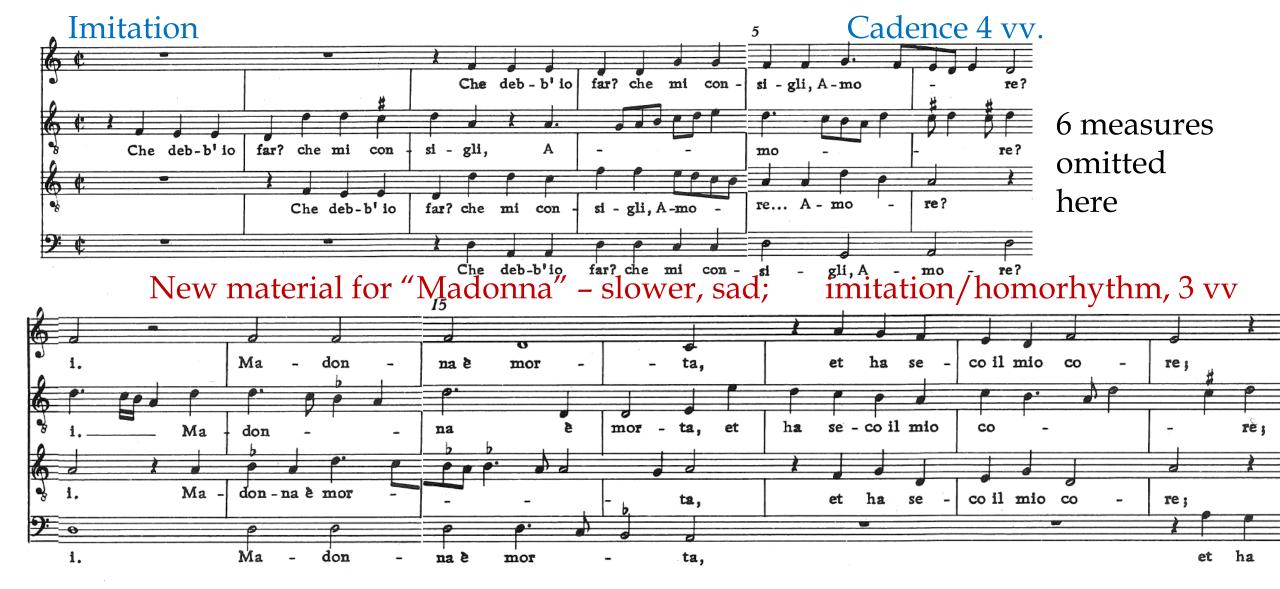
- Motetti e Canzone I (Rome, 1520), a lot of motets, a few madrigals
- Florence 164 (c. 1522), madrigals, villotte and frottole, chansons, and motets
- Chicago, Newberry Library (c. 1527); Verdelot madrigals and motets by many composers, including Verdelot

What do sources tell us? Madrigals are found in the first single-composer print for secular music (earlier single-composer prints are sacred Masses and laude)

• Pisano, Musica sopra le Canzone del petrarcha (Petrucci, Fossombrone, 1520)

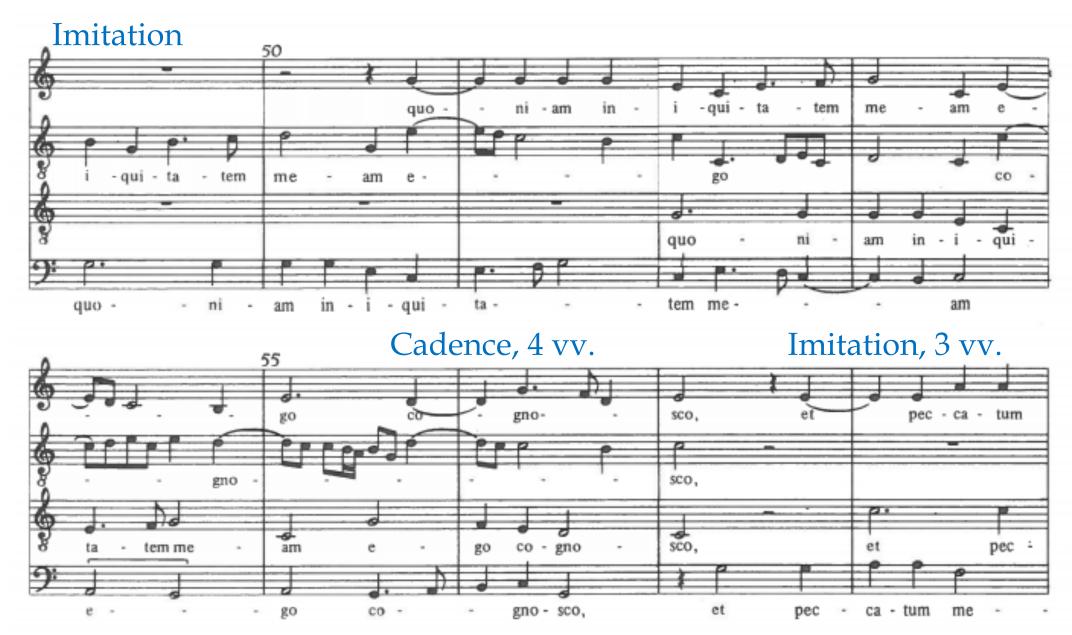
# Similarities between madrigals and motets

- Text: both are "high-style" serious genres
  - Latin-texted sacred music is at the top of the genre hierarchy (Tinctoris and Cortese)
  - Early madrigals set high-style Italian texts: mostly Petrarch, plus new texts
- Form: both are through-composed, and avoid schematic repetition
- Both have varied textures, including imitation and homorhythm



B. Pisano, Che degg'io far, Madrigal (from Pisano, Musica sopra le Canzone del petrarcha, 1520, and Florence 164, no. 12)

No schematic repetition, varied texture



Carpentras, Miserere mei deus, F 164, n. 78

## How can we test this hypothesis?

- Compare the music of different genres
  - as understood during the period

### Florence 164 (set of 4 partbooks); all for 4 voices Physical organization reveals genre distinctions between madrigals and other genres

Section divisions are shown by

- gathering structure
- blank pages between sections in partbooks

Part 1: 27 Madrigals

Part 2: 19 Villotte and Frottole

Part 3: 24 Chansons (not today)

Part 4: 12 Motets

No composer attributions; composer names are found in concordant sources

### Florence 164, Part 1: 27 Madrigals

#### Part 1A: Pisano

- 14 secure Pisano
- 5 probably Pisano

#### Part 1B: Sebastiano Festa

- 5 secure Festa
- 2 probably Festa

Added to the end of the section slightly later

Anon. (maybe Festa)

#### Florence 164, Part 2: 19 pieces, 13 Villotte, 4 Frottole

- 4 "Northern proto-villotte" (arrangements of Italian popular tunes by northern composers, from c. 1500)
- Isaac, Compere (*Che fa la ramazina*), Obrecht, Josquin (*Scaramella*) 6 Villotte (northern Italian polyphonic arrangement of a popular song)
  - 3 Pesenti
  - 2 F.P[atavino?]
  - 1 S. Festa, 1 Anon.

3 anon. Zibaldoni (quodlibets; a subgenre of the villotta)

- \_\_\_\_\_
- 4 Frottole (2 Tromboncino; 2 Anon.)
- 1 Unclassified (anon.) (a voci pari; imitative; literary text)

### Pesenti, Villotta, Quando lo pomo (quotes "O traditora"); Florence 164, no. 32

ben?

Imitation and homorhythm; repeated notes; cites popular song in Tenor



O

O

15

#### Florence 164, Part 4: 12 Motets

8 composed between 1485 and 1515

- 4 Josquin
- 3 Mouton
- 1 Isaac

4 composed c. 1515-20, composers associated with Medici popes in Rome

- 1 de Silva, 1 Carpentras (78)
- 2 Anon. (one may be by Medici Pope Leo X)

## Genre classification – using the computer

How can we describe the differences between genres in terms that a computer can understand?

Extract musical features that can be quantified, with

- jSymbolic 2.2, developed by Cory McKay
- Text and text-setting are NOT considered in jSymbolic

#### What is a "feature"?

- A piece of information that statistically characterizes a piece of music in a simple way
- Usually has a numerical value
  - Can be a single value, or it can be a set of related values
- Features can be automatically calculated by computers
  - From hundreds or thousands of pieces of music or dozens!
- Features can then be used to gain empirical insights:
  - Manually examined
  - Processed using statistical tools or machine learning, such as Weka

## Example: Range

• Range (Feature 1-D): Difference in semitones between the highest and lowest pitches



• Range = G - C = 7 semitones

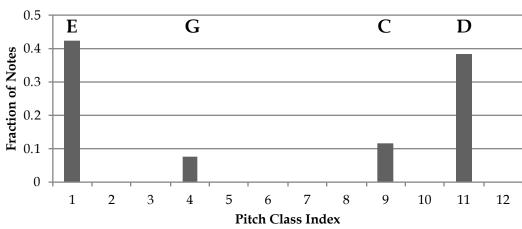
# Example: Pitch Class Histogram (set of related values

• Pitch Class Histogram (Feature 12-D): values represent the percentage of notes with a particular pitch class



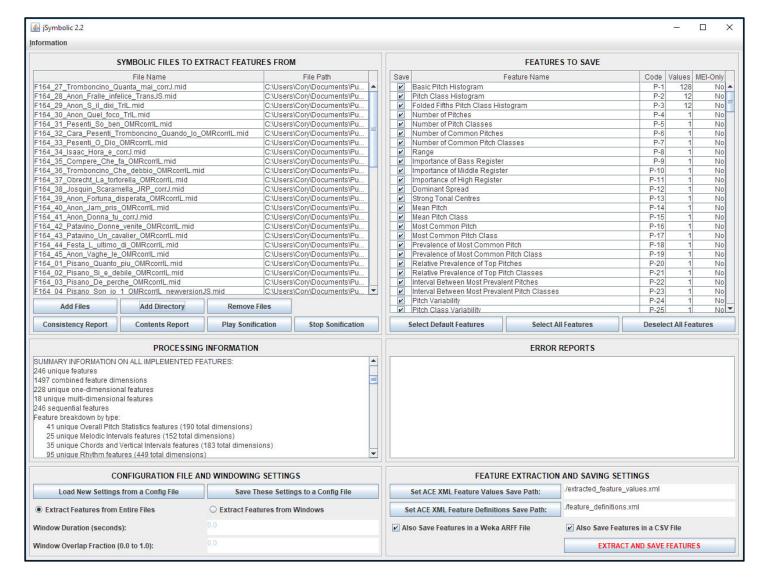
- Pitch Class Histogram: see graph
  - □ Note counts: C: 3, D: 10, E: 11, G: 2
  - $\square$  Most common note: E (11/26 notes)
    - Corresponding to 0.423 of the notes





# jSymbolic 2.2

- Software produced to automatically extract features
  - And develop new features
- In all, extracts a total of 1497 separate feature values
  - Pitch statistics
  - Melody + Horizontal intervals
  - Chords + Vertical intervals
  - Rhythm
  - Texture
  - Dynamics
  - Instrumentation



## jSymbolic 2.2

- More information (<a href="http://jmir.sourceforge.net">http://jmir.sourceforge.net</a>)
  - MedRen 2017: "Using Statistical Feature Extraction to Distinguish the Styles of Different Composers"
  - ISMIR 2018: "jSymbolic 2.2: Extracting Features from Symbolic Music for use in Musicological and MIR Research"

## Our experiment: pieces from F 164

• Began by constructing our dataset, consisting of 58 MIDI files:

Genre	Pieces
Pt. 2: Villotte&frottole	19
Pt. 1: Madrigals	27
Pt. 4: Motets	12

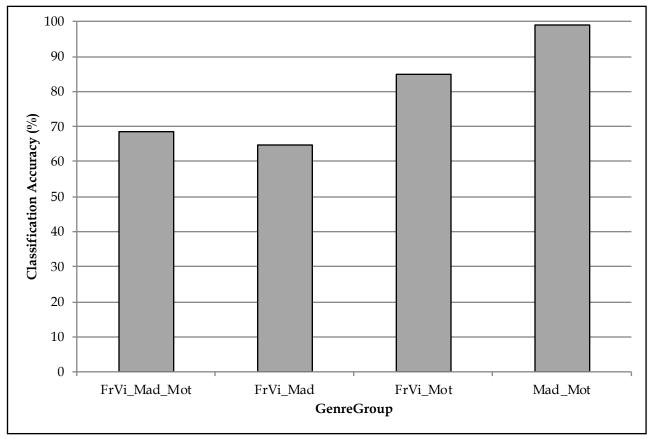
- Extracted features from each of these pieces using jSymbolic
  - Excluded features not relevant to this corpus
    - Associated with tempo, dynamics, instrumentation, etc.
  - 801 feature values were extracted per piece

## Methodology

- Used machine learning to teach a classifier to automatically distinguish the music belonging to each of the genres
  - Based on the jSymbolic features
  - Using Weka's SMO SVM implementation

### Genre Classification results

Genre Group	Classification Accuracy
Villotte&frottole vs. Madrigals vs. Motets	68.4%
Villotte&frottole vs. Madrigals	64.6%
Villotte&frottole vs. Motets	84.8%
Madrigals vs. Motets	99.1%



## First set of experimental conclusions

- The madrigals and motets are the most **different** genres
  - Because they can be easily distinguished with features and machine learning (99.1% success rate)
- Villotte&frottole and madrigals are the most similar genres
  - Because they are harder to tell apart (only 64.6% success rate)
- Villotte&frottole and motets are in between (84.8% success rate)
  - More similar than motets and madrigals
  - But less similar than villotte&frottole and madrigals

#### Caveats

- There are relatively few pieces in the dataset (58)
  - Statistical patterns found in this dataset may not necessarily generalize to all relevant music in the three genres
- There are relatively few composers represented (12 & 10 anon.)
  - Detected patterns may be linked to differences in composers' compositional style rather than genre
- Nonetheless, the results are certainly meaningful within the scope of this study

## But how do the genres differ?

• We can look at particularly important specific feature values . . .

## A priori expectations (1/3)

- What characteristics might an expert musicologist (Julie Cumming) expect to differentiate the genres?
  - Before actually examining the feature values
- Once formulating these expectations, we can then see if the feature data confirms or repudiates these expectations
  - Both are useful!

## A priori expectations (2/3)

- What do you think might distinguish the three genres?
  - Villotte&frottole vs. Madrigals vs. Motets
- According to our (a priori) expectations . . .

## A priori expectations (3/3)

- Length of piece?:
  - V&f shortest, then Madrigals, Motets longest
- Melodically repeated pitches:
  - Motets fewer; V&f + Madrigals more
- Variation in range between voices:
  - V&f more variety; Madrigals + motets less
- Variation in size of melodic leaps per voice:
  - V&f more variety; Madrigals + motets less
- Variation in number of notes per voice:
  - V&f more variety; Madrigals + motets less
- Number of voices sounding simultaneously:
  - V&f mostly 4; Motets mostly 1 to 3; Madrigals a mix of both

## Were our expectations correct?

- Length of piece:
  - V&f shortest, then Madrigals, Motets longest YES (strongly)
- Melodically repeated pitches:
  - Motets fewer; V&f + Madrigals more YES
- Variation in range between voices:
  - V&f more variety; Madrigals + motets less PARTLY
- Variation in size of melodic leaps per voice:
  - V&f more variety; Madrigals + motets less YES
- Variation in number of notes per voice:
  - V&f more variety; Madrigals + motets less NO
- Number of voices sounding simultaneously:
  - V&f mostly 4; Motets mostly 1 to 3; Madrigals a mix of both PARTLY

## Expectations vs. reality

- Variation in range between voices:
  - Expectation: V&f more variety; Madrigals + motets less
  - Reality: V&f + motets more variety; Madrigals less
- Variation in number of notes between voices:
  - Expectation: V&f more variety; Madrigals + motets less
  - Reality: Motets (much) more variety, then Madrigals, V&f least variety
- Number of voices sounding simultaneously:
  - Expectation: V&f mostly 4; Motets mostly 1 to 3; Madrigals a mix of both
  - Reality: V&f and Madrigals mostly 4; Motets mostly 3

## (Free) diving into the feature values

- We can also explore the feature data to see if it reveals unexpected insights as to which features are particularly effective
  - Based purely on the data itself, not on our expectations
- We used ten statistical techniques to find the features most consistently statistically effective at distinguishing the genres
  - We then manually examined these feature subsets to find the features likely to be the most musicologically meaningful

## Novel insights revealed (1/3)

- Madrigals vs. motets (99.1%):
  - Rhythm-related features are extremely powerful
- In particular:
  - Half notes (minims) and eighth notes (fusae) are both much more common (relative to other rhythmic values in a given piece) in madrigals
  - Series of notes of the same rhythmic value in a voice tend to be longer overall in madrigals, and also vary more in the number of notes in each series
  - Motets have more long notes (breves and longs)

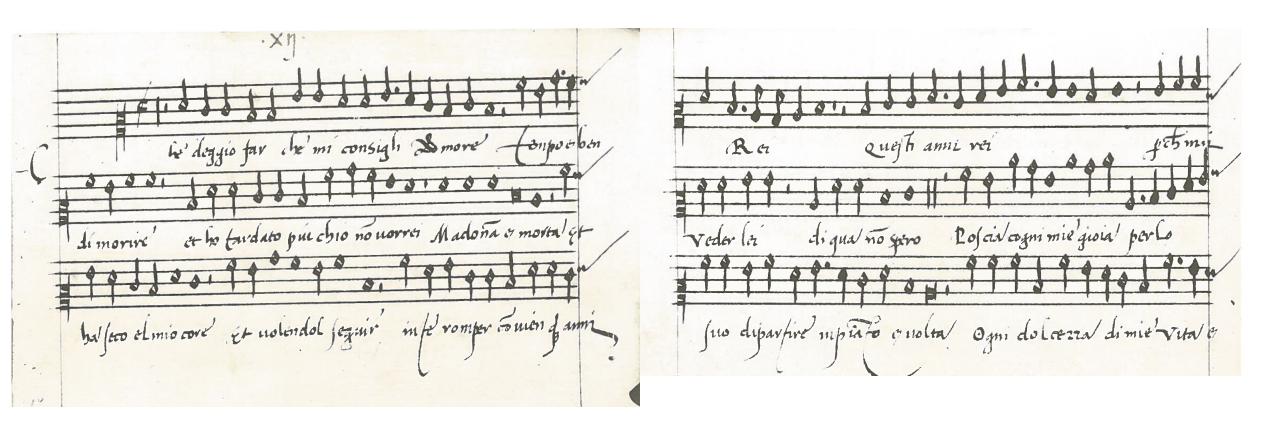
## Novel insights revealed (2/3)

- Villotte&frottole vs. madrigals (64.6%):
  - The differences are less pronounced, but there are still certain patterns, especially relating to rhythm
- Details:
  - Madrigals tend to have a greater difference between the shortest and longest note durations in a piece
    - Madrigals tend to have longer note durations in the lowest voice (relative to durations in other voices in the same piece)
    - The minimum rhythmic value in a piece tends to be shorter in madrigals

### Novel insights revealed (3/3)

- Villotte&frottole vs. motets (84.8%):
  - Features based on rhythm (and texture) dominate
- Details:
  - Note density is important once again:
    - Motets tend to have a much lower note density in the highest voice
    - The most common rhythmic value tends to be longer in motets
  - Rests are particularly significant:
    - Motets tend to have more rests in general
    - In particular, motets tend to have more points where at least one voice is silent while at least one other is sounding

# Madrigal, B. Pisano, *Che deggio far*, cantus Florence 164 no. 12 (madrigal section)



Carpentras, Miserere mei deus, F 164, n. 78 Altus (pt. 4, motets)



## Pesenti, Villotta, *Quando lo pomo*, Florence 164, no. 32 (villotta and frottola section), altus



#### Caveats

- The madrigal does share some features with the motet which lend themselves to the "high style"
  - Madrigals are longer than other secular Italian genres
  - All voices are similar in terms of the size of leaps; i.e. melodic style
- The motets mostly earlier than madrigals (affecting ranges, rhythm); a better comparison set might be later motets
- Some of the similarities between madrigals and motets (such as imitation) are things that jSymbolic does not yet include as features
- Many of the differences are related to text-setting practices for Italian and Latin

#### What did we learn?

- The particular musical characteristics an expert might think differentiate the genres are generally correct, but not perfect
- Rhythm is a key feature in genre identification

# What does jSymbolic tell us about the origins of the madrigal?

- I was wrong about many of the similarities between the madrigal and motet they are very different
- The **villotta** emerges as an important genre for the origins of the madrigal even though it has almost never been considered in this role before
- Cory's jSymbolic has forced me to reconsider my hypotheses, and taught us a great deal about a key moment in music history

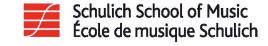
#### Thanks to:

- Ian Lorenz, Jonathan Stuchbery, and Vi-An Tran, for creating our symbolic corpus
- Zoey Cochran, for her ideas on the early madrigal
- Florentine libraries: the Biblioteca Nazionale Centrale and the Conservatorio di Musica Luigi Cherubini

SIMSSA : Single Interface for Music Score Searching and Analysis









Social Sciences and Humanities Research Council of Canada

Conseil de recherches en sciences humaines du Canada









### Our corpus: 12 composers, + 10 anon. pieces

Section:	1) Madrigal	2) V&F	4) Motet	Total
Pisano	19			19
Festa, S.	7	1		8
FP		2		2
Pesenti		3		3
Tromboncino		2		2
Anon	1	7	2	10
Compere		1		1
Obrecht		1		1
Isaac		1	1	2
Josquin		1	4	5
Mouton			3	3
Carpentras			1	1
de Silva			1	1
	27	19	12	58

# The First Madrigalists: Composers whose music is found in Florentine manuscripts

#### Bernardo Pisano (1490-1548)

- Trained in Florentine churches: the Duomo and Santa Annunziata
- Chapel master of the Duomo, 1512
- Also works with the Papal chapel in Rome under Leo X, 1514 **Sebastiano Festa** (c. 1490-1524)
- Active in Rome, connected with court of Leo X (Medici pope)

#### Philippe Verdelot (c. 1480-c. 1530?), French composer

- Venice (according to Vasari), then Rome in 1510s
- Arrives in Florence, 1521 (probably dead by 1530)

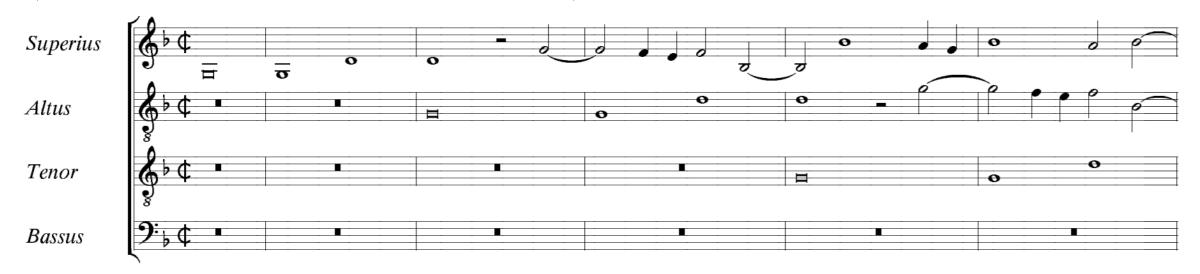
### Can we distinguish these genres in F164?

Genre (style height) Text (all Italian unless noted)	Dates of genre
Motet (high, serious) Latin, sacred; Psalms, prayers, bible, liturgy	1480 to 1520 (continues)
Frottola (middling; popular or serious) Popular to Petrarch; fixed forms, many stanzas	1490 to 1520
Northern proto-villotta (low; popular) <i>Popular song texts and melodies</i>	1490 to 1510
Villotta (low; popular) Northern dialect, quotes popular song, often obscene	1510 to 1530
Madrigal, Pisano & S. Festa (high; serious)  Petrarch and high-style new poetry	1515-1525 (continues)

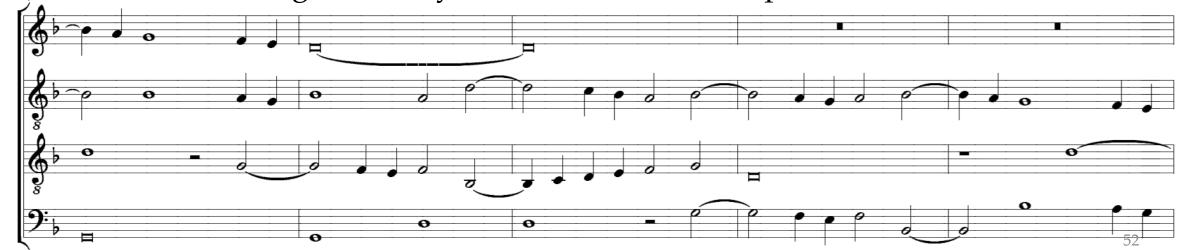
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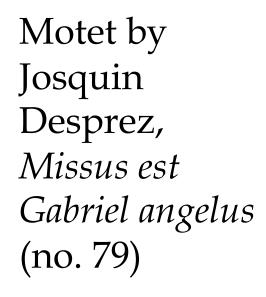
## Motet by Josquin Desprez, *Missus est Gabriel angelus* (F164 no. 79, from the JRP)



Imitation; wide ranges; variety of note values; few repeated notes, melismatic









Cantus and Bassus partbooks Florence, BNC, Magl. XIX 164-167



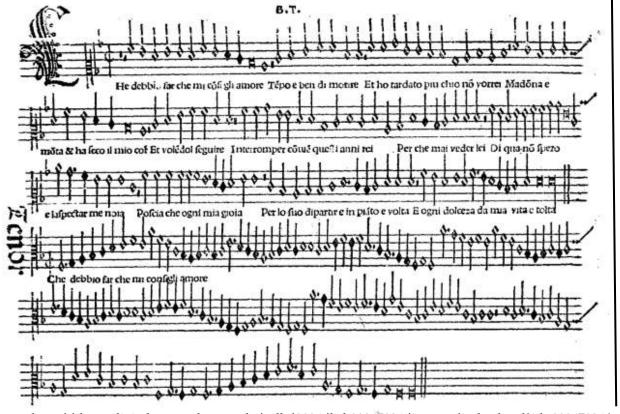
Frottola by Tromboncino, Che debb'io far (F164, no. 36)

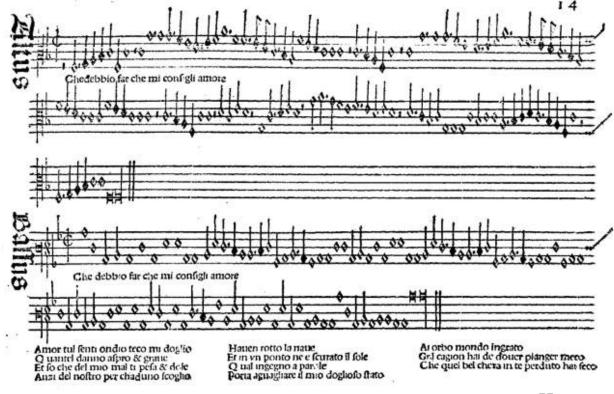
Ruffled homophony
Schematic repetition (aab)
Text fits in top voice only
Repeated notes in top voice



## Frottola in small choirbook format, one opening Petrucci, *Frottole Libro Septimo*, Venice 1507

Bartolomeo Tromboncino, *Che debbio far* (ff. 13v-14r); canzona by Petrarch; second stanza below Bassus





## Pesenti, Villotta, *Quando lo pomo* (quotes "O traditora"); Florence 164, no. 32

Imitation and homorhythm; repeated notes; cites popular song in Tenor



O

## Petrarca, no. 268, first stanza of canzone Che debb'io far? che mi consigli, Amore?

Che debb'io far, che mi consigli, Amore? Tempo è ben di morire		What must I do? What do you counsel, Love?	
		The time has truly come to die,	
ed ò tardato piú ch' i' non vorrei:		and I have lingered longer than I wish.	
Madonna è morta ed à seco il mio core,		My lady is dead, and my heart with her:	
e volendol seguire		and if I wish to follow,	
interromper conven quest' anni rei;		I must interrupt this cruel life,	
perché mai veder lei	b	since I have no more hope	
di qua non spero, e l' aspettar m' è noia:		of seeing her here, and waiting galls me.	
poscia ch' ogni mia gioia		Now all my joy	
per lo suo dipartire in pianto è volta,		has turned to weeping at her going,	
ogni dolcezza de mia vita è tolta.		all sweetness has been taken from my life.	

#### Sebastiano Festa, O passi sparsi (Petrarch), last line (4 times)

Found in 23 sources, until 1573. Used as the model for Masses by Lassus and Sermisy.



Deh, restate a veder qual è 'l mio male.

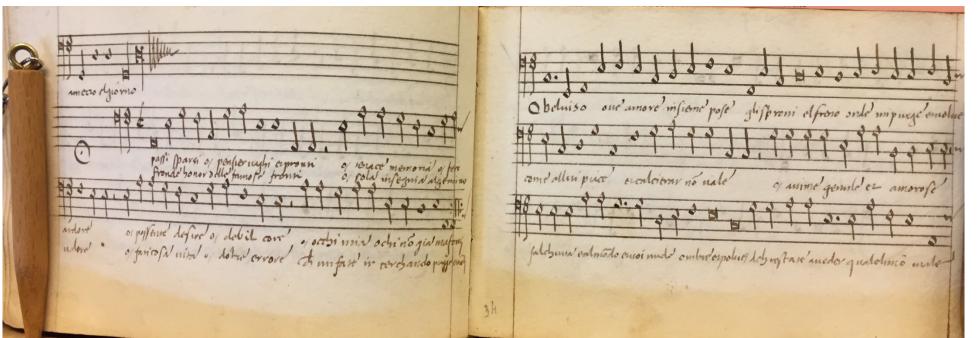
Ah, stay and see how great my suffering is.

All homorhythm, but also very expressive

F164, no. 25







Florence, BNC, Magl. XIX 164-167, no. 25.

### Genre and musical style

Musical genres of vocal music are characterized by

Text types

#### and

- Features of musical style, including
  - Form
  - Melody and text-setting
  - Texture
  - Counterpoint
  - Length