# Revisiting the Origins of the Italian Madrigal
## (*with machine learning*)

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## Medieval and Renaissance Music Conference
## Maynooth, Ireland, July 6, 2018

# 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

# Music Prints before Verdelot
## Thanks to I. Fenlon, J. Haar, and A. Cummings

## Naming of Genres: *Canzona* in 1520s; *Madrigale* 1530

**Prints (in or near Rome)**

- Pisano, *Musica sopra le Canzone del petrarcha* (partbooks, Petrucci, Fossombrone, 1520) (all Madrigals)

- *Motetti e Canzone I* (partbooks, Rome, 1520)

- *Libro primo de la croce*, choirbook, c. 1522 (surviving copy, later ed., Rome, Pasoti & Dorico, 1526)
  - Mix of frottole, villotte, and madrigals

# Music MSS before Verdelot
## Thanks to I. Fenlon, J. Haar, and A. Cummings

**Florentine Manuscripts (all from Florence)**

- Florence, Basevi 2440, choirbook, c. 1515-22; 2 sections:
  - music with multiple stanzas of text (frottole)
  - through-composed works (madrigals & villotte)
- Florence, BNC 164-167, partbooks, c. 1520-22 (4 sections)
  - Florence 164 or F 164 henceforth

# My hypothesis

The madrigal was deliberately created as a
- high-style genre of secular music
- that emulates the style of the motet

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

# What do sources tell us?
## Madrigals are the first secular genre to be treated like Latin-texted motets in prints and manuscripts

Copied and printed in partbooks (previously used only for Masses and motets)

- *Motetti e Canzone I* (Rome, 1520), partbooks

- Florence 164 (c. 1522), partbooks

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

- Chicago, Newberry Library (c. 1527) partbooks

# What do sources tell us?
Madrigals are the first secular genre to be treated like Latin-texted motets in prints and manuscripts

Madrigals and motets found 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 the first secular genre to be treated like Latin-texted motets in prints and manuscripts

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 texts: mostly Petrarch, plus new texts
- Form: both are through-composed, and avoid schematic repetition
- Both have varied textures, including imitation and homorhythm

Imitation                                                   5          Cadence 4 vv.

Che deb-b'io far? che mi con - si - gli, A-mo — re?

Che deb-b'io far? che mi con - si - gli, A — — mo — — re?

6 measures
omitted
here

Che deb-b'io far? che mi con - si - gli, A-mo — re... A - mo — re?

Che deb-b'io far? che mi con - si — gli, A — mo — re?

New material for "Madonna" – slower, sad;     imitation/homorhythm, 3 vv

15

i.          Ma — don — na è mor — — ta,        et ha se — co il mio co — re;

i. _____ Ma - don — — na      è mor - ta, et ha se - co il mio co — — re;

i.          Ma - don - na è mor — — — — ta,            et ha se — co il mio co — re;

i.          Ma - don — na è mor — ta,                       et ha

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 as a guide to genre

- Snapshot of notated musical culture in Florence c. 1520
- The concordant sources for each section confirm the genre attributions – madrigals are found in other sources devoted to madrigals, frottole are found in frottola prints…

# Madrigal, B. Pisano, *Che deggio far*, cantus Florence 164 no. 12 (Part 1, madrigal section)
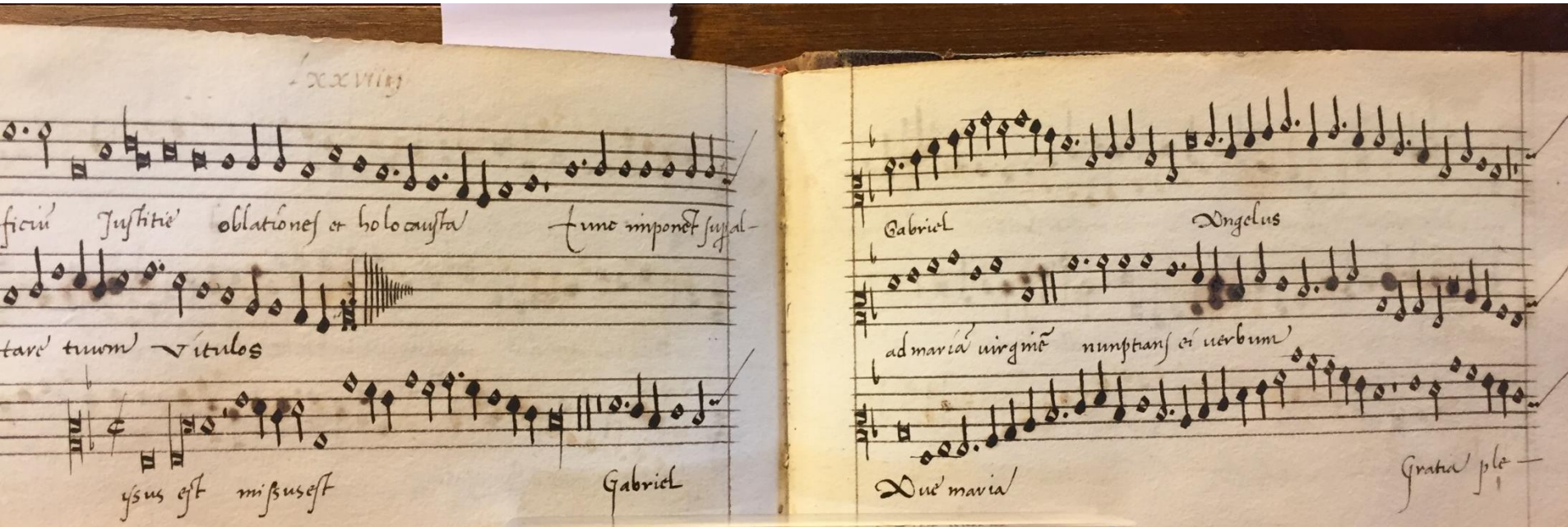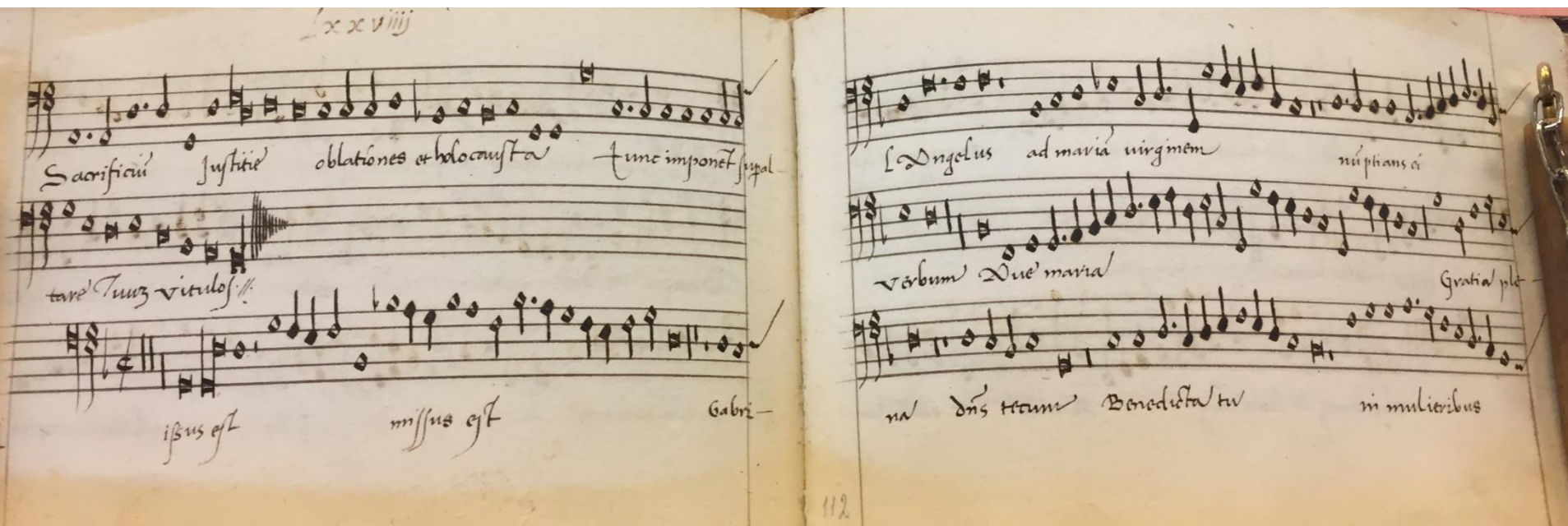
Motet by Josquin Desprez, *Missus est Gabriel angelus* (no. 79)

Cantus and Bassus partbooks Florence 164, Part 4, motet section

# 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)

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- 4 Frottole (2 Tromboncino; 2 Anon.)

- 1 Unclassified (anon.) (*a voci pari*; imitative; literary text)

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

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



Petrucci Frottole XI (1514)
Antico Frottole II (1516 or 1520)
Florence 230, 337, and 2440
Venice 10653-6

# Florence 164, Part 4: 12 Motets

Composed between 1485 and 1515
- 4 Josquin
- 3 Mouton
- 1 Isaac

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)

# 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 |

# 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

# 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
  - Most common note: E (11/26 notes)
    - Corresponding to 0.423 of the notes



26
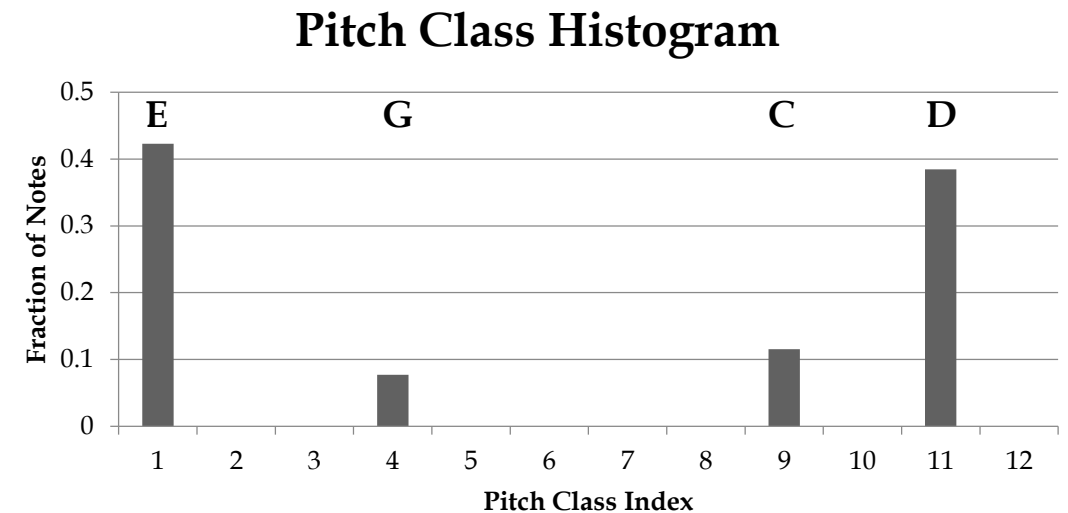
# jSymbolic 2.2

- Software we have produced for automatically extracting features
  - And developing 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 (http://jmir.sourceforge.net )

  - 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 <span style="color:red">machine learning</span> 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% |
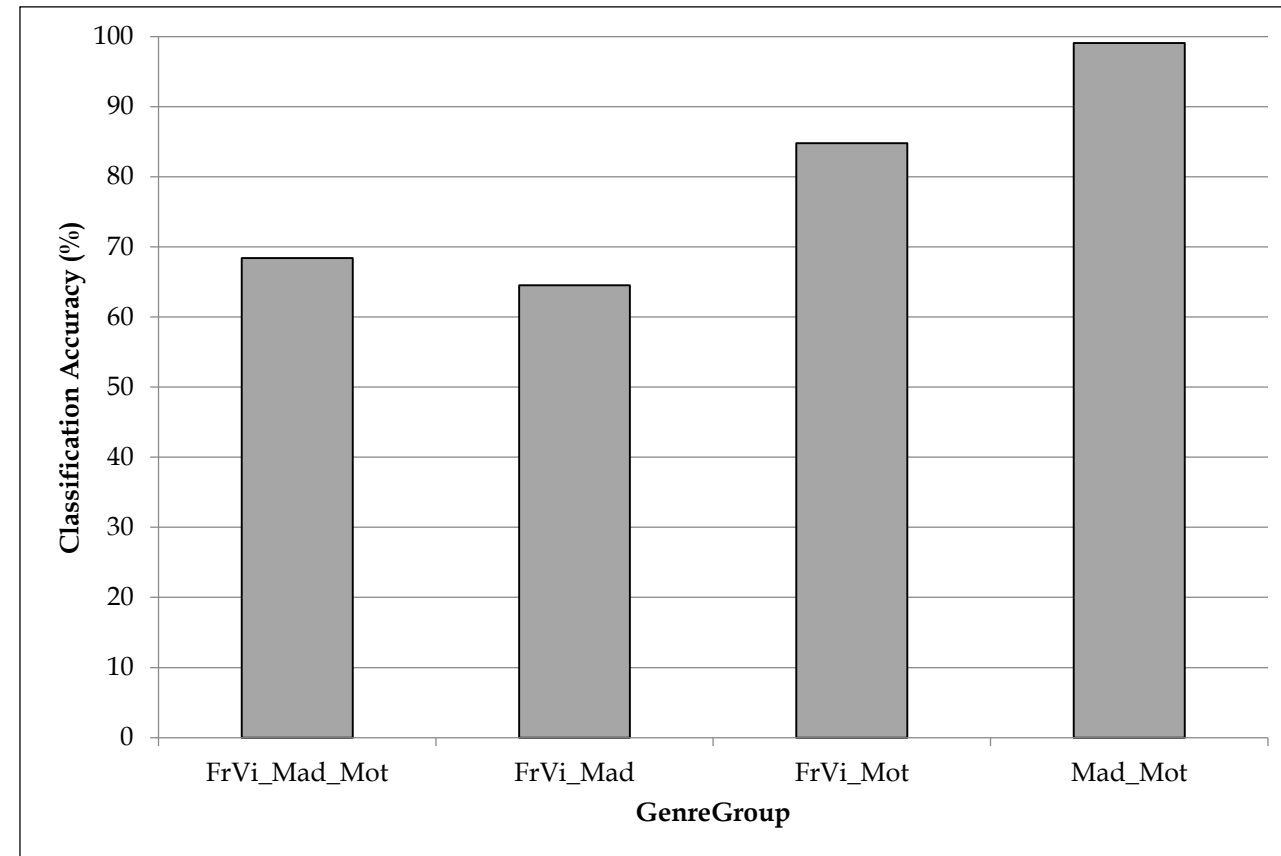
# First set of experimental conclusions

- 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 <span style="color:darkred">few pieces</span> in the dataset (58)
  - Statistical patterns found in this dataset <span style="color:darkred">may not necessarily generalize</span> to all relevant music in the three genres

- There are relatively <span style="color:darkred">few composers</span> represented (12 & 10 anon.)
  - Detected patterns may be linked to <span style="color:darkred">differences in composers' compositional style</span> 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 <span style="color:red">confirms</span> or <span style="color:red">repudiates</span> these expectations
  - <span style="color:red">Both</span> are useful!

# *A priori* expectations (2/3)

- What do <span style="color:red">you</span> 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
  - Madrigals tend to have a higher note density
  - 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 much lower note density in the highest voice
  - 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 lower variability in note density in a given piece
    - 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

# Second set of experimental conclusions

- The particular musical characteristics an expert might think differentiate the genres are generally <span style="color:red">correct, but not perfect</span>

- The (statistically) most effective features at distinguishing the three genres are <span style="color:red">overwhelmingly rhythmic</span>

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

- Rhythm is a key feature in genre identification
- 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
  - The villotta emerges only slightly earlier than the madrigal, though it has roots in the "northern proto-villotte" from the turn of the century
  - It is associated with northern Italy, but it is often found in Florentine manuscripts
  - It appears both in frottola and madrigal sources, suggesting that it has a flexible generic identity

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

- I was (at least partly) wrong about similarities between the madrigal and motet – they are very different
- However – 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
- Some of the similarities that I saw (such as imitation) are things that jSymbolic does not yet include as features;
- The motets mostly earlier than madrigals (affecting ranges, rhythm)
- Cory's jSymbolic has forced me to reconsider my hypotheses, and taught us a great deal about a key moment in music history

# Thank you!

And 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