MUSICAL-LINGUISTIC ANNOTATIONS OF *IL LAURO SECCO*

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ABSTRACT

The *Italian madrigal*, a polyphonic secular a cappella composition of the 16th century, is characterised by a strong musical-linguistic relationship, which has made it an icon of the 'Renaissance humanism'. In madrigals, lyrical meaning is mimicked by the music, through the utilisation of a composition technique known as *madrigalism*. The synergy between Renaissance music and poetry makes madrigals of great value to musicologists, linguists, and historians—thus, it is a promising repertoire for computational musicology. However, the application of computational techniques for automatic detection of madrigalisms within scores of such repertoire is limited by the lack of annotations to refer to. In this regard, we present 30 madrigals of the anthology *Il Lauro Secco* encoded in two symbolic formats, MEI and **kern, with hand-encoded annotations of madrigalisms. This work aims to encourage the development of algorithms for madrigalism detection, a composition procedure typical of early music, but still underrepresented in music information retrieval research.

1. INTRODUCTION

The *Italian madrigal* of the 16th century is a secular polyphonic vocal composition characterised by the use of *madrigalisms*, a composition technique that mimics the linguistic content of the lyrics (e. g., emotional concepts such as happiness or sorrow) through the music [14]. This synergy between poetry and music shows the important role that the arts played in the development of the 'Renaissance humanism' [29]. Given the intellectual and cultural repercussion of this philosophical movement in Western Europe [13], madrigals evoke high interest for musicological, linguistic, and historical research. Yet, for the comprehension of madrigals, advanced knowledge of the Italian language and poetry, as well as music analysis expertise and knowledge of *mensural notation* [1] are essential. Since music historians, literary scholars, and librarians not always have all these abilities, the development of automatic systems for musical-linguistic synergy detection within madrigals would assist them in analytical, pedagogical, and cataloguing tasks.

The application of machine learning techniques to early music is restricted by early music being mainly conserved in scanned copies of the original, i. e., no symbolic (machine-readable) information is available. To address this limitation, Optical Music Recognition (OMR) has shown promising results in the automatic generation of symbolic representations of such repertoire [6]. Nevertheless, in the framework of automatic analysis within symbolically encoded scores, for the development of successful systems able to automatically interpret composition procedures, appropriate annotations of such techniques are essential. Despite the large amount of scores from early music repertoire freely available on-line, symbolically encoded or not, labeled early music is still missing. Our work represents an initial contribution to address this lacuna, by presenting the symbolically encoded transcription and annotated representation of 30 madrigals of the *Il Lauro Secco* anthology [21]. A total of 120 scores are presented, 60 in MEI and 60 in **kern—30 of each annotated [1].

With the presented work, we aim at encouraging the development of algorithms for pattern recognition that would pursue identification of musical-linguistic synergies, as e. g., madrigalisms. This will advance automatic analysis techniques, whose practical applications could help researchers from diverse fields (e. g., musicology, linguistics, and history) by assisting them in the evaluation of artistic Renaissance manifestations. The manuscript is laid out as follows: an overview of related work (Section 2); an evaluation of musical-linguistic connections in the Italian madrigal and in the presented repertoire (Sections 3 and 4); a description of the annotation methodology (Section 5); an outline of the annotated repertoire (Section 6); finally, conclusions and future work (Section 7).

2. RELATED WORK

Given the musical, literary, and historical value of the Italian repertoire of the late 16th and early 17th centuries, some initiatives, such as *Tasso in Music Project* [25] [2] or *The Marenzio Online Digital Edition* – MODE [3], spend great effort in making available online symbolic representations of such repertoire. Even though analytical tools are

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[1] `https://github.com/SEILSdataset/SEILSdataset`
[2] `http://www.tassomusic.org/`
[3] `http://www.marenzio.org/about-mode.html`

Figure 1: Example of Contrapunctal madrigalism (CON) in Giovanelli's madrigal. The word *foco* (fire) is mimicked by a contrapunctal texture where the five voices are involved: C (Canto) and Q (Quinto) perform the motive 1 (highlighted in red), in which the word *foco* is displayed by a melisma; A (Alto), T (Tenor), and B (Basso) perform the motive 2 (in blue for T and B), being considered the contrary motion for A (in green).

provided by these initiatives, such as text extraction, word counting, or graphic representation of pitch and rhythm, the symbolically encoded scores, presented in a variety of formats, such as MEI [27][4] or **kern [15], do not contain annotations of the musical content. This may limit, e. g., the evaluation of the performance of analytical toolkits, such as Humdrum Toolkit [15][5] and music21 [7][6], since no ground truth is provided.

Ground truth is essential in the development of algorithms for music information retrieval. Due to this, datasets with annotated information have been developed in order to support a variety of machine learning tasks, as e. g., OMR [22], or harmonic analysis [8]. With the rise of the world-wide web, crowd-sourcing has become a very effective strategy to collect annotations [9]. Indeed, within the framework of digital score libraries, this has been considered for web-based annotation tools [26] as well as to collaboratively perform hand-written transcription [4]. Nevertheless, the annotation of musical content could require a musicological expertise, as e. g., harmonic analysis [8], or the identification of melodic similarities [28] which would make a collaborative annotation system impracticable, thus leading to consider only a limited number of annotators.

3. RHETORIC & MUSIC IN THE ITALIAN MADRIGAL

Rhetoric is the discipline that, through an efficient codification of the discourse (either spoken or written), achieves to convince the audience. Having a consolidated tradition from the times of the ancient Greece [2], in the 16th century, this discipline has been directly applied to music, laying the foundation of *Musica Poetica* [5]. This stylistic movement is founded in a close collaboration between poetry and music, by highlighting the emotional content of the text through the use of musical-rhetoric figures, which will evolve in the 17th century into the *Affektenlehre*, i. e.,

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[4] http://music-encoding.org/
[5] http://www.humdrum.org/
[6] http://web.mit.edu/music21/

the 'Doctrine of the affections' [17]. As these musical-rhetoric principles are characteristic of the Italian madrigal from the 16th century, such 'word painting' strategies are also known as *madrigalisms* [24]. In madrigalisms, the use of 'chromatism' is progressively introduced, a practice typical of Monteverdi, who at the beginning of the 17th century coined that known as *Seconda pratica* [3]: a new conception of composition in which the music should be governed by the words, thus justifying dissonances and melodic movements that were considered unacceptable till that time, according to Zarlino's harmonic rules [30].

Yet, the madrigal of the 16th century is characterised by madrigalisms which relate to the alternation of musical textures, and not to chromatism, as typical for the madrigal of the 17th century. The madrigal of the 16th century, since based on strong musical-linguistic synergies, differs clearly from other contemporary musical genres such as *frottola*, in which such 'word painting' strategies are not present [14]. Indeed, the artistic value of this madrigal relates also to the high qualification of poets, composers, and interpreters involved in such artistic representation, though to be interpreted in high status social reunions, i. e., in the court [20]. In this regard, the music of the madrigal, in contrast to the *frottola*, shows a more free representation of the text, highlighting its content (usually related to pastoral, sentimental, and erotic themes) through virtuous musical writing [12]. Thus, the essential point of the Italian madrigal of the 16th century is that the composer puts the music into the same artistic level as the poetry [14].

The *Il Lauro Secco* anthology, published for the first time by Angelo Gardano in 1582 at Ferrara (Italy) [18], is a good example of such a repertoire, since both music and lyrics were created by some of the most reputable composers and poets of the time [20]. Furthermore, it was intended to be interpreted in the court of Ferrara, by the *Concerto delle donne* [10], a vocal ensemble of professional singers, which rapidly became an example for other contemporary courts, transforming Italy, for the first time, into the center of music in Europe [14]. Moreover, *Il Lauro Secco* was conceived as a unitary anthology with a common theme where music and poetry of all the madrigals were expressively created for the anthology itself, whose purpose was to be a wedding present for Laura Peverara [11,19], one of the singers of the *Concerto delle donne*.

4. MUSICAL-LINGUISTIC SYNERGIES IN *IL LAURO SECCO*

In the madrigals of *Il Lauro Secco* ('The Dry Laurel'), the meaning of the lyrics is expressed mainly through textural 'musical metaphors' and diatonic writing. Thus, the 'word painting' procedures are musically driven by the alternation of diverse musical textures, which we will identify as contrapunctal, homorhythmic, and antiphonal; the melodic development flows through step-wise motion, i. e., the melody is performed in conjunction, so each note is followed by the immediate upper or lower note. For this, rhythmic-melodic 'motifs' are chosen to represent each verse of the lyrics, and are placed into specific musical tex-

Figure 2: Example of homorhythmic madrigalism (HOM) in Giovannelli's madrigal. The voices C (Canto), A (Alto), Q (Quinto), and T (Tenor) perform the same musical-linguistic pattern simultaneously to musically mimic the lyrics' content. Notice that all the voices are written in treble clef (for T subctave).

tures. These motifs are characterised by specific rhythms and melodic contours that musically mimic the meaning of the lyrics, both linguistically (e. g., love as positive and hate as negative), and metaphorically (e. g., the word green as a synonym for life); thus, we refer to these motifs and their related lyrics as 'musical-linguistic patterns'. The musical texture determines how the musical-linguistic patterns interact between them across the different voices. Since other 'word painting' strategies, as e. g., those based on melodic contour and chromatism [14], are not as representative of the presented anthology as those based on musical texture, only madrigalisms which relate to the alternation of musical textures will be taken into account for the annotations. For an evaluation of more 'typical' madrigalism, as those based on chromatism, repertoire from the 17th century should be considered.

4.1 *Madrigalisms* based on Contrapunctal Texture

In contrapunctal *madrigalisms*—CONs, the same musical-linguistic pattern is staggered along the timeline over the different voices: Canto (C), Alto (A), Quinto (Q), Tenor (T), and Basso (B), from the highest to the lowest. In Figure 1, an example of CON is given. The extracted passage is composed considering two different motifs: motif 1 highlighted in red (voices C and Q), motif 2 highlighted in green (voice A) and blue (voices T and B). Motif 2 in voice A is displayed in contrary motion, i. e., a melody in opposite direction w. r. t. the voices T and B.

In this madrigalism, the word *foco* (fire) is mimicked by music as a dynamic and confused state, as it relates to fire as a physical phenomenon (and its typical instability) as well as a metaphor of *love*. The dynamism and confusion inherent of this concept is enhanced through a contrapunctal texture (most typical composition technique to create movement) as well as through the use of two contrasting motifs. The first of these is characterised by fast rhythm (made up of eighth-notes) and rising 'melismatic prosody' (a single syllable of text is sung through several different notes), whereas the second is characterised by a slower rhythm and descending 'syllabic prosody' (each syllable
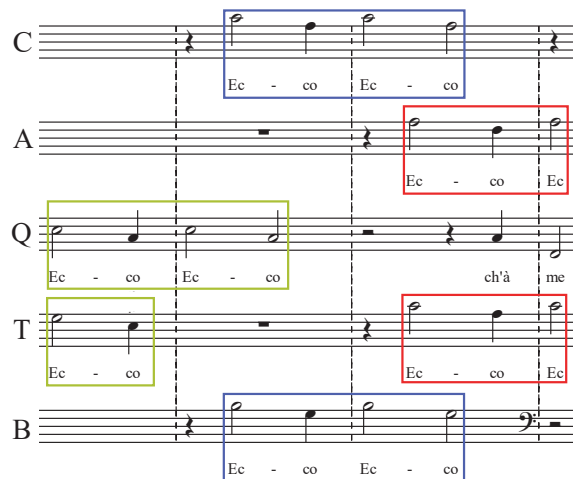

Figure 3: Example of antiphonal madrigalism (ANTIF) in Massaino's madrigal. The musical-linguistic pattern is displayed alternatively by couples of voices: Q (Quinto) and T (Tenor)—in green, C (Canto) and B (Basso)—in blue, A and T—in red, highlighting the word *eco* (similar to 'echo') by a musical metaphor. C, A, Q, and T are written in treble clef (for T suboctave), B in tenor clef, i. e., C–clef in the fourth line from the bottom.

of the text corresponds to a different note).

4.2 *Madrigalisms* based on Homorhythmic Texture

In homorhythmic madrigalisms—HOMs, a given musical-linguistic pattern occurs simultaneously in the different voices. In the identification of HOM, rhythmically characterised musical-linguistic patterns must be considered, regardless of the melodic contours, since in homorhythmic textures, melodic changes in voices are essential for creating harmonic relationships between voices, so no characteristic melodies would be found. In Figure 2, homorhythmic texture is used to represent the sentence *come unica Fenice* (as the only one Phoenix) in music. This sentence is a metaphor of reciprocal love, so the composer utilises HOM to mimic the stillness related to the stability typical of this emotional state. This quiet atmosphere is encouraged by the use of step-wise motion in all the voices.

4.3 *Madrigalisms* based on Antiphonal Texture

In antiphonal *madrigalisms*—ANTIFs, a given musical-linguistic pattern (usually performed by two voices simultaneously) is displayed by alternating 'entries' through the different voices, creating an acoustic effect similar to 'echo'. ANTIFs could be identified as a texture at the mid-point between counterpoint and homorhythm, since the consecutive repetition of a musical-linguistic pattern is displayed sometimes before the previous has concluded (as in contrapunctal texture), and this is displayed in different voices simultaneously (as in homorhythmic texture). Yet, ANTIFs are characterised by a clear alternation of the musical-linguistic pattern entries, which are mainly performed by a couple of voices, thus showing a texture not so confused as in CON, and less dense as in HOM.

In Figure 3, antiphonal texture is used to highlight the similarity between the word *ecco* (interjection used to

Figure 4: Engraved version of the annotation in MEI for the first madrigalism (CON) of Giovanelli's madrigal. Two motifs (CON1 and CON2), one displayed in contrary motion (inv), and a melisma are indicated (cf. Figure 1).

claim attention), and *eco* (acoustic phenomenon for which a sound, through the reflections, is repeatedly perceived, i. e., 'echo'). Here, the 'word painting' procedure is based on the acoustic metaphor generated by the phonetic similarity between the two words. This is a typical example of ANTIF, where each repetition of the musical-linguistic pattern (which consist in two repetitions of the word *ecco* musicalised by a syllabic motif based on a descending third) starts just before the previous has finished and is performed alternatively by different couples of voices.

5. ANNOTATION METHODOLOGY

5.1 Encoding formats

We present 30 madrigals of the *Il Lauro Secco* anthology transcribed in modern notation and encoded in MEI and **kern format. For both formats, the annotated and not annotated symbolic scores (cf. subsections 5.2 and 5.3) are included—120 symbolic representations in total, 60 for each format (30 annotated). Both representations have been generated from the Music XML representation of the repertoire given in [21]. The MEI representation has been generated through the on-line Music XML converter `Verovio` [23] [7], whereas **kern files have been produced by using the **xml2hum** compiled program of `Humdrum-extras` toolkit [16] [8]. Conversion errors were manually corrected; given the difficulty to find several annotators with the adequate expertise, the 30 madrigals were annotated by only one expert (one of the authors). Aware of the limitations due to taking into account one single annotator, we will focus on the development of an annotation methodology which adequately describes the considered composition strategies; yet, the presented annotations might be subject to some bias. Notice that both, the original Music XML file and the newly presented symbolic transcriptions in MEI and **kern, take

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[7] `http://www.verovio.org/musicxml.html`
[8] `extras.humdrum.org/man/xml2hum/`

into account the accidentals of the original source, something relevant to consider since in early music, even though some accidentals are not written, they might be considered when performing the repertoire. In this regard, when playing the MEI and **kern files, some dissonances should not be considered as 'real' indications of the composer, but just as the result of performing a 'diplomatic', faithful transcription of the source. A transcription which contains cautionary accidentals is included in *finale* and *pdf* formats in [21].

5.2 Annotation in MEI

For the annotation of the madrigalisms in MEI, the function <harm> has been considered, which visually engraves the annotations above each staff. For each voice, each single musical-linguistic pattern within a madrigalism has been marked by a starting and ending point, indicated by ' * ', followed by the name of the madrigalism, i. e., CON, HOM, and ANTIF (cf. Figure 4). Additional composition strategies have also been indicated:

Melisma (mel): When several notes are performed for a syllable of the text (cf. Figure 4 upper staff). Notice that typical embellishments, i. e., ornaments added to a note to 'briefly' decorate it are not considered a *melisma*.

Inversion (inv): When the melodic line of a musical-linguistic pattern is displayed in contrary motion w. r. t. the 'reference', i. e., the first presentation of such musical-linguistic pattern (cf. Figure 4, second staff from the top).

Acephalous (acef): When a musical-linguistic pattern starts without the initial part present in the reference. See, e. g., CON in Marenzio's madrigal at measure 27.

Multiple voices: Double and triple voices, i. e., voices that perform simultaneously the same musical-linguistic pattern, are intrinsic of HOMs and ANTIFs. However, this procedure may also be considered in CONs—when a musical-linguistic pattern is performed simultaneously by more than one voice; yet, it is possible to perceive the contrapunctal texture. Such voices have been indicated as 'CONdouble' or 'CONtriple' (see, e. g., the CON of Gabrieli's madrigal at measure 12). Notice that 'anticipations' and 'retardations' (i. e., when one of the voices, performed simultaneously, starts before or finishes after the others), since typical of madrigalisms, have not been taken into account for the annotation.

Repetition (rep): When a musical-linguistic pattern is repeated in the same voice within a madrigalism, this has been indicated as *rep*. When a whole madrigalism is repeated, this has been indicated as *CONrep*, *HOMrep*, and *ANTIFrep*. Notice that the end of madrigalisms is usually denoted by rests, and their repetition uses to be performed by a different combination of voices. See, e. g., the HOM of Fronti's madrigal at measure 19 (four voices) and its repetition at measure 23 (five voices).

Variation (var): When a musical-linguistic pattern is perceived as similar to the reference, due to rhythmic-melodic aspects still present but with modifications that goes beyond minimal melodic alterations, which would be typical

**kern	**text	**kern	**text	**kern	**text	**kern	**text	**kern	**text	**cdata-harm
*staff5	*staff5	*staff4	*staff4	*staff3	*staff3	*staff2	*staff2	*staff1	*staff1	*
=1-	=1-	=1-	=1-	=1-	=1-	=1-	=1-	=1-	=1-	=1-
*clefF4	*	*clefGv2	*	*clefGv2	*	*clefG2	*	*clefG2	*	*
*k[]	*	*k[]	*	*k[]	*	*k[]	*	*k[]	*	*
*M4/4	*	*M4/4	*	*M4/4	*	*M4/4	*	*M4/4	*	*
1r	.	2g\	Nel	1r	.	1r	.	4r	.	<CON_5v+2mot
.	.	.	.	.	.	.	.	4g/	Nel	.
.	.	4.f\	fo-	.	.	.	.	8a\L	fo-	.
.	.	.	.	.	.	.	.	8b\J	.	.
.	.	8f\	co	.	.	.	.	8cc\L	.	.
.	.	.	.	.	.	.	.	8dd\J	.	.
=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2
1r	.	4e\	d'un	1r	.	2g/	Nel	8ee\L	.	.
.	.	.	.	.	.	.	.	8ff\J	.	.
.	.	4e\	bel	.	.	.	.	8gg\L	.	.
.	.	.	.	.	.	.	.	8ee\J	.	.
.	.	2d\	lau-	.	.	4.a/	fo-	2ff#\	.	.
.	.	.	.	.	.	8a/	co	.	.	.

Figure 5: **kern annotation for the CON at the beginning of of Giovanelli's madrigal, in which five voices (5v) and two motifs (2mot) are involved. Notice that the annotation would be visually displayed above the first staff, in the same position as *CON1 (cf. Figure 4).

in order to prevent dissonant collisions. See, e. g., Massaino's madrigal at measure 50.

Imitation (imit): When a voice within a madrigalism 'freely' imitates a musical-linguistic pattern, usually by repeating single elements taken from it, such as a rhythm and/or melodic extracts, and by repeating words or by anticipating the next verse. See, e. g., the first madrigalism (ANTIF) of Perue's madrigal at measure 2–5.

Libero (lib): In CON and ANTIF, when all the voices perform the same verse of the lyrics in 'free musical imitation' among them, i. e., since no specific rhythmic-melodic pattern is associated to the textual verse, no musical-linguistic pattern can be identified as reference. In HOM, this indicates that a madrigalism starts and finishes in homorhythm but in its central area, the voices present rhythmic variations that disrupt their perfect vertical alignment; see, e. g., Fronti's madrigal at measure 71.

Different motifs: When a verse of the text is musicalised by different musical motifs within the same madrigalism; this has been identified with a different number, e. g., CON1 and CON2 (cf. Figure 4).

Diminution (dim): When a musical-linguistic pattern is performed in rhythmic diminution, i. e., the rhythm displayed is divided by half w. r. t. the reference. See, e. g., the last madrigalism of Giovanelli's madrial at measure 62.

5.3 Annotation in **kern

For the annotation of madrigalisms in **kern, the **harm spine has been considered, which visually displays the harmonic annotations below the staff, where the lyrics are located in the presented repertoire. In order to avoid collision with the lyrics, and since our intention is not to annotate harmonic content, we have engraved the annotations above the first staff from the top, by using the command 'cdata', i. e., **cdata-harm (cf. Figure 5). For each madrigalism, the starting and ending point has been identified as ' < ' and ' > ', respectively. When a madrigalism starts before

the previous has finished, i. e., there is a overlap between both, ' <<>> ' has been considered. In addition to these, other elements have been indicated:

(i) The number of voices, i. e., for CON and HOM the voices participating (from 1v to 5v); for ANTIF the alternating entries (e. g., four entries—4v). When in CON 'multiple voices' are involved (cf. Section 5. 2), these were also indicated (e. g., one doubled voice—1doub).

(ii) The combination among textures: HOM + imit and ANTIF + imit—when the majority of the voices are homorhythmic or antiphonal and one performs imitatively (see, e. g., the first madrigalism of Perue's madrigal); HOM + CON and ANTIF + CON—when the majority of the voices are homorhythmic or antiphonal and one performs the same musical–linguistic pattern in counterpoint.

(iii) The number of motifs considered, when 'different motifs' (cf. Section 5. 2) have been used to musicalise a verse of the lyrics (e. g., two motives—2mot).

(iv) The repetitions of a madrigalism are indicated as <CONrep, <HOMrep, and <ANTIFrep (cf. Section 5. 2).

6. ANNOTATIONS ASSESSMENT

6.1 Musical Evaluation

In the presented repertoire, we identified a total of 437 madrigalisms across the 30 madrigals (mean of 14.5, and standard deviation (std) 3.7): 199 CON (mean of 6.6, std 2.9); 139 HOM (mean of 4.6, std 3); 59 ANTIF (mean of 1.9, std 1.9); 40 combination between the previous—comb (mean of 1.3, std 1). In Table 1, the distribution of madrigalisms across the 30 madrigals displays the typical alternation between contrapunctal and homorhythmic textures, which is shown by almost all the madrigals presenting both CON and HOM. Even those in which HOM has not been considered, i. e., Correggio's and Strigio's madrigals, present a high number of multiple voices, which decreases the sensation of movement typical of CON; this is

	Alberti	*Bardi*	*Belli*	*Bertani*	*Correggio*	*Da Locca*	*Eremita*	*Fiorino*	*Fronti*	*Gabrielli*	*Giovanelli*	*Ingegneri*	*Isnardi*	*Luzzaschi*	*Macque*	*Manara*	*Marenzio*	*Massaino*	*Milleville*	*Mosto*	*Perue*	*Pigna*	*Porta*	*Spontone*	*Stabile*	*Strigio*	*Vecchi*	*Virchi*	*Wert*	*Zoilo*
CON	11	8	5	8	8	9	2	3	4	5	8	8	9	14	3	3	8	10	7	10	4	6	3	7	4	11	5	6	5	5
HOM	2	4	8	1	–	7	7	5	15	5	5	2	4	3	3	3	7	5	8	7	9	1	3	6	3	–	3	5	5	3
ANTIF	1	–	1	–	–	4	3	–	–	3	–	1	3	2	1	6	7	4	1	2	–	2	2	2	7	–	2	1	2	2
comb	2	2	–	1	1	1	3	3	–	–	2	2	1	–	3	4	2	–	1	1	1	1	2	2	–	2	1	–	2	–
TOTAL	16	14	14	10	9	21	15	11	19	13	15	13	17	19	10	16	24	19	17	20	14	10	10	17	14	13	11	12	14	10
voice$_{mul}$	3	6	4	3	5	3	–	1	1	2	–	2	6	5	–	1	6	8	3	6	–	5	3	4	1	5	–	2	1	2
<<>>	2	–	–	1	2	3	–	1	1	1	–	4	1	2	1	2	–	2	1	3	3	1	–	–	1	5	–	–	1	–
rep	–	–	3	–	2	4	3	2	5	1	4	1	1	6	1	2	2	–	6	–	–	–	–	3	2	1	–	–	3	–
mot$_{dif}$	1	–	–	1	–	–	–	–	–	3	1	2	2	3	1	–	1	–	2	–	–	–	–	–	–	2	3	1	–	–
mel	2	–	5	5	1	–	4	2	–	–	5	–	10	22	13	–	30	2	–	–	–	14	3	3	1	13	3	4	–	–
# ms	77	61	66	75	71	84	69	63	87	65	82	81	99	130	71	71	100	96	81	92	50	75	63	69	72	96	70	79	96	66

Table 1: Occurrence for each madrigal of CON, HOM, ANTIF, and textural combinations (comb). Total number of madrigalisms, overlap between these (<<>>), their repetitions, and length of the madrigals in measures (# ms). The use within madrigalisms of multiple voices (voice$_{mul}$), different motifs (mot$_{dif}$), and melisma (mel), is also given.

also observed in madrigals with more CON than HOM (see e. g., Luzzaschi's madrigal amongst others).

The madrigals with more HOM than CON are rare, and present the opposite tendency, i. e., a low number of multiple voices, as e. g., those from Fronti and Perue. The use of ANTIF, even less typical than the other madrigalisms, is characteristic in the musical writing of Marenzio, Stabile, and Manara. As it would be expected, the use of repetitions is mostly related to longer madrigals, with the exception of the one by Belli that—only 66 measures long—presents three repetitions of a madrigalism. However, this is related to the fact that Belli's madrigal presents a majority of HOM, which commonly are shorter than CON. This is clear in Perue's madrigal, i. e., the shortest (50 measures), presenting 14 madrigalisms (9 of them HOM), whose compactness is increased by the use of 3 overlaps between madrigalisms. For general statistics of the dataset, such as total number of notes or accidentals, see [21].

6.2 Linguistic Evaluation: Melismas

One of the most interesting musical-linguistic synergies within madrigals is the use of *melisma* (cf. Section 5.2). By annotating the presented repertoire, we have identified 142 melismas, which usually are displayed within CON. Indeed, apart from Macque's madrigal, which presents 13 melismas and only 3 CON, all the other madrigals with a high number of melismas are also characterised by presenting a high number of CON. Yet, we should also consider that in Macque's madrigal, there are 3 combined madrigalisms, which implicitly present contrapunctal texture. Furthermore, the relationship between counterpoint and melismatic writing should not be taken as a rule but only as a tendency, as shown by Mosto's madrigal, with 10 CON and no melismas. The purpose of a melisma is to highlight a word, thus this rhetoric 'artifact' relates most of the times to linguistic concepts that have an important meaning within a madrigal.

The evaluation of the melisma in the presented repertoire makes the unity of the *Il Lauro Secco* anthology evident, whose madrigals have been composed expressively for the creation of the anthology itself. The majority of the linguistic concepts highlighted through melisma are therefore mostly the same across the whole anthology, and can be clustered into three categories: (i) Nature, i. e., words such as *leaf* or *green*, making often a meaning game with the name of the addressee of the anthology—'Laura' and 'lauro' (*laurel* in Italian); (ii) Emotion, i. e., words such as *love*, *happiness*, or *rage*; (iii) Elements of nature, i. e., words such as *fire* or *wind*. Out of the 142 melisma, 46 relate to nature and are displayed across 11 madrigals, the most recurrent words being *lauro* (laurel), *verde* (green), *foglie* (leaves), and *rami* (branch), as well as synonyms of those; 42 relate to emotions, displayed across 8 madrigals through recurrent words such as *lieto* (happy), *amore* (love), and *ira* (ire), and synonyms of those; 34 relate to elements, displayed across 9 madrigals through recurrent words such as *venti* (winds), *acqua* (water), and *fuoco* (fire), as well as synonyms and other related words.

7. CONCLUSIONS AND FUTURE WORK

Our study presents symbolically codified scores and annotations, in **kern and MEI format, of 30 madrigals of the anthology *Il Lauro Secco*. The evaluation of the annotations confirms the unity of the presented repertoire, by displaying similarities across the different madrigals, related in a particular way to musical-linguistic synergies, such as the use of *melisma* to highlight specific concepts. The relationships between poetry and music inherent in the presented repertoire, and consistently presented across pieces by different composers, make it promising for the application of machine learning techniques aimed at the detection of similarities among composers. Our future goals include to continue the annotation of the anthology by other experts, in order to offer an appropriate 'gold standard' to refer to. We also plan to further evaluate the presented repertoire through available toolkits for automatic music analysis, as e. g., music21. In addition, we will also work on symbolic annotations of similar repertoires, in order to promote the advancement of algorithms for automatic analysis of scores in early music, especially considering the automatic recognition of music-linguistic synergies.

8. ACKNOWLEDGEMENT

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