Appendix C

This section contains the analysis of the individual pieces of the experiment. This includes the pieces of the ND dataset, for which the dissonance filter (DF) was kept deactivated during the experiment, and the D dataset, where the DF was used. For each piece, I list the corrections done by the experimenter and compare them to the ones found in the corresponding CPDL transcription (when available) using the scripts presented in the "Methodology and Evaluation Procedure" section of the dissertation. When there are differences, I evaluate which version is better by looking into the orange labels left in each version and comparing the versions in terms of imitative textures. I also consulted Professors Julie Cumming and Peter Schubert when I was not able to determine the best solution (this is especially true for masses 10 and 13). For some of the pieces where the experimenter's corrections could have been better, I provide comments about how the DF could be useful in finding a better solution. For the ND dataset, I also comment on what happens when activating the DF on the experimenter's file, specifically looking into: what orange labels are left after the experimenter's corrections, if these orange labels are true illegal dissonances or not (e.g., rearticulations, which are not handled well by the DF), and whether these labels would have identified any errors still present.

Some of the pieces listed below include figures to illustrate certain issues. All the figures present examples using modern clefs. In most of them, the superius is in G clef, the alto and tenor are in suboctave G clef (though the '8' indicating the suboctave is not rendered), and the bass is in F clef. There are a few exceptions, with Missa 7 having the bass also in suboctave G clef; Missa 9, 15, and 16 having the superius and alto in G clef and the tenor and bass in suboctave G clefs; and Piece 25 with both tenor and bass in F clef. All these exceptions are indicated by a "note about clefs" clarification at the end of the corresponding figures.

Mass 7: Missa sine nomine by Palestrina (XVI c.)

This sixteenth-century mass does not have a transcription in CPDL. However, its concordant source—the *Missarum liber secundus* published in 1567 (RISM A/I P 660)—is transcribed in IMSLP.[1] The two auto-contained units of this mass, shown below, were part of the D dataset.

Missa7.4_Sanctus1

"Sanctus" section (f.38v–39r) of Sanctus movement. No transcription in CPDL.

Dataset D: 29 measures | 4 voices | 0 illegal dissonances | Correction time: 1 minutes

- The experimenter did not make any corrections.
- There is no CPDL transcription of this piece against which to compare the scored-up OMR file to check for editorial corrections to the original source. However, looking at IMSLP's RISM A/I P 660 transcription (concordant source), no corrections were needed. There are a few extra measures at the end in RISM A/I P 660.

Missa7.4_Sanctus2

"Benedictus" and "Osanna" sections (39v–41r) of Sanctus movement. No transcription in CPDL.

Dataset D: 50 measures | 4 voices | 52 illegal dissonances | Correction time: 10 minutes

- The experimenter extended the last note in the superius (from breve to a note five times as long) and shortened the last note in the alto and bass (from longs to breves). These are all corrections that coincide with IMSLP's transcription of the piece in the concordant source RISM A/I P 660; moreover, the final long is understood to extend to the end of the piece in mensural notation.
- The experimenter realized that a note in the beginning of the bass should be shortened by a minim, so she shortened the E3 breve in measure 14 of the bass to a dotted semibreve. However, she noticed that some illegal dissonance labels were still left (see Figure 1). In the IMSLP's transcription of

[1] IMSLP's PDF transcription of RISM A/I P 660 can be found at https://imslp.org/wiki/Missa_sine_nomine_à_4_(Palestrina%2C_Giovanni_Pierluigi_da), with this mass starting on page 41. The Sanctus movement starts in page 49.

this piece in RISM A/I P 660, the note that is shortened by a minim comes a bit earlier (measure 11, just before the ligature). Figure 2 shows how this earlier correction results in no illegal dissonance labels. This shows that making corrections and seeing their effects on the following orange labels can help the user to locate the best place for the correction.

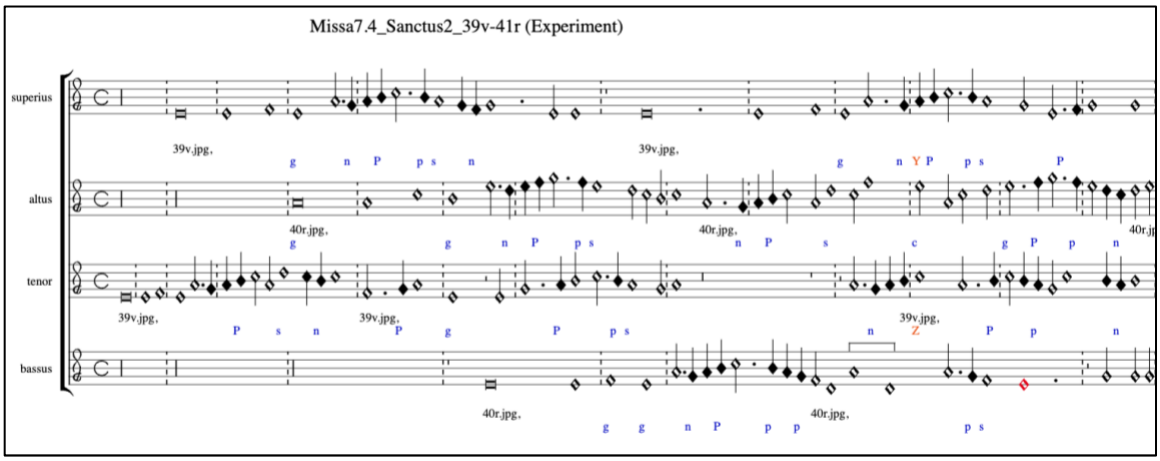


Figure 1: Corrections done by the experimenter in Missa7.4_Sanctus2. The red note was a breve in the manuscript, and she shorten it by a minim. This correction did get rid of a lot of illegal dissonance labels that followed this note, but it did not manage to get rid of the two illegal dissonance labels shown in the image.
Note about clefs: *The three lower voices are in suboctave treble clef.*

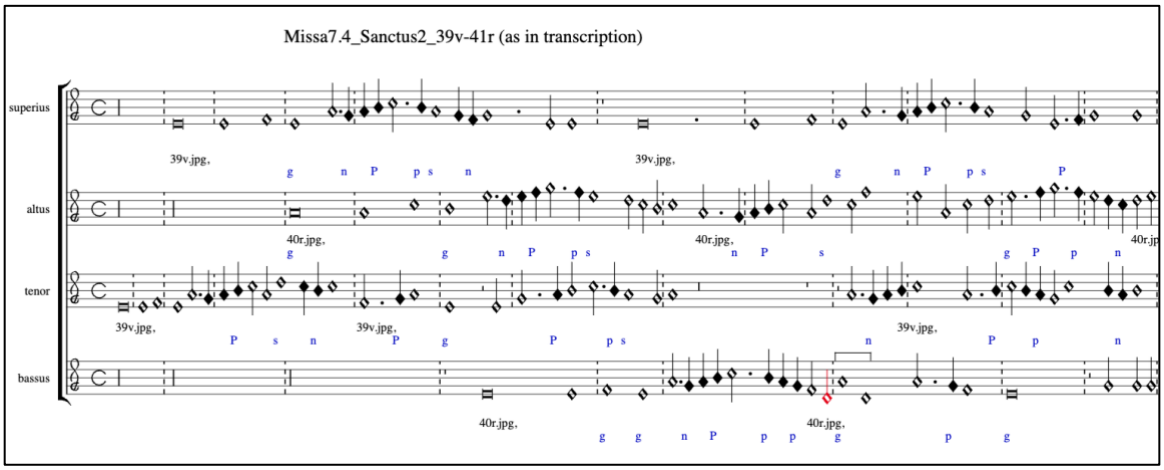


Figure 2: Correction based on the IMSLP transcription of the same piece shown in Figure 1 as found in the concordant source RISM A/I P 660. The note that was shortened by a minim is marked in red. This correction eliminates all illegal dissonance labels.
Note about clefs: *The three lower voices are in suboctave treble clef.*

Mass 8: Missa Pere de nous by Colin (XVI c.)

This sixteenth-century mass is transcribed in CPDL.[2] Only one auto-contained unit of this mass was used in the experiment, which is part of the ND dataset.

Missa8.4_Sanctus0

Full Sanctus movement (f.52v–53r). Transcription in CPDL.

Dataset ND: 29 measures | 4 voices | 9 illegal dissonances | Correction time: 8 minutes

- The only edit made by the experimenter was to extend the last note of the tenor.
- Perfect match with the CPDL transcription based on a microfilm of the same manuscript.
- When using the DF on the experimenter's corrected file, there is one orange label remaining, a 'y' in the F semiminim in the superius (see Figure 3). This note is marked as illegal because it is attacked against the passing G in the tenor and, therefore, it is ok to ignore the label.

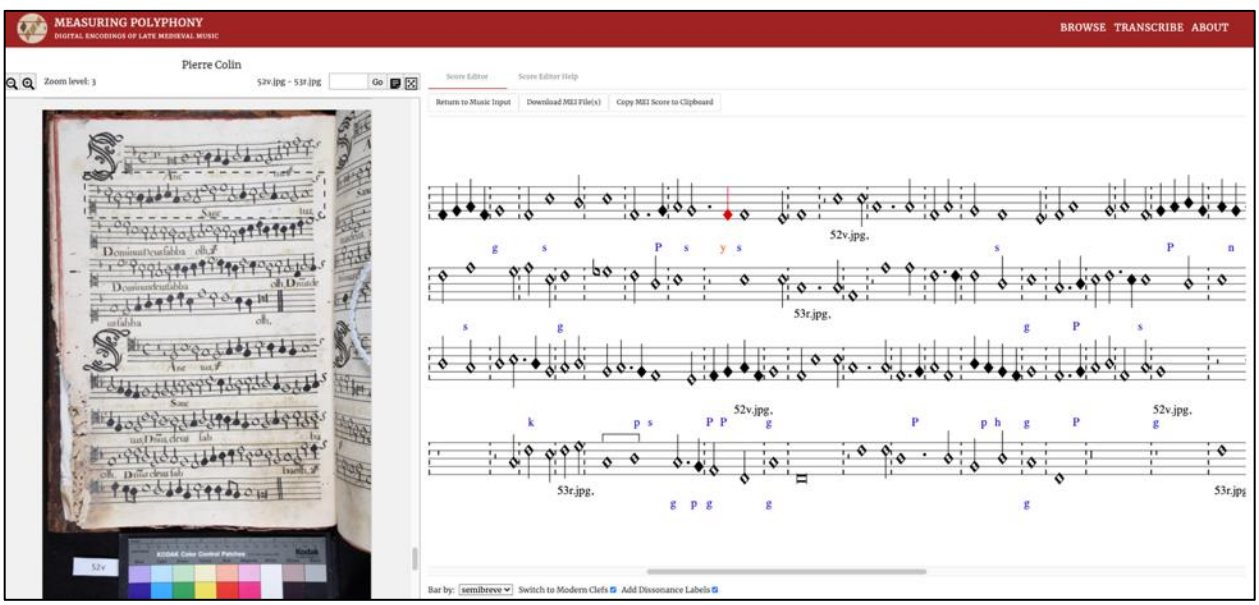


Figure 3: If using the DF, this is the only orange label that appears in the Missa8.4_Sanctus0 after the experimenter's corrections. ***Key signature:*** *with a B flat.*

[2] https://www.cpdl.org/wiki/index.php/Missa_cum_quatuor_vocibus_(Pierre_Colin)

Mass 9: Missa de 3° tono by Ceballos (XVI c.)

This sixteenth-century mass is distributed into both D and ND datasets. There is a transcription of the complete mass in CPDL.[3]

Missa9.2_Gloria1

"Et in terra pax" section (f.56v–58r) of the Gloria movement. Transcription in CPDL.

Dataset ND: 44 measures | 4 voices | 46 illegal dissonances | Correction time: 13 minutes

- Scribal error, the experimenter added a semibreve rest in the bass (at the end of measure 6, before the minim rest). A correction for the scribal error can be seen in the manuscript, added by another hand (see Figure 4).[4] The experimenter discovered this error by looking at the end of the section and cadences, and then looking at the counterpoint.

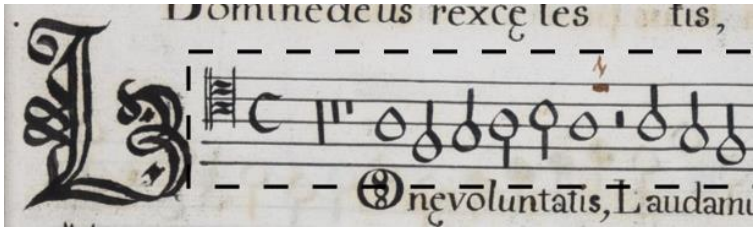


Figure 4: Beginning of the bass line in Missa9.2_Gloria1.

- Perfect match with the CPDL transcription based on a microfilm of the same document.
- If applying the DF on the scored-up OMR file, one can see many orange labels (forty-six in total). The missing semibreve rest happens a bit before the first orange label in the piece (see Figure 5). Once this missing rest is inserted (as the experimenter did), this orange label and all the others disappear. This is an example of a piece in the ND dataset where using the DF could have saved time as the error was detected by the DF; looking for errors just before the first orange label, rather than looking at the counterpoint of the whole piece, could expedite the process.

[3] https://www.cpdl.org/wiki/index.php/Missa_tertii_toni_(Rodrigo_de_Ceballos)

[4] During the OMR stage, I did not manually add this rest because I could not be sure if this added rest was right unless I presented the piece as a score, so I left it for the editorial correction stage of the workflow.

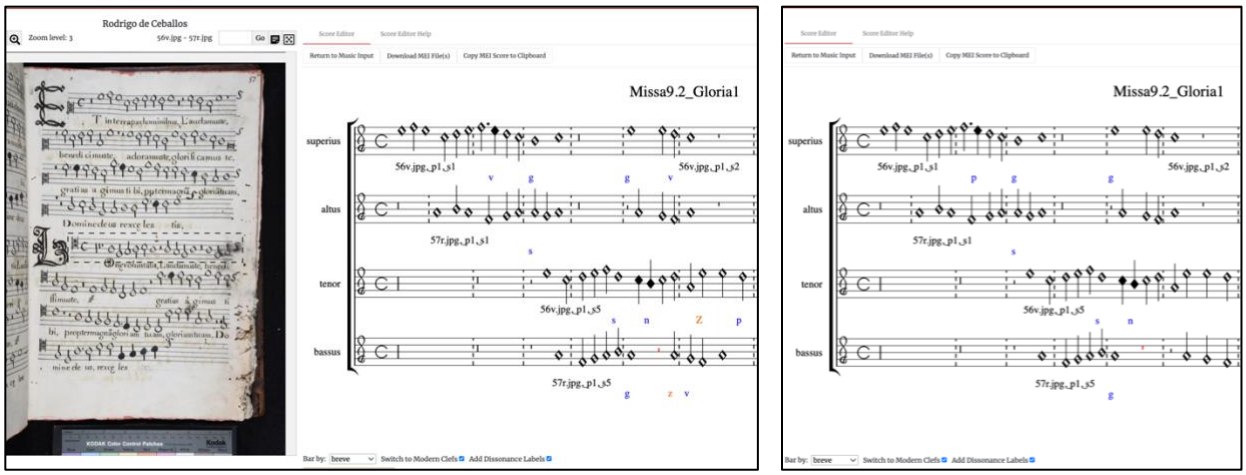


Figure 5: Orange labels at the beginning of Missa9.2_Gloria1 before and after the experimenter's correction of the missing semibreve rest.
Note about clefs: *The superius and alto are in treble clef, while the tenor and bass are in suboctave treble clef.*

Missa9.2_Gloria2

"Qui tollis peccata" section (f.58v–60r) of the Gloria movement. Transcription in CPDL.

Dataset ND: 37 measures | 4 voices | 8 illegal dissonances | Correction time: 17 minutes

- OMR error, the experimenter added a minim rest in the superius (beginning of measure 32). She found this error by looking at cadences, then looking for an error in counterpoint, and finally looking at the manuscript around that spot to see if there was a symbol missed by the OMR process or if she needed to make an editorial correction.
- Perfect match with the CPDL transcription.
- If applying the DF on the scored-up OMR file, the experimenter could have noticed this error with the help of the orange labels (see Figure 6) by finding the first orange label, checking the manuscript around that spot, and realizing that a rest appearing in the manuscript was missing in the rendered file. After her correction, one can see two orange labels remaining, both are the results of a rearticulation (see Figure 6).

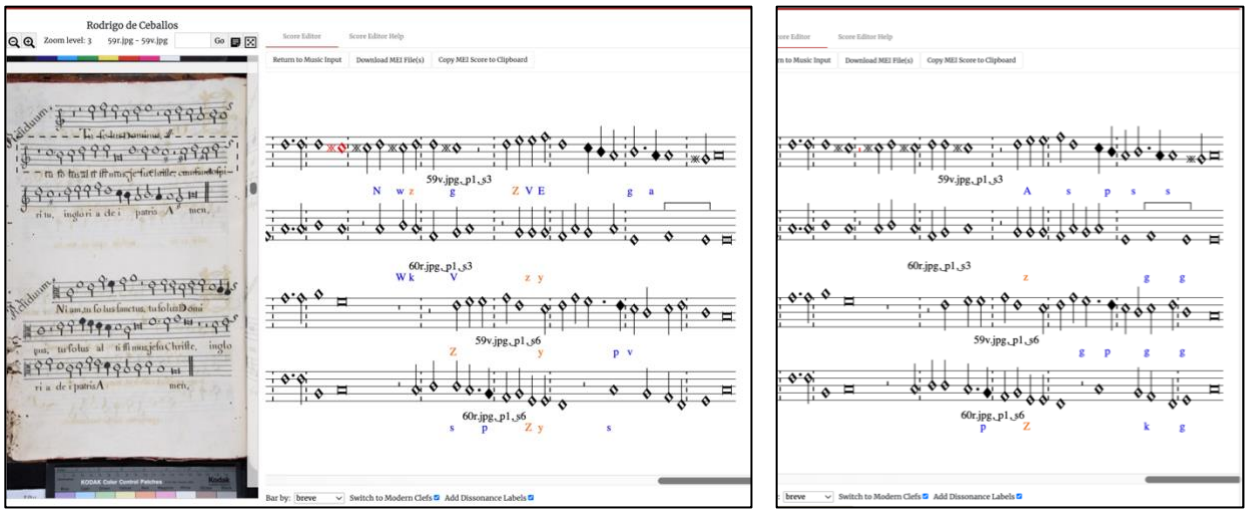


Figure 6: Orange labels in Missa9.2_Gloria2 before and after the experimenter's correction of the missing semibreve rest.
Note about clefs: *The superius and alto are in treble clef, while the tenor and bass are in suboctave treble clef.*

Missa9.6_AgnusII0

Full Agnus II movement (f.70v–71r). Transcription in CPDL.

Dataset D: 35 measures | 5 voices | 14 illegal dissonances | Correction time: 7 minutes

- The experimenter extended the last note in both the alto and bass, which matches the CPDL transcription.
- The experimenter also changed a D minim in the contratenor into a C to eliminate an illegal ‘Z’ label and make it consonant (see red note in Figure 7, left and middle panel). In CPDL’s transcription, this note was left as it is (as a D). The illegal dissonance was a bit confusing in this passage as it is the result of a rearticulated note. Considering the two D minims in the tenor as a rearticulated note, that ‘Z’ is not a true illegal dissonance and, instead, the Ds behave as the agent of the suspended C in the superius (see Figure 7, right panel).

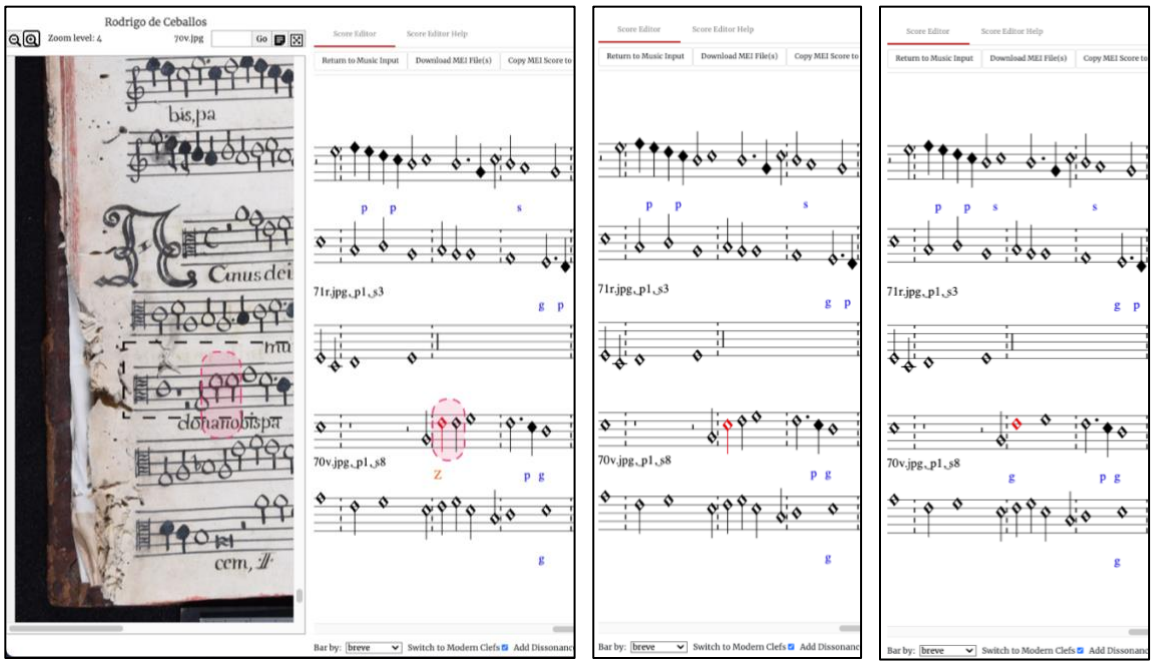


Figure 7: Missa9.6_AgnusII0's original reading (left), experimenter's correction (middle), and substitution of the two rearticulated minims by a single semibreve (right). The 'Z' in the rearticulation misled the experimenter to try to correct the first D minim, moving it down to a C to make it consonant. However, as evident by the right panel, the r-articulated D was behaving as an agent to a suspension in the superius, which is not shown in the left panel.
Note about clefs: *From bottom up, the voices are in F clef, suboctave G clef, and the three upper voices are in G clef.*

- One orange label remained on the experimenter's file, but it can be ignored since it happens in a stepwise passage of semiminims (see Figure 8).

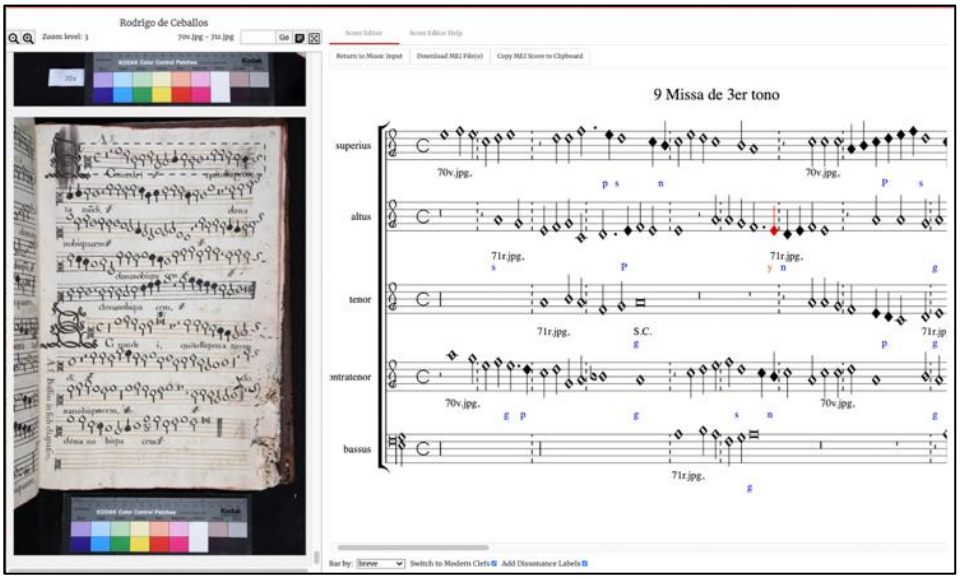


Figure 8: The one orange label left by the experimenter in Missa9.6_AgnusII0.
Note about clefs: *From bottom up, the voices are in F clef, suboctave G clef, and the three upper voices are in G clef.*

Mass 10: Missa sine nomine by José de Torres y Martínez Bravo (XVIII c.)

This is the only mass out of the six masses added in the eighteenth century, that was composed in the eighteenth century. The experiment data contains five auto-contained units from this mass, distributed in both D and ND datasets. Most of the mass is transcribed in CPDL (except for an extra Kyrie section).[5]

Missa10.1_Kyrie0

Full Kyrie movement and extra Kyrie section (f.71v–73r). Partial transcription in CPDL.

Dataset ND: 71 measures | 4 voices | 4 illegal dissonances | Correction time: 18 minutes

- The experimenter did not make any corrections.
- Perfect match for the first full Kyrie movement (71v-72r) with the CPDL transcription. If we apply the DF to the experimenter's file, one can see four orange labels left in this full Kyrie (see Figure 9). Regarding the 'Y' in the alto in measure 3, the experimenter said she noticed this dissonance between the alto and tenor but decided to ignore it because the dissonant notes were "in a flow of semiminims" in both voices (this is, in a stepwise passage of semiminims). I think the 'z' in the next measure of the tenor is part of an A7 chord that resolves to Dm. The next 'z' in the tenor (in the second group of systems), which marks a fourth over the bass, can be ignored since it takes place on a weak beat. Finally, I think that the alto's 'Z' on the A semibreve—which is dissonant with both the G in the superius and the B in the tenor—could be changed to a G to imitate the superius a few notes before; moreover, this change would also result in imitation of the other two voices that have the same progression starting in C (see green boxes in Figure 9). In this case, the orange dissonance label allowed me to catch an error missed by the experimenter and the CPDL transcriber.

[5] https://www.cpdl.org/wiki/index.php/Missa_a_4_(José_de_Torres)

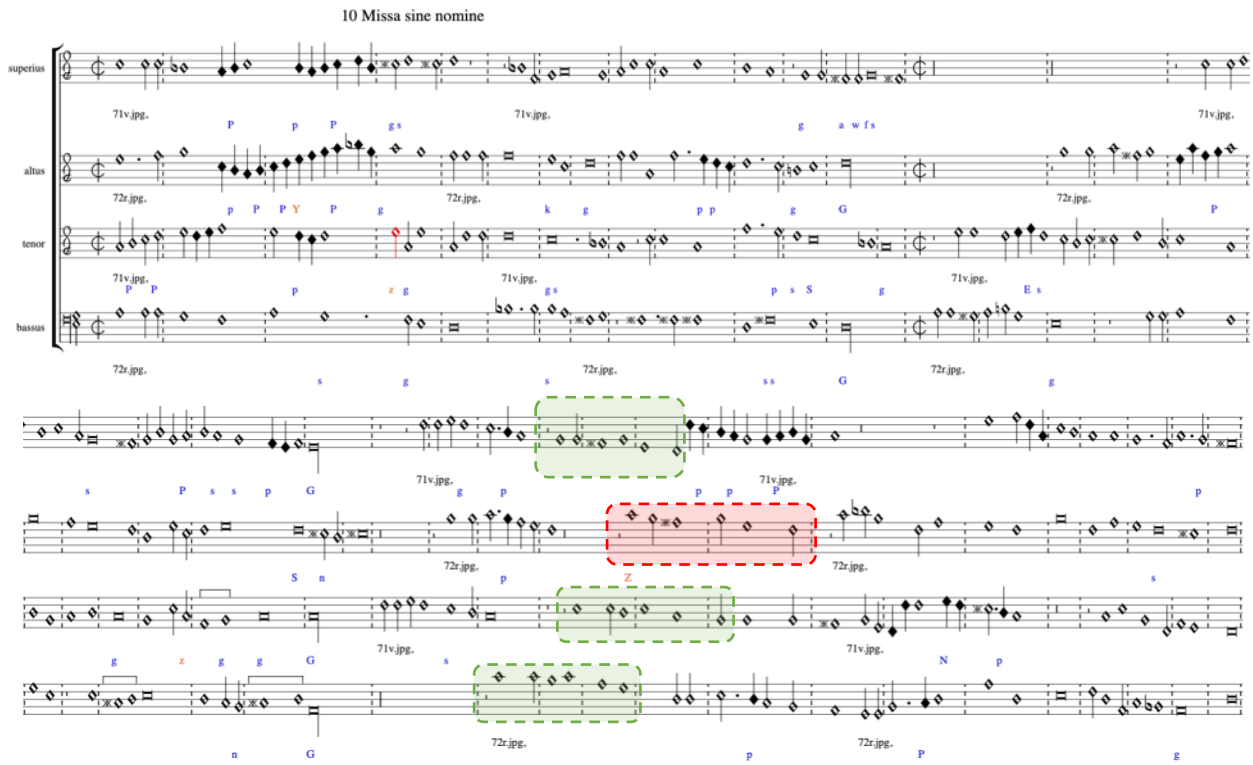


Figure 9: Experimenter and CPDL version of the first full Kyrie movement (f.71v–72r) of Missa10.1_Kyrie0 with the DF turned on. The boxes show passages that are similar in the various voices. The imitative texture is broken in the alto (red box) by a scribal error, which was unidentified by the CPDL transcriber and the experimenter.

- The extra Kyrie section in folios 72v-73r was not transcribed in CPDL, but it looks correct as it is, showing no illegal dissonance labels (see Figure 10).

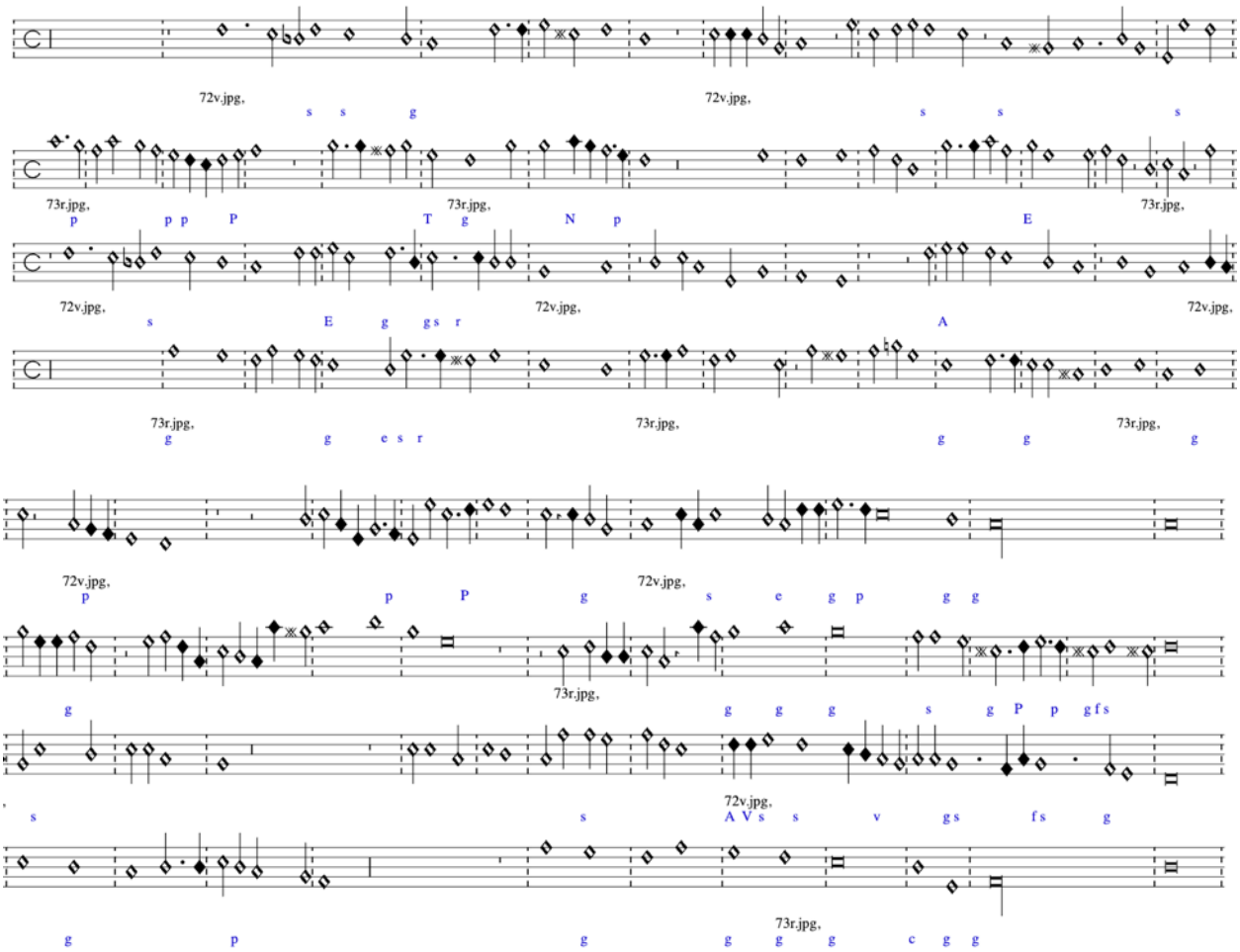


Figure 10: Extra Kyrie (f.72v–73r) in the Missa10.1_Kyrie0 piece.

Missa10.3_Credo1

The “Patrem omnipotentem” and “Et incarnatus est” sections (f.76v–78r) of the Credo movement.

Transcription in CPDL.

Dataset ND: 67 measures | 4 voices | 64 illegal dissonances | Correction time: 16 minutes

- OMR error, the experimenter changed a semibreve rest to a minim rest in the alto (measure 10). This coincides with the CPDL transcription. Activating the DF shows many orange labels disappearing from the piece when making this correction (see Figure 11).

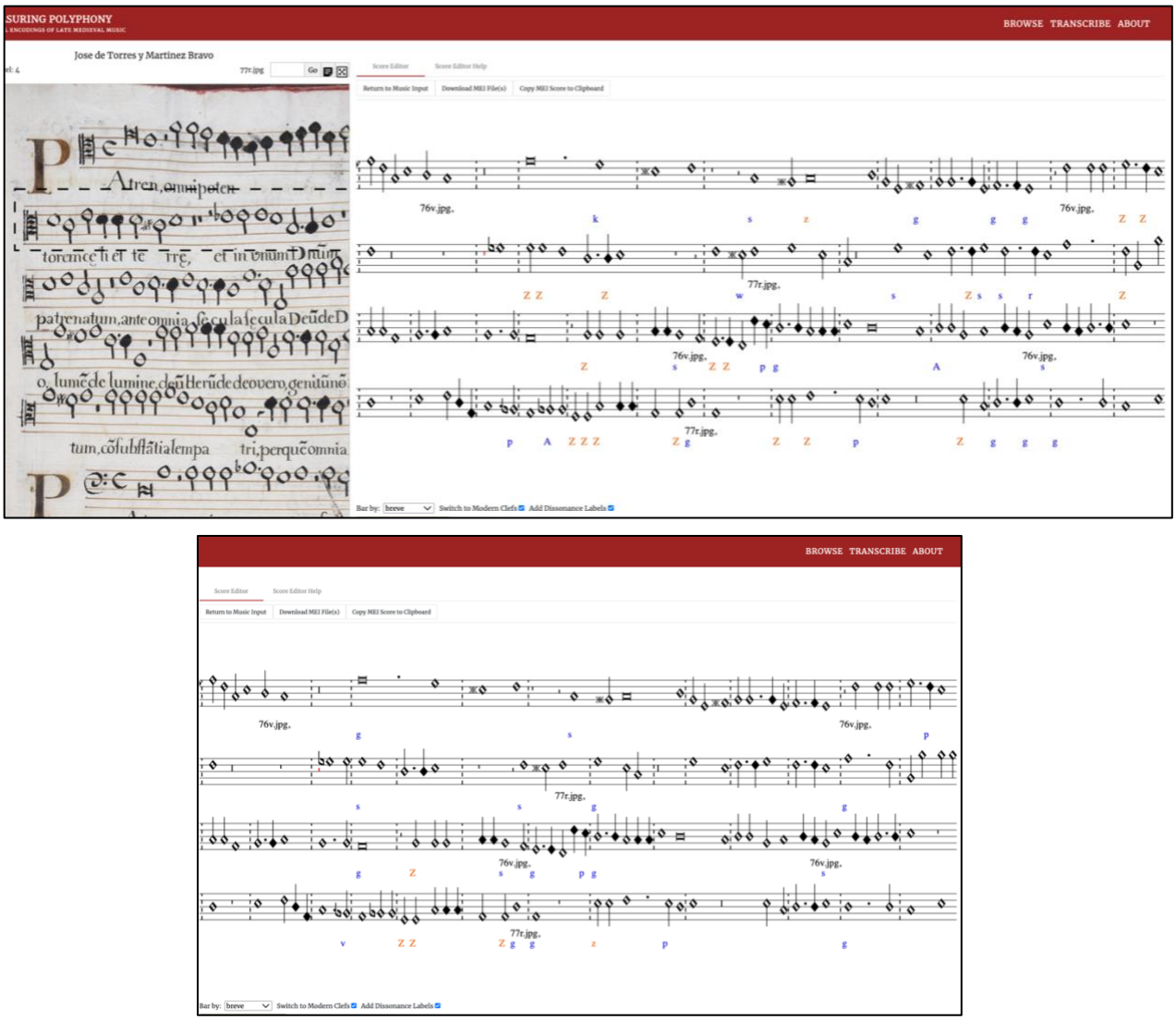


Figure 11: Some of the orange dissonance labels that disappear when correcting the rest value provided by the OMR. The top panel shows the experimenter file without the correction of the rest, and the bottom panel shows the same file with the rest corrected.

- There are a few differences with the CPDL transcription:

  1. In CPDL's transcription, the transcriber changed the A flat dotted breve starting at measure 47 of the alto into a B flat (see Figure 12), while the experimenter kept the original pitch. The change of the dotted breve to a B-flat results in illegal dissonances (see Figure 13). Professors Peter Schubert and Julie Cumming suggested a better solution: separating the dotted breve into a B-flat breve and an A semibreve, which results in imitation with other voices (see Figure 14).

While an orange label can still be seen in this solution, this label is a false illegal dissonance as the C minim in the tenor is doubling the agent C breve in the superius an octave below.

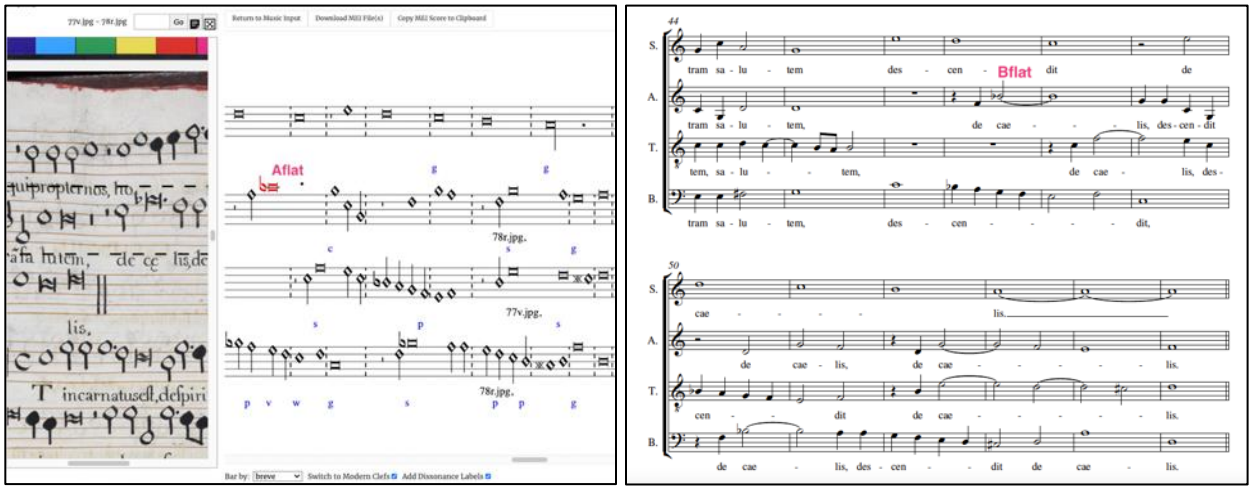


Figure 12: Manuscript and OMR file in the MP Editor (left) compared to CPDL's transcription (right). Notice the editorial correction from CPDL transcribers in measure 47, from A flat to B flat in the alto part.

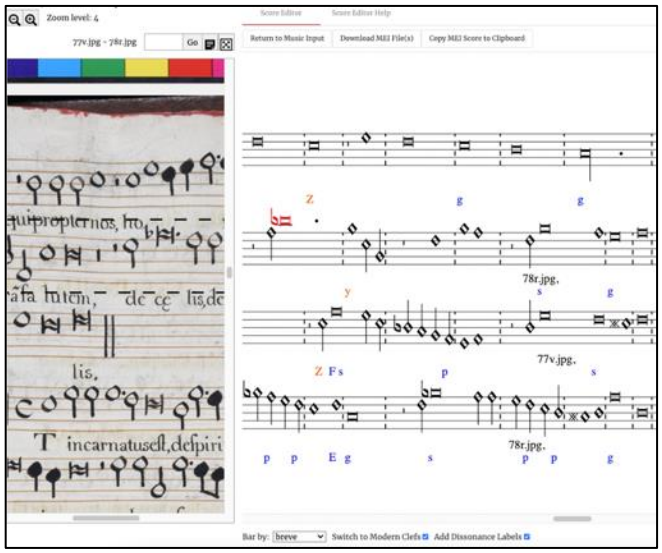


Figure 13: If moving the A flat to a B flat in the MP Editor, following the CPDL transcription of the same manuscript, this results in 'Z' and 'y' labels appearing.

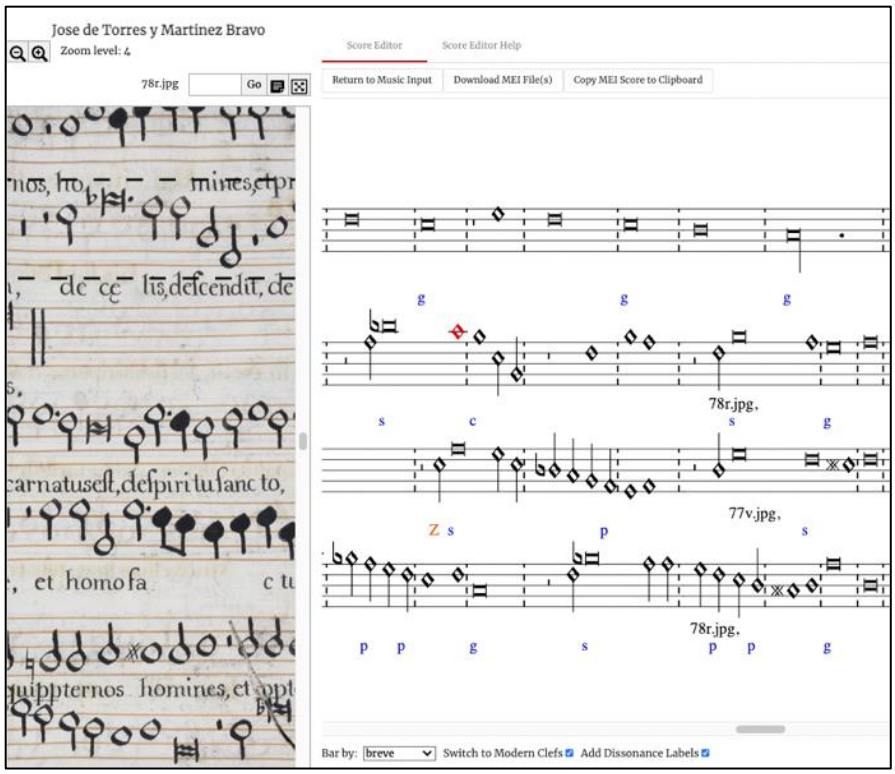


Figure 14: Proposed way to correct the passage shown in Figure 12, separating the dotted breve into a B-flat breve and an A semibreve.

2. In the Patrem omnipotentem section (at measure 38), the CPDL transcriber also substituted two C3 semibreves in the bass by a single C3 breve, while the experimenter kept them as they were recognized by the OMR. The OMR output was wrong because there is a tie between the two semibreves in the manuscript (see Figure 15).

   I did not notice 'ties' when performing the OMR as I was not expecting their presence in a mensural piece. MuRET needs support for ties in later mensural notation.

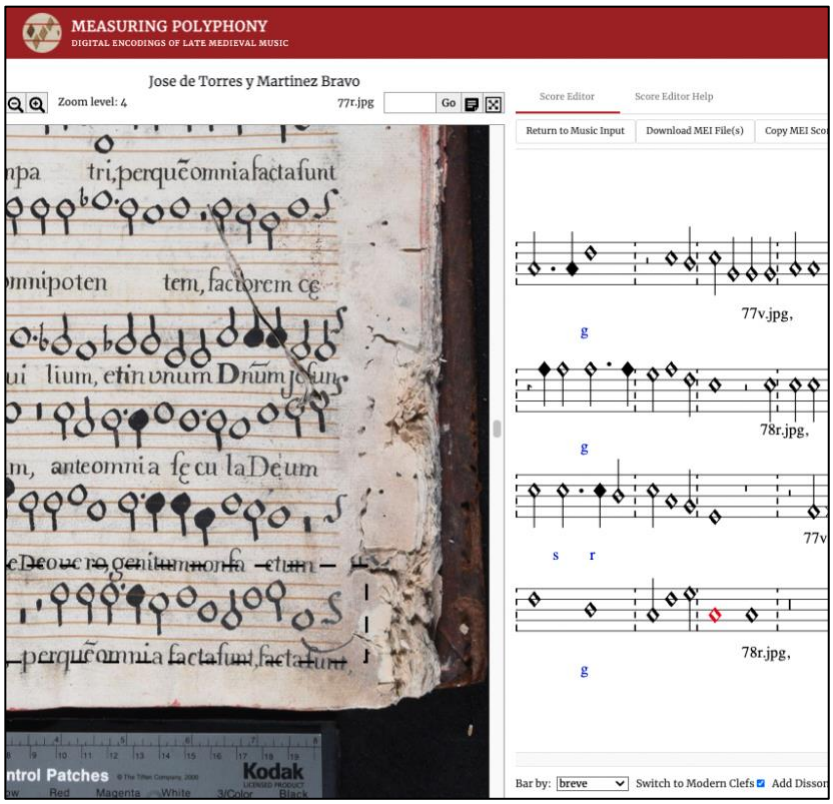
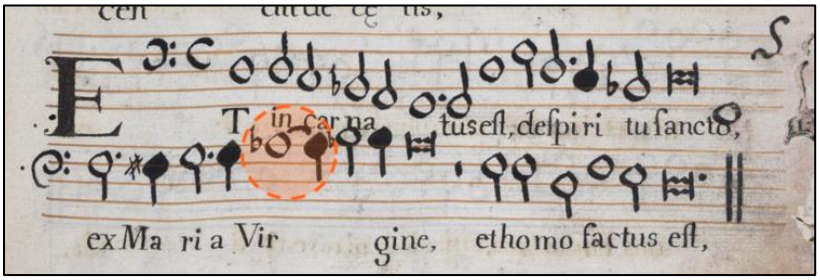


Figure 15: Experimenter file for Patrem omnipotentem section in Missa10.3_Credo1. The two C3 semibreves shown in the bass are supposed to be tied together (see the tie shown at the end of the folio, just before the custos). This error comes from the OMR that was not designed to recognize ties in mensural notation as they are not usually present.

3. Also in the bass, the CPDL transcriber substitutes an A3 flat semiminim and following B3 flat minim by a single B3 flat dotted minim (start of measure 63). This substitution is weird considering that in the manuscript, the A3 semiminim is tied to a previous semibreve (in A3 flat). Moreover, that note value is impossible to express in mensural values (see Figure 16). I prefer the experimenter's decision to leave the piece as it is in the manuscript since, according to Professor Schubert, this seems like a stylistic choice on the part of the composer.



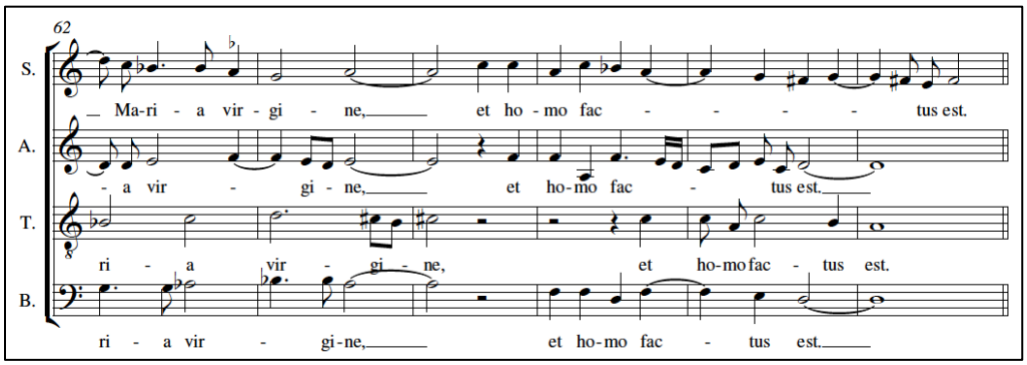


Figure 16: Et incarnatus section of the bass in the manuscript (top) and the CPDL transcription of its ending (bottom). Notice in the manuscript the A3 flat semibreve and semiminim tied together and followed by a B3 flat minim. In the transcription, there are transcribed into the equivalent of an A3 flat semibreve (no tied note) and a B3 flat dotted minim.

- The experimenter stated that this was a "funky piece with chromatic lines in the bass" and places with dissonances that she could not explain but that she suspected were intentional given the behavior of the piece, so she left them. As an example of these dissonant passages, she pointed to the place shown in Figure 17, where an F6/5 chord resolves to Bb and a G-minor 7th chord resolves to a C chord, pointing that while these are correct resolutions, she had never seen a dominant seventh chord in Renaissance music.

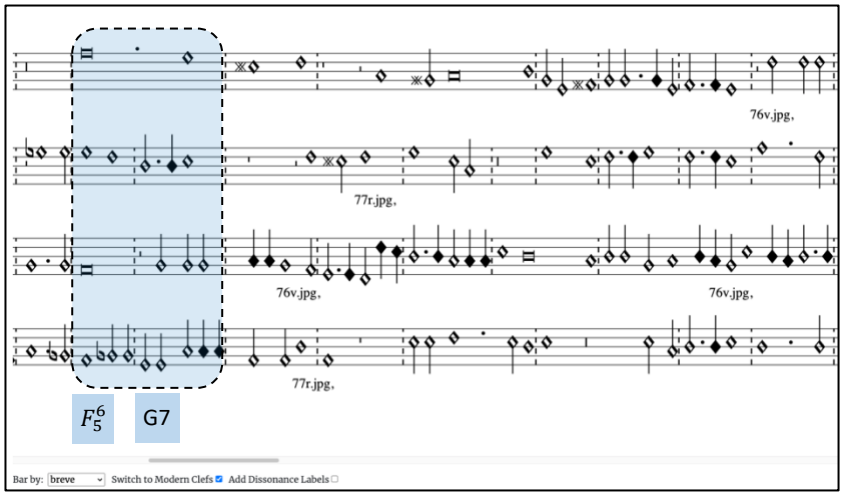


Figure 17: Dominant seventh chords pointed out by the experimenter.

- This mass is the only of the masses added to the collection in the eighteenth-century that we know was composed in the eighteenth century—it was composed by de Torres y Martínez Bravo who lived ca. 1670–1738. The fact that this piece uses ties to express note values that are not possible

to express with mensural notation (point 3) and the use of seventh chords reveals that this piece was not written in Renaissance style. Applying the DF to the experimenter's file results in lots of orange labels (see Figure 18 and Figure 19). A lot of them are the result of rearticulations, another one is the result of the tie (point 3), the rest are the result of seventh chords, and there is one orange label at the end of the piece—caused by the G in the superius being a fourth above the bass—that could also be considered as a G major chord moving to a D major chord with the G on the superius working as a suspension that resolves to an F# as pointed out by the experimenter (see Figure 19). From these, it is easy to conclude that the Renaissance DF does not work well for this piece because it is written in a later style. The same conclusion can be inferred from the rest of the auto-contained units in this mass.

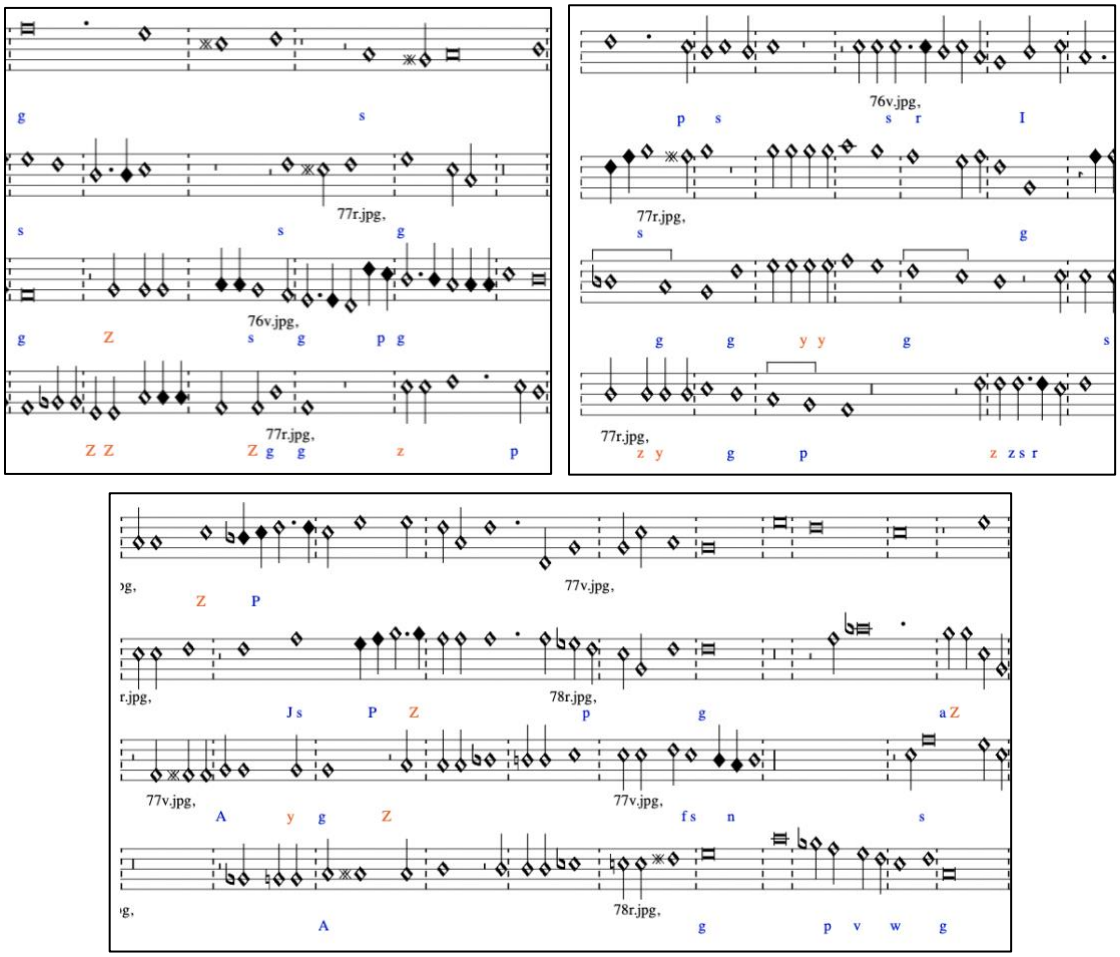


Figure 18: All orange labels in the Patrem omnipotentem section of Missa10.3_Credo1 in the experimenter's file. All these labels are the results of rearticulations and seventh chords.

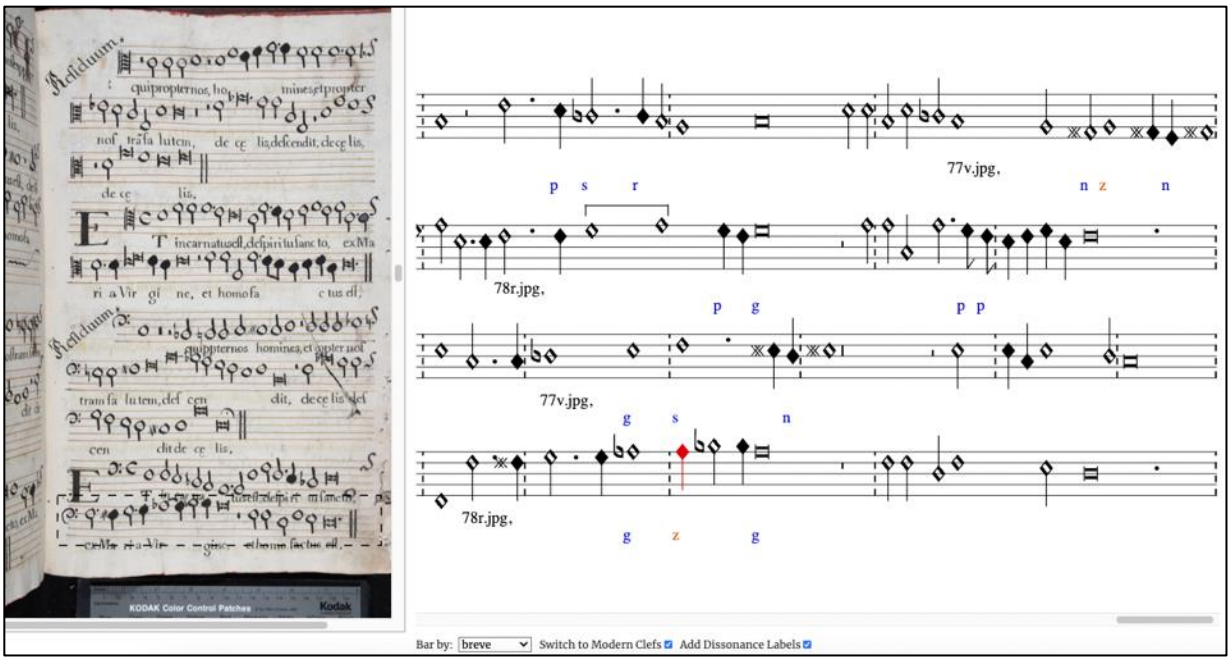


Figure 19: Original reading of the ending of the Et incarnatus section (shown in Figure 16) with the dissonance labels displayed in the MP Editor. This image shows all the remaining orange labels in this section of the piece. The A flat semibreve and semiminim on the bass are supposed to be tied, behaving as a single note, and the agent of the suspension in the superius. There is one 'z' at the end of the superius due to a fourth with the bass, but this can also be interpreted as a G chord moving to a D chord, with the suspended G in the superius resolving to an F#.

Missa10.3_Credo2

"Crucifixus" section (78v–79r) of Credo movement. Transcription in CPDL.

Dataset D: 40 measures | 4 voices | 3 illegal dissonances | Correction time: 2 minutes

- The experimenter did not make any corrections.
- Perfect match with the CPDL transcription.
- There were three orange labels remaining (see Figure 20). The experimenter left these because, according to her notes, she considered them to be either part of a chord or forming a unison with the agent of the suspension (i.e., doubling/echoing the agent).

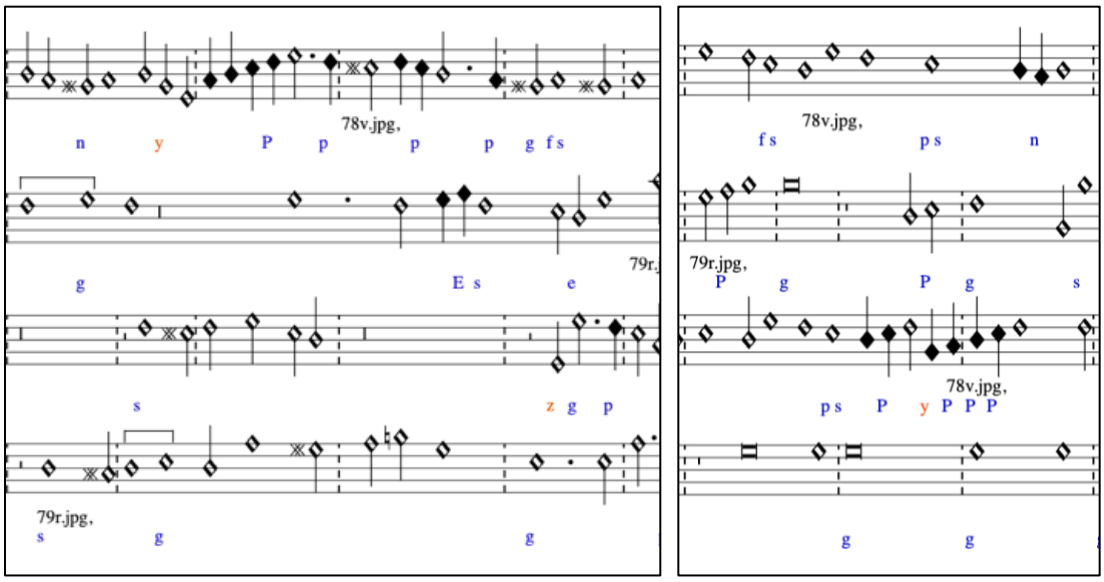


Figure 20: Orange labels left by the experimenter in Missa10.3_Credo2 as she judged these were not "true" illegal dissonances. The first 'y' could be considered part of a C chord. The 'z' label in the tenor is on the E minim, which forms a unison with the bass, behaving as a rearticulated note on another voice and doubling the agent. The last 'y' in the G minim of the tenor forms a unison with the G in the bass, also doubling the agent. It also forms a G chord with the Cs as suspensions or passing tones.

Missa10.3_Credo3

"Et in spiritum sanctum" section (f.79v–81r) of Credo movement. Transcription in CPDL.

Dataset D: 64 measures | 4 voices | 17 illegal dissonances | Correction time: 30 minutes

There are a few differences between the corrections done by the experimenter and CPDL's transcription, all of which are enumerated below. The first four show places where the experimenter changed the pitch of the notes to get rid of the orange labels in that place. As will become clear after seeing the examples, all these orange labels were the result of rearticulated notes. The fifth point contains a passage that was modified in different ways by the experimenter and the CPDL transcriber. The sixth point shows both an OMR error that was corrected by both experimenter and CPDL transcriber and the remainder of the passage where the experimenter admits spending a great amount of time trying to eliminate the orange labels unsuccessfully. In this piece, the CPDL transcription is correct (for the most part), and the DF seems to have mislead the experimenter in investing more time in the correction of notes marked as illegal dissonances that work fine within the piece.

1. In the superius, at measures 13–14, the experimenter changed the pitches of three consecutive notes to get rid of two ‘Z’ labels: moving a B4 minim, A4 dotted minim, and A4 semiminim to G4. In CPDL’s transcription of the same document, these three notes keep their original pitches. This was a rearticulation, producing a seventh chord (B7), with the A (the seventh) behaving as a passing tone.

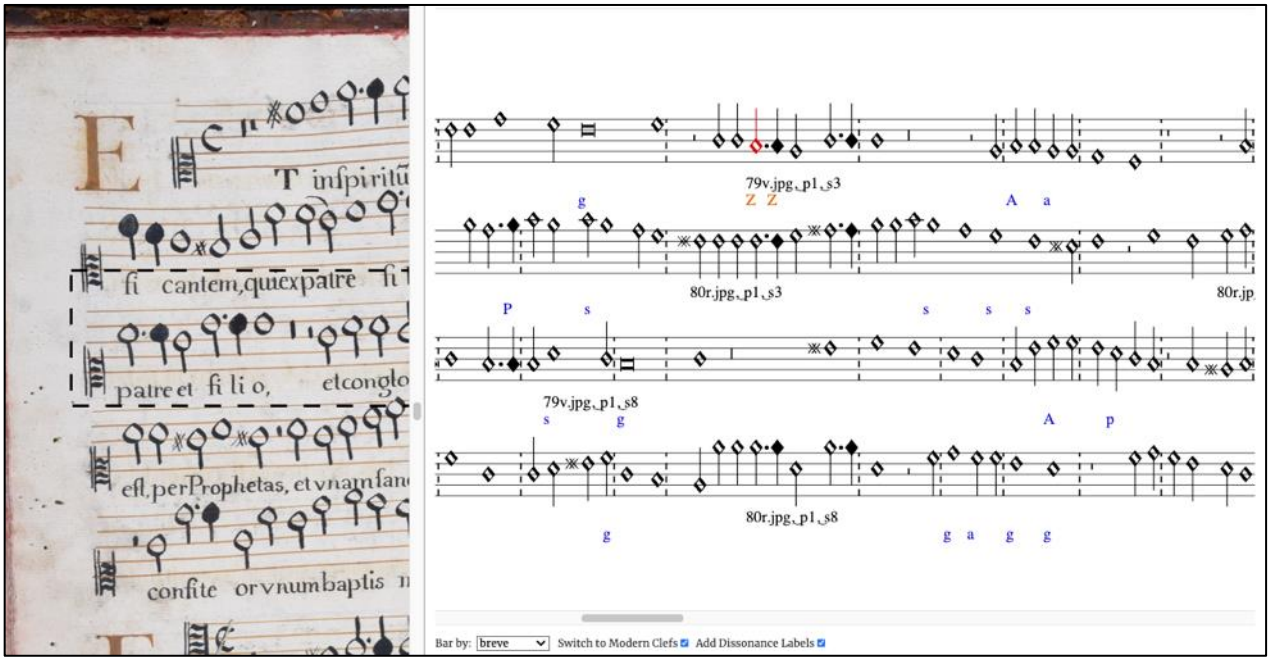


Figure 21: Recognized symbols. The experimenter corrected the 'Z' labels by moving the notes a second down. However, according to the CPDL transcription, this change is not necessary.

2. In the alto, at measure 25, the experimenter changed the second D4 minim to an E4. With this change, she got rid of a ‘y’ illegal dissonance. In CPDL’s transcription, this note keeps its original pitch. This note is also a rearticulation, and it is an example of another seventh chord.

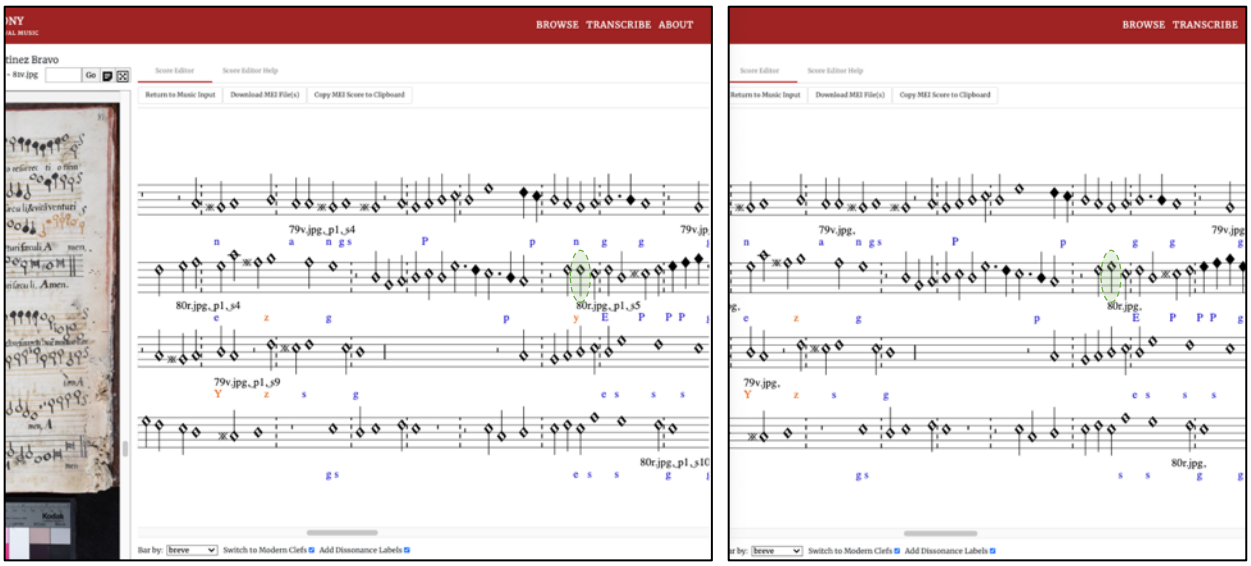


Figure 22: Experimenter edit (right) to get rid of the 'y' label in the alto of the recognized symbols (left). According to the CPDL transcription, this change is not necessary.

3. In the tenor, the experimenter changes the D4 minim starting measure 48 into a B3. With this change, she got rid of a 'y' label. In CPDL's transcription, the note keeps its original pitch. This is another example of a rearticulation and seventh chord.

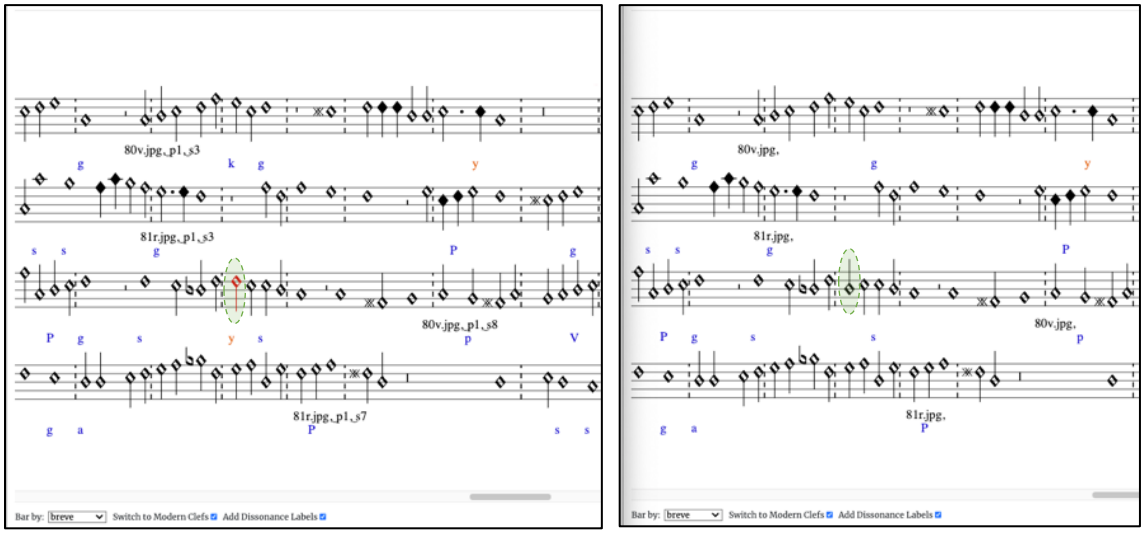


Figure 23: Experimenter edit (right) to get rid of the 'y' label in the tenor of the recognized symbols (left). According to the CPDL transcription, this change is not necessary.

4. In the bass, at measure 36, the experimenter changed the first G3 into an F3 to get rid of a 'Y' label. In CPDL's transcription, the note keeps its original pitch. This note is a rearticulation, if combining

the two G3 minims into a single semibreve, it would be labelled as a blue ‘g,’ behaving as a double agent (since the G in the bass and the D in the superius would both be agents of suspended C in the tenor).

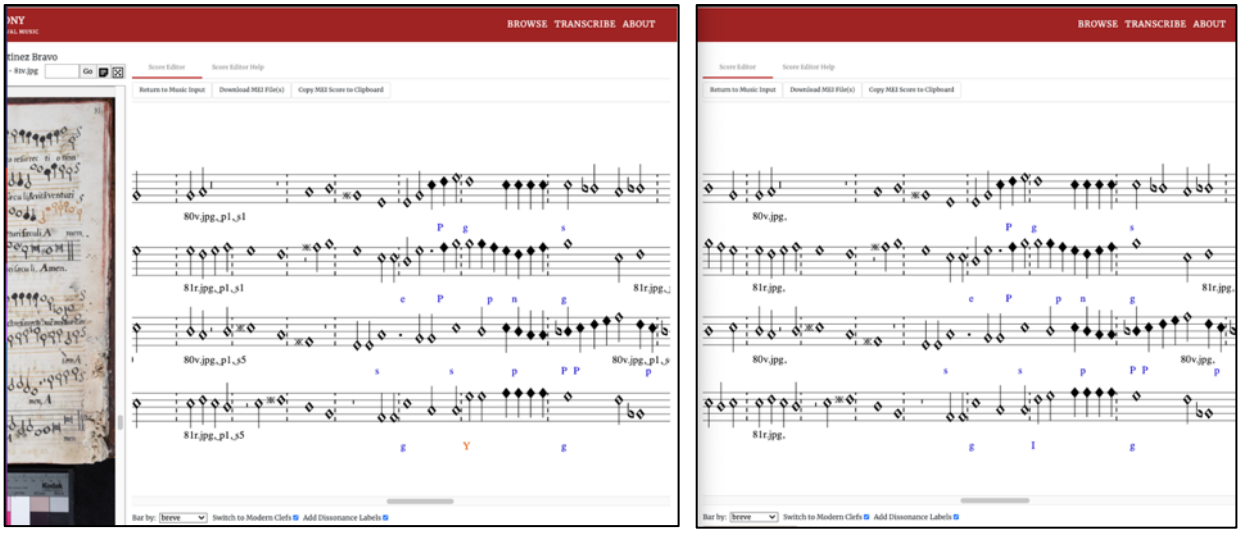


Figure 24: Experimenter edit (right) to get rid of the ‘Y’ label in the bass of the recognized symbols (left). According to the CPDL transcription, this change is not necessary.

5. In the alto, there is a passage from measures 55–57 that has a few differences when comparing the manuscript against the experimenter’s and CPDL versions. Figure 25 shows the manuscript reading of this passage, the circled notes are modified in either the experimenter or the CPDL version. Figure 26 shows the experimenter version of the same passage, where she changed the F4 and A4 semiminims at the start of measure 57 into minims, displacing the following notes by a minim. In CPDL’s transcription these two notes are kept in semiminim values and instead a later note is increased by a minim value (the F4 minim in measure 57 is changed into a semibreve). Figure 27 shows the CPDL version of this passage. Both the experimenter’s and the transcriber’s correction result on eliminating the illegal dissonance labels following—except for a ‘y’ label due to a rearticulation—and on a simultaneous ending of the voices. The CPDL correction is better in this case since the experimenter’s one results in a leap to a dissonance. Moreover, CPDL’s transcription keeps the two semiminims in F and A followed by the G, which is a motive that repeats a few measures later.

In addition to the minim increase, Figure 27 also shows a modification in measure 55. The manuscript reading shows an E4 dotted semibreve and a D4 minim in that measure (see Figure 25), which the experimenter preserves too (see Figure 26). However, in the CPDL transcription, these notes are changed for an E4 minim, A4 minim, and D4 semibreve. Figure 28 shows this difference between the original reading and CPDL's transcription more clearly. This particular change was not needed.

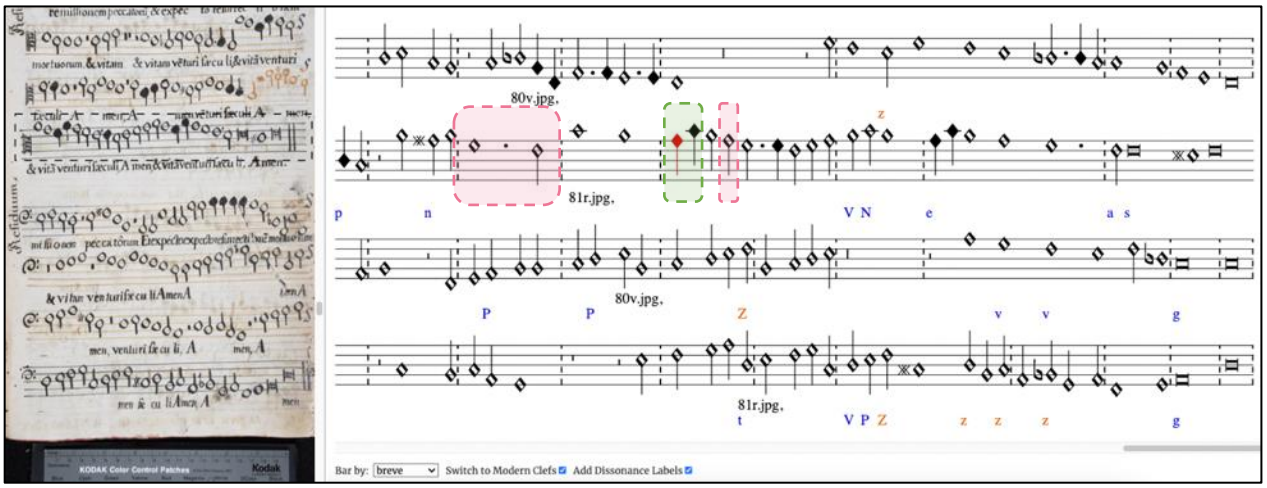


Figure 25: Original reading of the alto at the end of Missa10.3_Credo3 (f. 81r). The green box shows the notes that were modified by the experimenter, while the ones in the pink box are the ones modified in CPDL's transcription of the same passage.

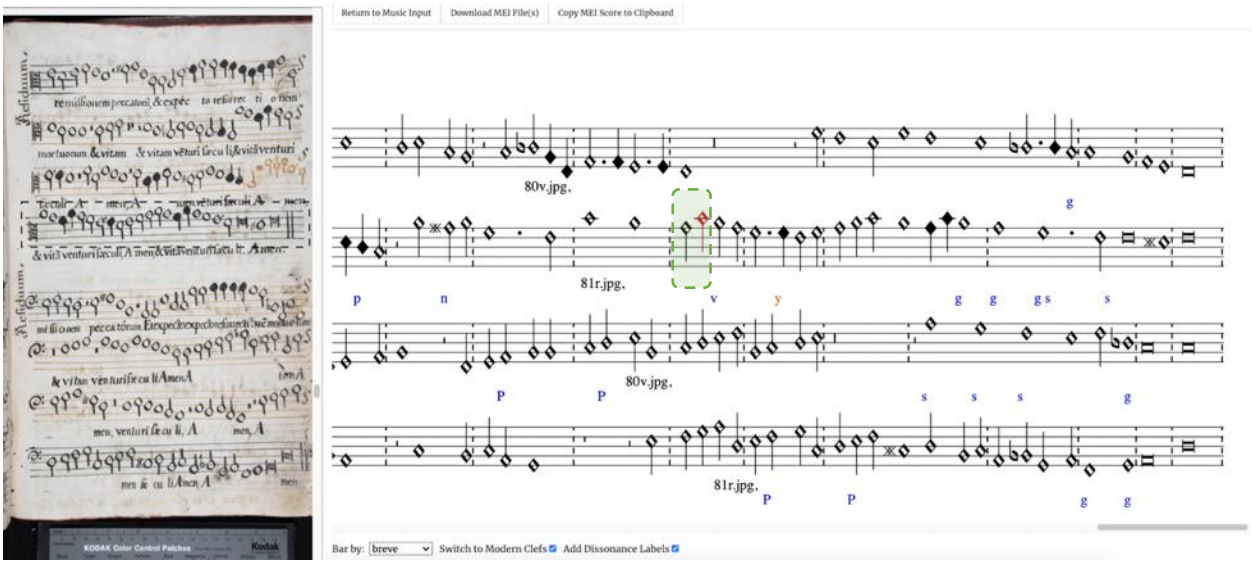


Figure 26: Experimenter version of the same passage shown in Figure 25. The experimenter changed the F4 and A4 semiminims into minims (green box), which displaced the following notes by a minim and provided a simultaneous ending of the alto with the other voices. The orange 'y' is a rearticulated note.

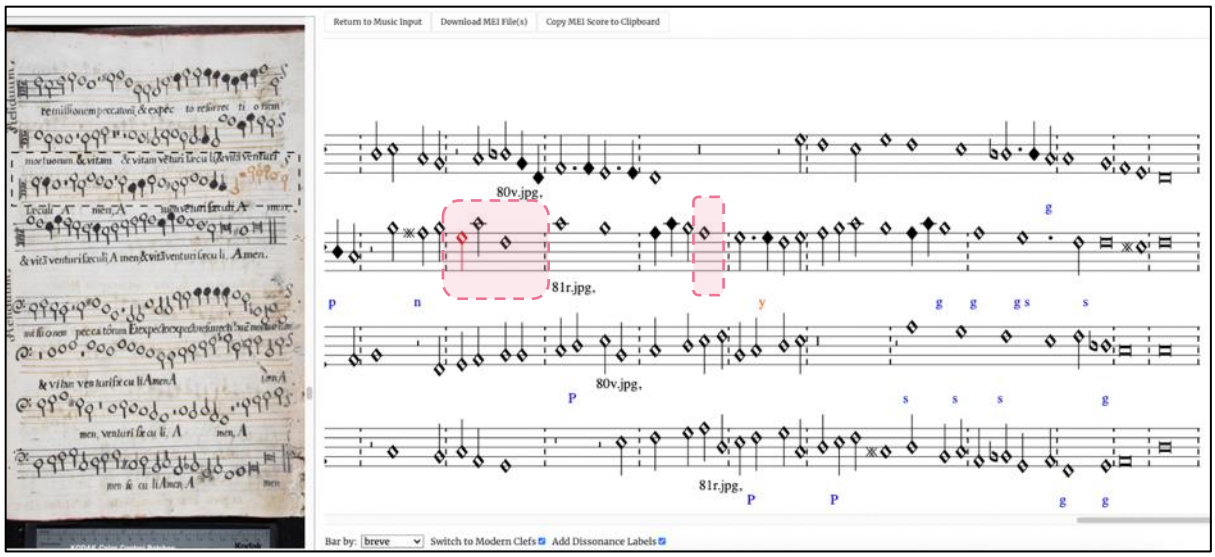


Figure 27: CPDL version of the same passage shown in Figure 25. The transcriber changed the F4 minim into a semibreve (second pink box), which displaced the following notes by a minim and provided a simultaneous ending of the alto with the other voices. He also changed the E4 dotted semibreve and D4 minim into an E4 minim, A4 minim, and D4 semibreve (first pink box), this change is shown also in Figure 28. The orange 'y' is a rearticulated note.

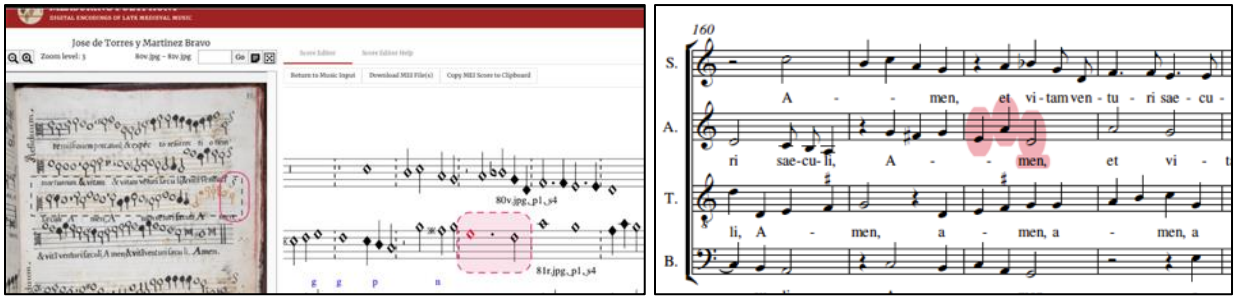


Figure 28: Original reading as in manuscript and preserved by the experimenter (left) and CPDL correction (right).

6. In the bass, at measures 19–20, the experimenter changed two D3 minims to one semibreve. This modification is found in the CPDL transcription too. In the manuscript, there is a tie between those two minims that was not captured in the OMR process.

   The following figures show this passage, with Figure 29 showing the results of the OMR and the tie in the manuscript, Figure 30 shows the CPDL transcription, and Figure 31 shows the correction of the tie in the MP Editor and the remaining illegal dissonances in this passage.

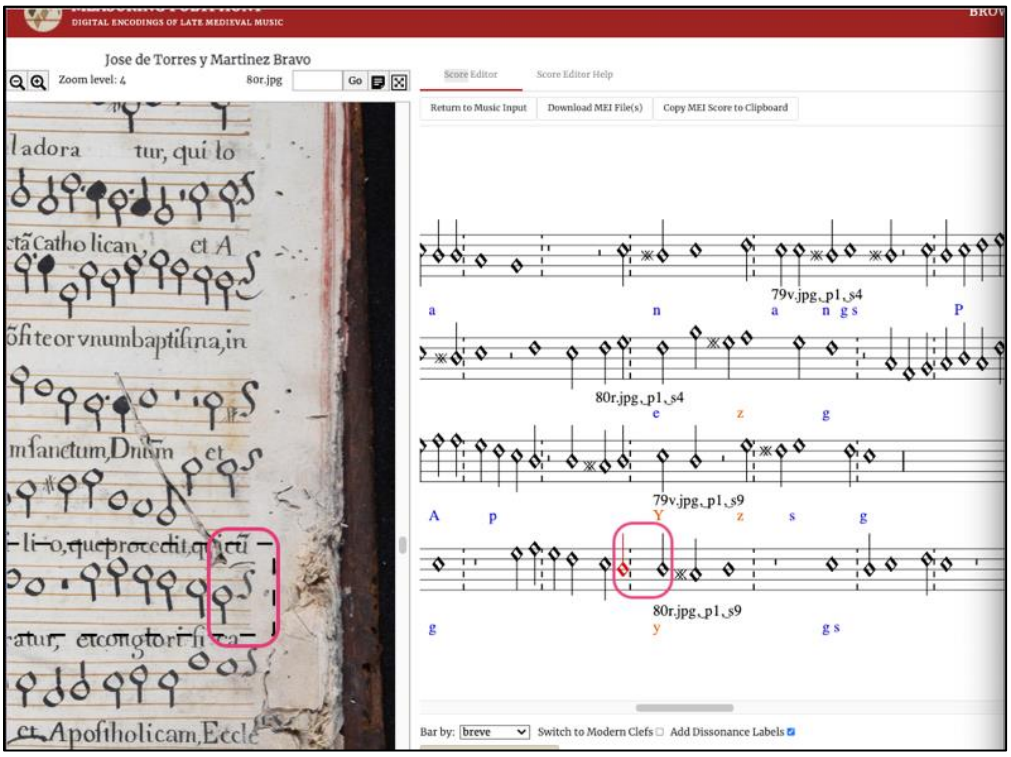


Figure 29: As recognized by the OMR, ignoring the tie that is present on the manuscript.

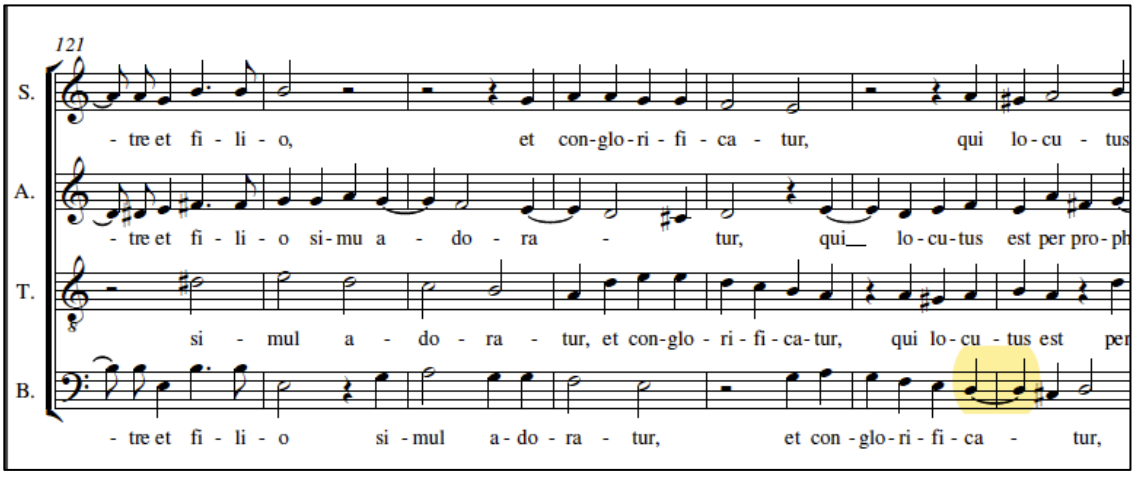


Figure 30: Both the experimenter and the CPDL transcription correct this and substitute the two minims by the semibreve value it represents. This correction does eliminate the 'y' label shown in the bass in Figure 29.

While the tie correction does eliminate the 'y' label in the bass, there are a few other illegal dissonances remaining in this passage as shown in Figure 31. The experimenter points to this as a problematic spot in the piece where she spent a lot of time trying to figure out how to eliminate these illegal dissonance labels. Eventually, she just left it as it was, which was the correct answer according to CPDL's transcription of

that passage. The G in the alto is a fake suspension (prepared from below) against all the other Ds. This fake suspension is not labeled as ‘f,’ but rather as ‘z’ because of the simultaneous attack with the D in the tenor, which can be considered as a rearticulation of the D in the bass (starting one minim earlier). As pointed out by Professor Peter Schubert, this passage seems like a combination of Baroque and Renaissance style, with seventh chords and fake suspensions.

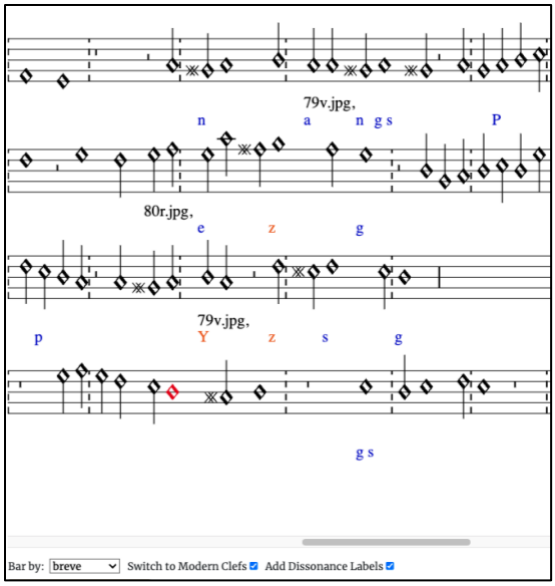


Figure 31: Same excerpt as shown in Figure 29 with the tied notes corrected. The experimenter invested a lot of time in this passage trying to eliminate the remainder of the illegal dissonance labels. However, in the transcription from CPDL, this passage is kept as shown in this image.

- The points described above, specifically 1–4 and the last part of 6 (Figure 31), provide evidence that for this piece the use of the DF was more distracting than helpful. The DF does not work well for this mass of the eighteenth century, as it has been pointed out in other of its sections. The mass has elements that are not Renaissance-like, including seventh chords and ties. When comparing the correction times of this piece (30 minutes) to other units of this mass, it is evident that keeping the DF deactivated worked better. Even in the other unit (Missa10.3_Credo2) where the DF was used, the corrections and time (2 minutes) were better because the experimenter chose to ignore the orange labels in favor of a more “chord-oriented” approach.

Missa10.5_AgnusI0

Full Agnus I movement (f.83v–84r). Transcription in CPDL.

Dataset ND: 23 measures | 4 voices | 2 illegal dissonances | Correction time: 7 minutes

- The experimenter did not make any corrections.
- Perfect match with the CPDL transcription.
- When I applied the DF, one can see two orange labels left: ‘y’ and ‘z.’ The ‘z’ results from a rearticulation. Therefore, the only “true” illegal label would be the ‘y,’ which can be seen in Figure 32. The ‘y’ label represents a note that is only dissonant against a known dissonance. In this case, the G# on the superius is dissonant against the D in the tenor, which forms a suspension with the E in the alto. However, the sonorities in this measure could also be considered as an Am(maj7) chord, with a D that is resolving to a C.

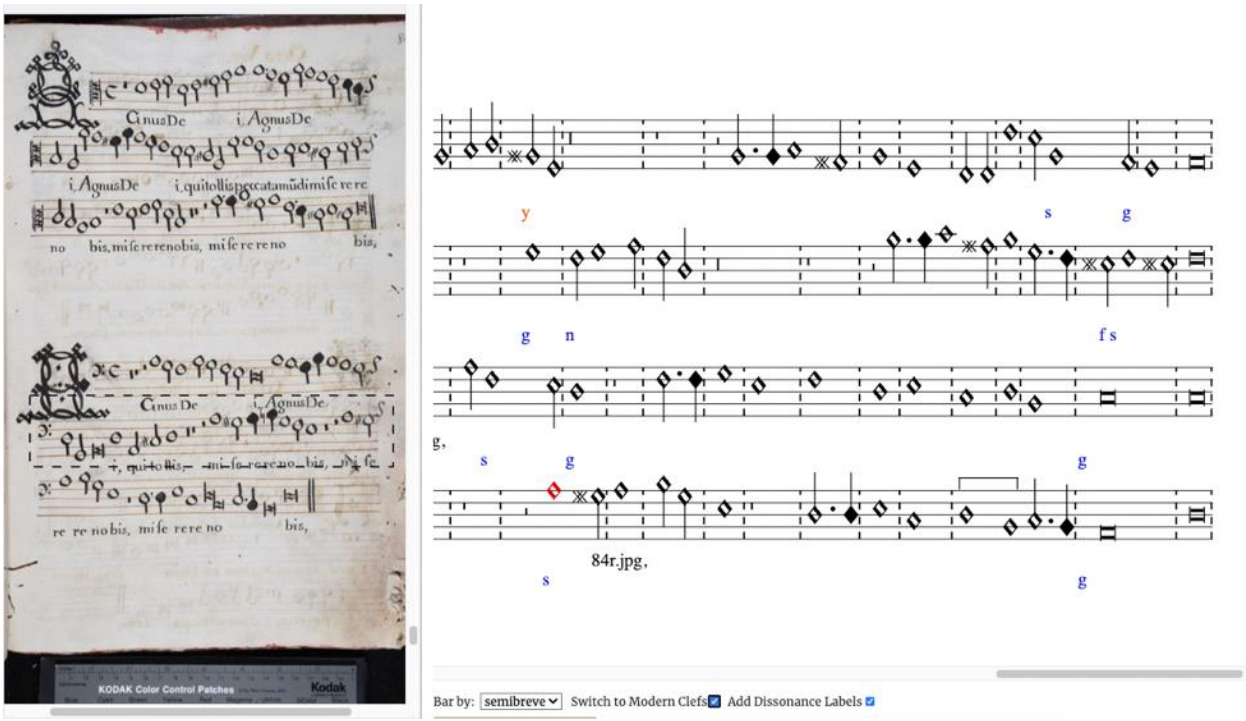


Figure 32: One true illegal dissonance remains in Missa10.5_AgnusI0.

Mass 13: Missa de 5° tono by Luis Serra (? c.)

One of the masses added in the eighteenth century, fully transcribed in CPDL.[6] The region and period of activity of its composer is unknown. Only one auto-contained unit of this mass was used in the experiment, and it belongs to the D dataset.

Missa13.5_Agnus0

Full Agnus movement (f.118v–119r). Transcription in CPDL.

Dataset D: 30 measures | 4 voices | 6 illegal dissonances | Correction time: 6 minutes

Although the voices ended simultaneously in this piece, there were a couple of orange labels, which the experimenter tried to fix.

- In the bass, at measure 20, the experimenter changed the first semibreve from D3 to E3 to get rid of an illegal 'Z' label. This correction is also found in CPDL's transcription. Her other edit concerning the bass can be seen in point 3.

A few differences between the experimenter version and the transcription from CPDL:

1. In the alto, at measures 25–26, an E4 dotted minim was moved a second up in the CPDL transcription, while the experimenter kept the original values. The correction from CPDL is correct, since one should not tie from a dissonance, which is what is happening in the original with the E in the alto.

[6] https://www.cpdl.org/wiki/index.php/Missa_a_4_de_quinto_tono_punto_bajo_(Luis_Serra)

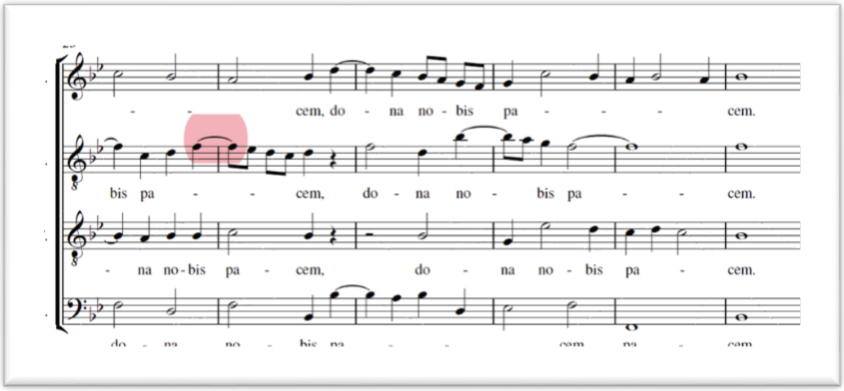


Figure 33: CPDL Transcription of Missa13.5_Agnus0 ending. The highlighted note was a second down in the original.

2. In the tenor, at measures 11–12, a C4 semibreve is moved up a second, while the experimenter kept the original pitch. While this correction does not result in discarding any illegal dissonance, it guarantees the repetition of the descending stepwise motion. This is also a case where the CPDL correction is correct, and "it creates a nice parallel sixth with the superius" as pointed out by Professor Cumming.

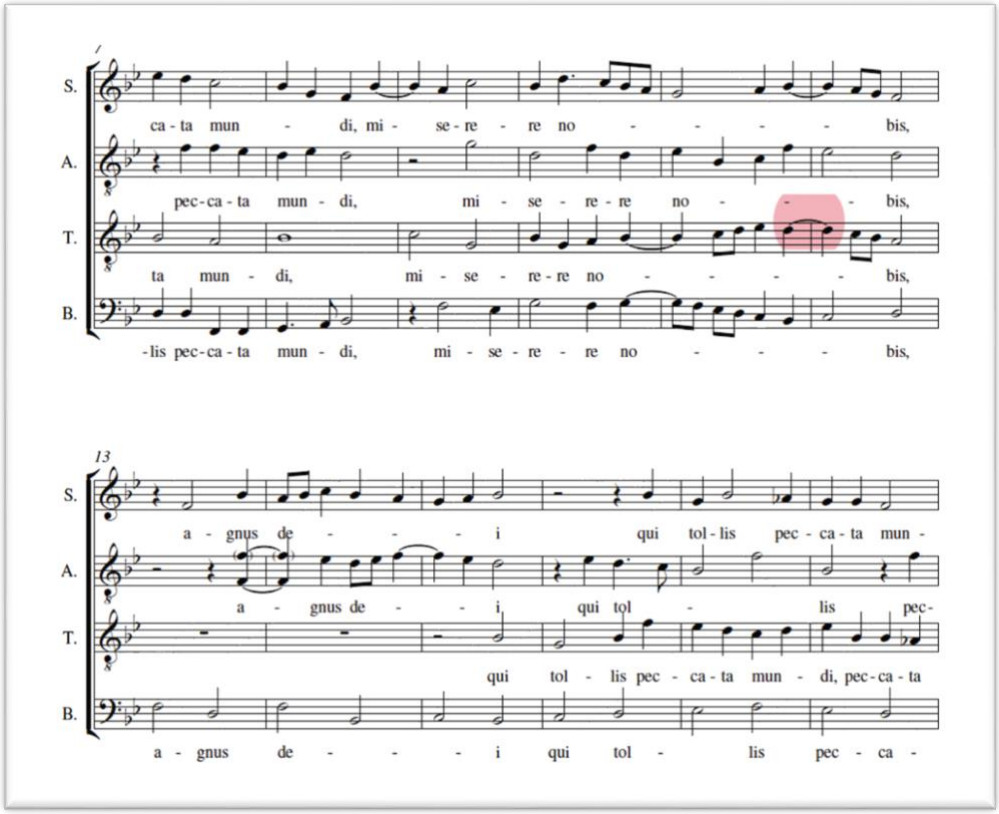


Figure 34: CPDL Transcription of Missa13.5_Agnus0. The highlighted note was a second down in the original.

3. In the bass, at measure 5, the experimenter changed the last semibreve from F3 to A2 to get rid of the illegal ‘Z’ label, while the transcription in CPDL keeps the original pitch (see Figure 35). Indeed, the original F in the bass against the E-flat in the alto is an issue, and the experimenter was correct in trying to fix it. However, her edit implies a significant change from what is written in the manuscript. A more suitable correction was suggested by Professor Schubert, where the alto’s E-flat is changed into an F. This change removes the illegal dissonance while keeping the F, D, F motive in the bass that repeats later on, as shown in Figure 36. The DF allows playing around with different solutions and seeing their effects on the orange labels, until finding the ideal solution that removes all these orange labels (like the one suggested by Schubert).

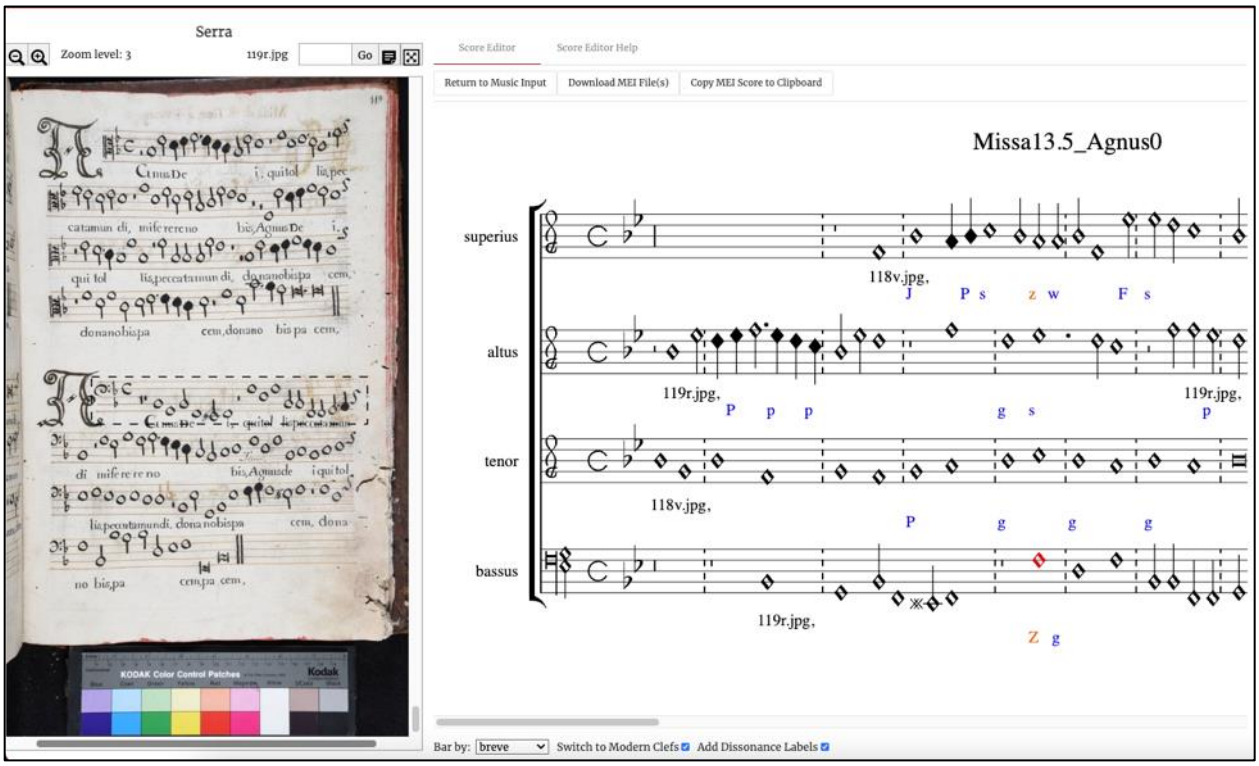


Figure 35: Original reading of the beginning Missa13.5_Agnus5. The ‘z’ in the superius is a rearticulation, while the ‘Z’ in the bass is a “true” illegal dissonance. The red F3 note, responsible for the latter ‘Z’ was changed to an A2 by the experimenter to remove the illegal dissonance; however, CPDL’s transcription keeps it as is.

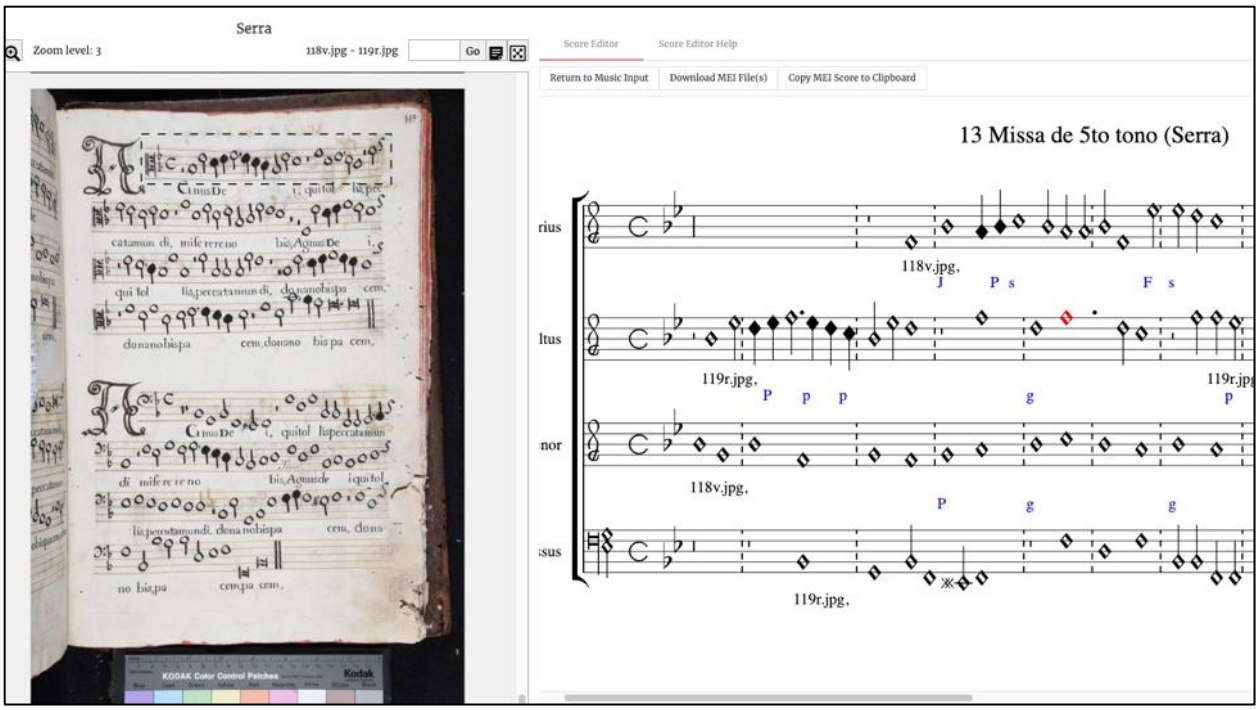


Figure 36: Best solution for the passage shown in Figure 35, where the alto's E flat is changed to an F, removing the illegal dissonance it was forming with the bass's F.

4. In the bass, at measure 7, the CPDL transcriber moved two B2 minims to D3, while the experimenter kept the original pitches. This correction seems to be an error in the CPDL transcription, where the transcriber accidentally moved the notes a third up.

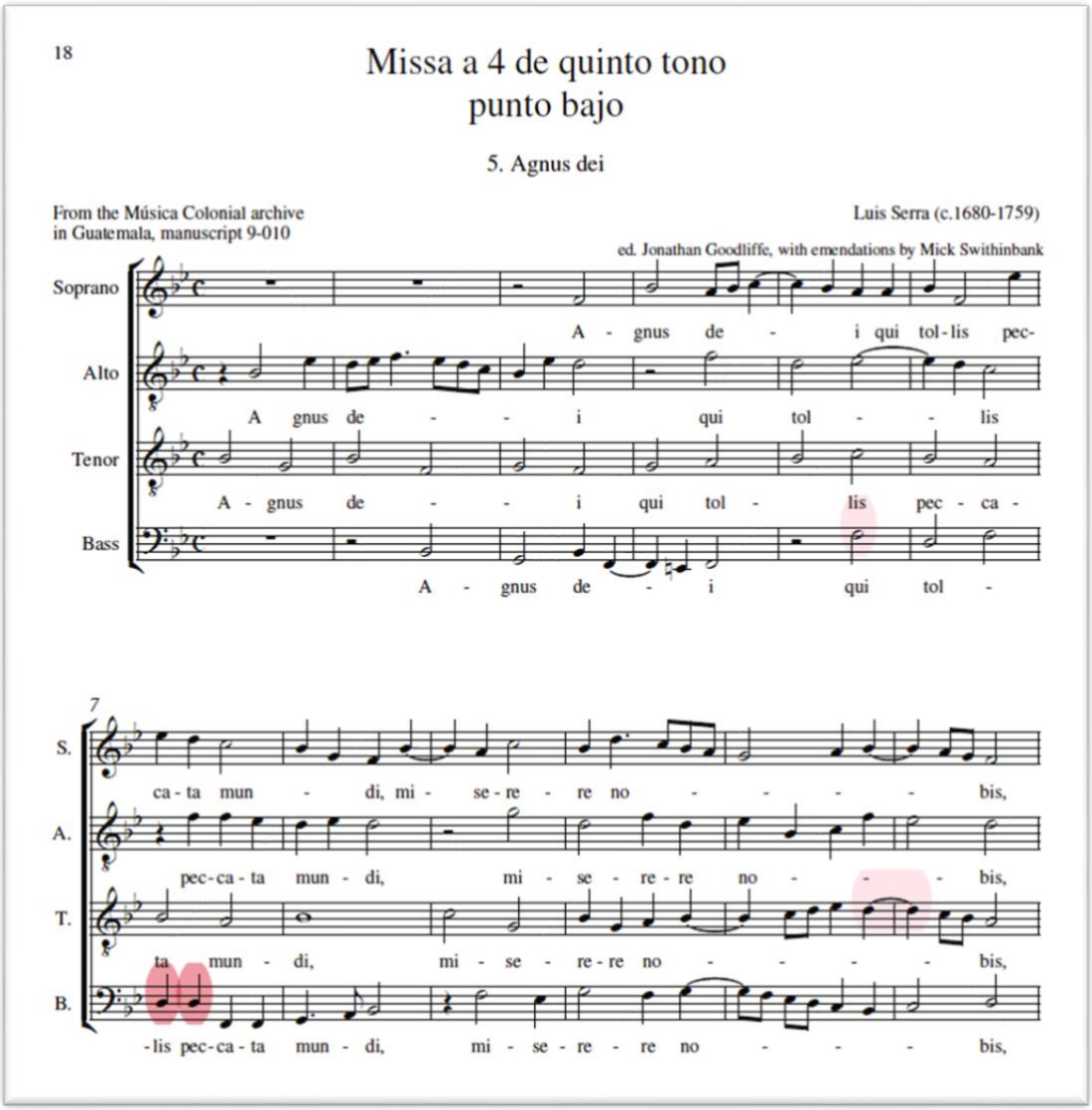


Figure 37: CPDL Transcription of Missa13.5_Agnus0. The highlighted note was a third down in the original.

The experimenter left two illegal dissonances (‘z’ and ‘y’), which are also left in CPDL transcription. The ‘z’ label is found in the superius in measure 9, and the ‘y’ label is in the tenor in measure 22. Both labels are marking notes that are consonant with the chord. Moreover, the ‘y’ in the tenor is in G, same note as the superius, behaving as an agent too. This is an example of a minim agent being marked as an illegal dissonance, even though the same note (with a longer value) is marked as an agent on another voice (another example can be found in Piece21_Surrexit1). All minims that are echoing the agent seem to have this

problem, even the ones that are acting as agents themselves (sharing even the same onset as the longer agent) which are labelled with an orange ‘y’ when they are in fact legal.

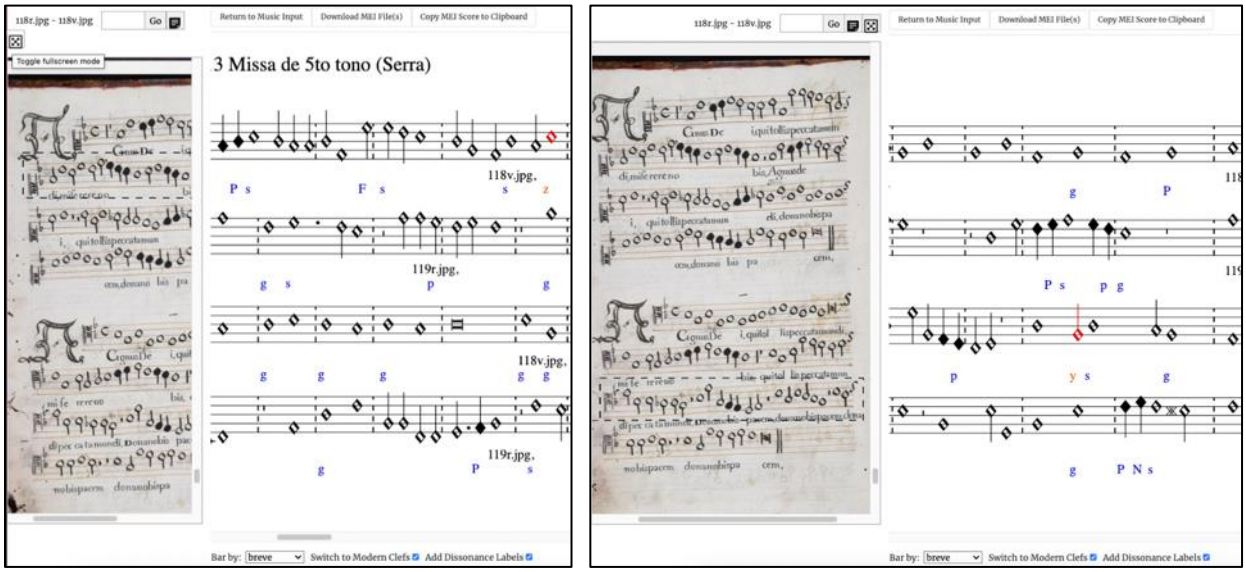


Figure 38: The two orange labels left by the experimenter. ***Key signature:*** *with B and E flats.*

Mass 14: Missa de 4° tono by Alegre (? c.)

One of the masses added in the eighteenth century, fully transcribed in CPDL.[7] The region and period of activity of its composer is unknown. Only one auto-contained unit of this mass was used in the experiment, and it belongs to the D dataset.

Missa14.1_Kyrie0

Full Kyrie movement (f.119v–121r). Transcription in CPDL.

Dataset D: 56 measures | 4 voices | 23 illegal dissonances | Correction time: 7 minutes

In the alto, at the penultimate measure of the first Kyrie, the experimenter shortened the A3 semibreve to a minim (see Figure 39 and Figure 40). This correction is also found in CPDL’s transcription. This eliminated all orange labels from the first Kyrie.

[7] https://www.cpdl.org/wiki/index.php/Missa_quarti_toni_(Gregorio_Allegri)

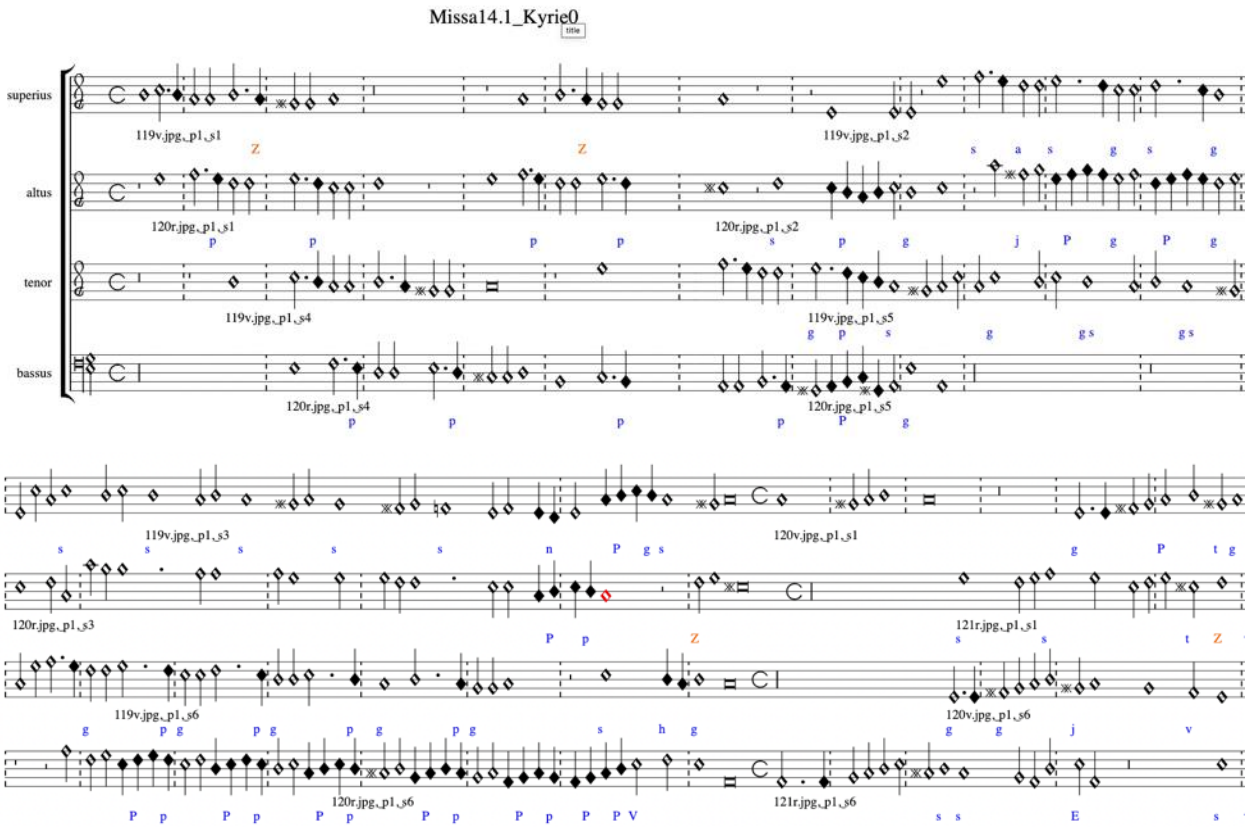


Figure 39: First Kyrie (and beginning of the Christe) of Missa14.1_Kyrie0 as recognized by the OMR.

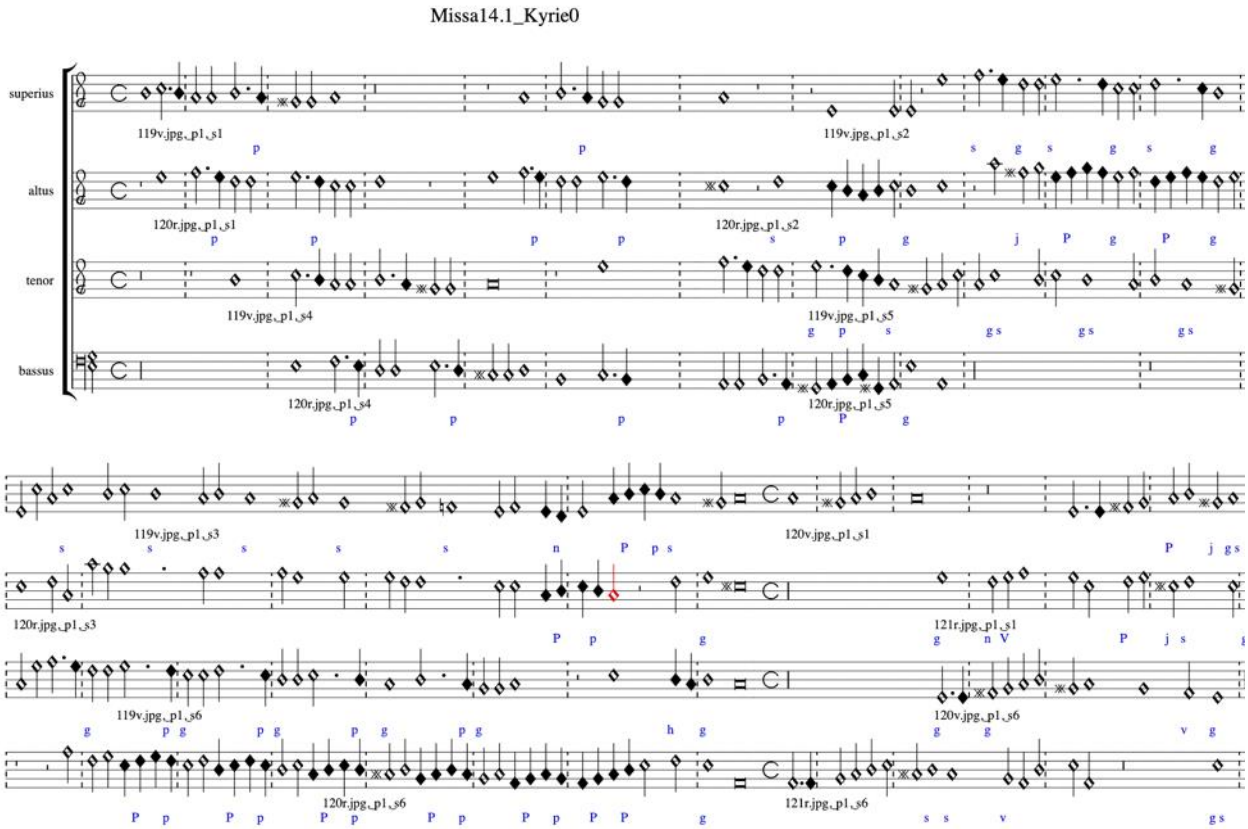


Figure 40: Experimenter correction, reducing the A3 semibreve to a minim at the end of the alto (see red note) for the first Kyrie of the Missa14.1_Kyrie0. This correction eliminates the orange labels shown in Figure 39.

Three corrections done in CPDL's transcription do not match the original (nor the experimenter version of the piece):

1. At the end of the first Kyrie, in measure 17 of the superius, the second minim was changed from its original pitch (G4) to an E4. The experimenter keeps the original pitch of the note. As found in the manuscript, there were no issues regarding illegal dissonances in this passage, and the CPDL's edit ends up breaking the pattern shown in the superius (see Figure 41 and Figure 42).

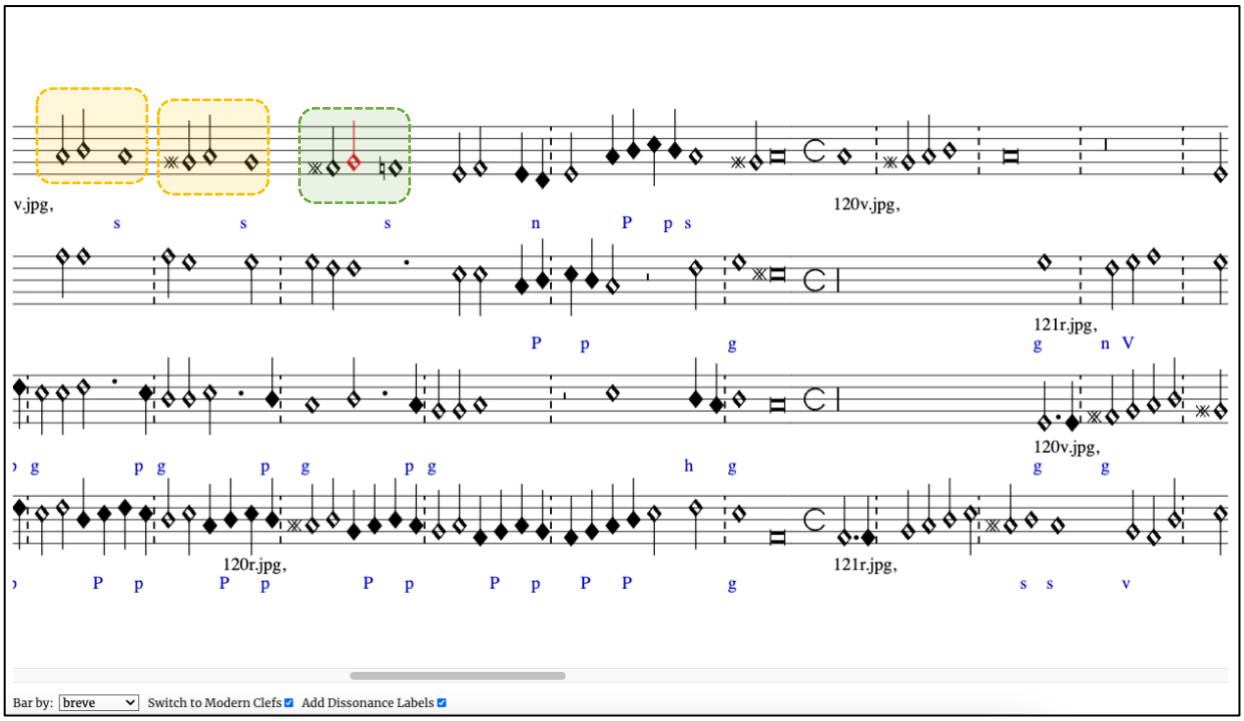


Figure 41: Experimenter version of the ending of the first Kyrie of Missa14.1_Kyrie0. The red note is changed in CPDL transcription and moved a third down (see Figure 42). The yellow boxes show the pattern in the superius.

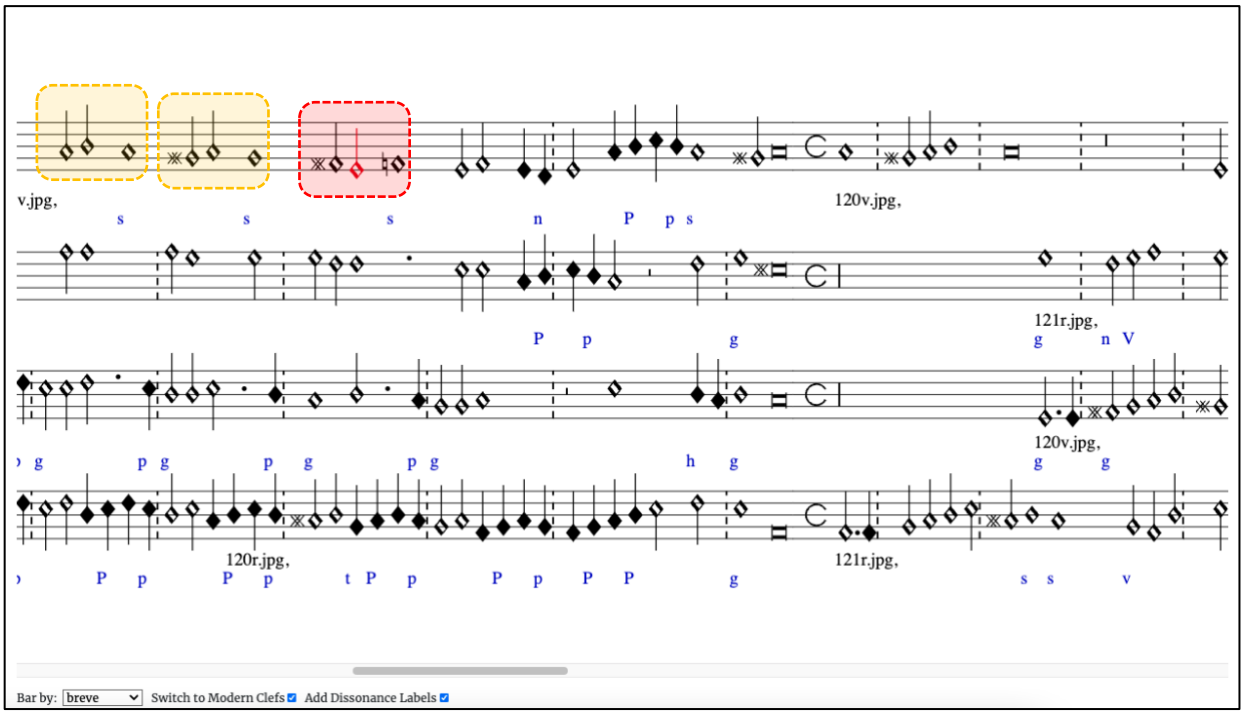


Figure 42: CPDL transcription version of the ending of the first Kyrie of Missa14.1_Kyrie0. The red note has been moved a third down, breaking the pattern of the superius as shown by the yellow boxes in Figure 41.

2. In the second Kyrie, the experimenter and the CPDL transcriber corrected the end of the superius in a different way. The experimenter shortened the last note (from breve to dotted semibreve, see Figure 43). The CPDL transcriber shortened this note further (to a semibreve) and dotted a previous semibreve (see Figure 44), which the experimenter left as it appeared in the manuscript. In terms of dissonances, both versions end up with the same results (all legal dissonances). These are just two solutions, one with consonances (Figure 43) and one with suspensions (Figure 44). According to Professor Cumming, the modification provided in the CPDL transcription is more likely since it is very rare to have a dotted note at the end of a measure (as in Figure 43). Moreover, the suspension with the dotted A in the top voice (see Figure 44) is typical of Renaissance style, Cumming noted.

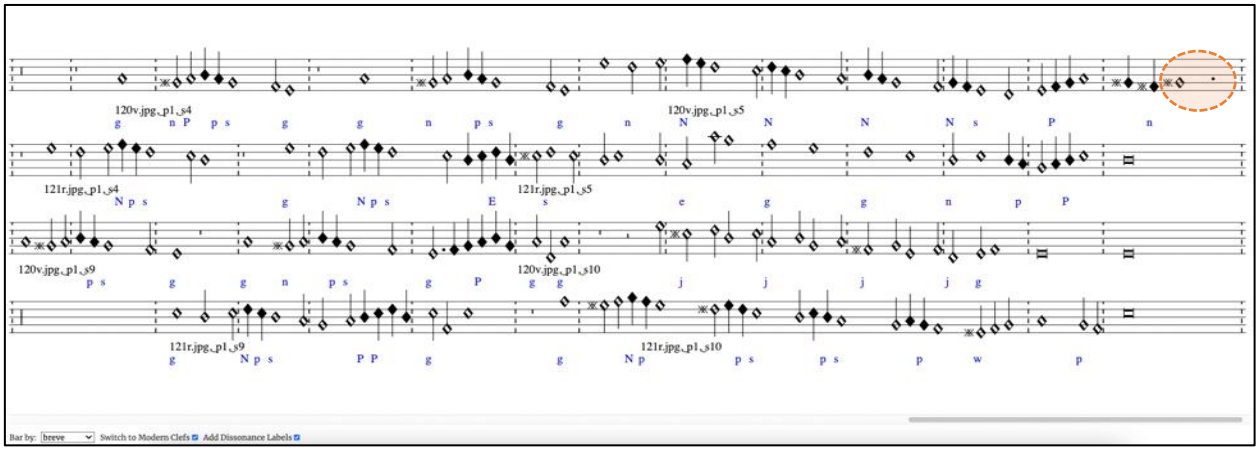


Figure 43: Experimenter version of second Kyrie from Missa14.1_Kyrie0. She reduced the last note of the superius from breve to dotted semibreve (orange circle).

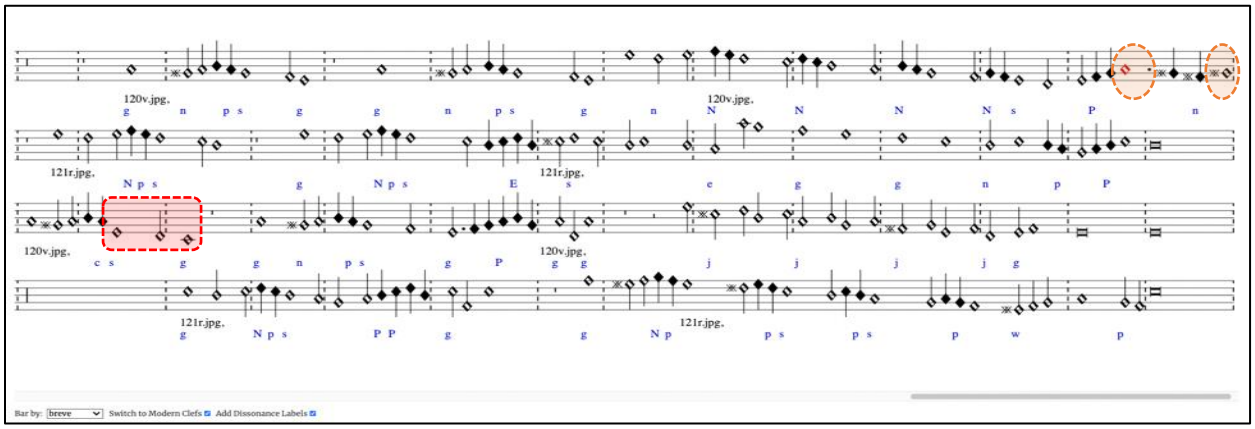


Figure 44: CPDL Transcription version of second Kyrie from Missa14.1_Kyrie0. The transcriber reduced the last note of the superius from a breve to a semibreve (last orange circle) and dotted a previous semibreve (first orange circle). The red box shows another difference which will be seen in more detail in Figure 45 and Figure 46).

3. In the tenor, at the beginning of the second Kyrie, the transcriber lowers the G3 semibreve, F3 minim, and E3 semibreve a third down. There were no illegal dissonances in this passage and the ones preceding the passage do not get resolved by this change. Moreover, this modification breaks the pattern held in other voices (see Figure 45 and Figure 46).

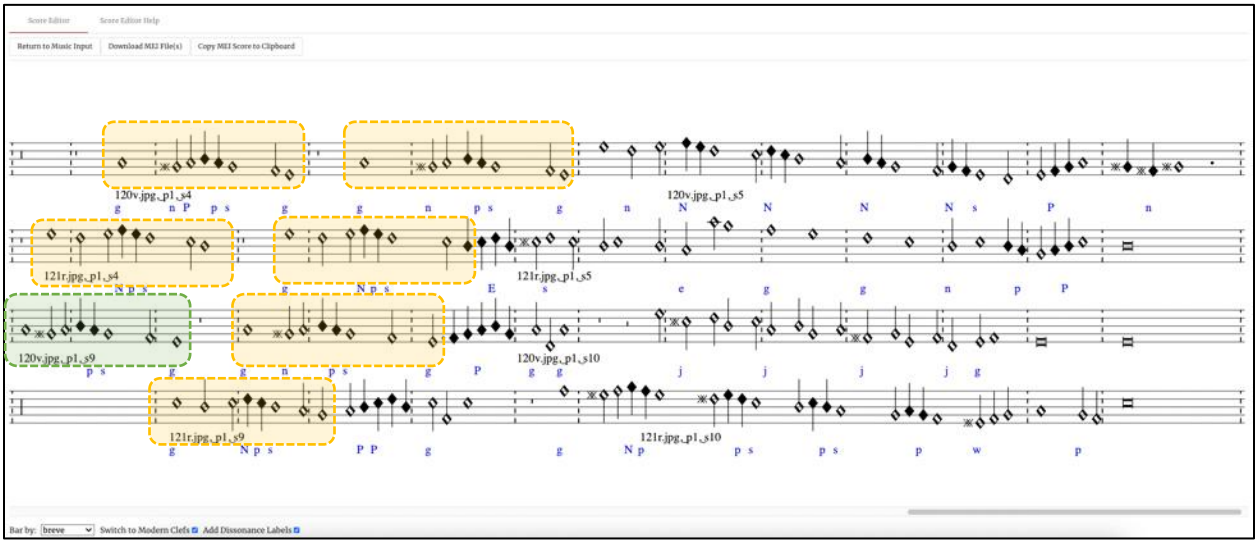


Figure 45: Experimenter version of second Kyrie from Missa14.1_Kyrie0 (same as in Figure 43). The experimenter keeps the original notes in the green box. Notice that this sequence appears as a pattern in other voices as well (yellow boxes). The last notes in the green box are lowered a third in the CPDL transcription (see Figure 46).

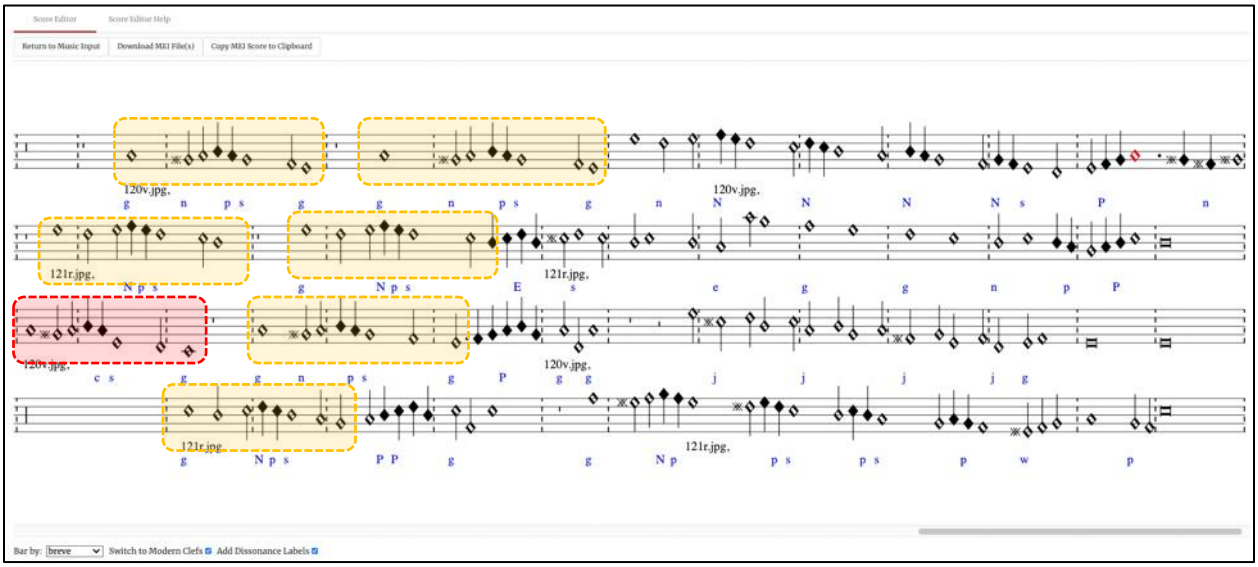


Figure 46: CPDL Transcription version of second Kyrie from Missa14.1_Kyrie0 (same as in Figure 44). The transcriber has lowered the last notes in the red box a third from their original pitches (compare to Figure 45). This breaks the pattern seen in other voices (yellow boxes).

The Christe section of Missa14.1_Kyrie0 is the only part where the experimenter left three orange ‘z’ labels (Figure 47), and this is also the case for the CPDL transcription. In the three places where the ‘z’ appears, the dotted minima and semiminima correspond to the syllables of the word “Chris-te.” The last two ‘z’ (in the superius and alto) are rearticulations. On the other hand, the first ‘z’ (in the tenor) is a “true” illegal dissonance since the voice is leaping to the dissonance—leaping to an A which makes a fourth over the bass. A way to correct this could be changing the A to a C, making it a repeated note as in the other instances.

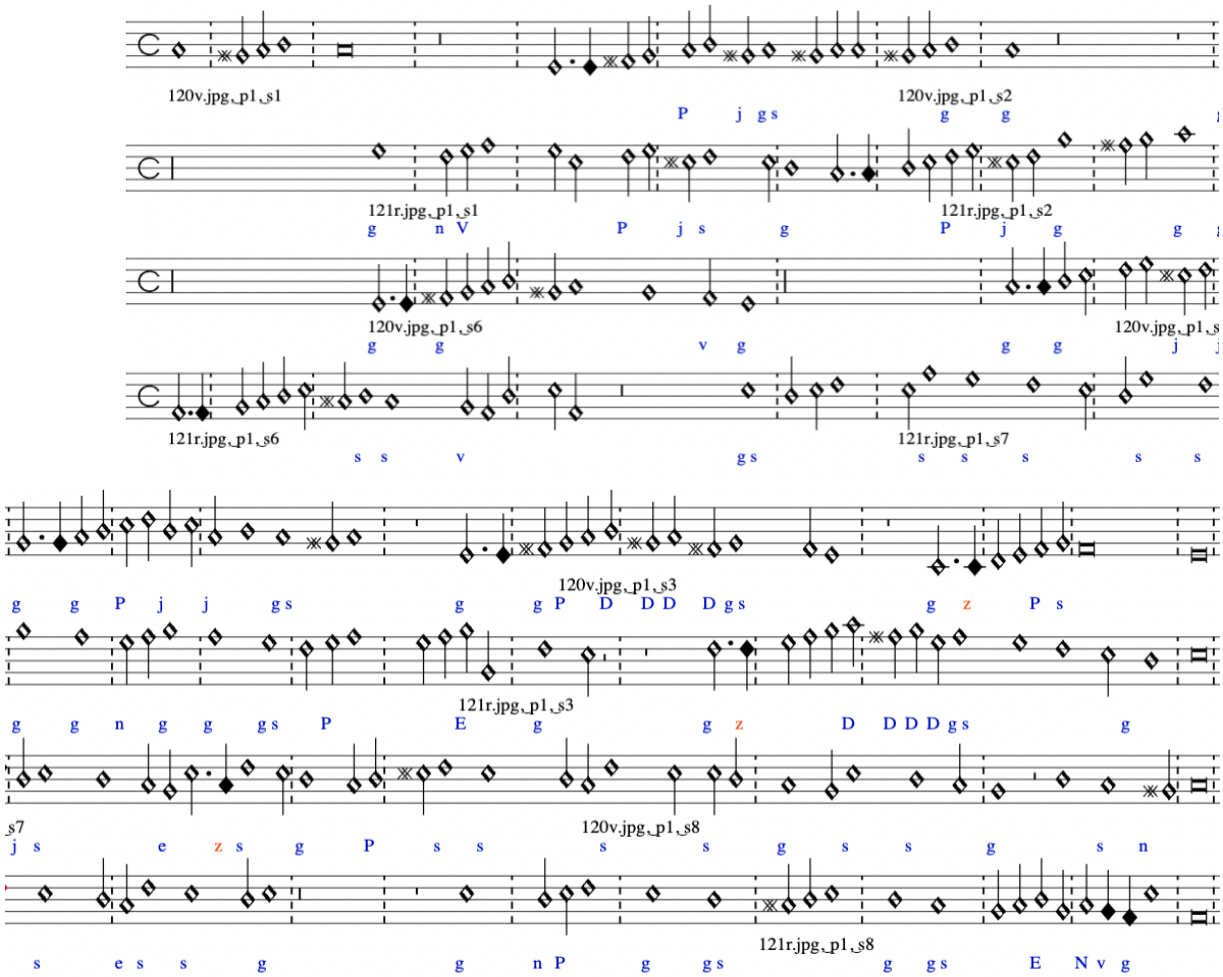


Figure 47: Christe section of Missa14.1_Kyrie0. This is the only place with orange labels left after the correction process. In the three places where the ‘z’ appears, the dotted minima and semiminima correspond to the syllables “Chris” and “te.” Therefore, the last two ‘z’ are a result of a rearticulation. CPDL transcription keeps the Christe section as in this Figure too.

Mass 15: Missa de 8° tono by Ceballos (XVI c.)

Sixteenth-century mass, fully transcribed in CPDL.[8] Four auto-contained units of this mass were part of the experiment dataset, distributed in both D and ND datasets.

Missa15.1_Kyrie0

Full Kyrie movement (f.133v–135r). Transcription in CPDL.

Dataset D: 44 measures | 4 voices | 0 illegal dissonances | Correction time: 1 minutes

- The experimenter did not make any corrections.
- Perfect match with the CPDL transcription based on a microfilm of the same document.

Missa15.3_Credo1

"Patrem omnipotentem" section (f.139v–141r) of Credo movement. Transcription in CPDL.

Dataset D: 64 measures | 4 voices | 61 illegal dissonances | Correction time: 2 minutes

- Scribal error, the experimenter changed a semibreve rest to a minim rest in measure 3 of the alto.
- Perfect match with the CPDL transcription.
- Only one orange label, out of the sixty-one at the beginning, was left after the corrections (see Figure 48).

[8] https://www.cpdl.org/wiki/index.php/Missa_octavi_toni_(Rodrigo_de_Ceballos)

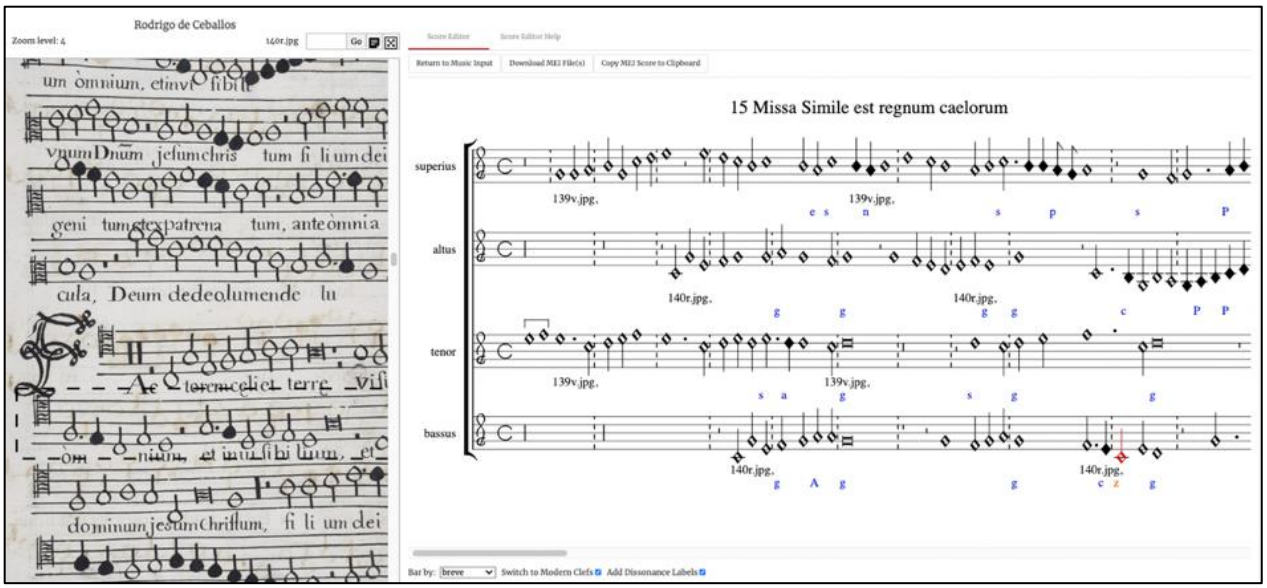


Figure 48: Missa15.3_Credo1 beginning according to CPDL and experimenter.
Note about clefs: *The superius and alto are in treble clef, while the tenor and bass are in suboctave treble clef.*

Missa15.3_Credo2

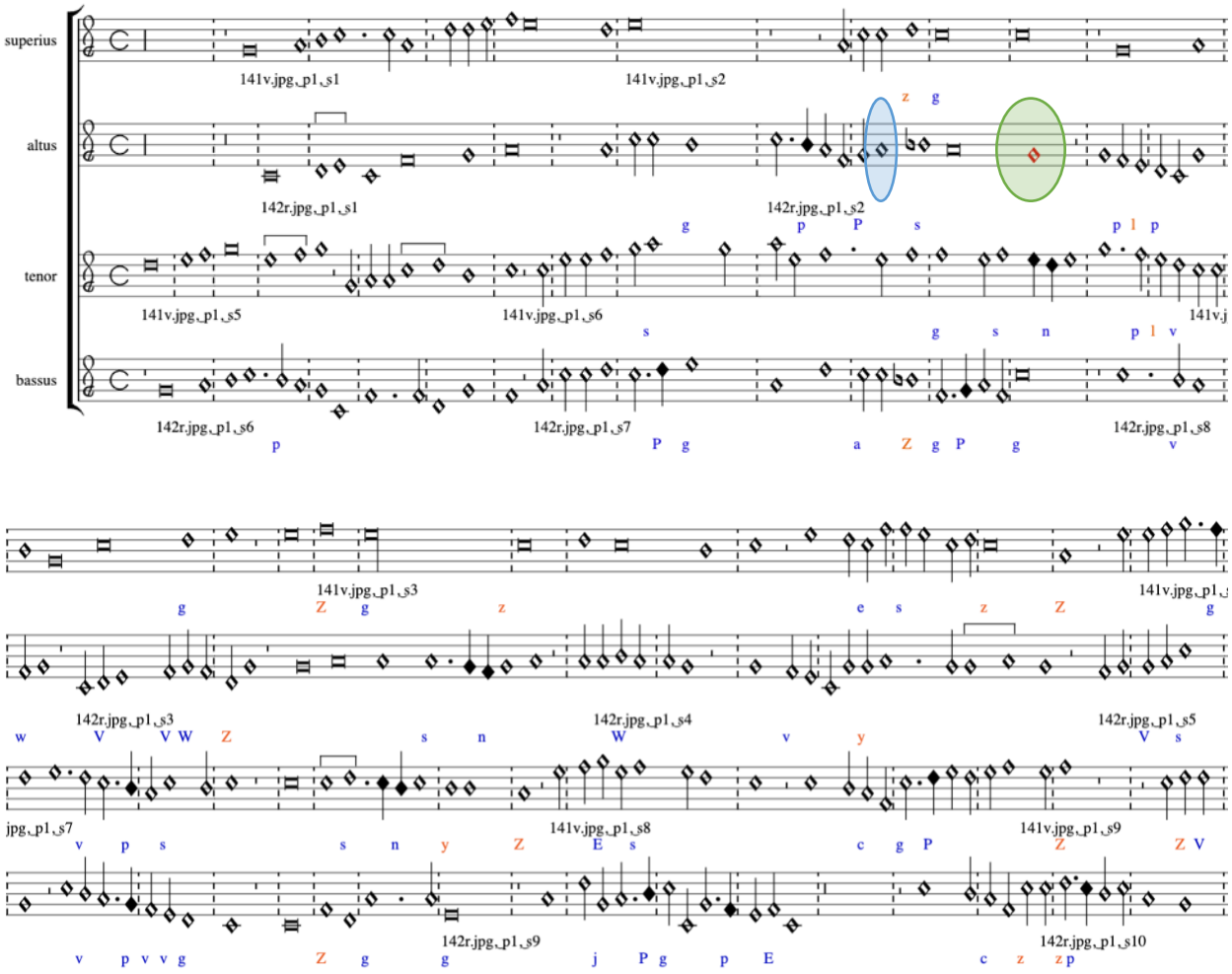
"Et incarnatus est" section (f.141v–143r) of the Credo movement. Transcription in CPDL.

Dataset ND: 56 measures | 4 voices | 43 illegal dissonances | Correction time: 15 minutes

- According to the notes of the experimenter, she knew she had to cut a minim in the alto towards the beginning, and she chose to shorten a G4 semibreve in measure 14 (she points out this was a guess). She also extended the last note in alto, tenor, and bass to have a simultaneous ending.
- In CPDL's transcription of the same document, the halved semibreve was a few measures earlier (an A4 in measure 12). The CPDL transcription also extends the last notes as the experimenter did.
- For this piece, I think that the DF would have been useful to determine the correct place for the correction, as shown in the following figures, where the DF is activated. Figure 49 shows the piece without the halved semibreve correction. Figure 50 shows the same piece as corrected by the experimenter (with the semibreve in the green circle halved). And Figure 51 shows the piece corresponding to CPDL's transcription (with the semibreve in the blue circle halved). While the change done by the experimenter removes all the following illegal dissonances—other than

rearticulated notes and one fusa—some dissonance labels still precede it. On the other hand, the correction done by the CPDL transcriber three notes before, removes all illegal dissonances—other than rearticulated notes and the one fusa. Therefore, while the experimenter knew that she needed to shorten the alto by a minim, the use of the dissonance filter might have helped her to find the right place to make this correction.

Missa15.3_Credo2_141v-143r (no fix)



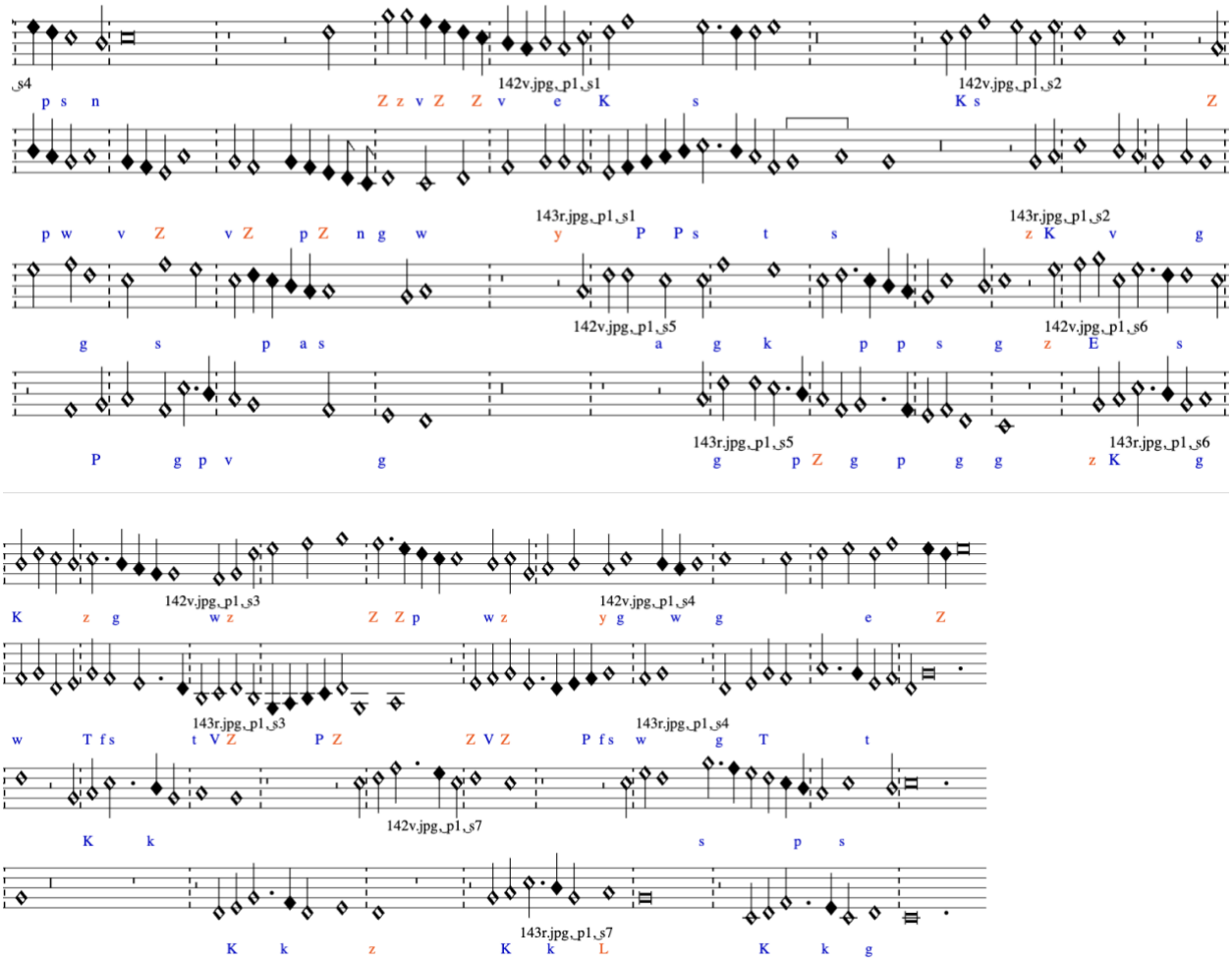
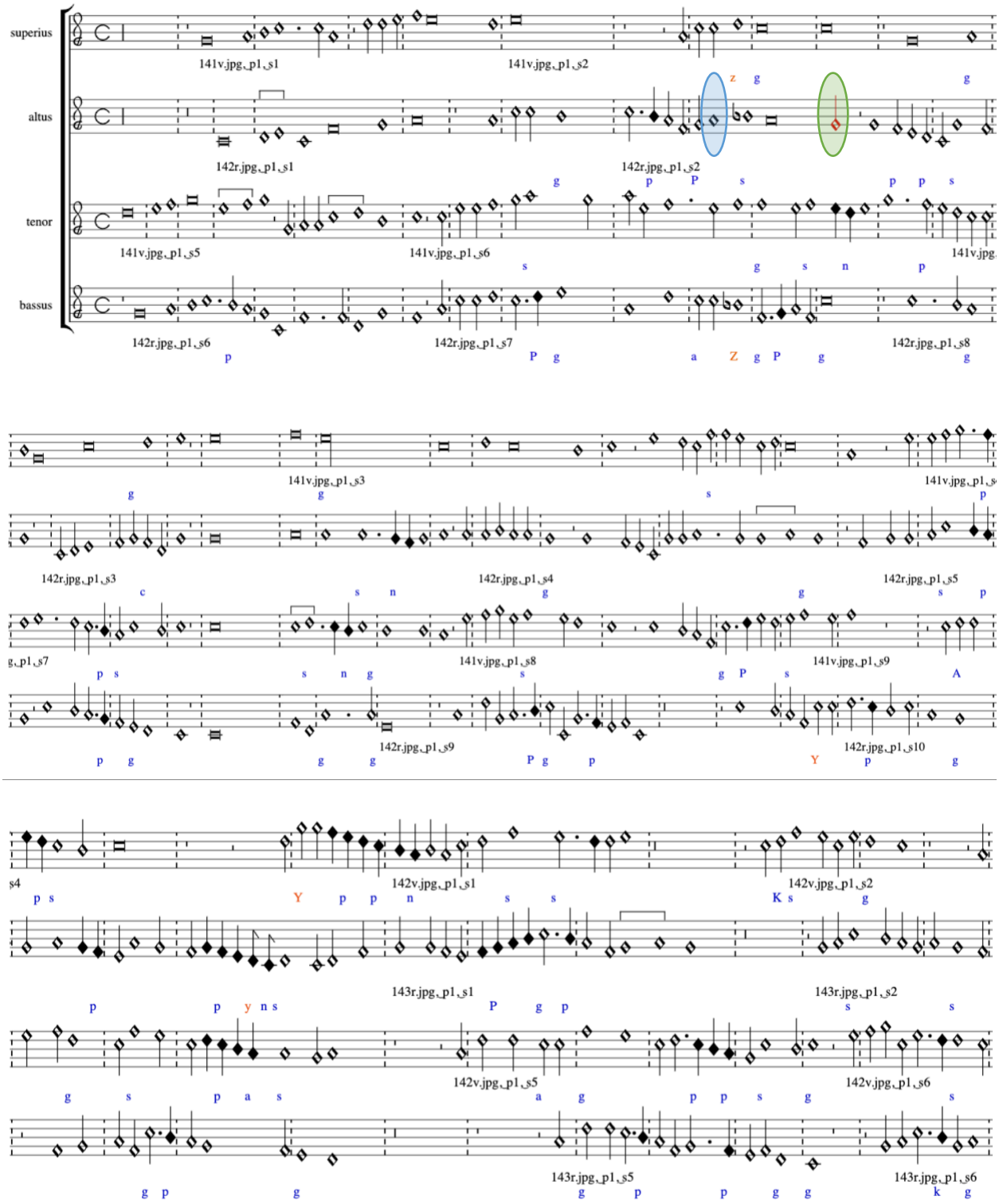


Figure 49: "Et incarnatus est" section of the Credo movement from Missa de 8° tono by Ceballos without the halving of the semibreve correction. The orange labels show the illegal dissonances of the piece in the MP Editor. The semibreve in the green circle is the one halved by the experimenter, while the semibreve in the blue circle is the one halved by CPDL's transcriber to correct the alignment of the voices.

Note about clefs: *The superius and alto are in treble clefs, and the tenor and bass are in suboctave treble clefs.*

Missa15.3_Credo2_141v-143r (Experimenter fix)



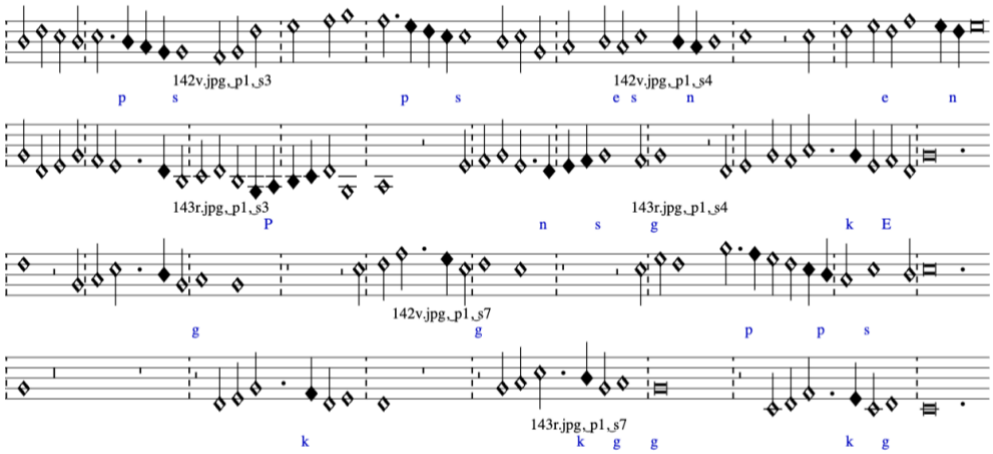
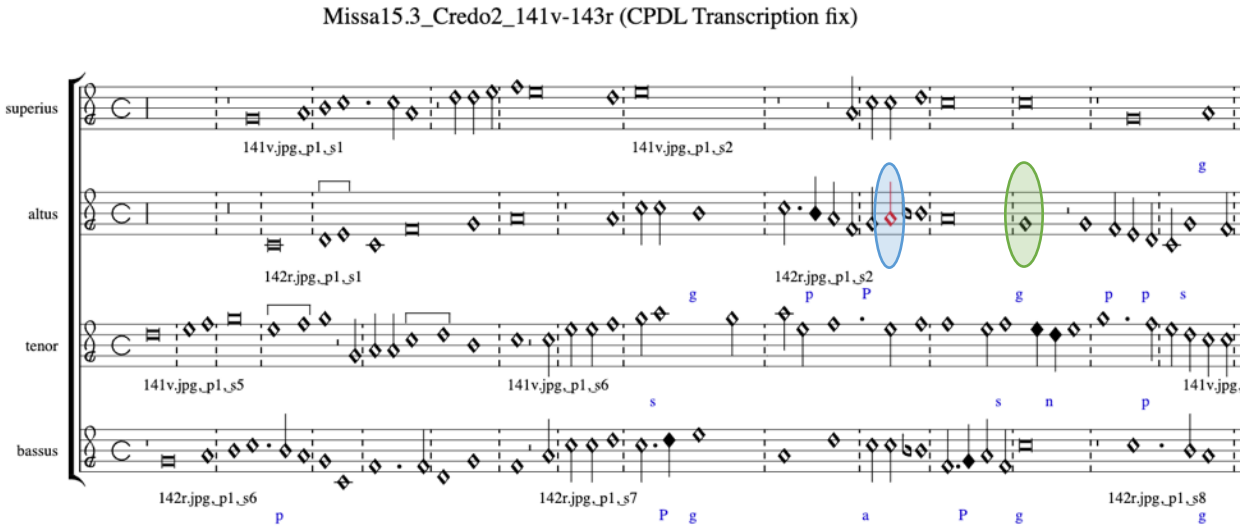


Figure 50: Correction according to the experimenter for "Et incarnatus est" section of the Credo movement from Missa de 8° tono by Ceballos. The green circle shows the experimenter correction, which consisted of halving the semibreve shown in the green circle of Figure 49. The correction removed all following "true" illegal dissonances, but not the ones preceding it.

Note about clefs: *The superius and alto are in treble clefs, and the tenor and bass are in suboctave treble clefs.*



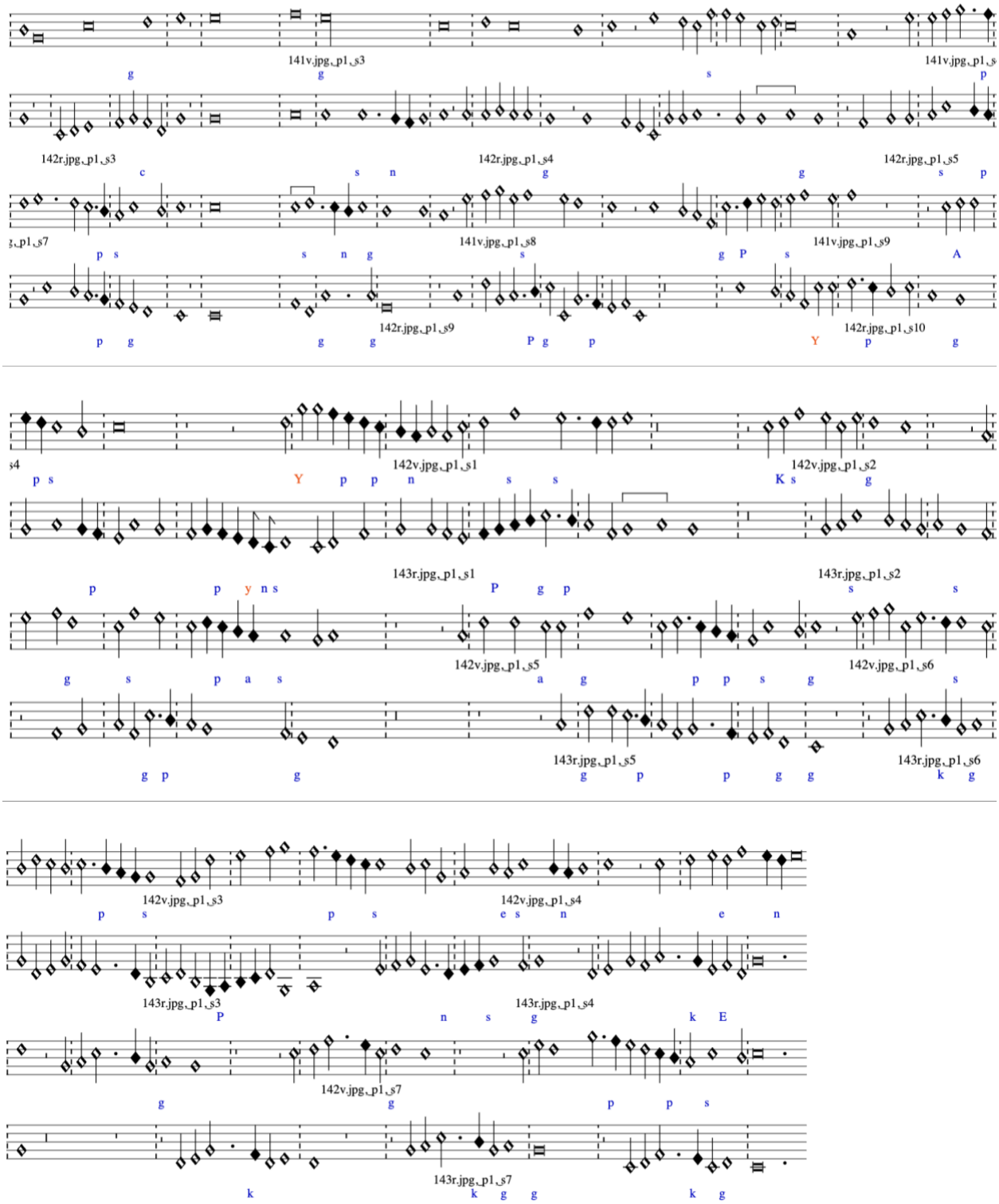


Figure 51: Correction according to the transcription from CPDL for "Et incarnatus est" section of the Credo movement from Missa de 8° tono by Ceballos. The blue circle shows the transcriber correction, which consisted of halving the semibreve shown in the blue circle of Figure 49. This correction removes all "true" illegal dissonance labels, contrary to the experimenter correction shown in Figure 50.

Note about clefs: *The superius and alto are in treble clefs, and the tenor and bass are in suboctave treble clefs.*

Missa15.3_Credo3

"Et ascendit in celum" section (f.143v–144r) of the Credo movement. Transcription in CPDL.

Dataset ND: 48 measures | 3 voices | 0 illegal dissonances | Correction time: 15 minutes

- The experimenter did not make any corrections.
- Perfect match with the CPDL transcription.

Mass 16: Missa de Bomba by Bermúdez (XVI c.)

Sixteenth-century mass, fully transcribed in CPDL.[9] Three auto-contained units of this mass were used in this experiment, distributed in both the D and ND dataset.

Missa16.4_Sanctus1

"Sanctus" section (f.165v–166r) of Sanctus movement. Transcription in CPDL.

Dataset D: 22 measures | 4 voices | 2 illegal dissonances | Correction time: 1 minutes

- The only correction made by the experimenter was to extend the last note of the alto. This one correction eliminated all orange labels.
- Perfect match with the CPDL transcription.

Missa16.4_Sanctus2

"Osanna" section (f.166v–167r) of the Sanctus movement from *Missa de Bomba* by Bermúdez.

Transcription in CPDL.

Dataset ND: 13 measures | 4 voices | 17 illegal dissonances | Correction time: 11 minutes

- Very short triple meter piece. The only triple-meter piece in the experiment dataset.

[9] https://www.cpdl.org/wiki/index.php/Missa_de_bomba_(Pedro_Bermúdez)

- Scribal correction. The experimenter added a E4 semibreve before the final breve, which also had an E4 pitch. This correction is equivalent to the one in CPDL's transcription, where the transcriber just dotted the final E4 breve.
- Scribal correction. The bass voice, shown in Figure 52, was a longa too short. To fix this, the experimenter doubled the longa rest in the bass (see Figure 53). In the CPDL transcription, they correct this passage by repeating the notes that follow this rest (see pink and blue rectangles in Figure 54). While the experimenter's correction is not wrong, the CPDL one is better since, as indicated by Professor Cumming, it is common to have a repeated bassline with rearranged voices on top.

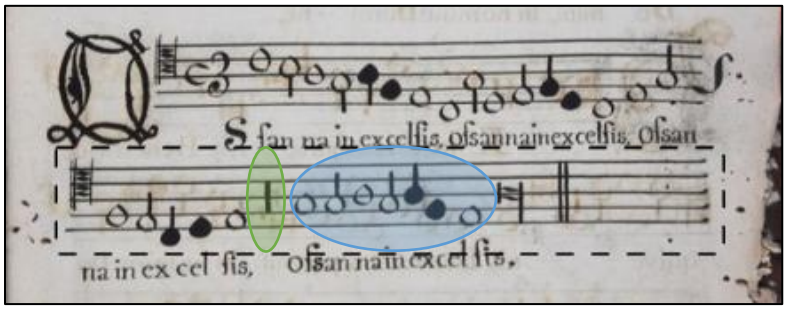


Figure 52: Bass voice of the Osanna section from the Sanctus movement in Missa de Bomba by Pedro Bermúdez. The colored ovals show the set of notes or rests repeated by the experimenter (green) or the CPDL transcriber (blue) to fix the missing longa value in the bass. These corrections can be seen in Figure 53 (for the experimenter) and Figure 54 (for CPDL).

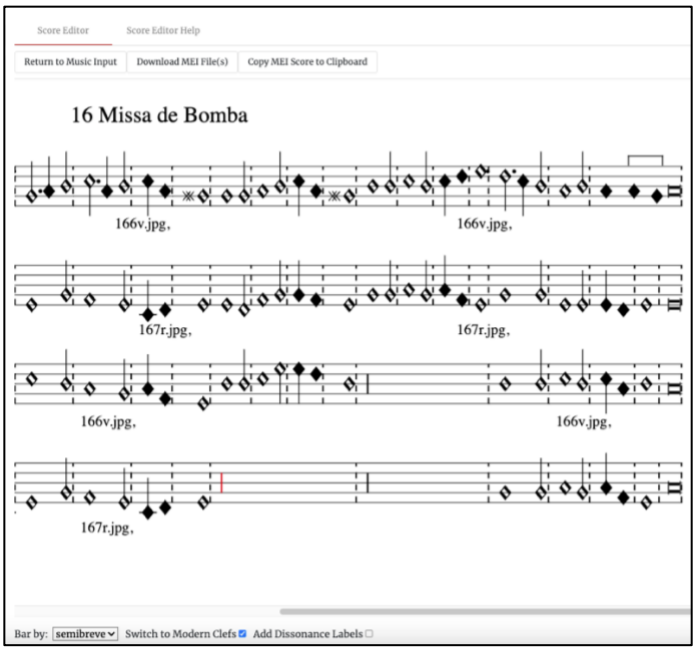


Figure 53: Ending of the Osanna section from the Sanctus movement in Missa de Bomba by Pedro Bermúdez according to the experimenter. Notice that she duplicated the long rest in the bass because this voice was one longa too short. ***Note about clefs:*** *The superius and alto are in G clefs, while the tenor and bass are in suboctave G clefs.*

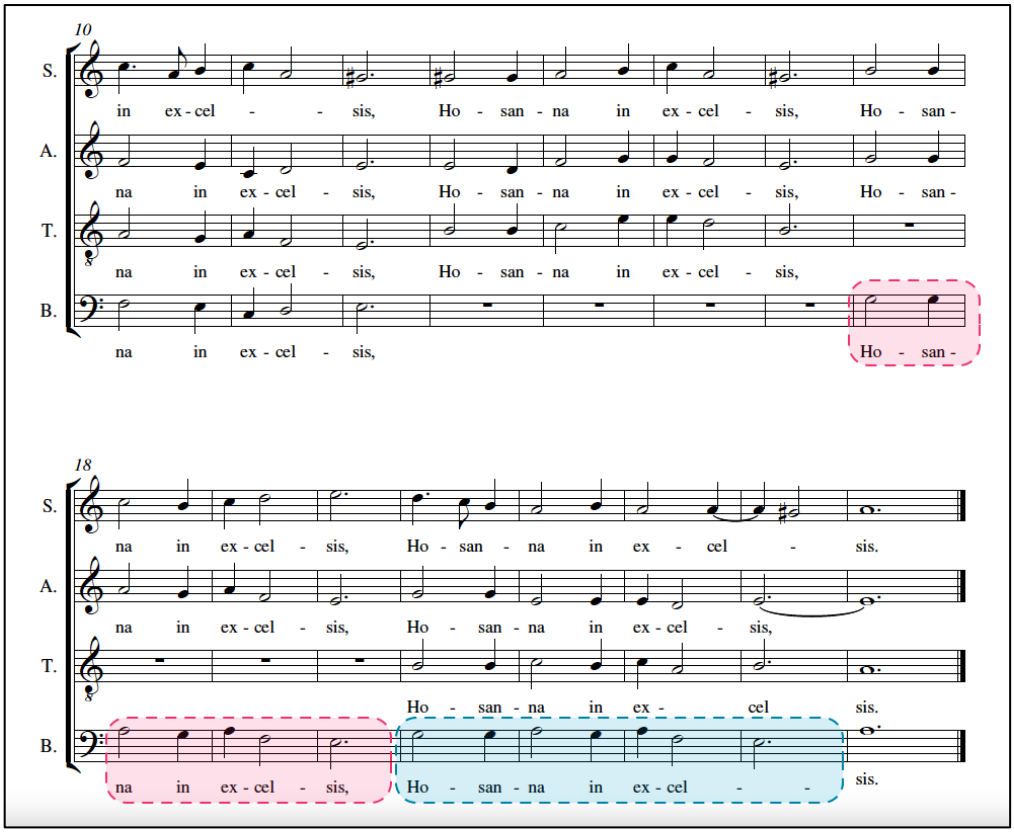


Figure 54: CPDL transcription of the same passage presented in Figure 53. The CPDL correction for the missing longa value in the bass was to repeat the passage following the rest (see dotted boxes).

Missa16.4_Sanctus3

"Benedictus" section (f.167v–168r) of Sanctus movement from *Missa de Bomba* by Bermúdez.

Transcription in CPDL.

Dataset D: 27 measures | 3 voices | 16 illegal dissonances | Correction time: 9 minutes

- According to the experimenter's notes, she knew the alto line needed an extra semibreve very early on and she picked what she considered the best spot changing the A4 semibreve in measures 3–4 to a breve. In the CPDL transcription of the same document, this note keeps its original value, and the transcriber instead adds an extra semibreve at the beginning of measure 5.
- While the experimenter's solution solves all following illegal dissonances, it generates a new illegal dissonance in the place of the correction (see Figure 55 and Figure 56). On the other hand, the transcriber's solution does not generate any new illegal dissonances, while also removing the following ones (see Figure 57). I think experimenting a bit more with the results of the DF—by making corrections and seeing their effects on the following orange labels—could have helped found the right place for the missing semibreve value.

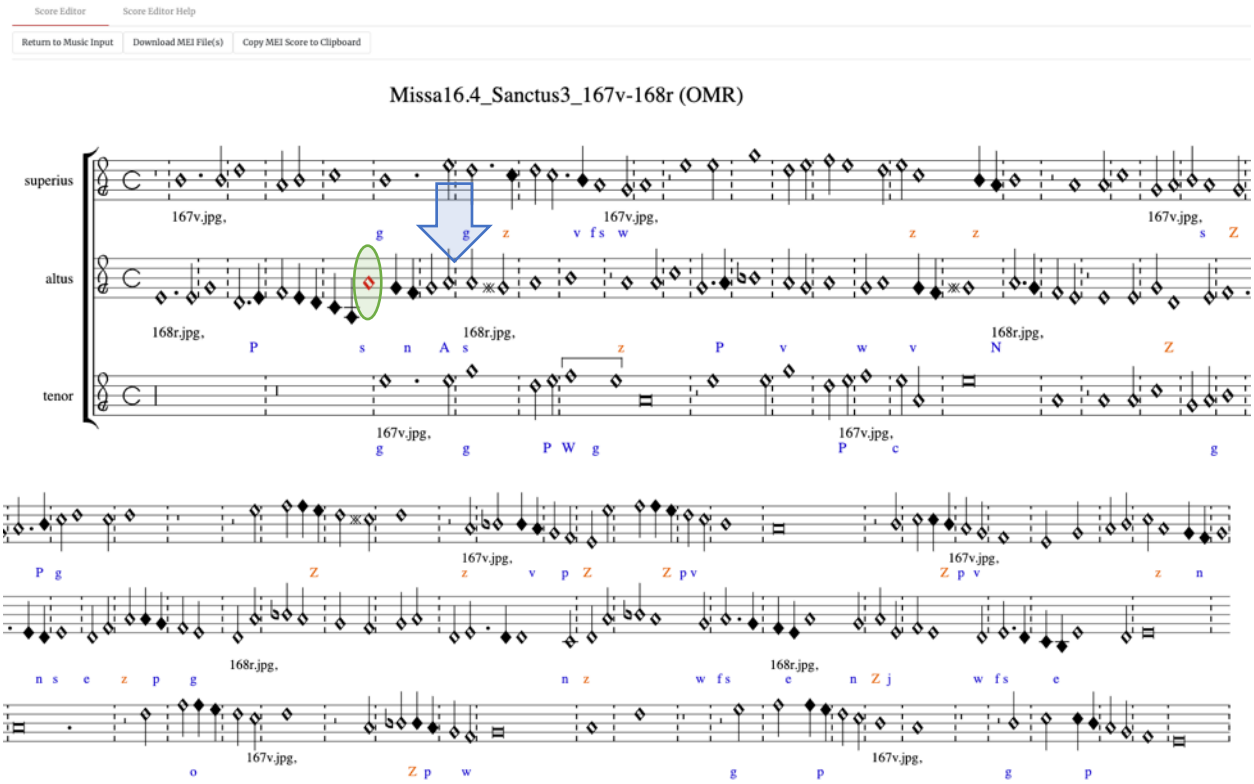


Figure 55: Missa 16.4_Sanctus3 as recognized by the OMR. The green circle shows the note corrected by the experimenter (shown in Figure 56) and the blue arrow points to the correction from CPDL's transcription (shown in Figure 57).

Note about clefs: *The superius and alto are in G clefs, while the tenor is in suboctave G clef.*

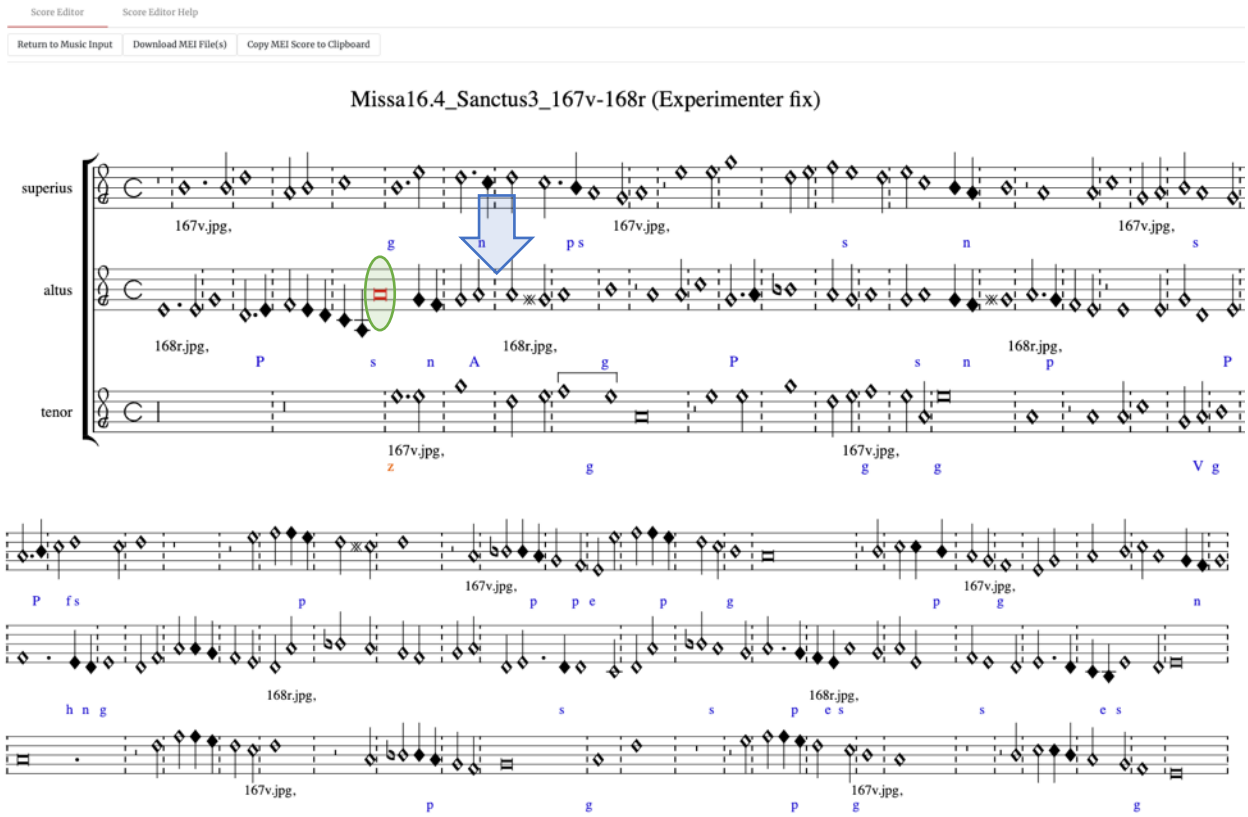


Figure 56: Missa 16.4_Sanctus3 with the red note corrected by the experimenter (green circle). Notice that all illegal dissonances from Figure 55 following this note have disappeared. However, a new illegal 'z' dissonance label has appeared in the bass. Compare this correction to the one done in CPDL (Figure 57, blue arrow).
Note about clefs: *The superius and alto are in G clefs, while the tenor is in suboctave G clef.*

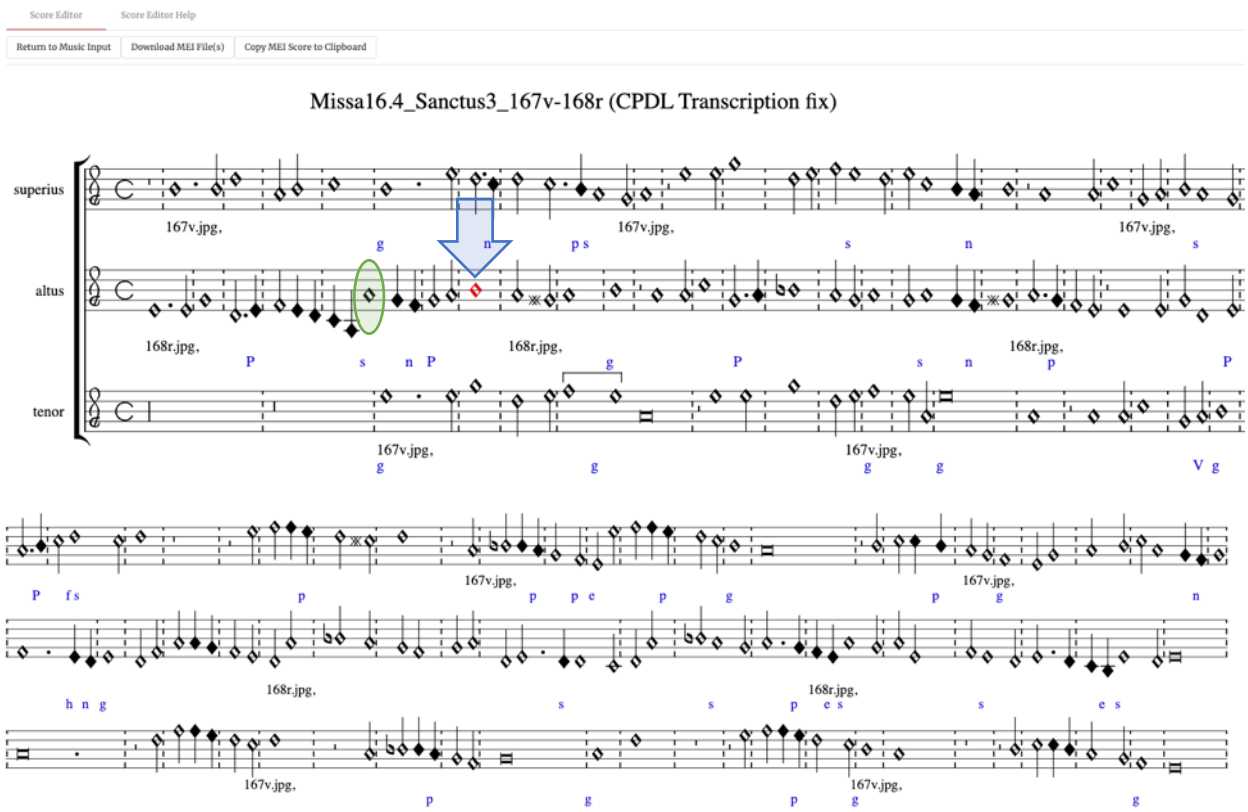


Figure 57: Missa 16.4_Sanctus3 as transcribed in CPDL. A new note has been added (see red semibreve in alto at the blue arrow). This correction has removed all illegal dissonance labels.
Note about clefs: *The superius and alto are in G clefs, while the tenor is in suboctave G clef.*

Mass 17: Missa sine nomine by Juan Matías de Rivera (XVII c.)

One of the masses added in the eighteenth century. This mass was composed in the seventeenth century, and it is fully transcribed in CPDL.[10] Only one auto-contained unit of this mass was used in the experiment, and it belongs to the ND dataset.

Missa17.5_Agnus0

Full Agnus movement (f. 179v–180r). Transcription in CPDL.

Dataset ND: 26 measures | 4 voices | 1 illegal dissonance | Correction time: 6 minutes

- The experimenter did not make any corrections.

[10] https://www.cpdl.org/wiki/index.php/Missa_a_cuatro_voces_(Juan_Matias_de_Rivera)

- Perfect match with the CPDL transcription.
- The use of the dissonance filter in this seventeenth-century piece (added in the eighteenth century) results in only one illegal dissonance, a ‘Z’ label from a rearticulated note.

Short polyphonic pieces: Surrexit by Anonymous composer (? c.)

The following two pieces, like all other short polyphonic pieces, were added in the eighteenth century. These two are anonymous pieces. One of them is transcribed in CPDL. Details are provided in each of the pieces.

Piece21_Surrexit1

Short anonymous polyphonic piece (f.184v–185r), *Surrexit Dominus vere*. No transcription in CPDL.

Dataset ND: 17 measures | 5 voices | 21 illegal dissonances | Correction time: 10 minutes

- The experimenter moved an F4 breve to G4 in the upper voice I, measure 12. This note is the second note of the penultimate ligature in 184v. She also added a dot to the second minim (G3) in the bass. And she shortened the last note of the alto from a F4 longa to a breve for a simultaneous ending of all voices.
- There is no transcription in CPDL corresponding to this piece, but all the experimenter corrections are good, with no “true” orange labels left as explained in the next point.
- Applying the DF to the experimenter’s file results in two orange labels, both “false” illegal dissonances. One of them is a ‘y’ close to the end of the tenor, which is due to a rearticulation. The other is a ‘y’ close to the beginning of the tenor, which is on a G. Both are agents of the suspended F in the alto.

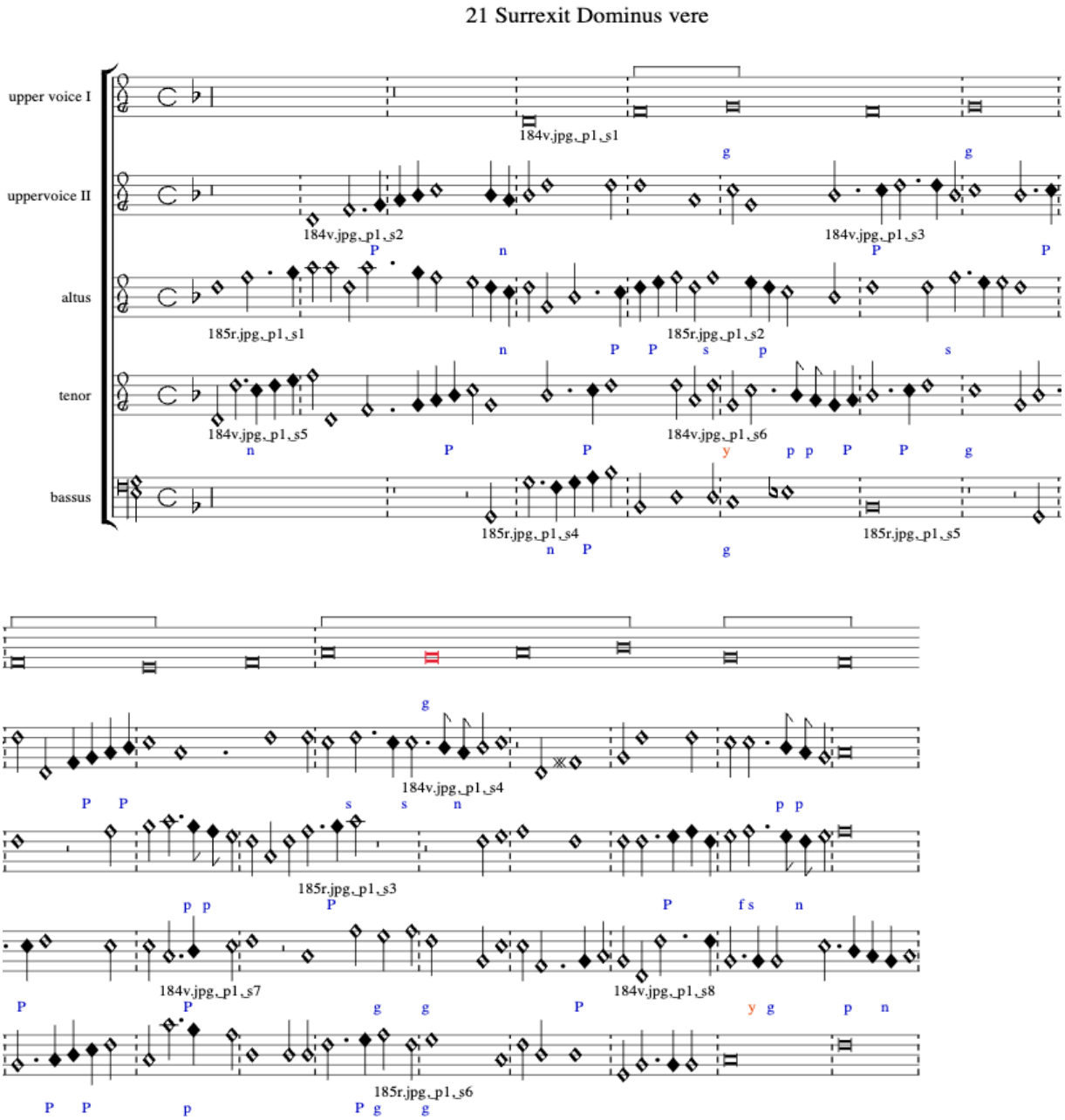


Figure 58: Experimenter's version of Piece21.

Piece25_Surrexit0

Short anonymous polyphonic piece (f.189v–190r), *Surrexit Dominus vere*. Transcription in CPDL.[11]

Dataset D: 15 measures | 4 voices | 13 illegal dissonances | Correction time: 6 minutes

[11] https://www.cpdl.org/wiki/index.php/Surrexit_Dominus_vere_II_(Anonymous)

- Note: In this piece, I transcribed the tenor notes as semibreves because the ligatures did not seem to have a mensural notation interpretation, but rather meant to represent a cantus firmus as suggested by Professor Cumming.
- The experimenter extended the last note of the tenor (D3). This correction is also found on CPDL's transcription.
- There are three mismatches between the score generated by the experimenter and the transcription from CPDL:
    1. First, in CPDL, the cantus firmus is transcribed as the bass voice. In the experiment, I assigned the cantus firmus to the tenor based on the voice range.
    2. The experimenter added a long in the cantus firmus (tenor voice) after the third ligature using the same pitch (A3) as in the previous note. She added this note to provide the last syllable of the word "ve-re," which is missing in the manuscript's text. This correction differs from what is in the CPDL transcription, where the transcriber adds a long rest (rather than a long note) and he assigns the missing "-re" syllable to the previous A3 semibreve. See the yellow box in Figure 59 and Figure 60 to compare both solutions. The solution of CPDL is better since it does not have dissonances in the strong beat (see the accented upper neighbor 'W' and the appoggiatura 't' shown in Figure 59).[12]
    3. The final excerpt of the cantus firmus is changed in the CPDL transcription as shown in Figure 60 (pink box). The experimenter keeps the original values. Both versions of the passages behave the same in terms of dissonances (all of them legal), but the experimenter's keeps the cantus firmus in semibreve values as it has been moving so far, while CPDL's transcription has a more ornamented ending. No illegal dissonances are

[12] According to the documentation of appoggiaturas in the Verovio Humdrum Viewer website, "This label is only assigned if the requirements are met and the note would otherwise be unexplainable," with these requirements being that the note is approached by a leap and resolved by a step.
https://doc.verovio.humdrum.org/filter/dissonant/#appoggiaturas-t-t

present in the experimenter's and CPDL's scores, except for a rearticulated note that behaves as an agent of a suspension (more specifically as a double agent, see the end of Figure 59 or Figure 60 where the rearticulated A in the bass and the E in the tenor are both agents of the suspended D in the alto).

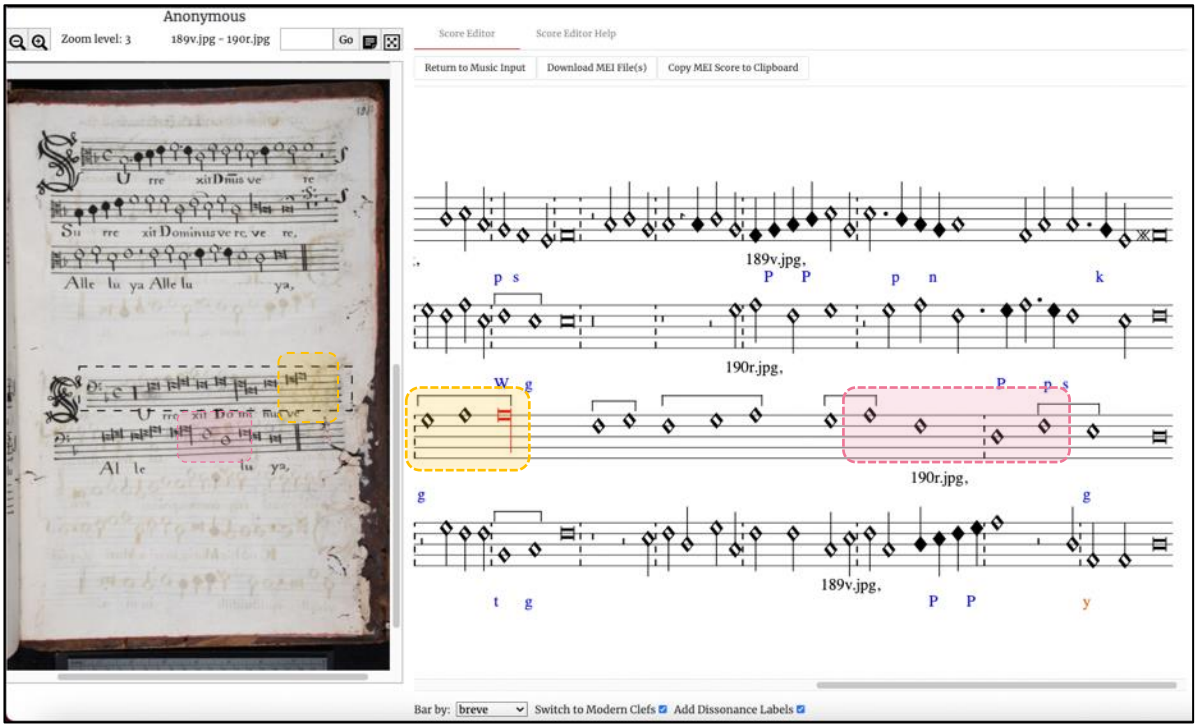


Figure 59: Experimenter's version of the ending of Piece25. The 't' stands for appoggiatura approached from above, and the 'W' for an accented upper neighbour.
Note about clefs: *The tenor and bass are in F clefs, while the superius is in G clef and the alto in suboctave G clef as usual.* ***Key signature:*** *with a B flat.*

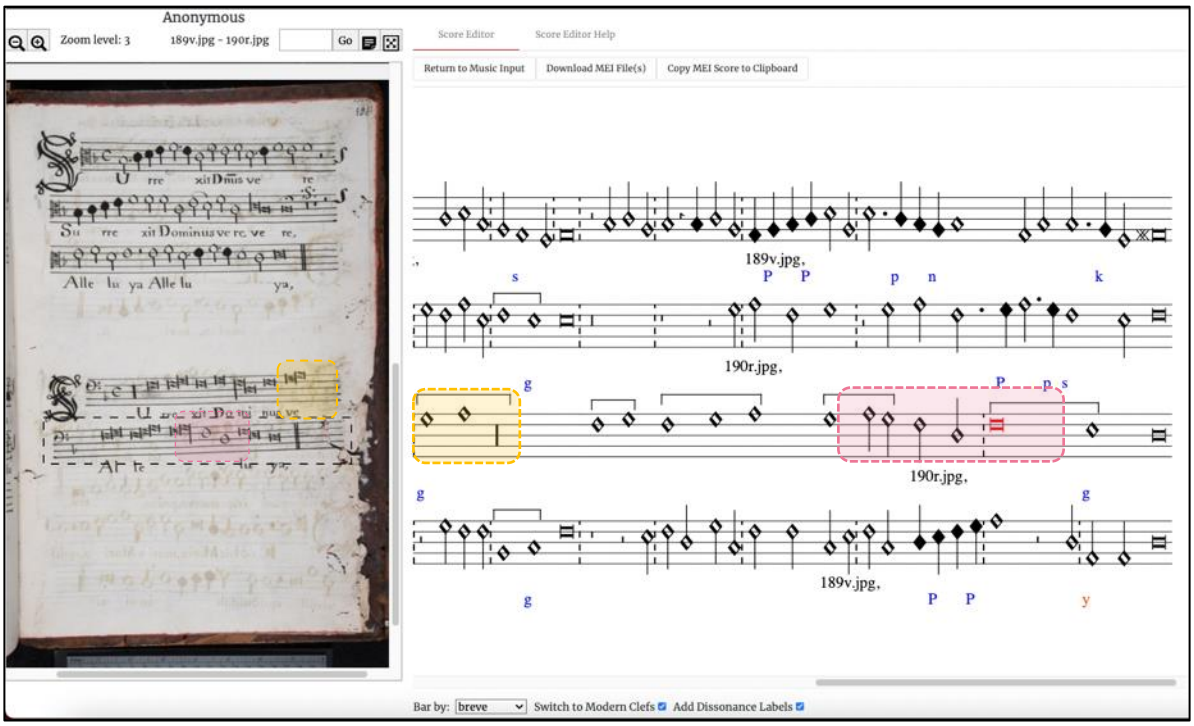


Figure 60: CPDL's transcription of the ending of Piece25.
Note about clefs: *The tenor and bass are in F clefs, while the superius is in G clef and the alto in suboctave G clef as usual.* ***Key signature:*** *with a B flat.*

RISM A/I P 660
Palestrina, Giovanni Pierluigi da. Missarum liber secundus. Rome: Dorico, Valerio, eredi and Luigi Dorico, eredi. 1567. Print.

References:
Schubert, Peter. 1999. *Modal Counterpoint, Renaissance Style*. Oxford University Press New York.