

Automatic Scoring up of Music in Mensural Notation

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McGill University

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Superius

T aulture d'antan l'autrier passa
percha. d'unz legard forque a melan q' me mist en
laruere l'm. tāt maluaue brassm me boassa
Kartel sachon me fricassa
Mau par dieu elle fist son don
l'aulture d'antan l'autrier passa.

Tenor

T Enor l'aulture d'antan l'autrier passa zen pas
sant me t'percha d'unz legard forque a melan.
qui me mist en laruere l'm tant maluaue
brassm l'aulture d'antan l'autrier passa.

Contratenor

T Dnt. l'aulture d'antan

Beinecke Rare Book & Manuscript Library

Mellon Chansonnier (MS 91), 25v-26r

Scoring up

The image displays a musical score for three voices: Superius, Tenor, and Contratenor. The score is presented in two systems. The first system shows the initial entries of the voices, with the Superius part starting on a high note and the Tenor and Contratenor parts following. The second system shows the continuation of the music, with the voices moving in parallel motion. The notation includes treble clefs, a key signature of one sharp (F#), and a common time signature (C). The background of the score is divided into three horizontal bands: light blue for the Superius part, light red for the Tenor part, and light green for the Contratenor part. The notes are written in black ink on five-line staves.

Mensural Notation

(An Introduction)

Mensural Notation

- There is a clear hierarchy in the note duration

longest
↓
shortest

Notes		Values	
Name	Shape	Perfect	Imperfect
Maxima	☐	☐ ☐ ☐	☐ ☐
Long	☐	◊ ◊ ◊	◊ ◊
Breve	◊	⌋ ⌋ ⌋	⌋ ⌋
Semibreve	◊	⌋ ⌋ ⌋	⌋ ⌋

☐ ☐ ◊ ☐
 —————
 3 x ◊ 2 x ◊ 1 x ◊ 3 x ◊

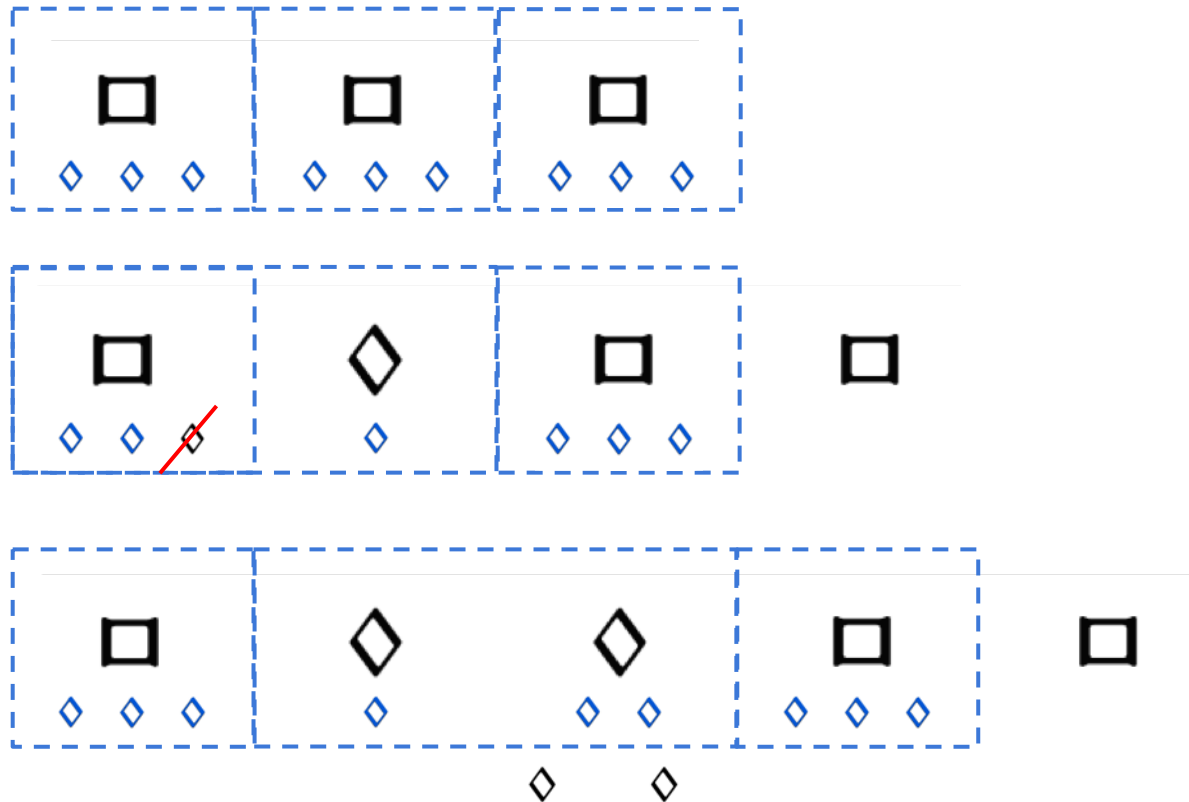
Mensuration

Establishes the relation between the note values (“perfect” or “imperfect”)

In perfect mensurations, the duration of the individual note symbols is not absolute, but rather **depends on context**

Examples of Context Changing the Note's Duration

Mensuration: Breve = 3 → Breves are perfect by default



*Principles of
Imperfection
and Alteration*

Imperfection

Perfect → Imperfect

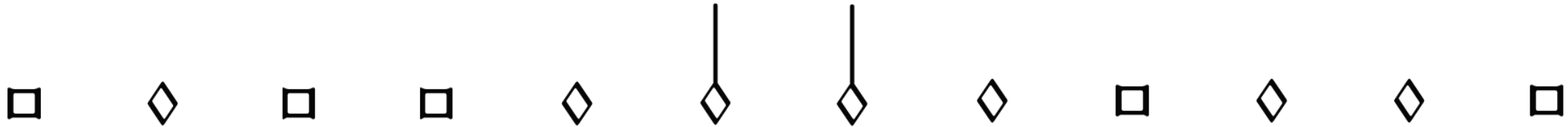
Alteration

Franco of Cologne
Ars Cantus Mensurabilis (ca. 1280)

The Scoring-up Tool

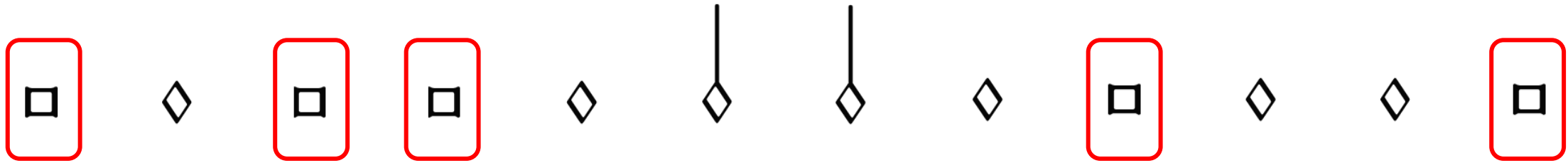
Algorithm

Mensuration: Breve = 3 \rightarrow Breves are perfect by default



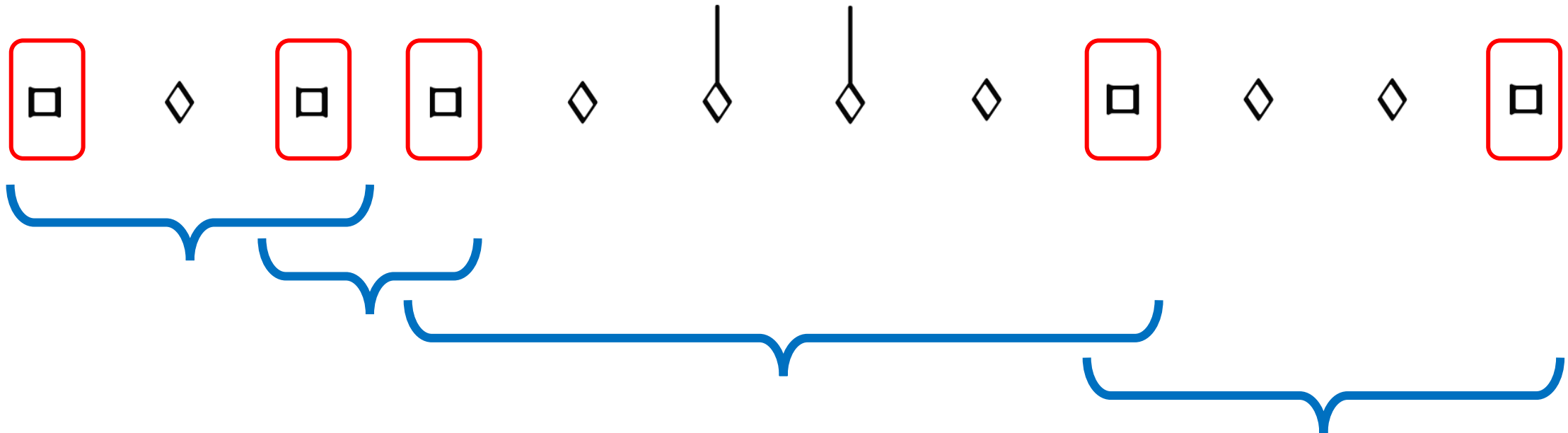
Algorithm

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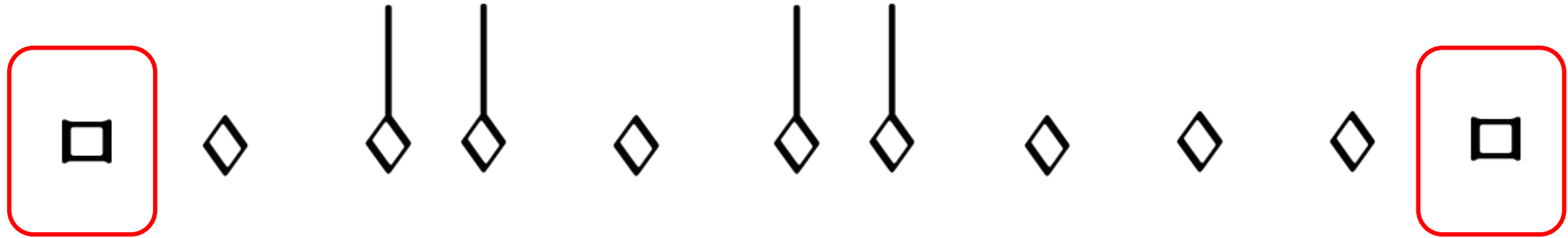


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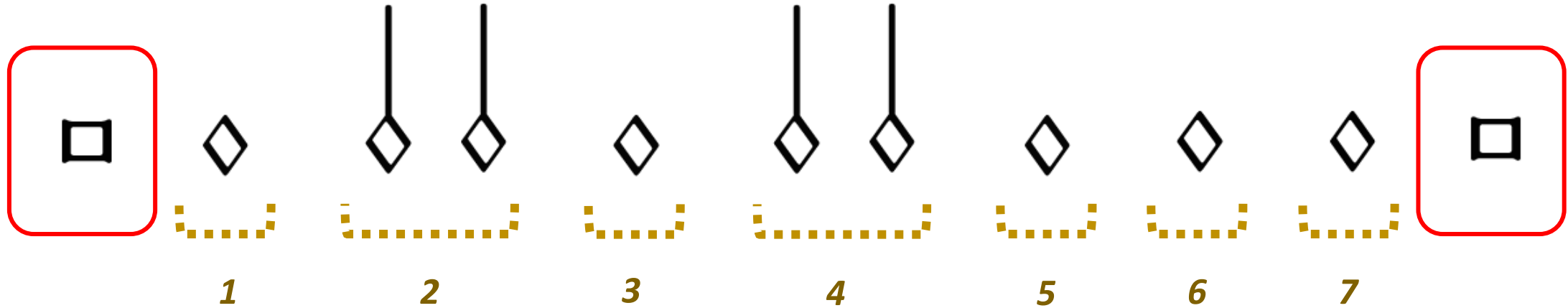
Mensuration: Breve = 3 \rightarrow Breves are perfect by default



Example: (sequence bounded by breves)

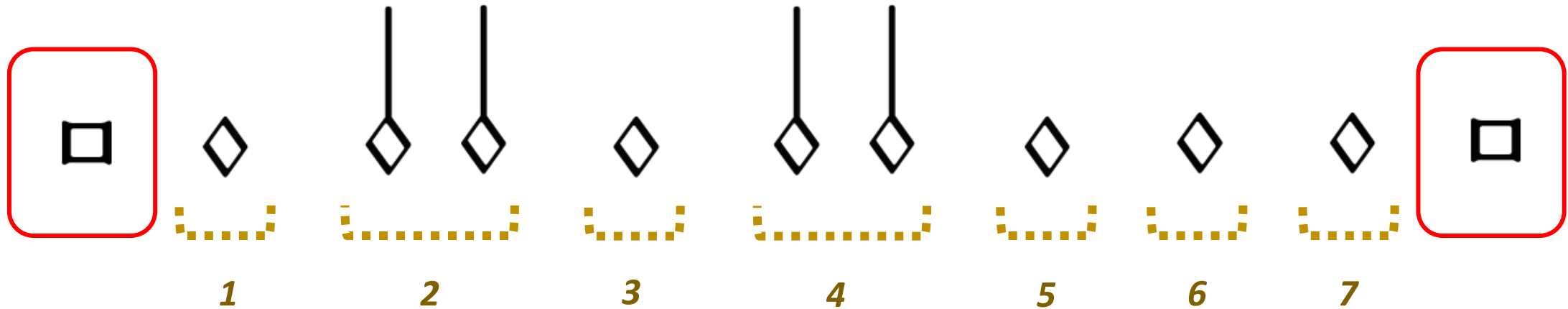


Example: (sequence bounded by breves)



7 semibreves

Example: (sequence bounded by breves)



7 semibreves = Two groups of 3 semibreves + 1

Number N of semibreves between the boundaries	Number P of perfect groups of semibreves	General Interpretation	Alternative Interpretation
$N = 3P + 1$	$P \geq 0$	Imperfection (by following)	Imperfection (by preceding)
$N = 3P + 2$	$P = 0$	Alteration	Imperfection (by following) & Imperfection (by preceding)
	$P > 0$	Imperfection (by following) & Imperfection (by preceding)	Alteration
$N = 3P$	$P = 0$	-	-
	$P = 1$		Imperfection (by following) & Alteration
	$P > 1$	Imperfection (by following) & Alteration	-

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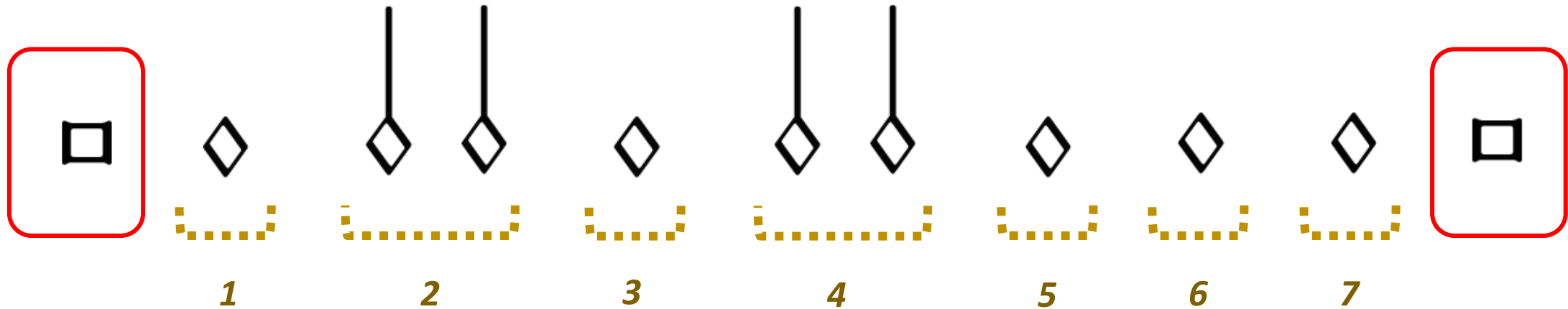
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7 semibreves

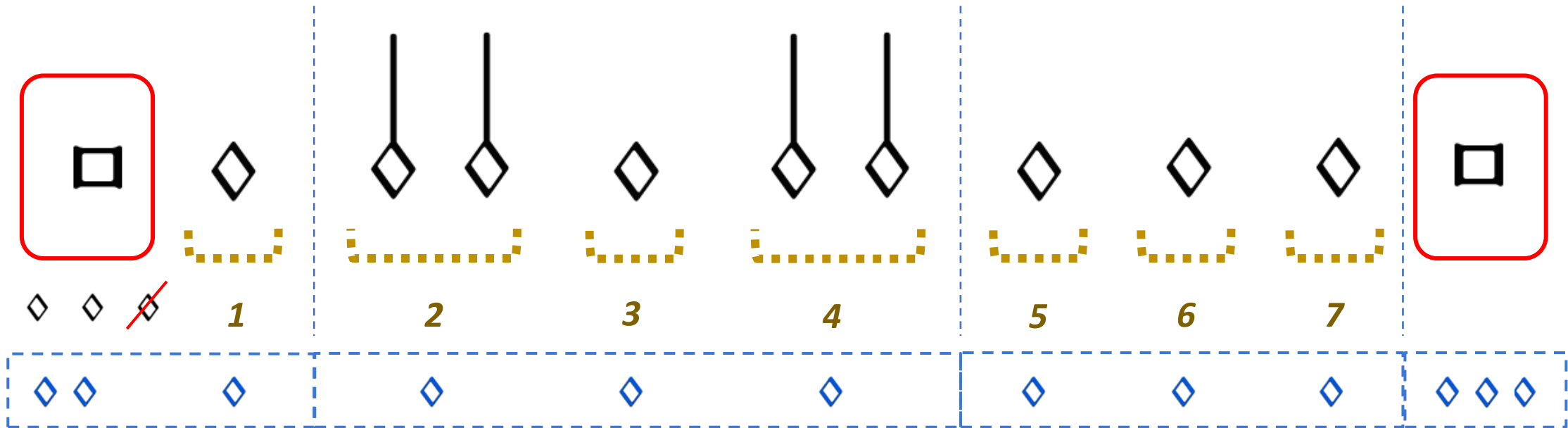
=

Two groups of 3 semibreves

+

1

Example: (sequence bounded by breves)



7 semibreves

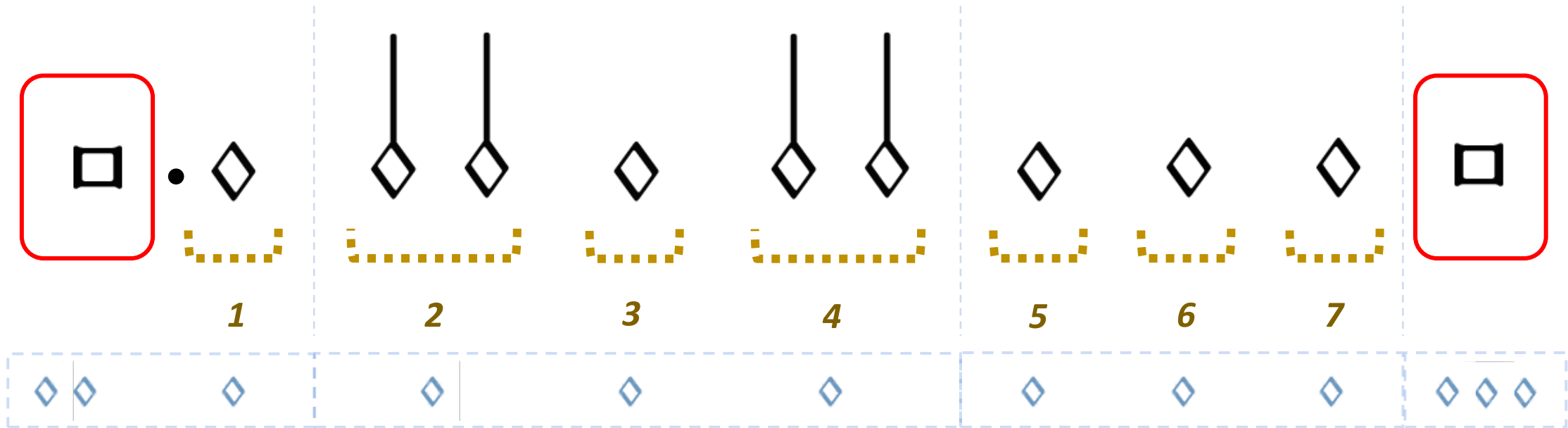
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Two groups of 3 semibreves

+

1

Example: (sequence bounded by breves)



7 semibreves

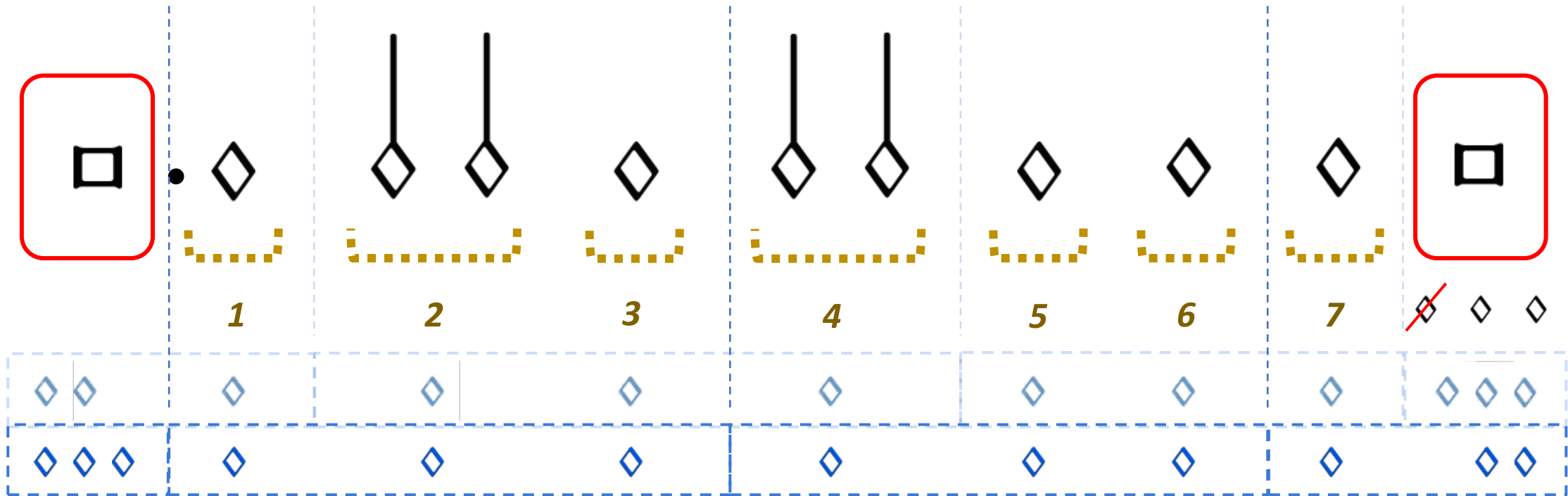
=

Two groups of 3 semibreves

+

1

Example: (sequence bounded by breves)



7 semibreves

=

Two groups of 3 semibreves

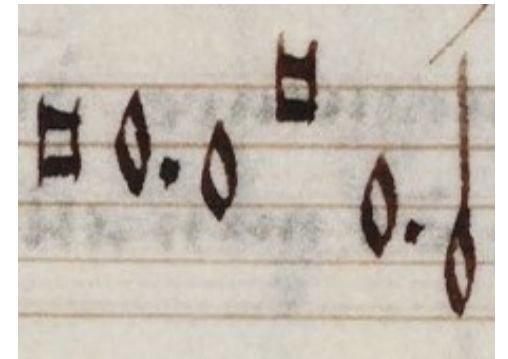
+

1

Scoring-up Tool

- Deals with the context-dependent nature of mensural notation
 - By implementing the “principles of imperfection and alteration”
- Deals with other non-context-related features:
 - Dots of augmentation →

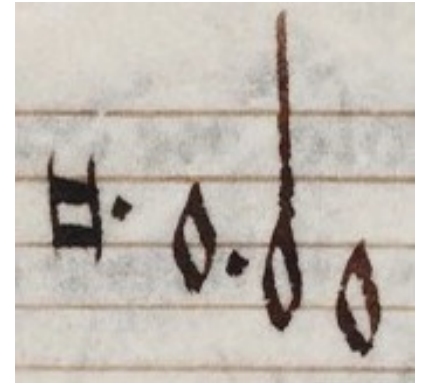
When?
Distinguish between “dots of division”
and “dots of augmentation”
 - Coloration



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When?

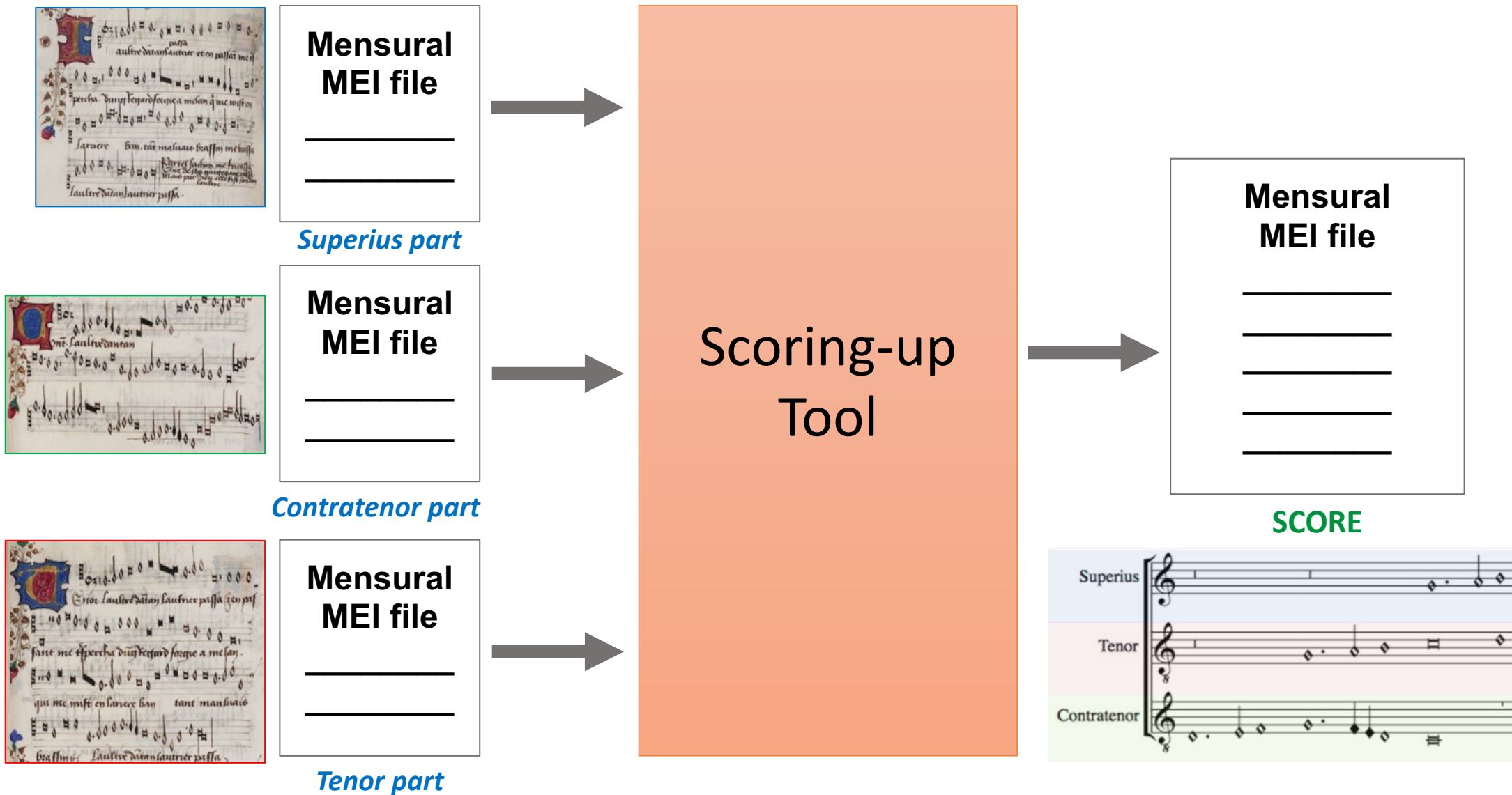
Distinguish between “dots of division”
and “dots of augmentation”

- Coloration



When does coloration affect the note value?

Scoring-up Tool



Scoring-up Tool

Modification	@num	@numbase
Imperfection	3	2
Alteration	1	2
Augmentation	2	3

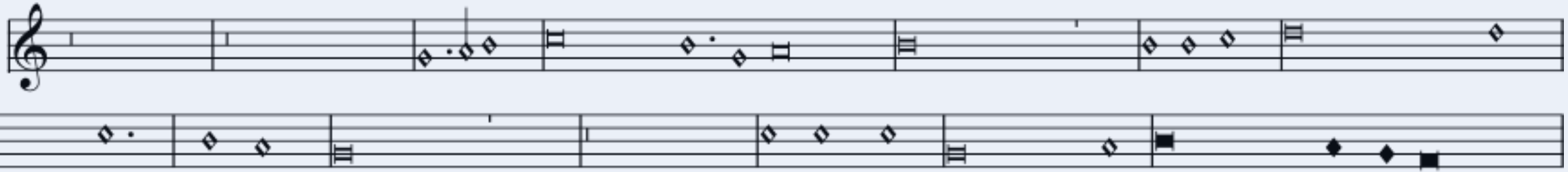
Data used for the Experiment

Pieces from the XIV and XV Centuries

Century	Project	Format	Composers and Sources	Number of Pieces
XIV	Measuring Polyphony Project (Karen Desmond)	Mensural MEI	Vitry, Machaut, Anonymous (Ivrea Codex)	8
XV	Josquin Research Project (Jesse Rodin, Craig Sapp, Clare Bokulich)	Modern transcriptions converted into Mensural MEI using: <i>SibMEI + Mensural MEI Translator</i>	Du Fay and Ockeghem (GB-Ob, Dijon, Mellon, Laborde, Wolfenbüttel)	Du Fay: 5 Ockeghem: 5

Example: Three Separate Parts

Superius



Tenor



Contratenor



In Quasi-Score Format – Without Scoring-up Tool (notes are not aligned)

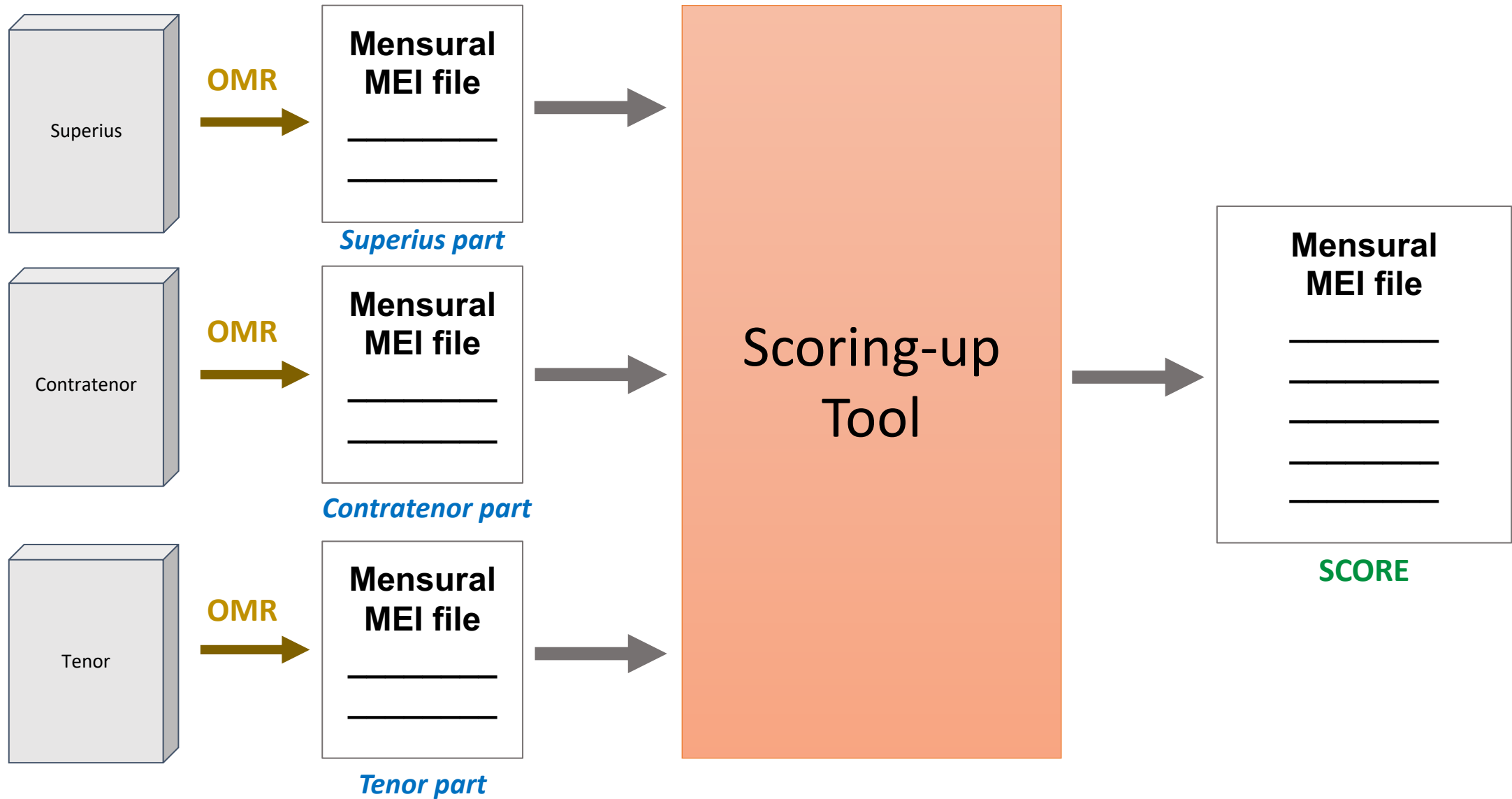
The image displays a musical score in Quasi-Score Format, organized into two systems. The first system contains three staves labeled 'Superius', 'Tenor', and 'Contratenor' on the left. Each staff begins with a treble clef and a common time signature 'C'. The notes are represented by diamond-shaped symbols, some with stems and flags, and are not aligned across the staves. Vertical red bar lines divide the music into measures. The second system consists of three additional staves, each containing diamond-shaped notes and vertical red bar lines, continuing the musical notation without alignment.

In Score Format – With Scoring-up Tool (modification values encoded)

The image displays a musical score for three vocal parts: Superius, Tenor, and Contratenor. The score is written in a system of five staves, each with a treble clef and a key signature of one flat (B-flat). The Superius part is the top staff, followed by Tenor, and Contratenor. The score is divided into measures by vertical red lines. The notation includes various musical symbols such as notes, rests, and accidentals, with modification values encoded in the notes. The Tenor and Contratenor parts are marked with an '8' below the staff, indicating an octave shift. The score is presented in a clean, professional format, typical of a musical manuscript.

Conclusions

- Preserves the original note values
- The scoring-up tool presents the piece in score format
- Facilitates visualizing the vertical sonorities and studying the relation between the voices of a piece
- Future work...



Thank you!

<https://github.com/elvis-project/scoring-up>

SIMSSA | Single Interface for Music
Score Searching and Analysis

Verovio

MUSIC ENCODING
MEI
INITIATIVE



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