Mode Classification and Natural Units in Plainchant
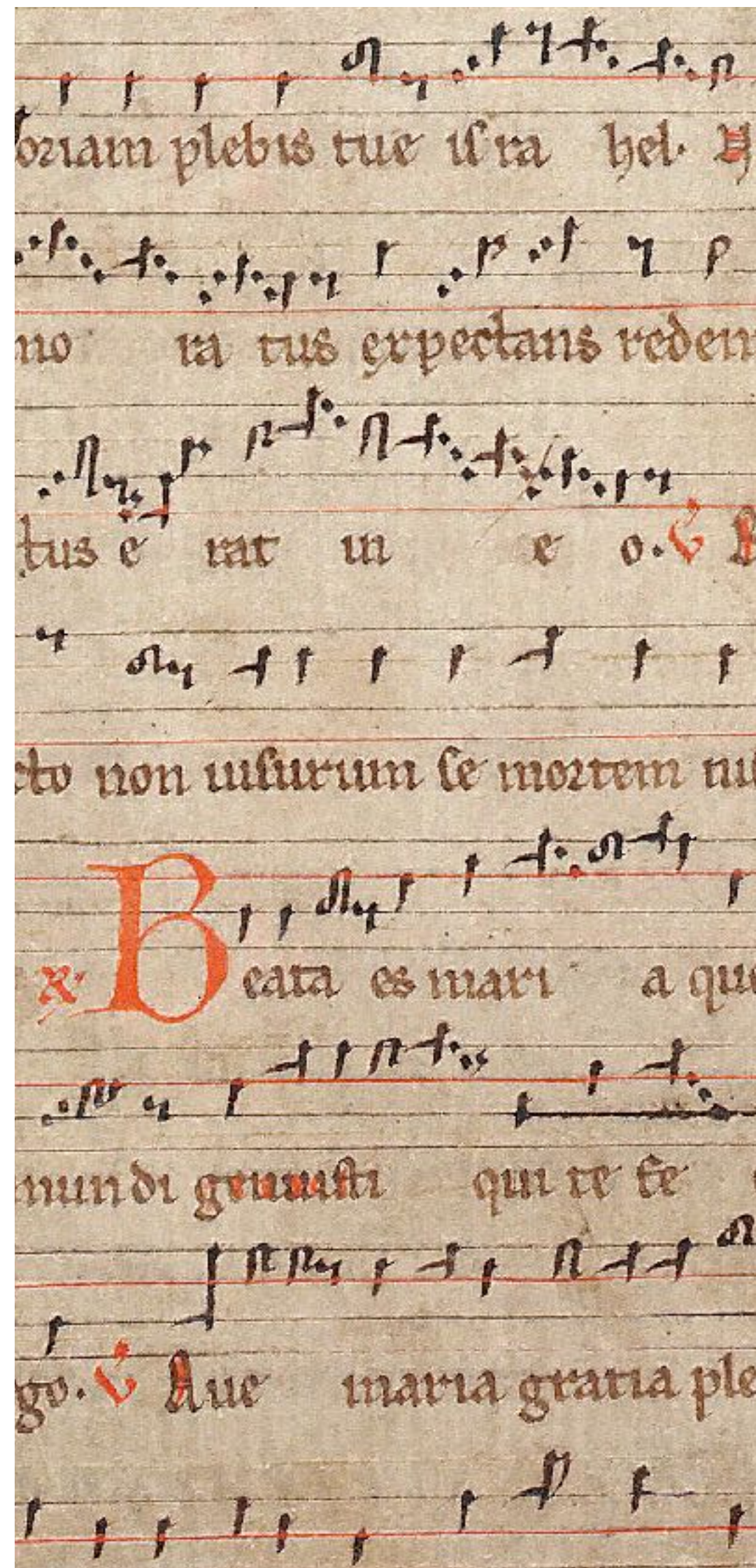
Cornelissen, Zuidema & Burgoyne

Institute for Logic, Language & Computation, University of Amsterdam

Mode Classification and Natural Units in Plainchant

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We study **3 approaches** to **mode classification** in medieval **plainchant** using **20.000 melodies** from the **Cantus database.**

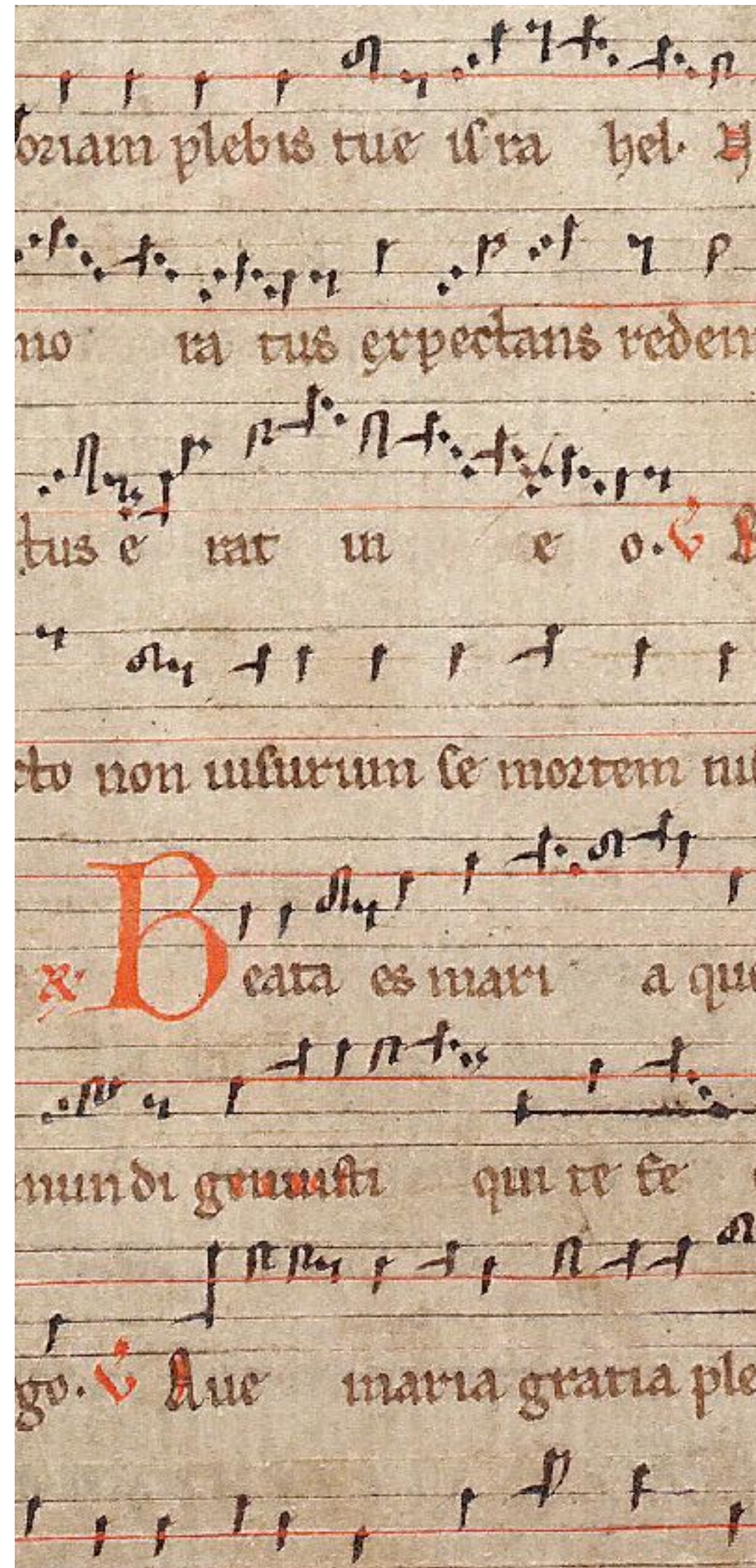# Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

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We study **3 approaches** to **mode classification** in medieval **plainchant** using **20.000 melodies** from the **Cantus database.**

Out of a total of >60.000 melodies

Mode Classification and Natural Units in Plainchant
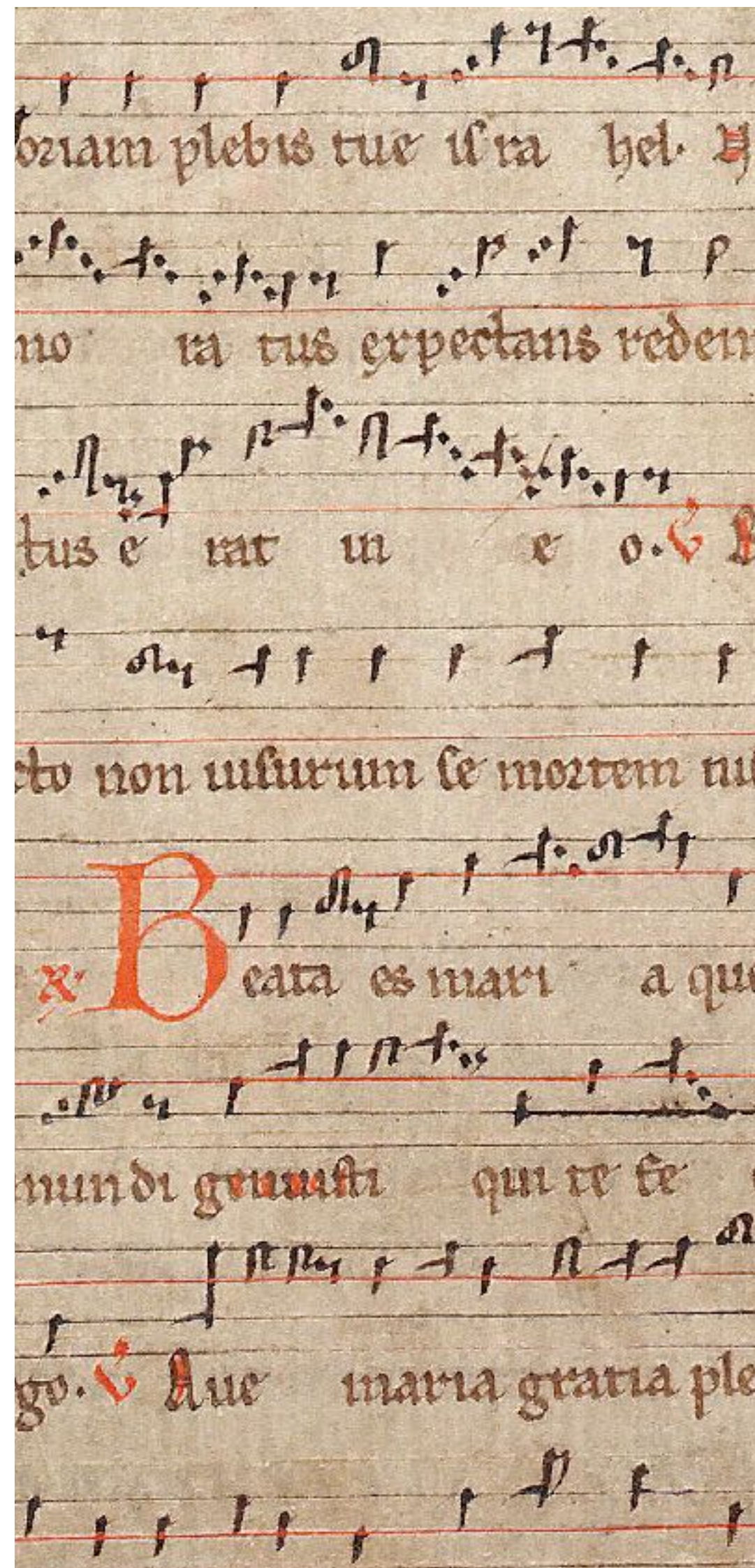
Cornelissen, Zuidema & Burgoyne

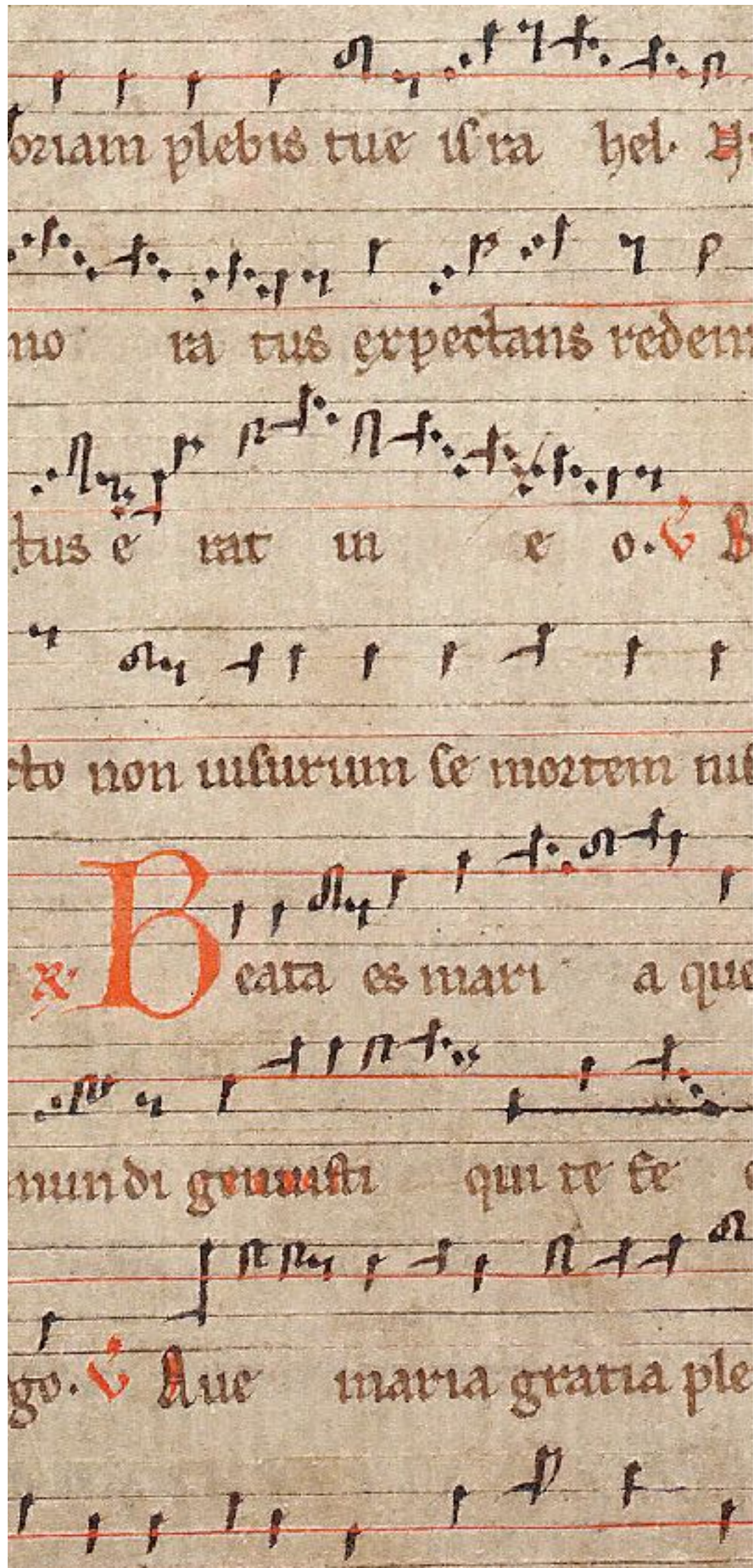Institute for Logic, Language & Computation, University of Amsterdam

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cantus.uwaterloo.ca

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

Find the **final** note...
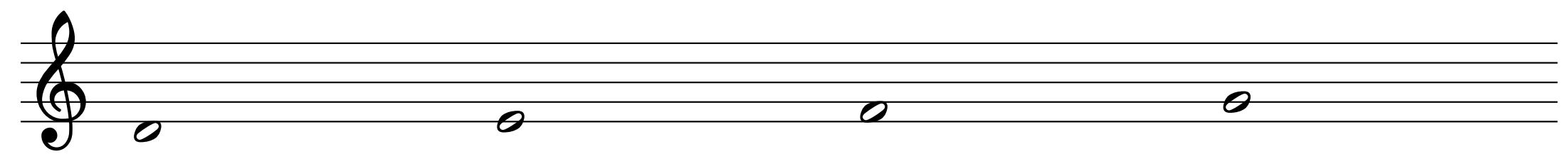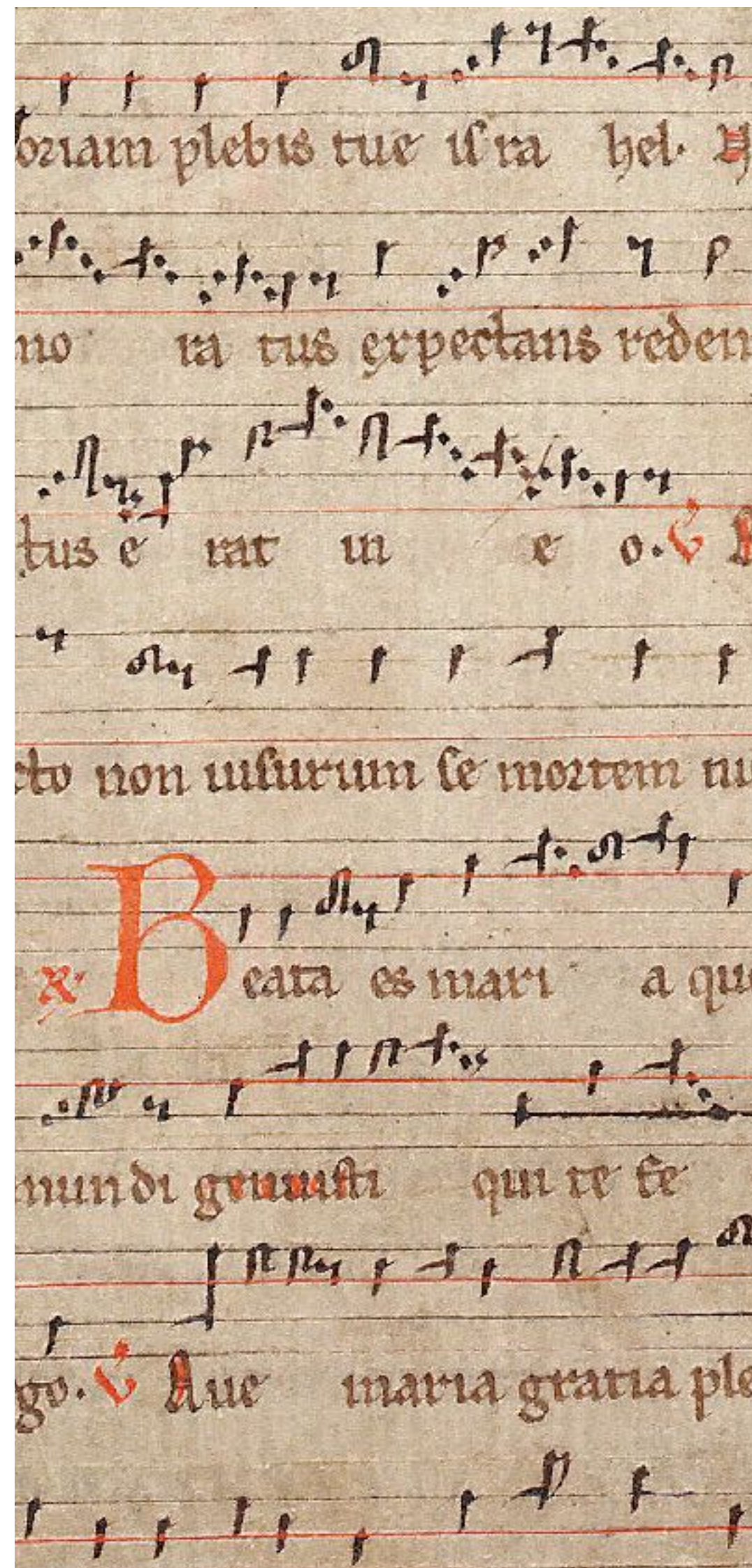
| Dorian | Phrygian | Lydian | Mixolydian |

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

1

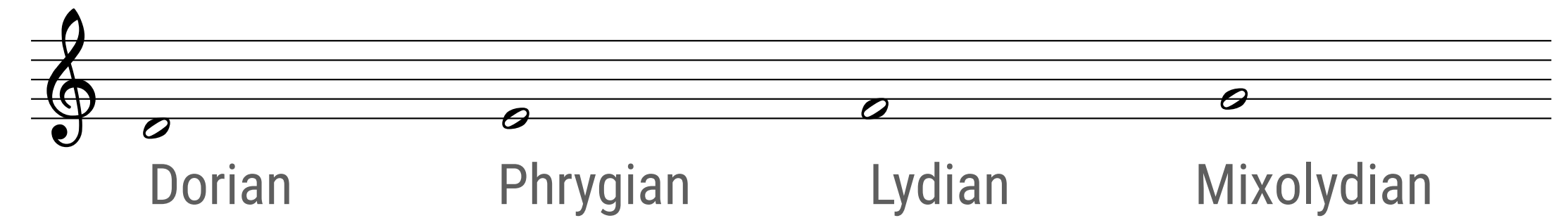Find the **final** note…
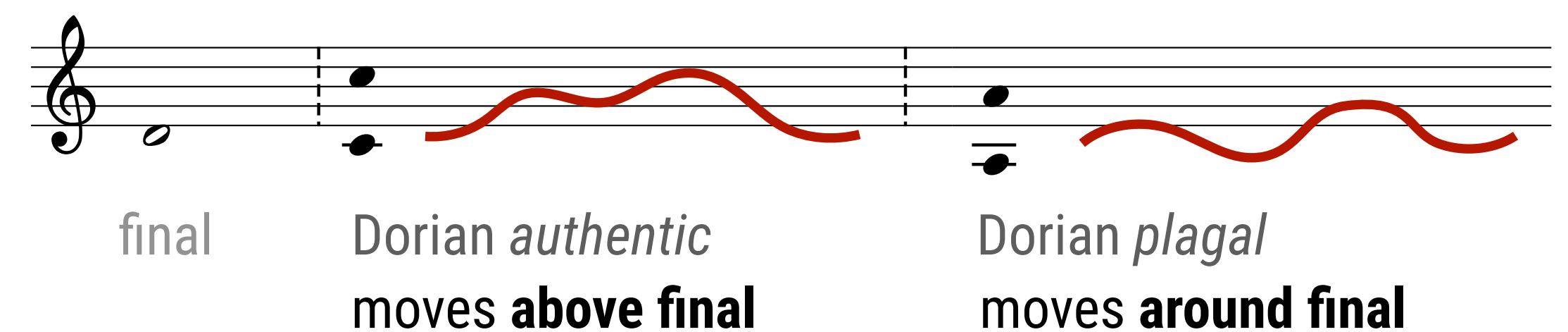
Dorian   Phrygian   Lydian   Mixolydian

2

… and the **range**.

final   Dorian *authentic*
moves **above final**

Dorian *plagal*
moves **around final**

A Classical approach

final	40
range	56
initial	37
final & range	**89**
final, range & init.	**<u>90</u>**

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

weighted F_1 score

1

Find the **final** note...

Dorian   Phrygian   Lydian   Mixolydian

2

... and the **range**.

final   Dorian *authentic*
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Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

Mode Classification and Natural Units in Plainchant

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final	40
range	56
initial	37
final & range	89
final, range & init.	**90**

B Profile approach

pitch class profile	85
pitch profile	**88**
repetition profile	81

weighted F$_1$ score

C Distributional approach

Aim: capture melodic aspect of mode

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tf–idf describes importance of a term for a document:

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tf–idf describes importance of a term for a document:

plus some smoothing

$$\text{tf–idf} = \text{term freq} \times \text{inverse document freq}$$

$$= \text{term freq} \times \log\left(\frac{1}{\text{document freq}}\right)$$

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fraction of documents containing the term

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Mode Classification and Natural Units in Plainchant

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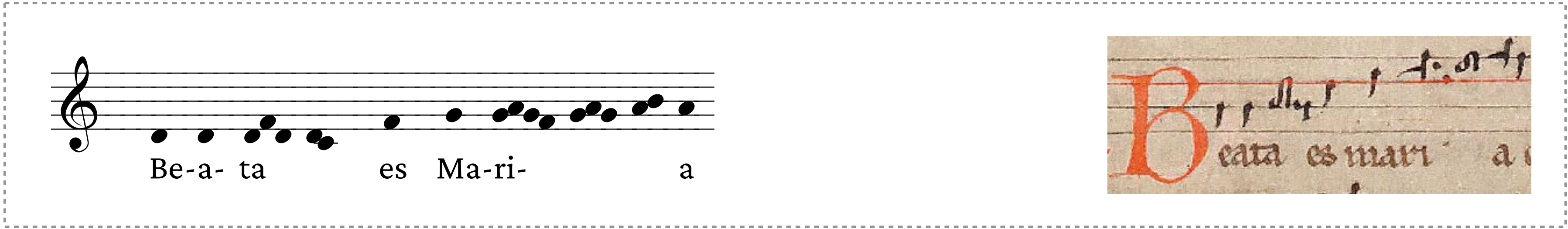**tf–idf** describes importance of a term for a document:

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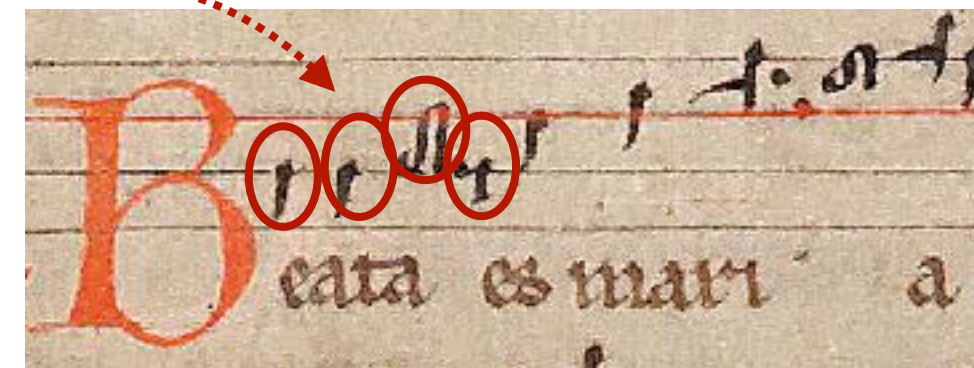Chants as **vectors** of weighted **motif frequencies**

Be-a- ta   es Ma-ri-   a

**Mode Classification and
Natural Units in Plainchant**

Cornelissen, Zuidema & Burgoyne

neume: symbol denoting one or multiple notes

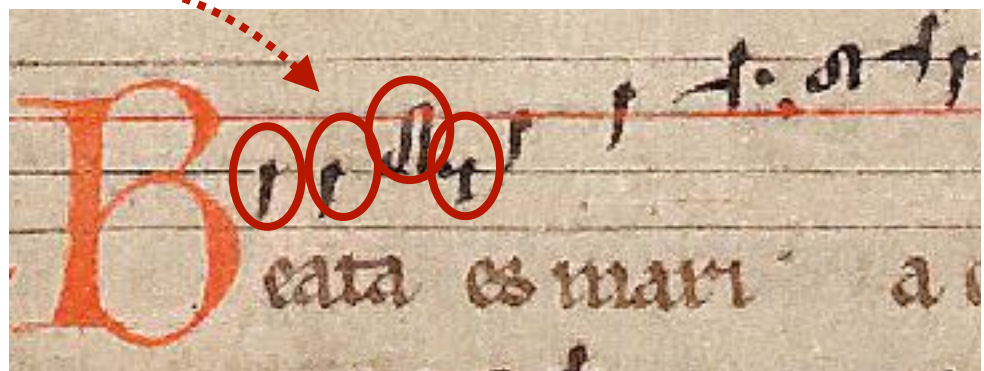Be-a- ta   es Ma-ri-   a

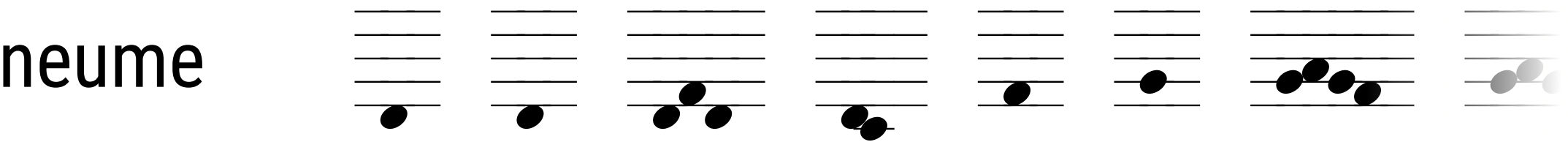**Mode Classification and Natural Units in Plainchant**

Cornelissen, Zuidema & Burgoyne

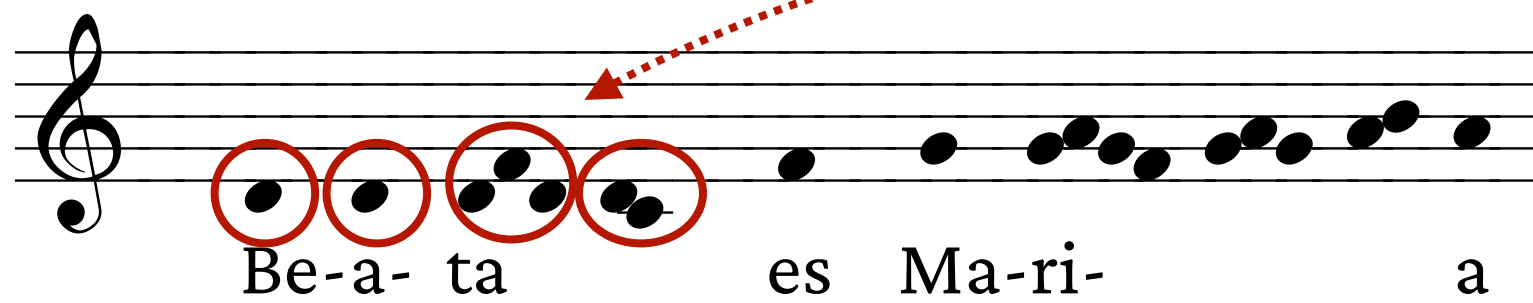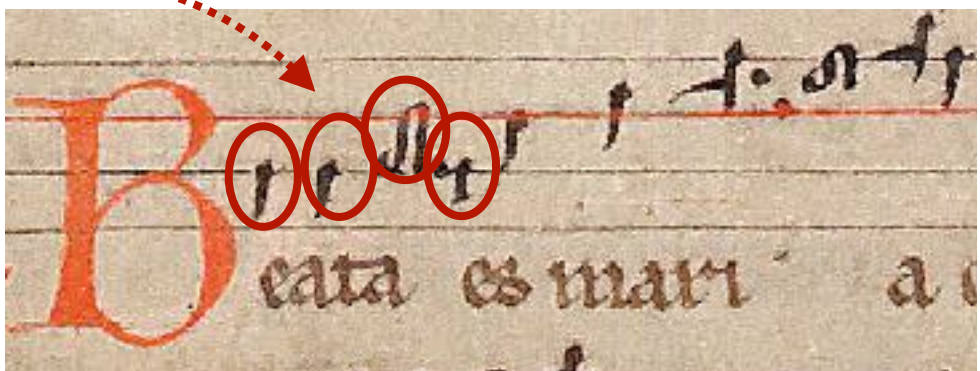*neume*: symbol denoting one or multiple notes

Segmentations

neume

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

neume: *symbol denoting one or multiple notes*

Segmentations

neume

syllable

neume: *symbol denoting one or multiple notes*

Be-a- ta   es Ma-ri-   a

Segmentations

neume

syllable

word

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

neume: *symbol denoting one or multiple notes*

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Segmentations

neume

syllable

word

natural units

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

neume: *symbol denoting one or multiple notes*

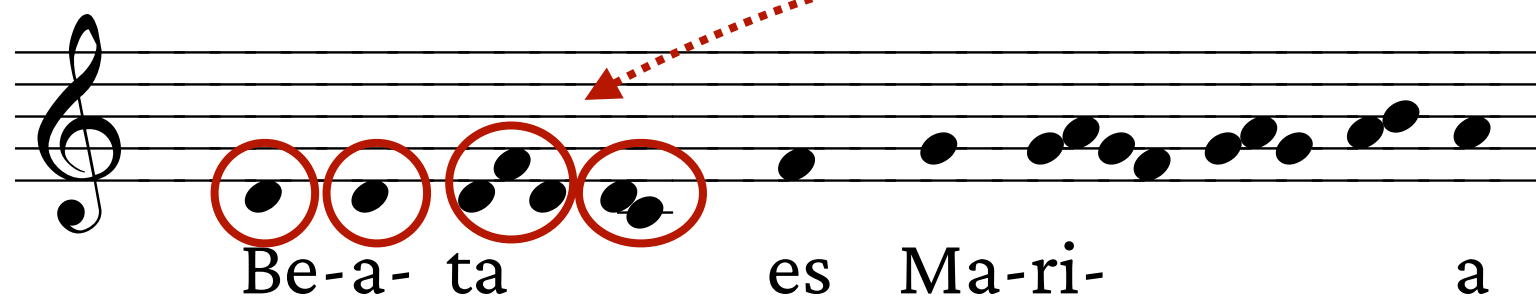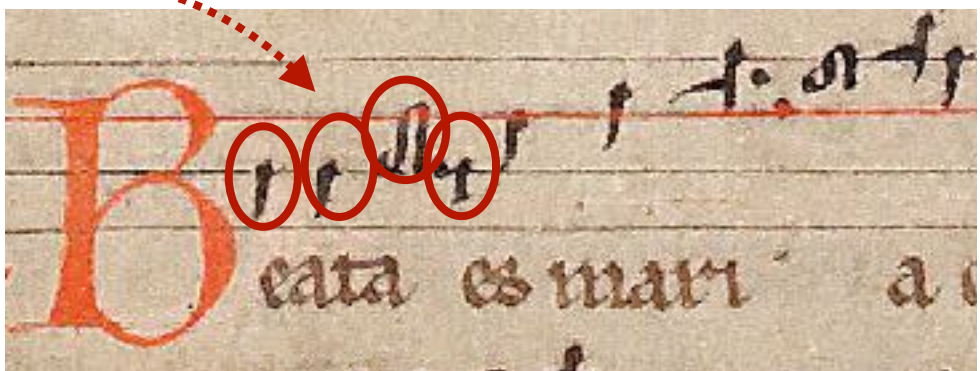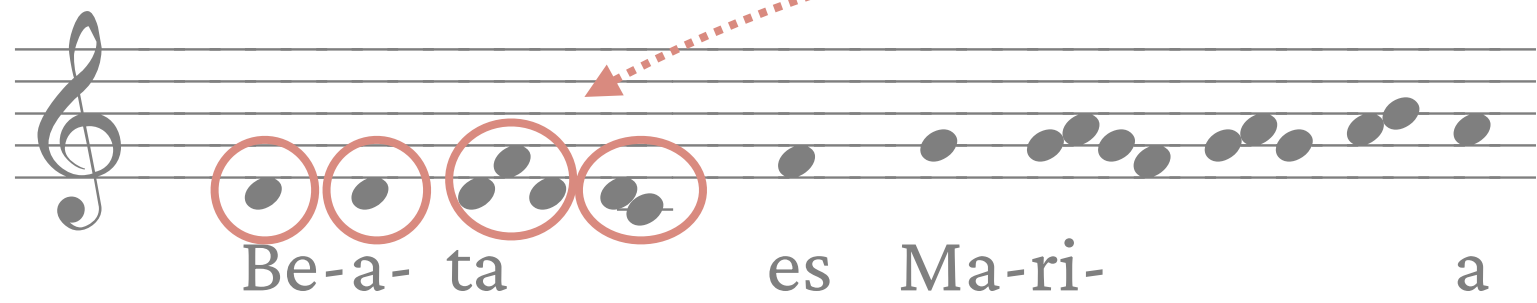Be-a- ta   es Ma-ri-   a

Segmentations

neume

syllable

word

natural units

2-gram

5-gram

baselines

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

Mode Classification and Natural Units in Plainchant

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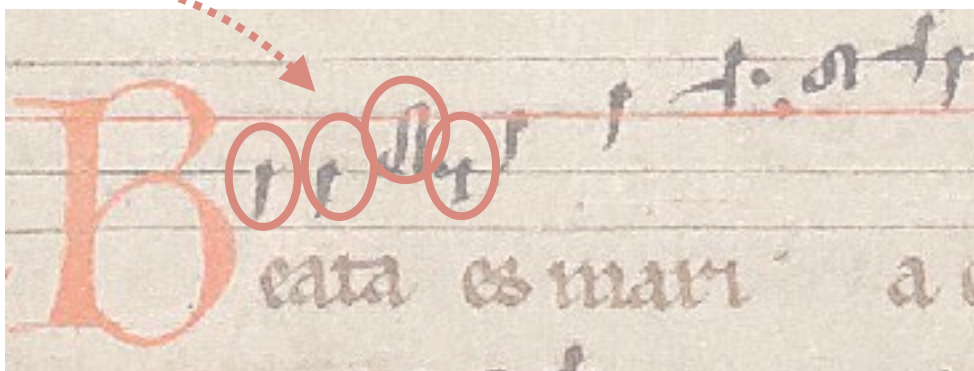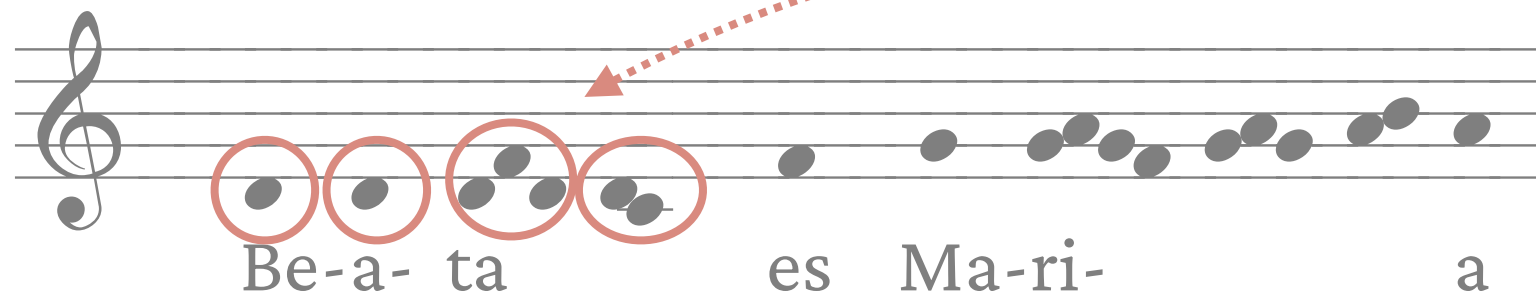
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Segmentations

neume

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Representations

neume: *symbol denoting one or multiple notes*

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neume

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baselines

Representations

Pitch   dfddc
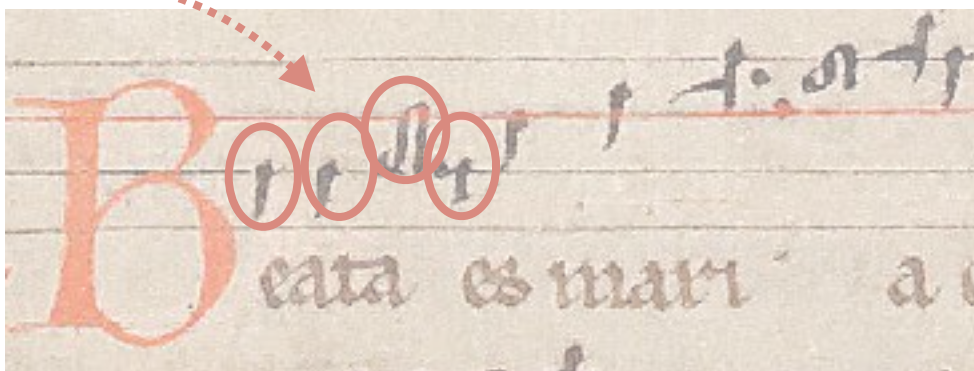
Mode Classification and Natural Units in Plainchant
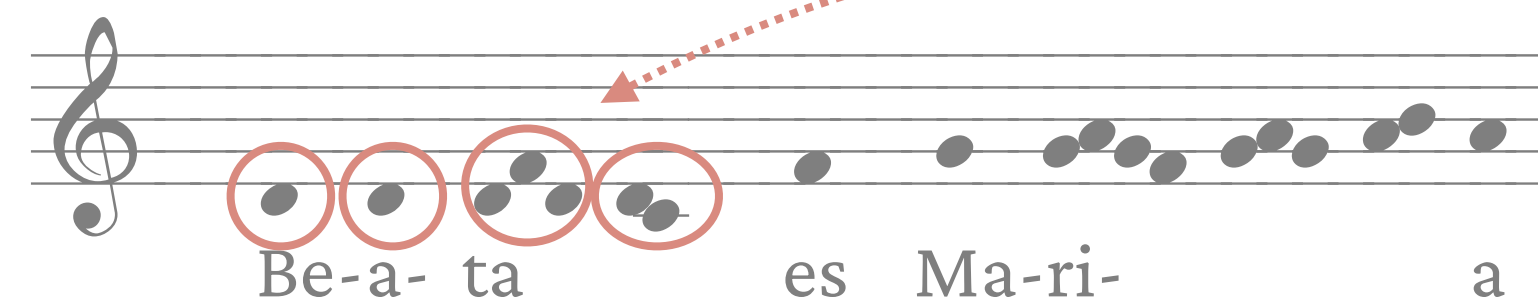
Cornelissen, Zuidema & Burgoyne

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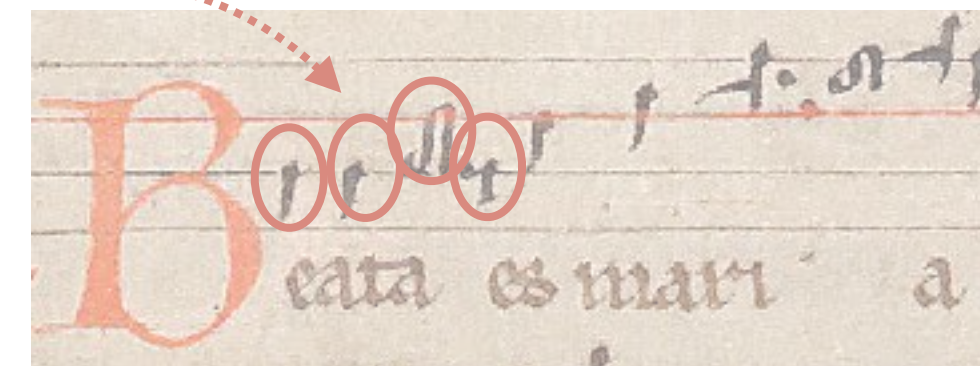
Segmentations
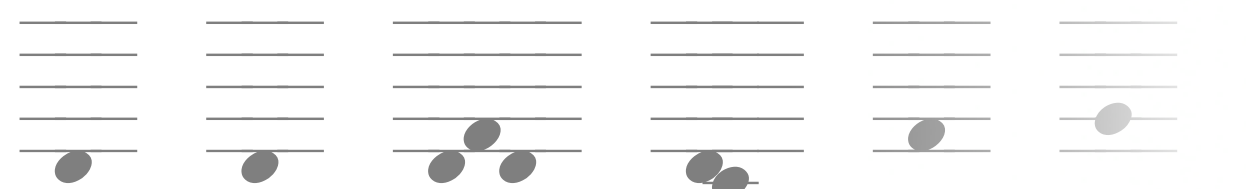
neume

syllable

word
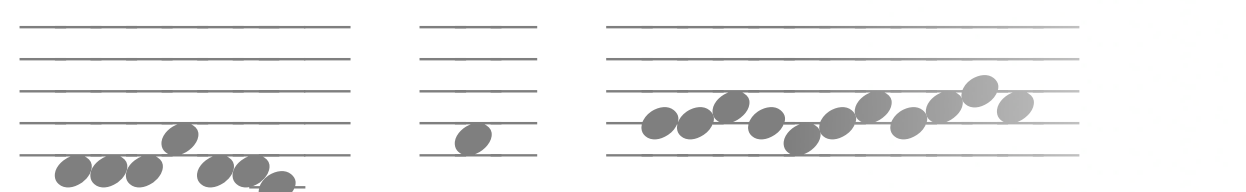
natural units

2-gram
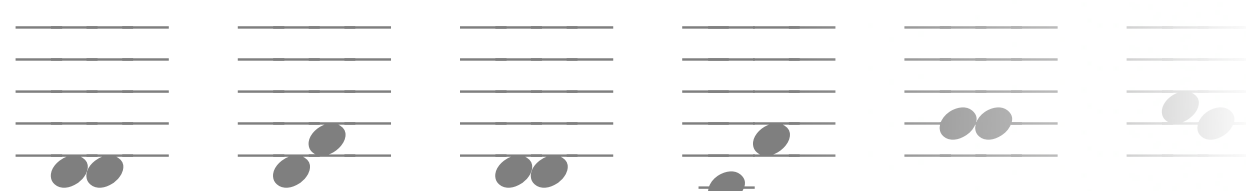
5-gram
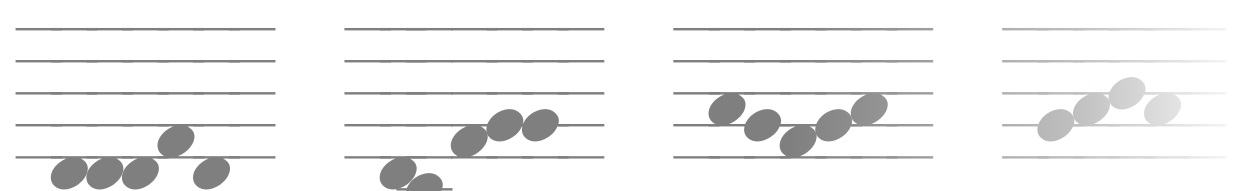
baselines

Representations

Pitch   dfddc
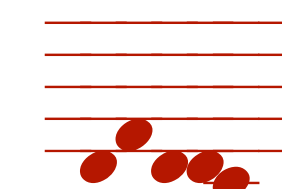
Interval $.^3\,_3\!-\!_2$

in semitones ^{up} or $_{down}$

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

neume: *symbol denoting one or multiple notes*
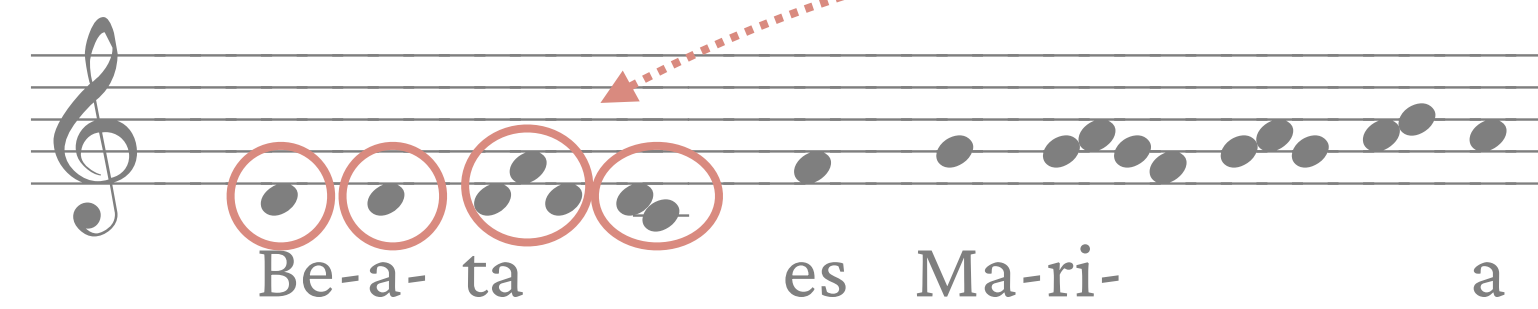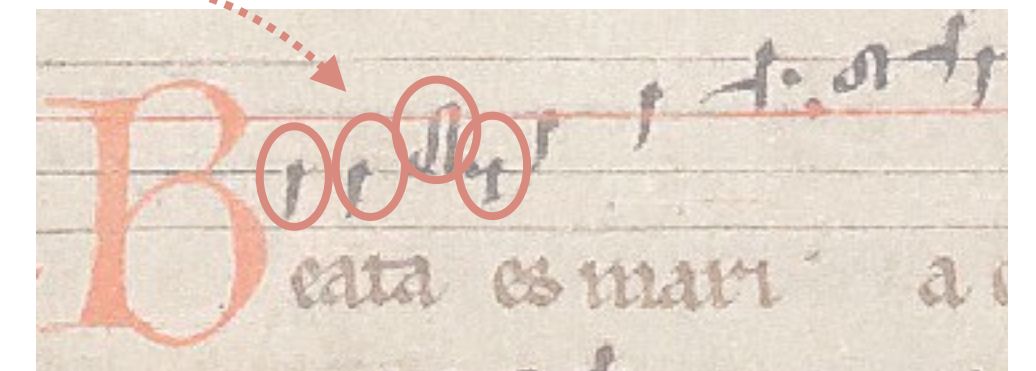
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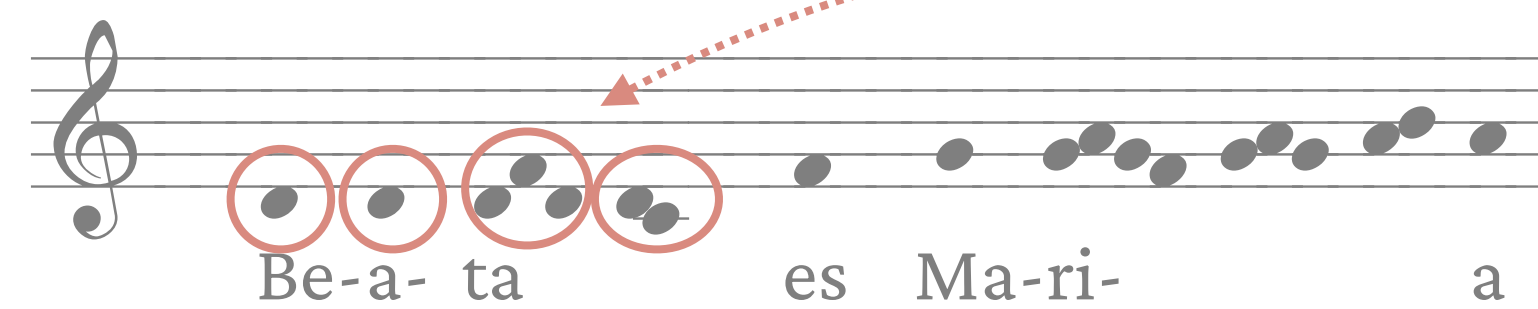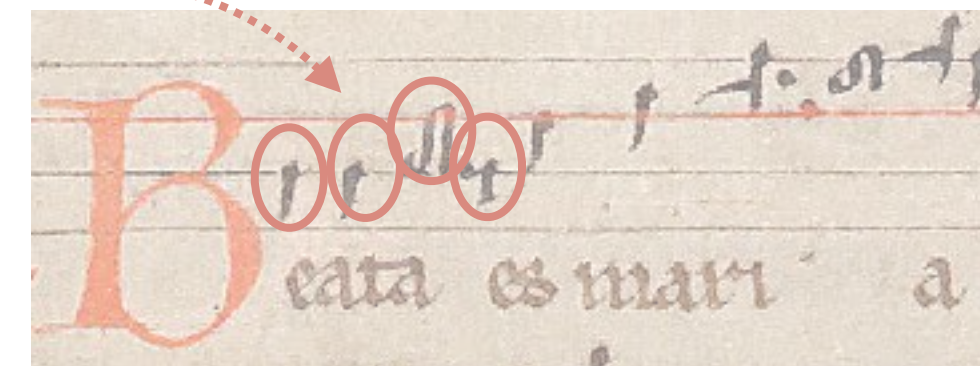
Segmentations

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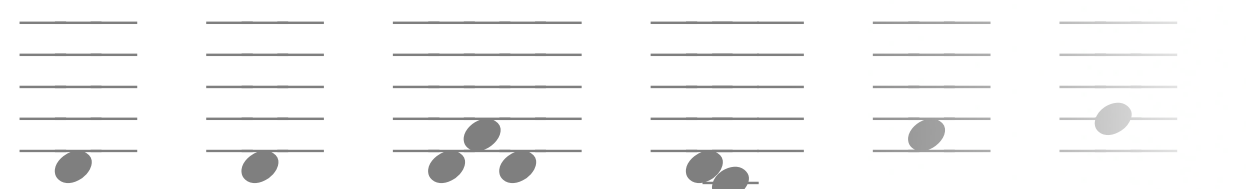
syllable

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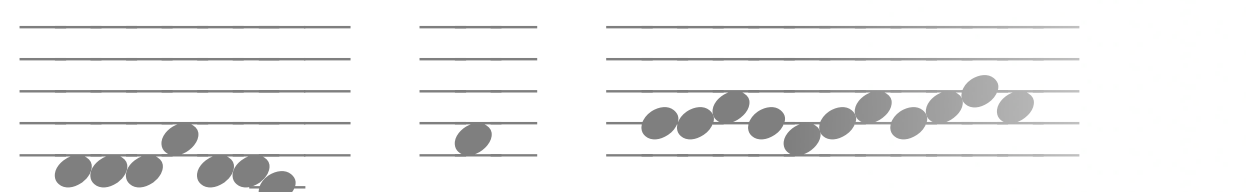
natural units

2-gram
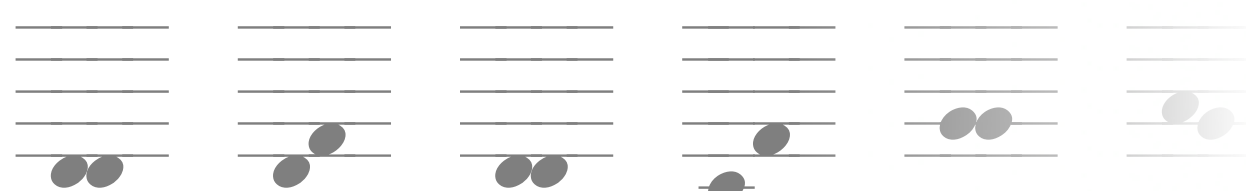
5-gram
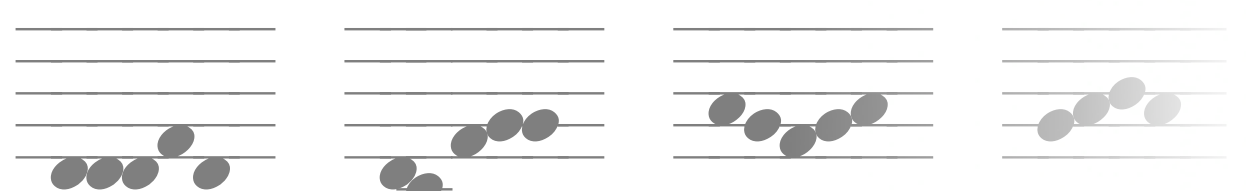
baselines

Representations

Pitch `dfddc`
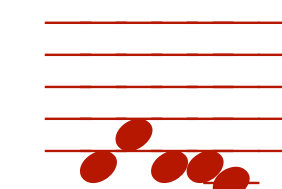
Interval $.^{3}$ $_{3}$—$_{2}$
in semitones up or down

Contour $._{\wedge \vee - \vee}$
direction up or down

Mode Classification and Natural Units in Plainchant
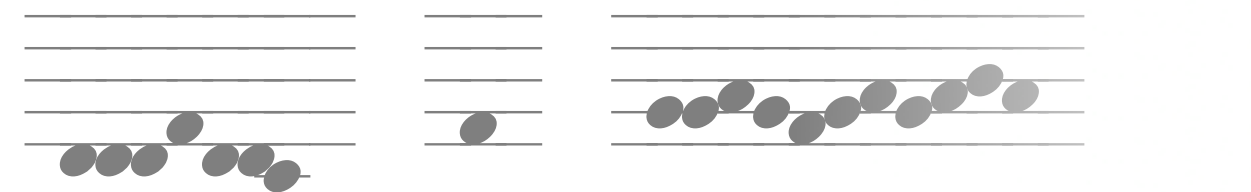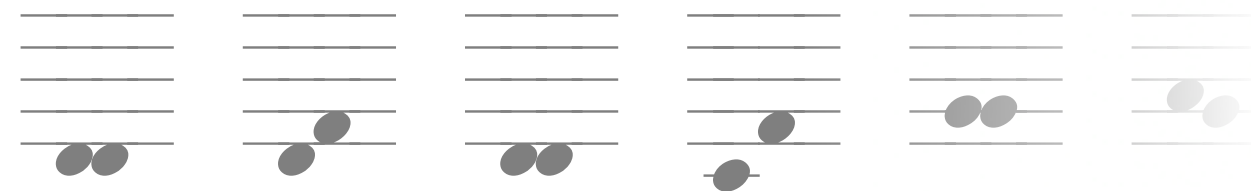
Cornelissen, Zuidema & Burgoyne

A Classical approach

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range	56
initial	37
final & range	89
final, range & init.	**90**

B Profile approach

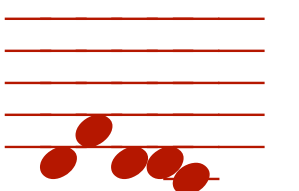|	
pitch class profile	85
pitch profile	**88**
repetition profile	81

weighted F$_1$ score

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

C Distributional approach

units	pitch	interval	contour
neume			
syllable			
word			
1-gram			
2-gram			
3-gram			
4-gram			
5-gram			
6-gram			
8-gram			

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6-gram			
8-gram			

segmentation

representation

Mode Classification and Natural Units in Plainchant

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pitch profile	**88**
repetition profile	81

weighted F$_1$ score

C Distributional approach

units	pitch	interval	contour
neume	92		
syllable	**93**		
word	90		
1-gram	87		
2-gram	91		
3-gram	92		
4-gram	91		
5-gram	91		
6-gram	88		
8-gram	82		

natural units

baselines

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weighted F$_1$ score

C Distributional approach

units	pitch	interval	contour
neume	92	79	
syllable	**93**	86	
word	90	**86**	
1-gram	87	7	
2-gram	91	38	
3-gram	92	65	
4-gram	91	75	
5-gram	91	81	
6-gram	88	82	
8-gram	82	78	

natural units

baselines

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

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weighted F$_1$ score

C Distributional approach

units	pitch	interval	contour	
neume	92	79	52	*natural units*
syllable	**93**	86	76	
word	90	**86**	**81**	
1-gram	87	7	7	*baselines*
2-gram	91	38	17	
3-gram	92	65	23	
4-gram	91	75	34	
5-gram	91	81	43	
6-gram	88	82	51	
8-gram	82	78	60	

C Distributional approach

units	pitch	interval	contour
neume	92	79	52
syllable	**93**	86	76
word	90	**86**	**81**
1-gram	87	7	7
2-gram	91	38	17
3-gram	92	65	23
4-gram	91	75	34
5-gram	91	81	43
6-gram	88	82	51
8-gram	82	78	60

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

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Natural units perform best, even without pitch information: **contours** are sufficient.

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

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Is (this) music perhaps made from natural units?

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

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Natural units perform best, even without pitch information: **contours** are sufficient.

Is (this) music perhaps made from natural units?

Code: github.com/bacor/ISMIR2020

CantusCorpus: github.com/bacor/CantusCorpus

Chant21 Python package: github.com/bacor/chant21

Volpiano & gabc in music21; see our DLfM paper.

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

Mode Classification and Natural Units in Plainchant

Cornelissen, Zuidema & Burgoyne

We present a highly accurate model of mode classification in plainchant that also reveals the importance of natural units.