



# Studying Large Plainchant Corpora Using chant21

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• **2 corpora**

CantusCorpus

GregoBaseCorpus

• **1 Python package**

Convert gabc and

Volpiano to music21

- **2 case studies**

Melodic arch

Differentiæ–antiphons

# CantusCorpus

[github.com/bacor/CantusCorpus](https://github.com/bacor/CantusCorpus)

source

Cantus database

music

Medieval manuscripts

goal

Chant scholarship

size

~60,000 melodies

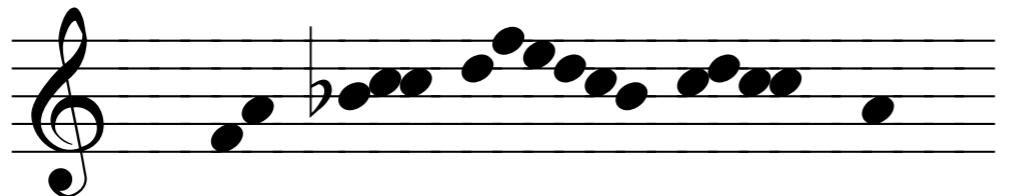
format

Volpiano

1---fh-ijkk-lnmlkj-klkk--h---

code

(cb3) AL(d.f!gwhhv//ikkvJ' IH' Ghih'h)  
ma(fef.) \*(\*,) Re(h)dem(h')ptó(d)...



rendition

# GregoBaseCorpus

[github.com/bacor/GregobaseCorpus](https://github.com/bacor/GregobaseCorpus)

GregoBase

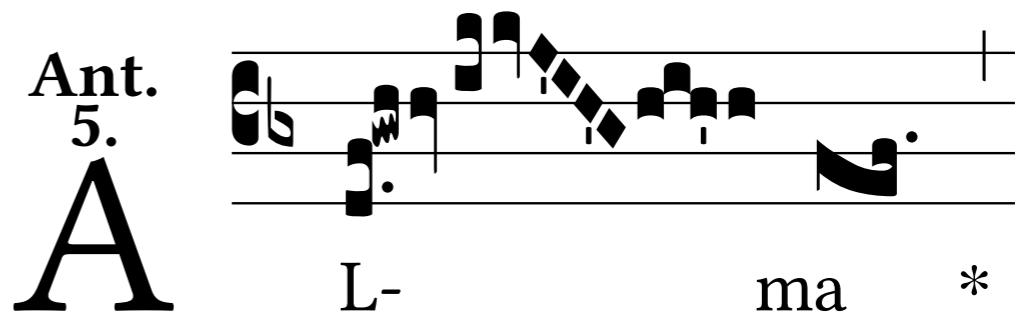
Modern chant books

Performance

~9,000 melodies

gabc

(cb3) AL(d.f!gwhhv//ikkvJ' IH' Ghih'h)  
ma(fef.) \*(\*,) Re(h)dem(h')ptó(d)...



# Chant21

## Aims

- ✓ Hierarchical representation: sections, words, sylls, neumes
- ✓ A gabc converter for music21
- ✓ A Volpiano converter with text alignment
- ✓ Quick chant visualisation in Jupyter notebooks using Volpiano

```
[1]: import chant21
from music21 import converter
kyrie = converter.parse('kyrie.gabc')
kyrie.show('html', showOptions=True)
```

Show:  metadata  sections  words  syllables  neumes

The image displays two musical staves. The top staff shows the beginning of a chant with the text "KY- ri- e \* e- lé- i- son.". The bottom staff shows the continuation with the text "iij. Chrí- ste e- lé- i- son.". Both staves use a soprano C-clef and common time. Vertical dashed red lines align the text under each note. The first note in each staff has a single dot above it, while subsequent notes have double dots above them.

## Related

gabc exporter & Volpiano in music21  
several other gabc converters.

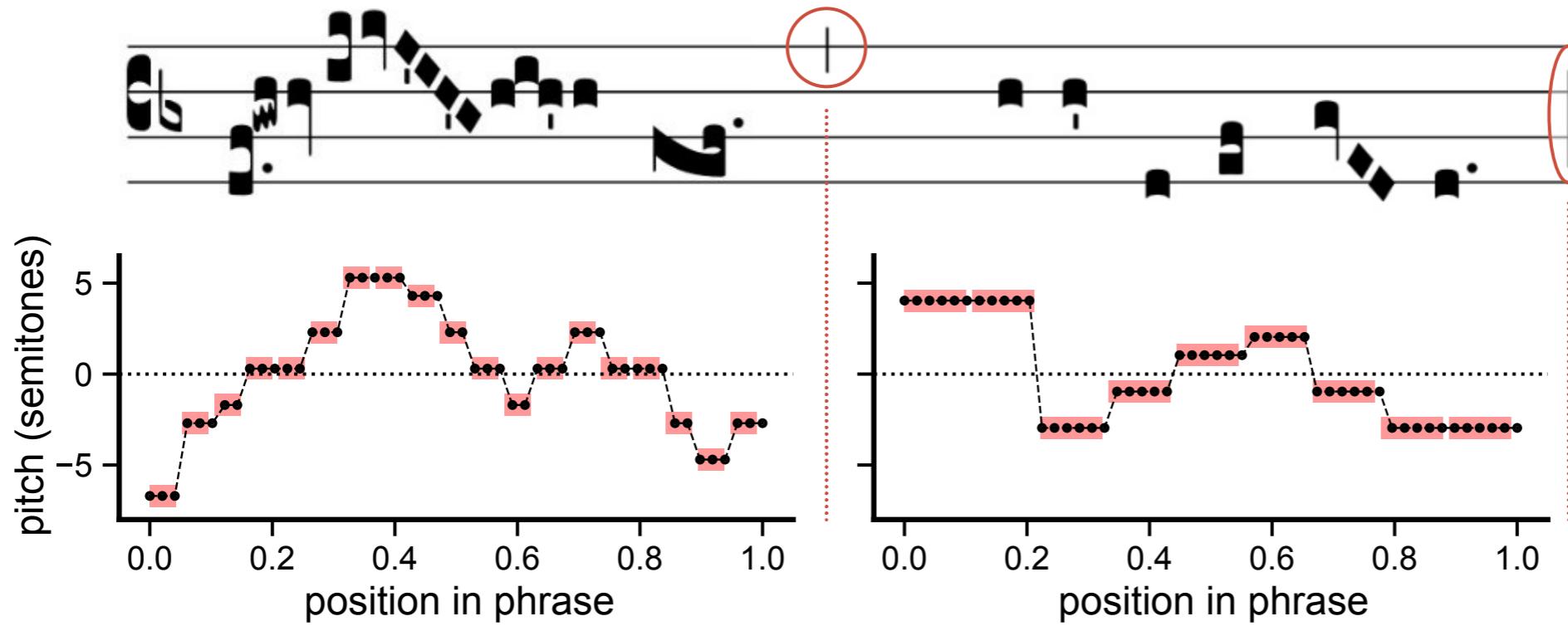
## Implementation

Custom PEG grammars with Arpeggio, a Python PEG parser

# Case 1: melodic arch hypothesis

*Are phrases in plainchant on average arch-shaped?*

e.g. Huron 1996



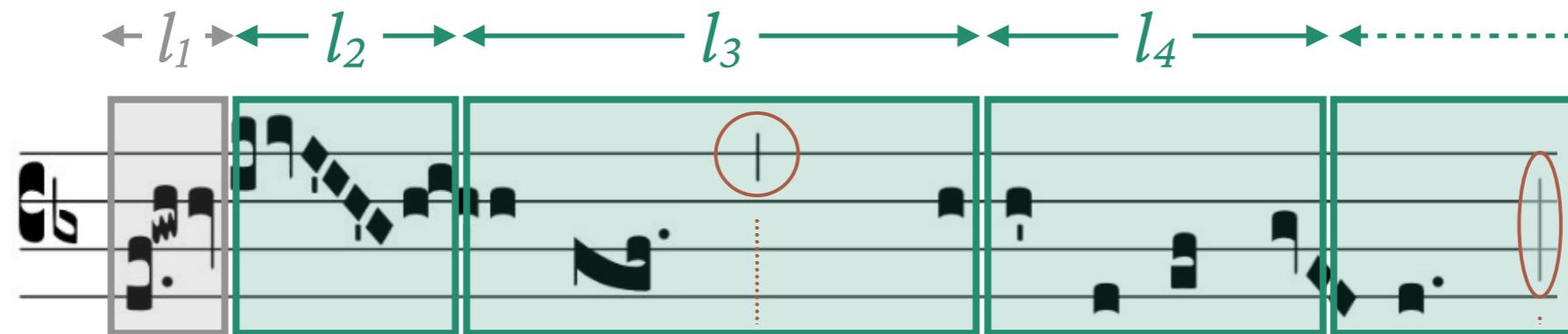
## Phrase contours

1. GregoBaseCorpus: phrases delimited by *pausas*
2. Contour: 50 equidistant pitches from the phrase
3. Phrases transposed to have mean pitch 0
4. All notes equal duration; total duration normalised

Similar to what is used in:  
[Savage et al 2017 Mus Perc](#)  
[Tierney et al 2016 PNAS](#)  
[Juhász 2015 J New Mus Res](#)

# Case 1: melodic arch hypothesis

*Are phrases in plainchant on average arch-shaped?*



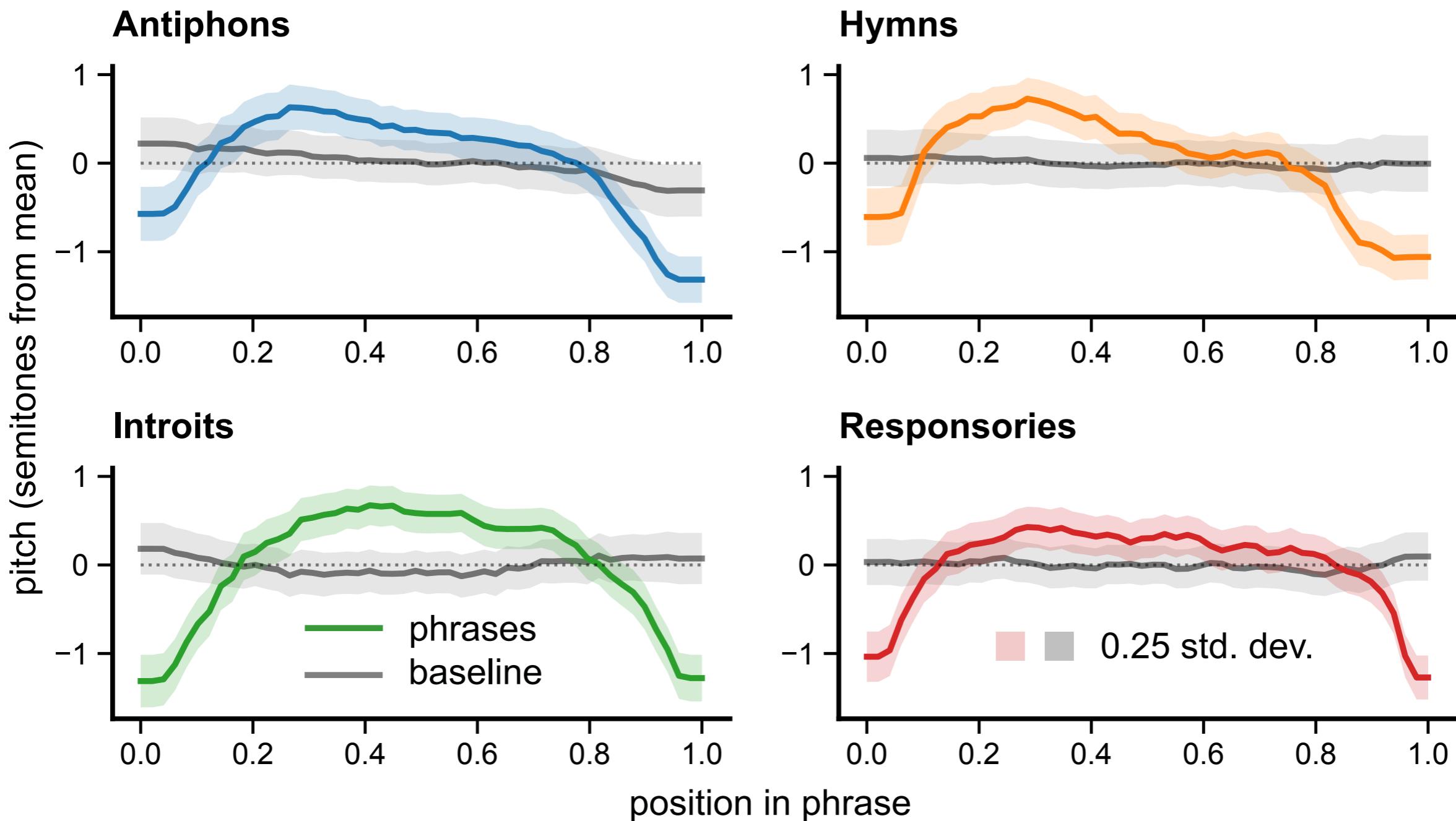
## Baseline: contours of random segments

1. Sample segment lengths  $l_1, l_2, l_3, \dots$  that are distributed like to actual phrase lengths
2. Discard initial and final random segment

This is *different* from  
Savage et al 2017 Mus Perc  
who shuffles pitches.  
We keep the melody intact.

# Case 1: melodic arch hypothesis

*Are phrases in plainchant on average arch-shaped?*



## Case 2: differentia–antiphon

# *Are differentia–antiphon connections systematic?*

— *Rebecca Shaw, DLfM 2018*

adapted from Shaw 2018

**Antiphon**

**Psalm** (*Mode 8 psalm tone*)

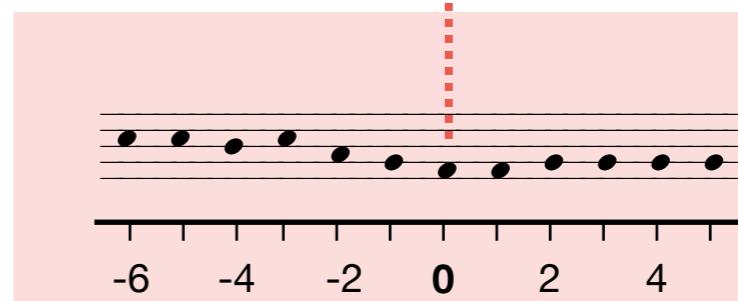
**Differentia**

**Antiphon (again)**

Do-mi-ne in ...      Sae-cu-lo-rum a-men  
(euouae)      Do-mi-ne in vir-tu-te

# Data

We extract **connections** in  
7102 antiphons (ending on *euouae*)  
from the CantusCorpus



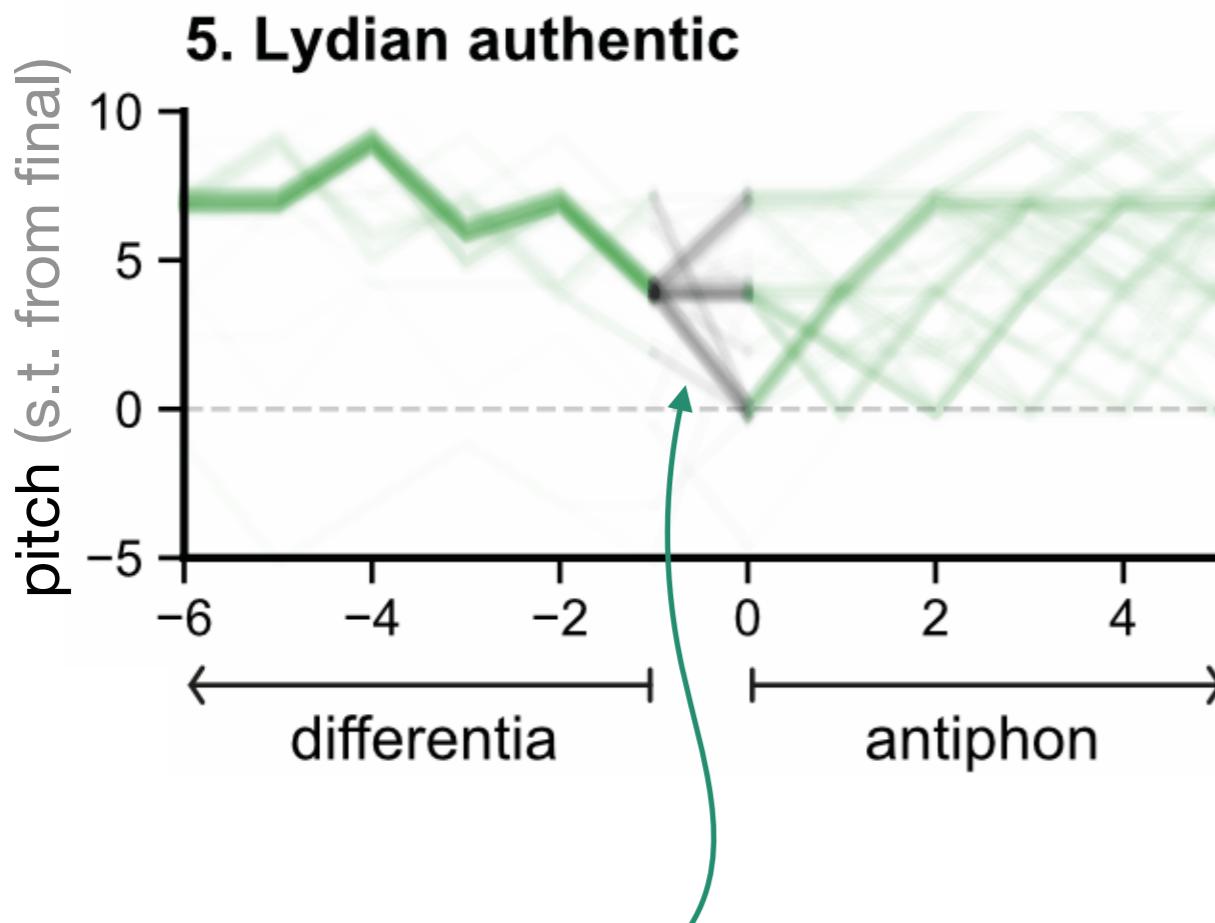
# Connections

# End of differentia + opening of antiphon

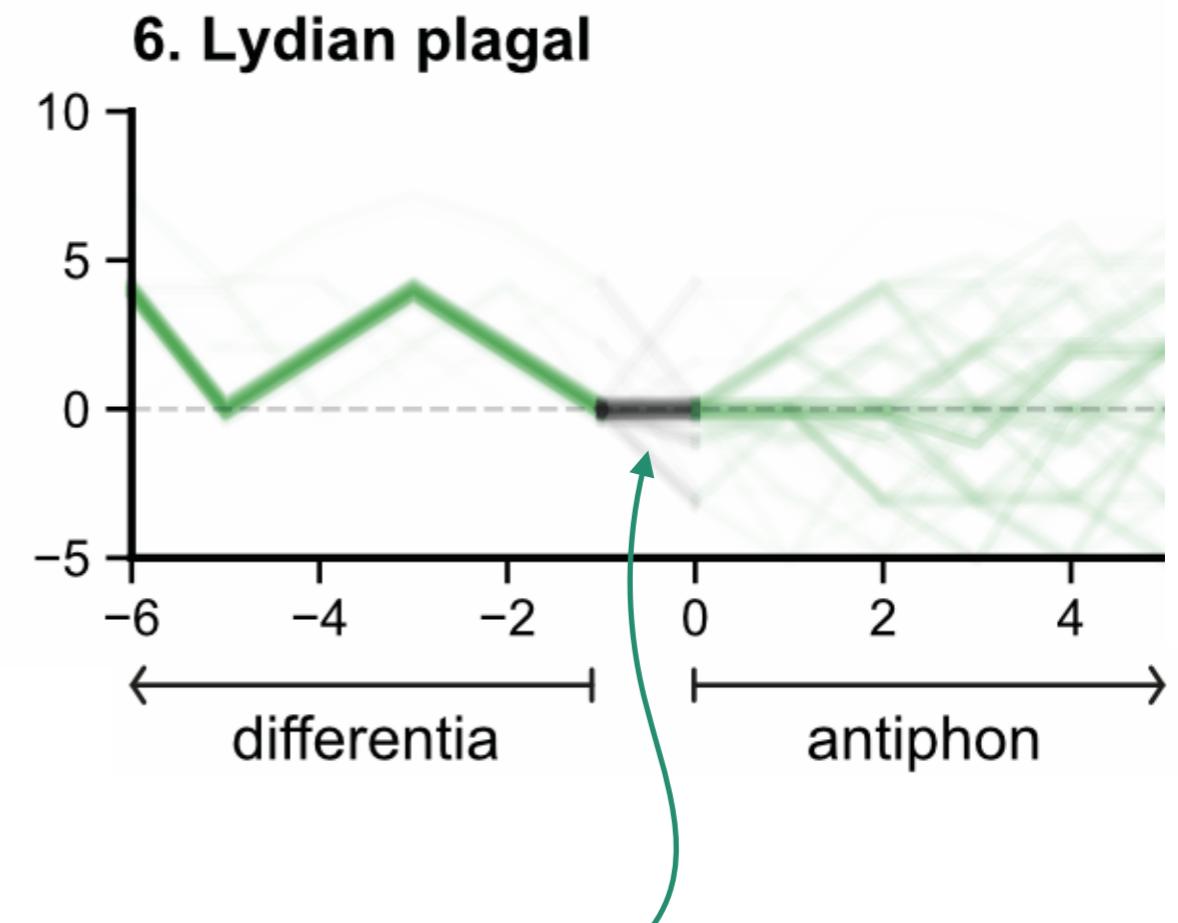
# Case 2: differentia–antiphon

*Are differentia–antiphon connections systematic?*

— Rebecca Shaw, DLfM 2018



**Not so systematic**  
less predictable connection  
*higher entropy?*

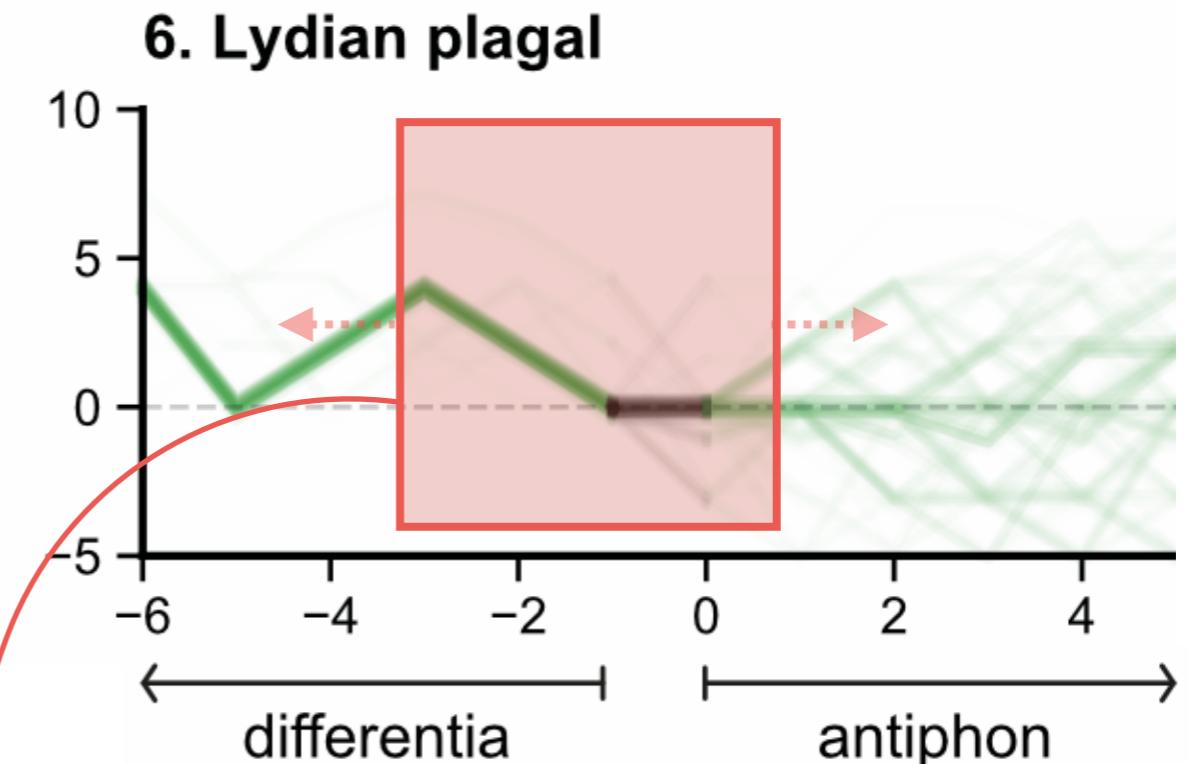
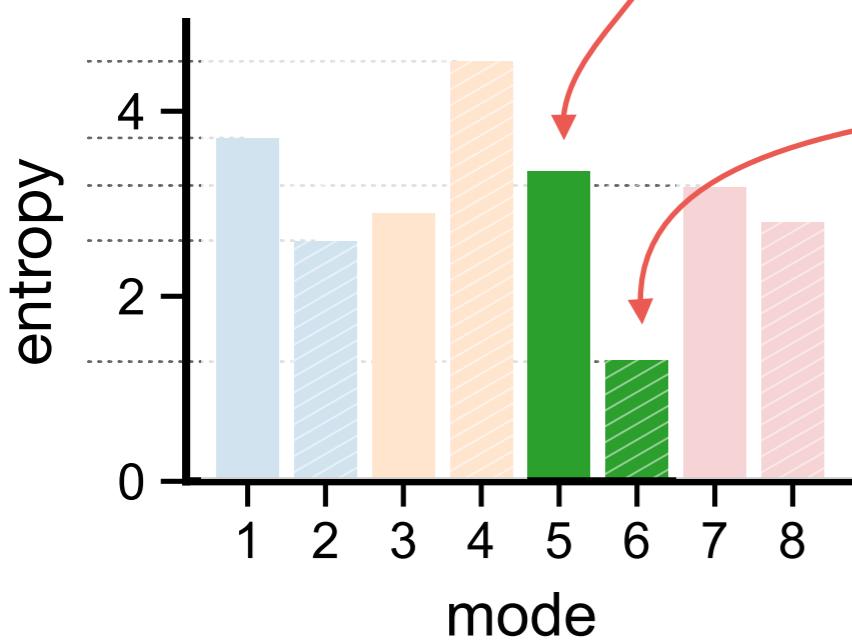
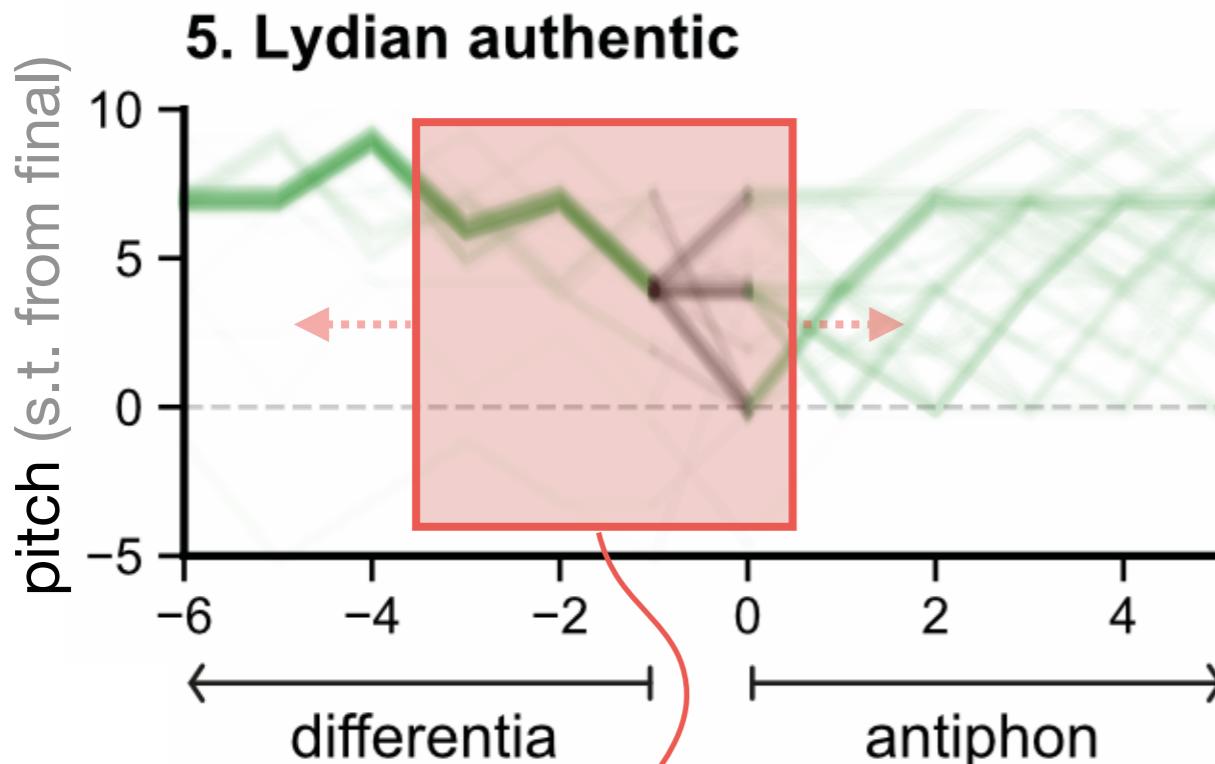


**Very systematic**  
predictable connection  
*lower entropy?*

# Case 2: differentia–antiphon

*Are differentia–antiphon connections systematic?*

— Rebecca Shaw, DLfM 2018



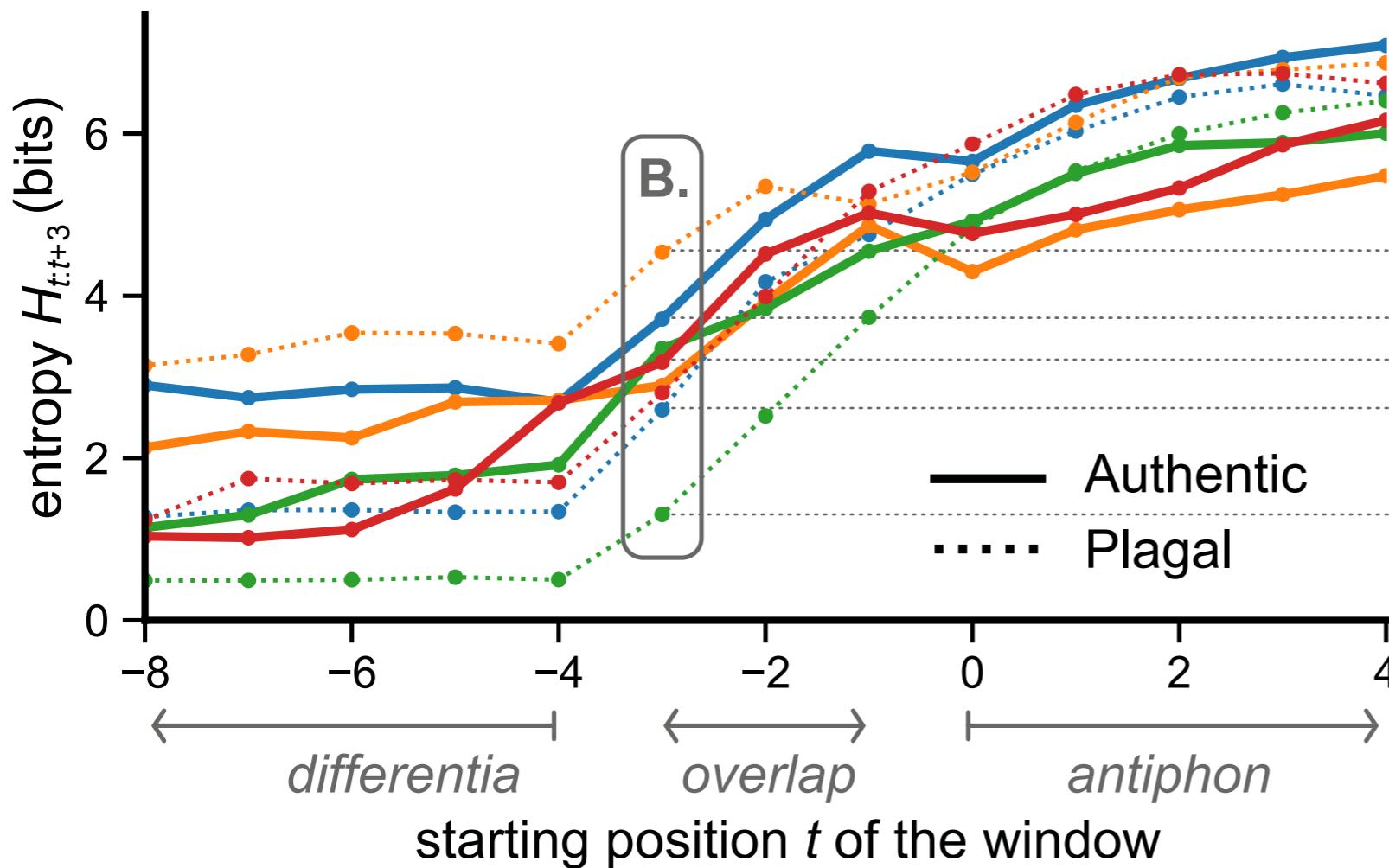
measure entropy  
of distr. over connections  
in a sliding  
window of 4 notes

# Case 2: differentia–antiphon

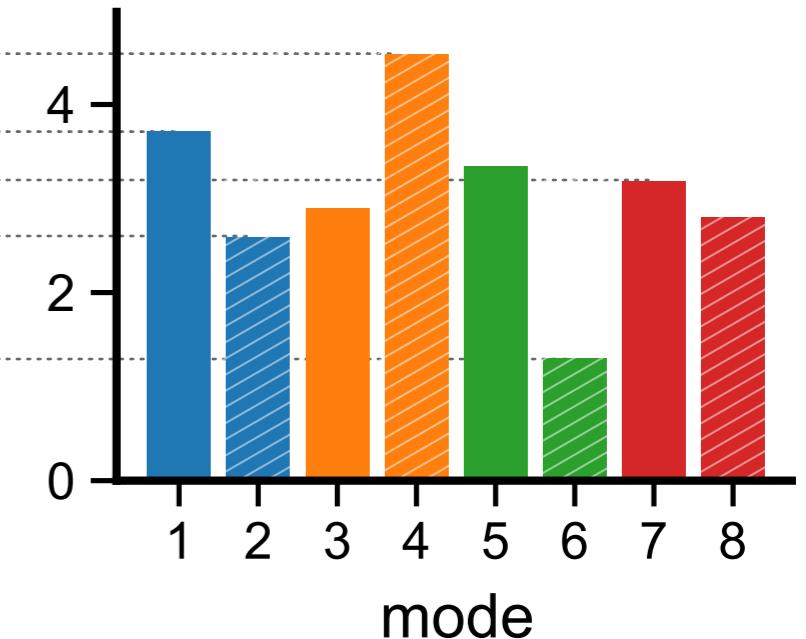
*Are differentia–antiphon connections systematic?*

— Rebecca Shaw, DLfM 2018

A. Entropy in a moving window of 4 notes



B. Entropy  $H_{3:0}$  of the differentia–antiphon connection



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**chant21:** [github.com/bacor/chant21](https://github.com/bacor/chant21) or pip install chant21

**CantusCorpus:** [github.com/bacor/CantusCorpus](https://github.com/bacor/CantusCorpus)

**GregoBaseCorpus:** [github.com/bacor/GregoBaseCorpus](https://github.com/bacor/GregoBaseCorpus)

**Case studies:** [github.com/bacor/DLfM2020](https://github.com/bacor/DLfM2020)

And check out our ISMIR paper  
on mode classification on CantusCorpus  
at [github.com/bacor/ISMIR2020](https://github.com/bacor/ISMIR2020)