A comprehensive framework for audio and music analysis

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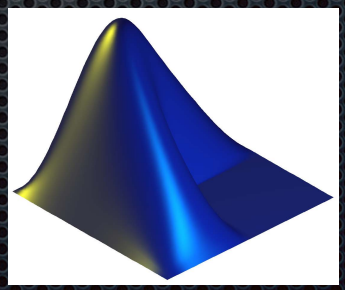
MIRtoolbox



MiningSuite

Outline

- Audio and musical feature extraction from **recordings**
  - *MIRtoolbox*
- Music analysis from **symbolic** representation:
  - grouping, reduction, motivic patterns
- *MiningSuite*

MIRtoolbox

- Comprehensive set of audio / musical features
- Modular syntactic layer on top of Matlab
  - both simple and powerful language
- Referential framework in Music Information Retrieval
  - 10000s of downloads, 500+ citations in papers

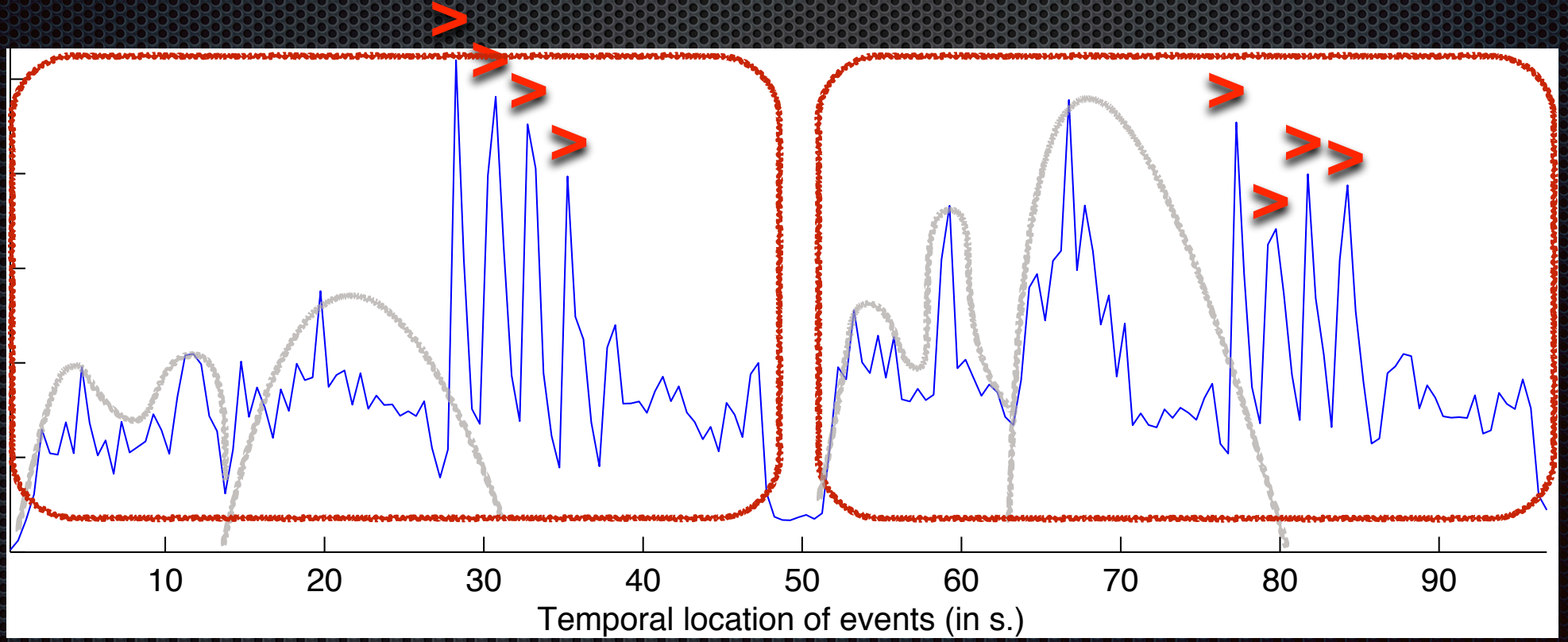
MIRtoolbox

Dynamics

Audio level

Sound

Dynamics: Global energy



Dvorak, Symphony 8 G major, *Allegretto grazioso - Molto vivace*

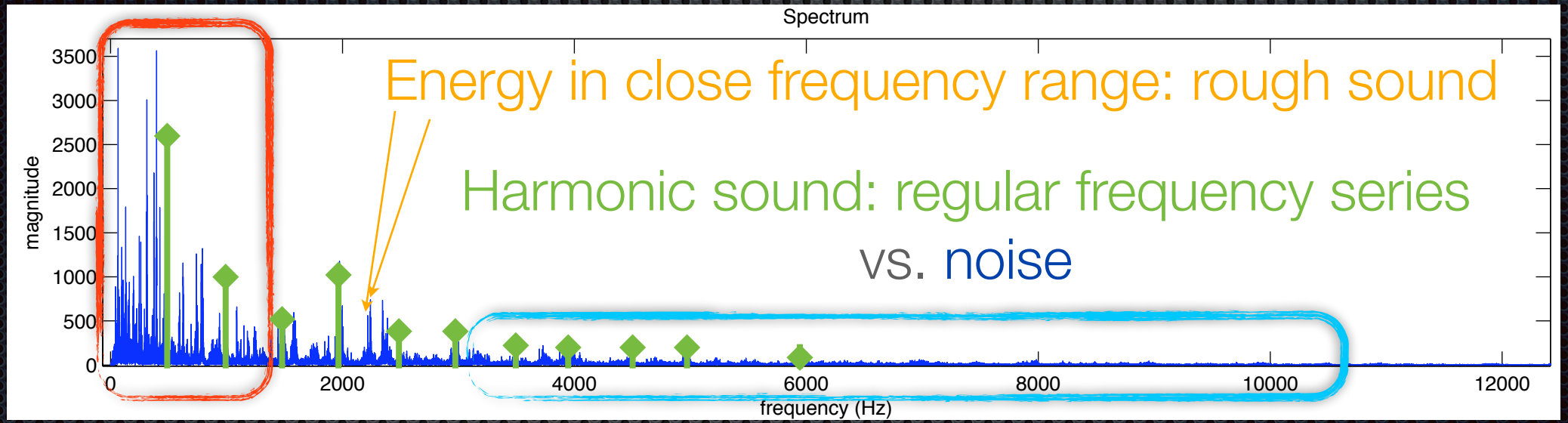
MIRtoolbox

Dynamics Timbre

Audio level **Sound**

Timbre

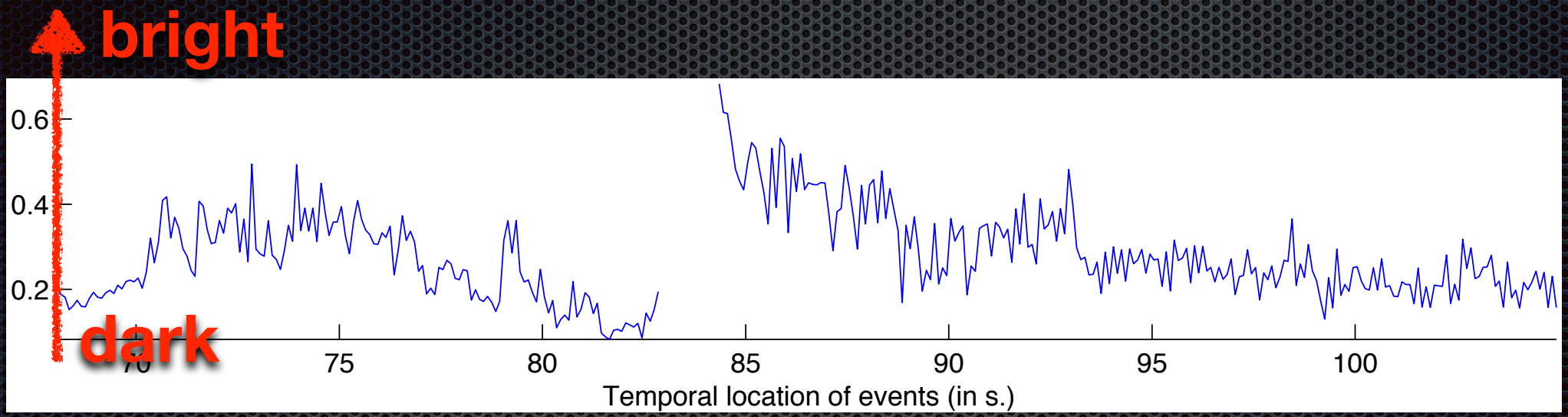
- Energy decomposed into frequencies (***spectrum***)



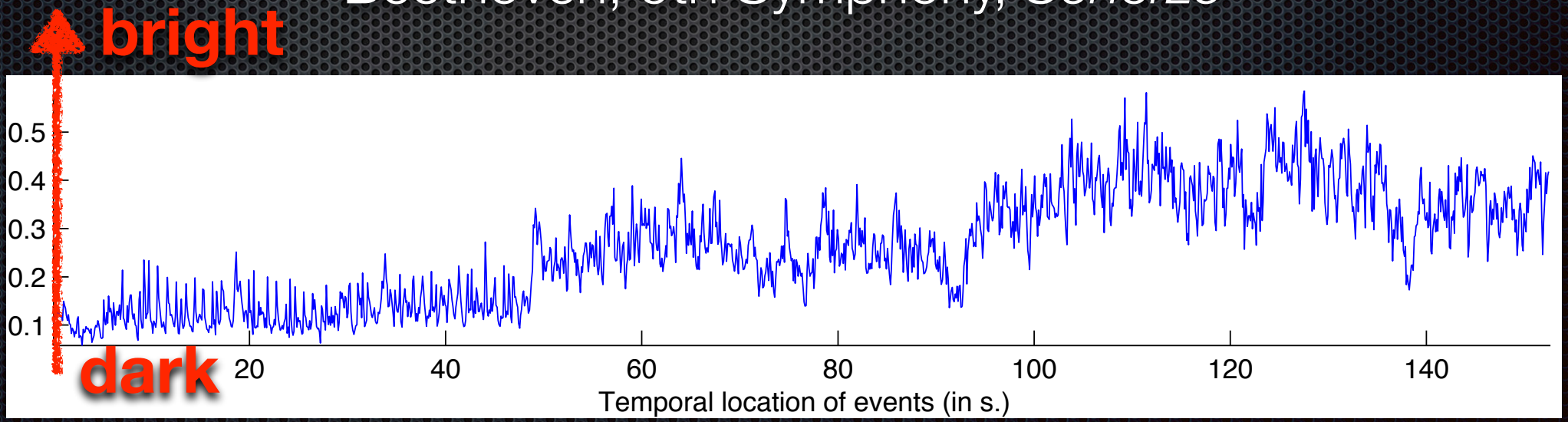
Low frequency energy: dark sound

High frequency energy: bright sound

Timbral gesture: brightness



Beethoven, 9th Symphony, *Scherzo*



Beethoven, 7th Symphony, *Allegretto*

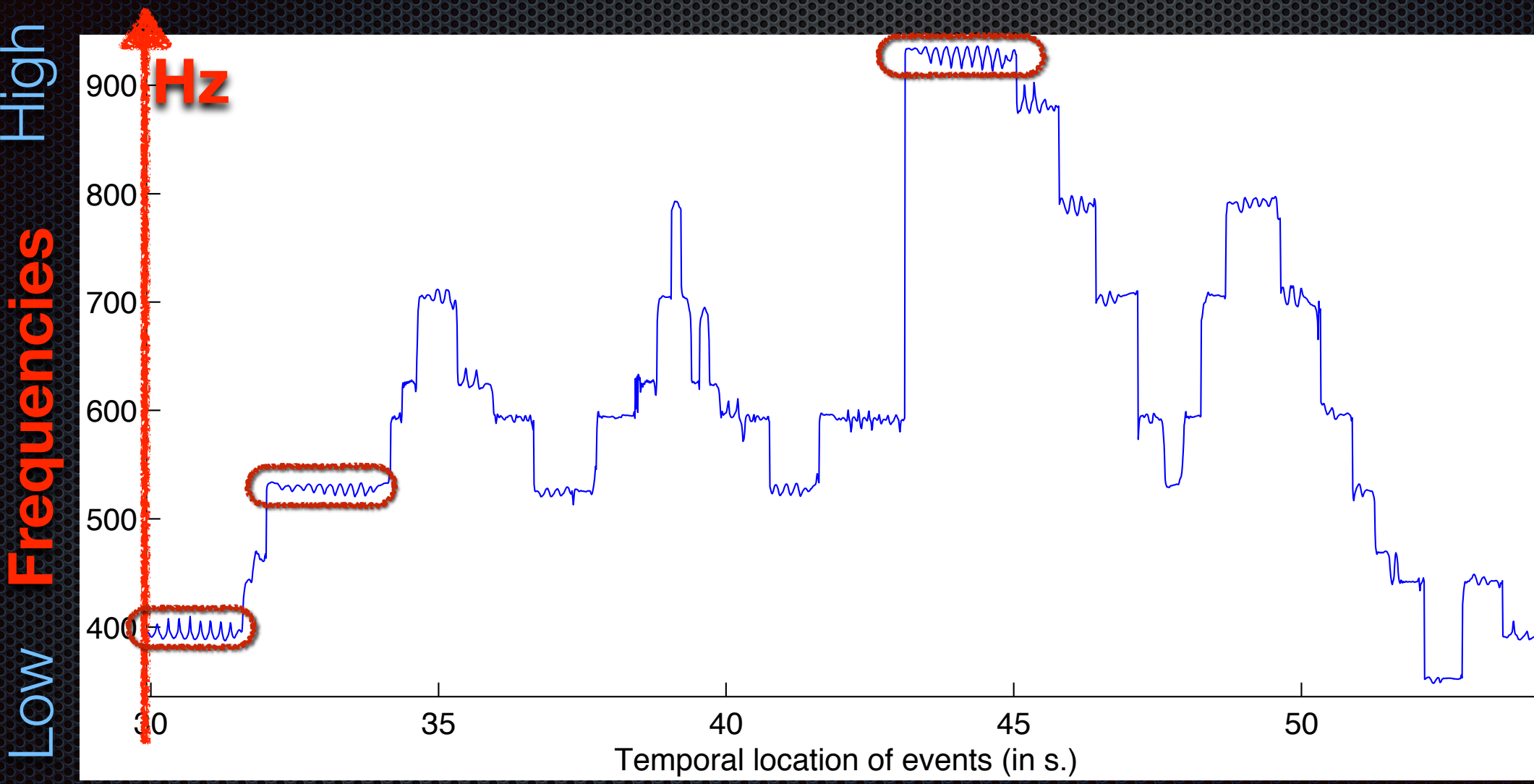
MIRtoolbox

Dynamics Timbre Pitch

Audio level **Sound**

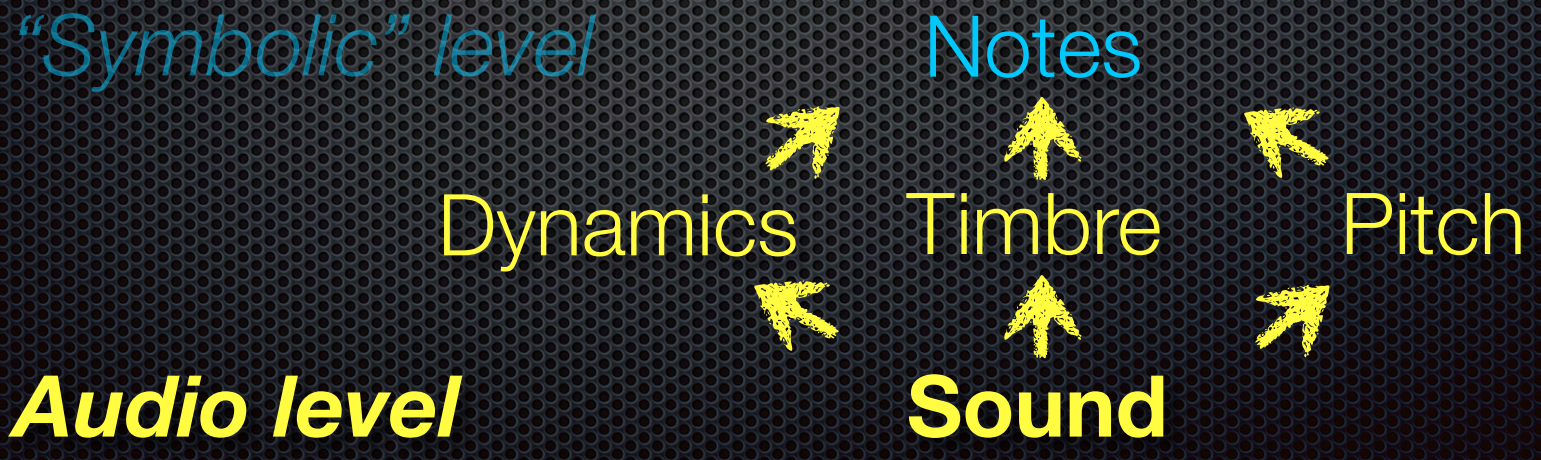
Van Zijl, Toiviainen, Lartillot, Luck. The sound of emotion: The effect of performers' experienced emotions on auditory performance characteristics. Music Perception (2014)

Pitch gesture

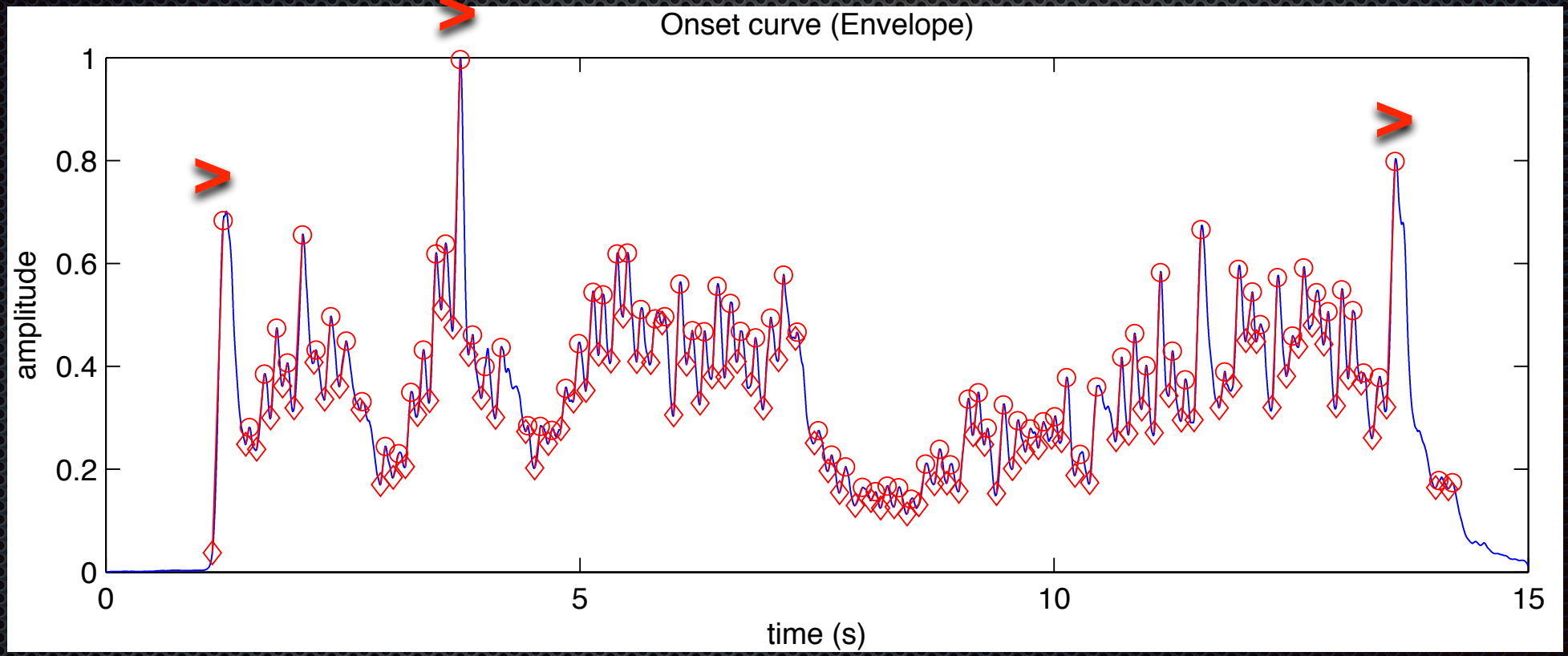


Harty, Miniature for oboe and piano, *Orientale*

MIRtoolbox

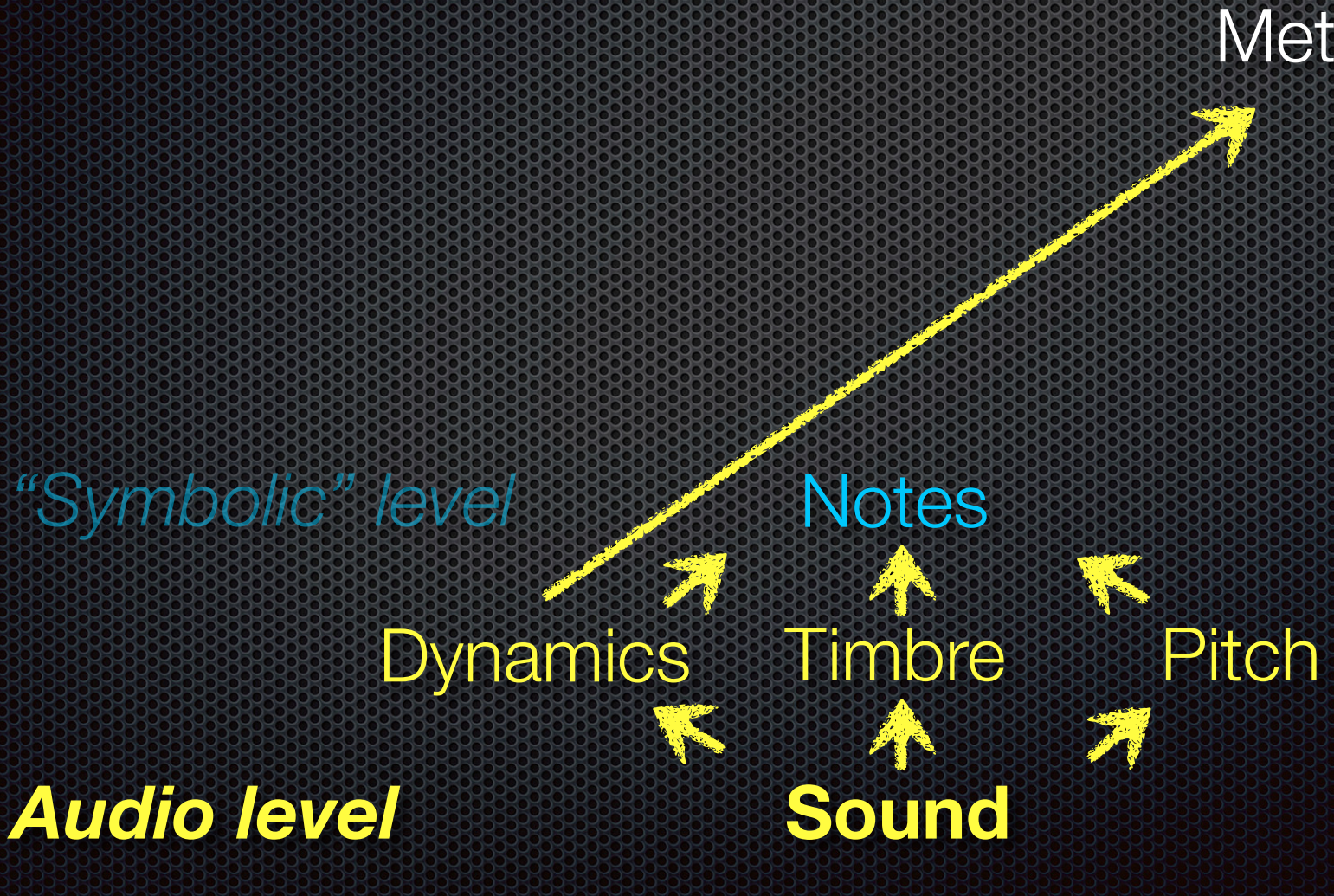

"Symbolic" level
Notes
Dynamics
Timbre
Pitch
Audio level
Sound

Dynamics: Note attacks



CPE Bach, Cello Concerto in A major, WQ172, 3rd movement

MIRtoolbox


Metre
"Symbolic" level
Notes
Dynamics
Timbre
Pitch
Audio level
Sound

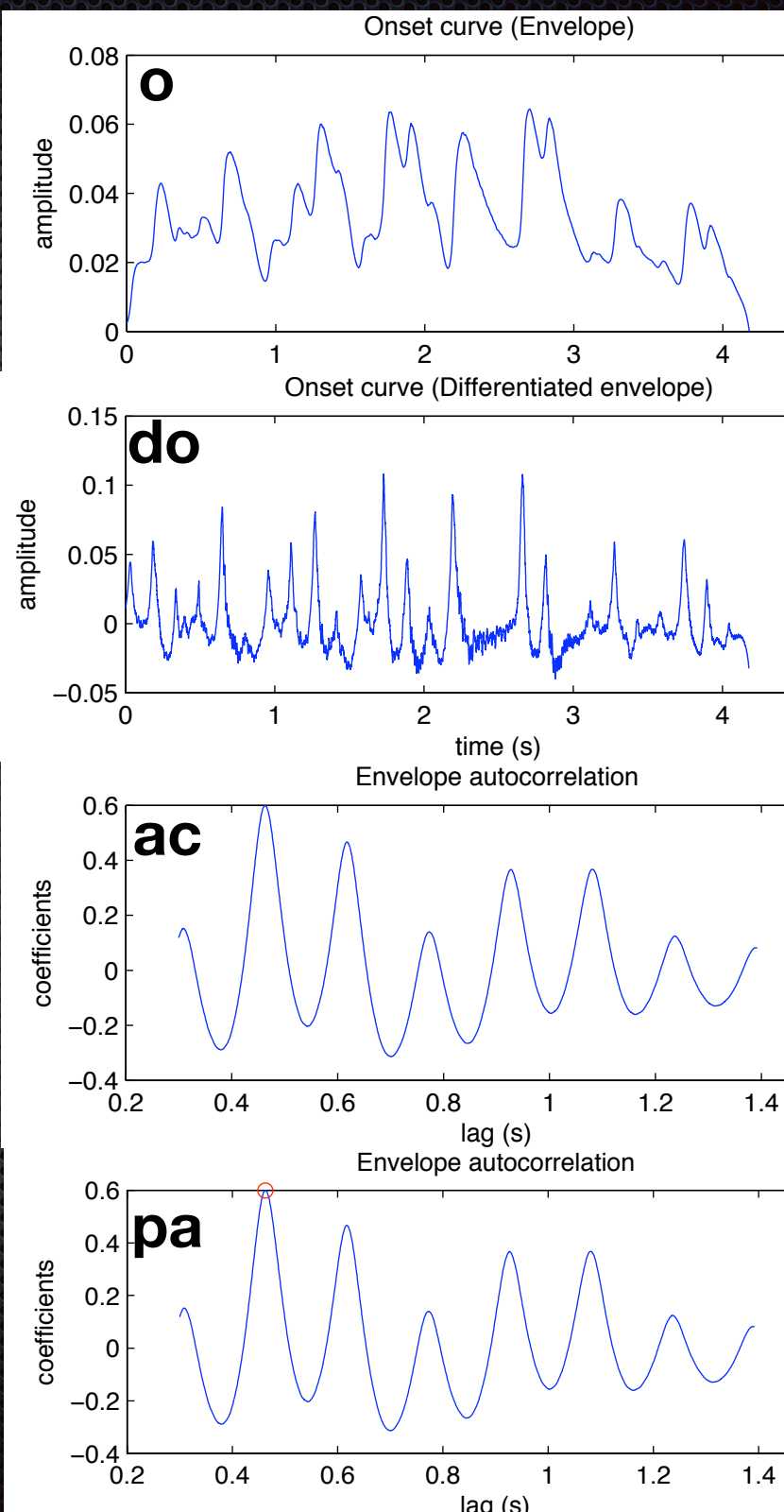
Tempo estimation

- o = mironsets('mysong', 'Detect', 'No')
- do = mironsets(o, 'Diff')
- ac = mirautocor(do)
- pa = mirpeaks(ac, 'Total', 1)

In short:

- [t, pa] = mirtempo('mysong')

t = 129.6333 bpm

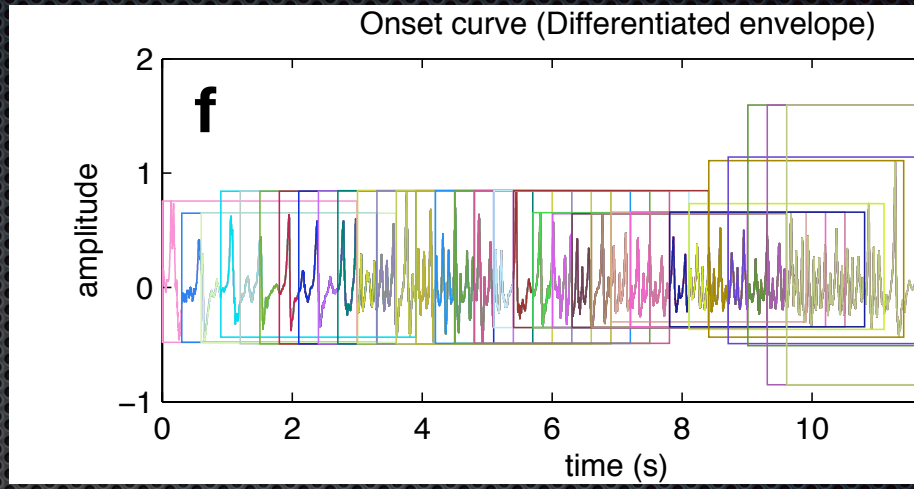


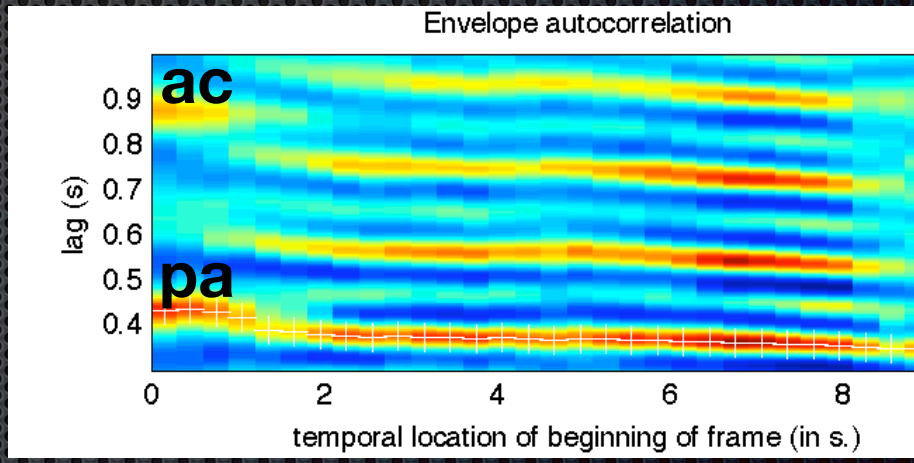
Tempo estimation

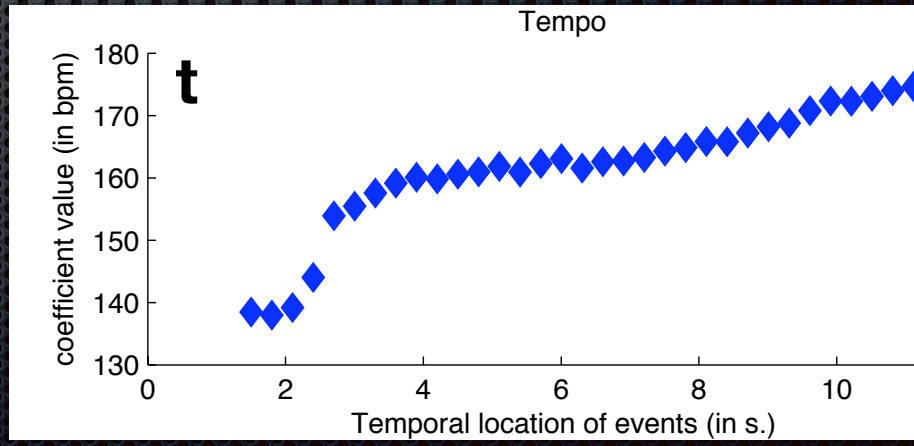
- o = mironsets('mysong', 'Detect', 'No')
- do = mironsets(o, 'Diff')
- **f = mirframe(do)**
- ac = mirautocor(do)
- pa = mirpeaks(ac, 'Total', 1)

In short:

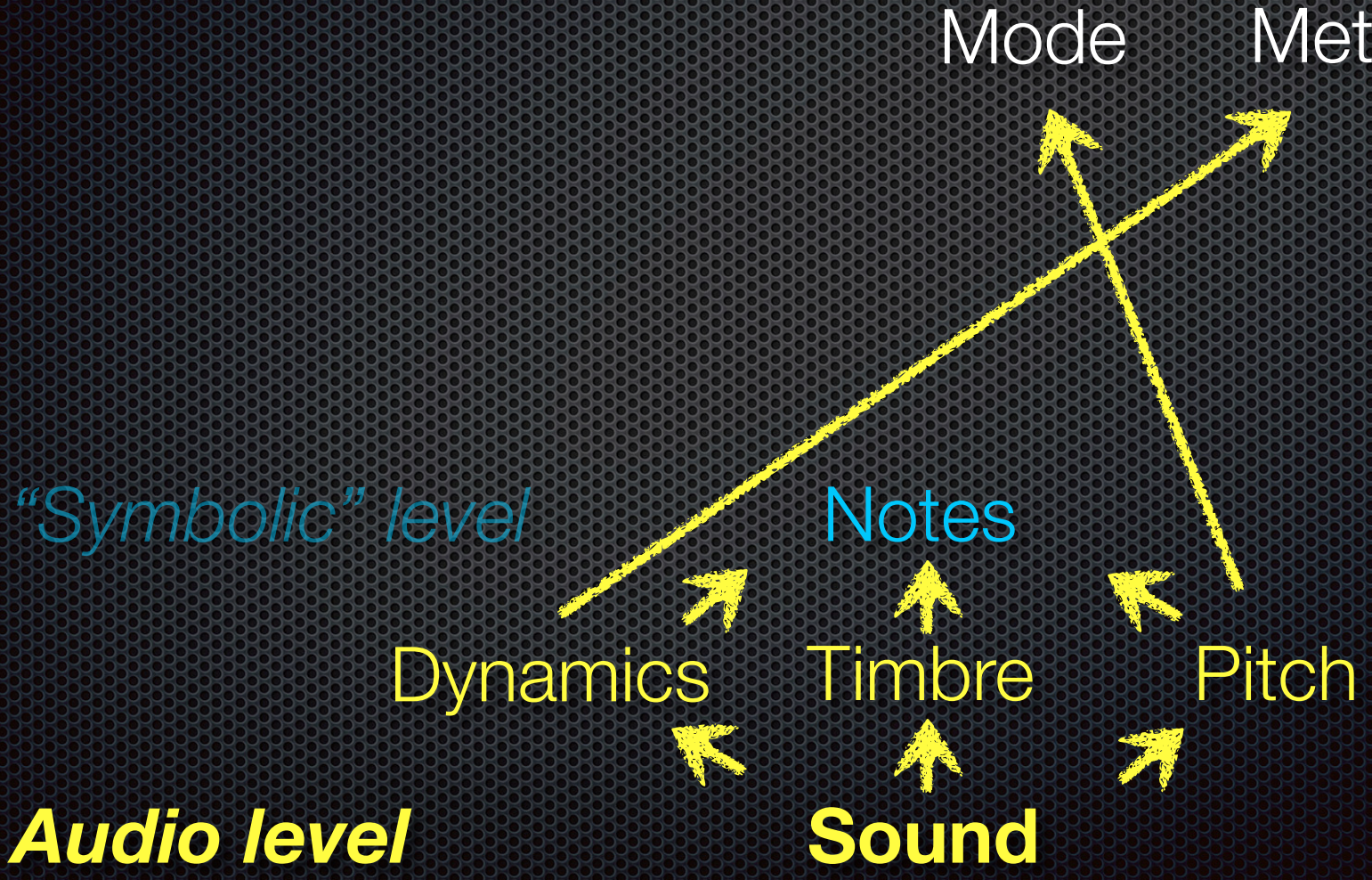
- [t, pa] = mirtempo('mysong', **'Frame'**)







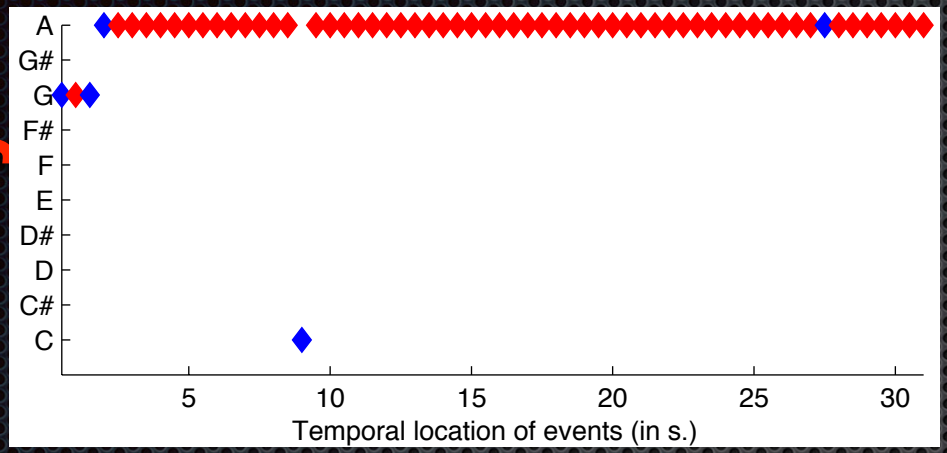
MIRtoolbox


Mode
Metre
"Symbolic" level
Notes
Dynamics
Timbre
Pitch
Audio level
Sound

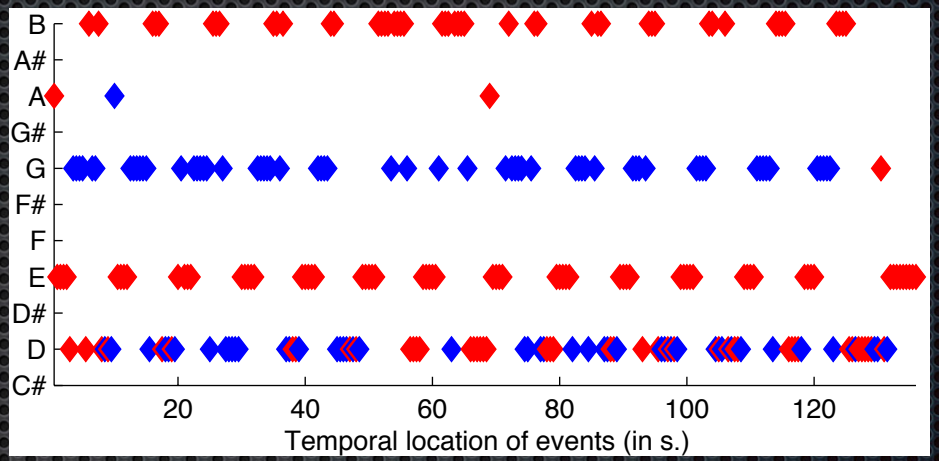
** Sykes, Glowinski, Grandjean, Lartillot, Eliard. Is a contemporary listener able to distinguish between the musical emotional figures created by Monteverdi? SysMus 2013*

Tonal gesture

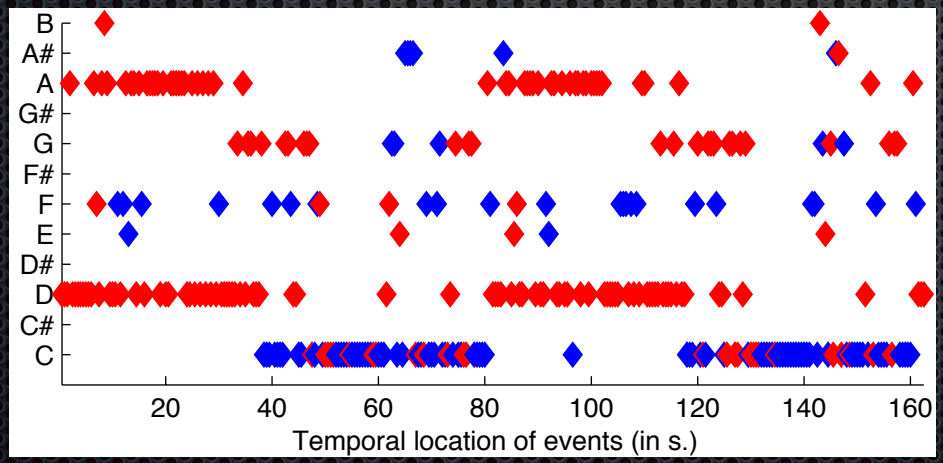
Keys



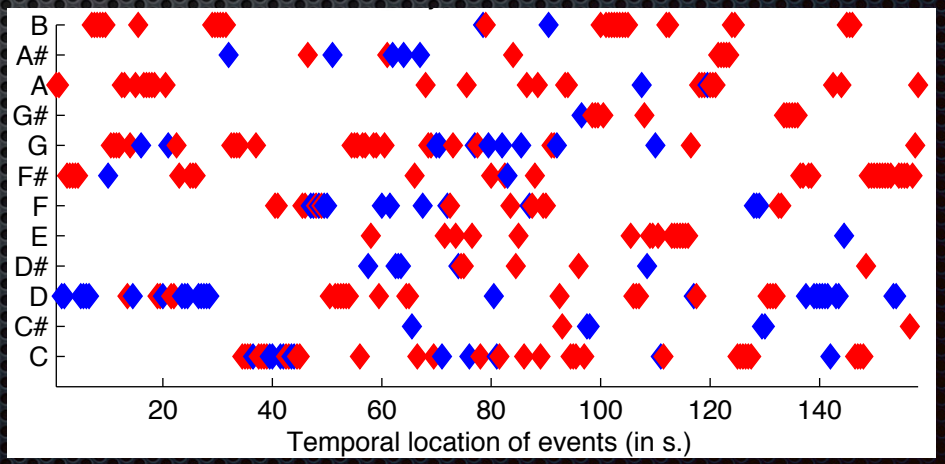
Monteverdi, *Hor che'l ciel e la terra*, 1st part *



Tiersen, *Comptine d'un autre été : L'après-midi*



Beethoven, 9th Symphony, *Scherzo*



Schönberg, *Verklärte Nacht*, *Sehr Ruhig*

MIRtoolbox

Segments

Mode

Metre

Motifs

"Symbolic" level

Notes

Patterns

Dynamics

Timbre

Pitch

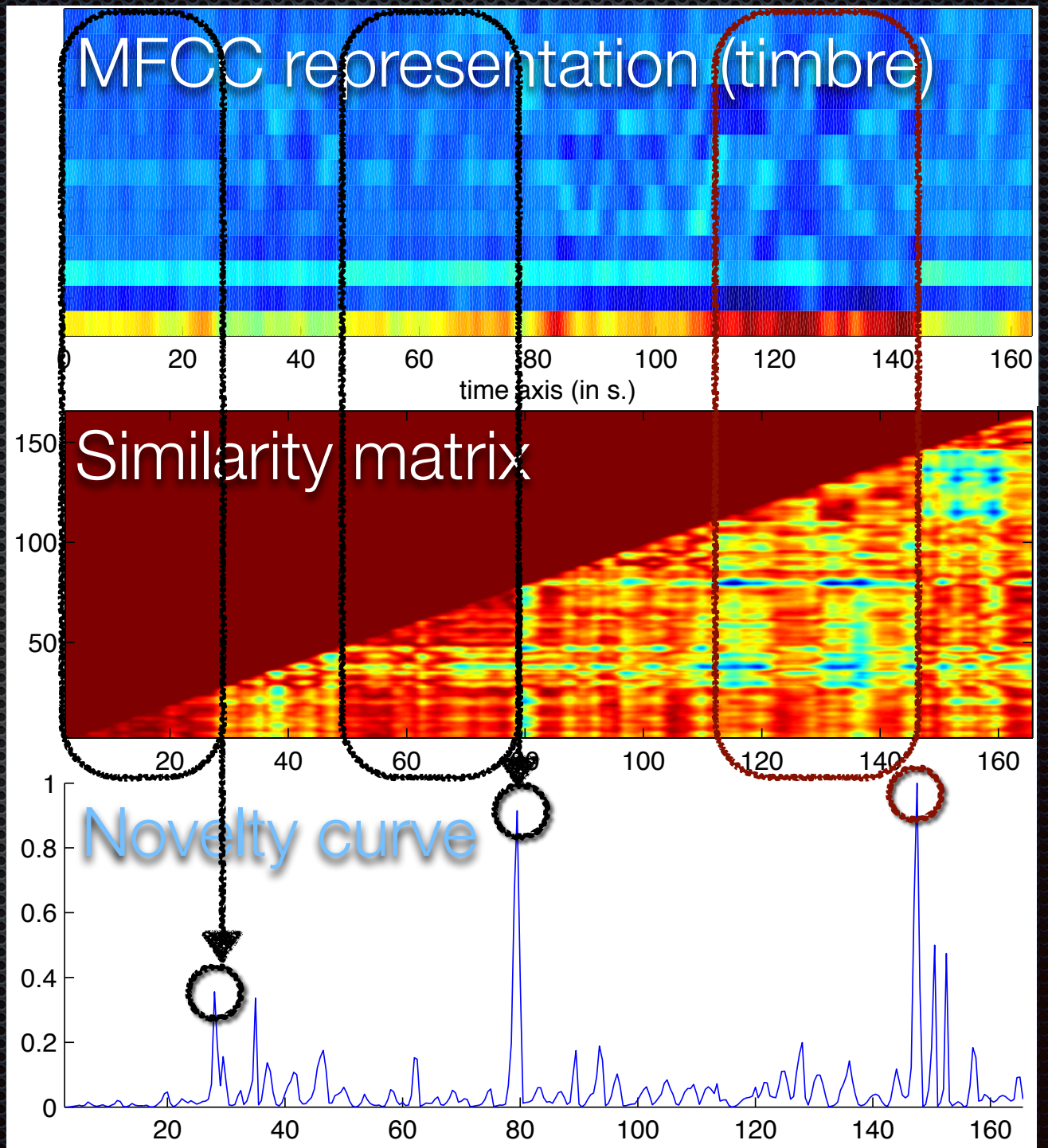
Audio level

Sound

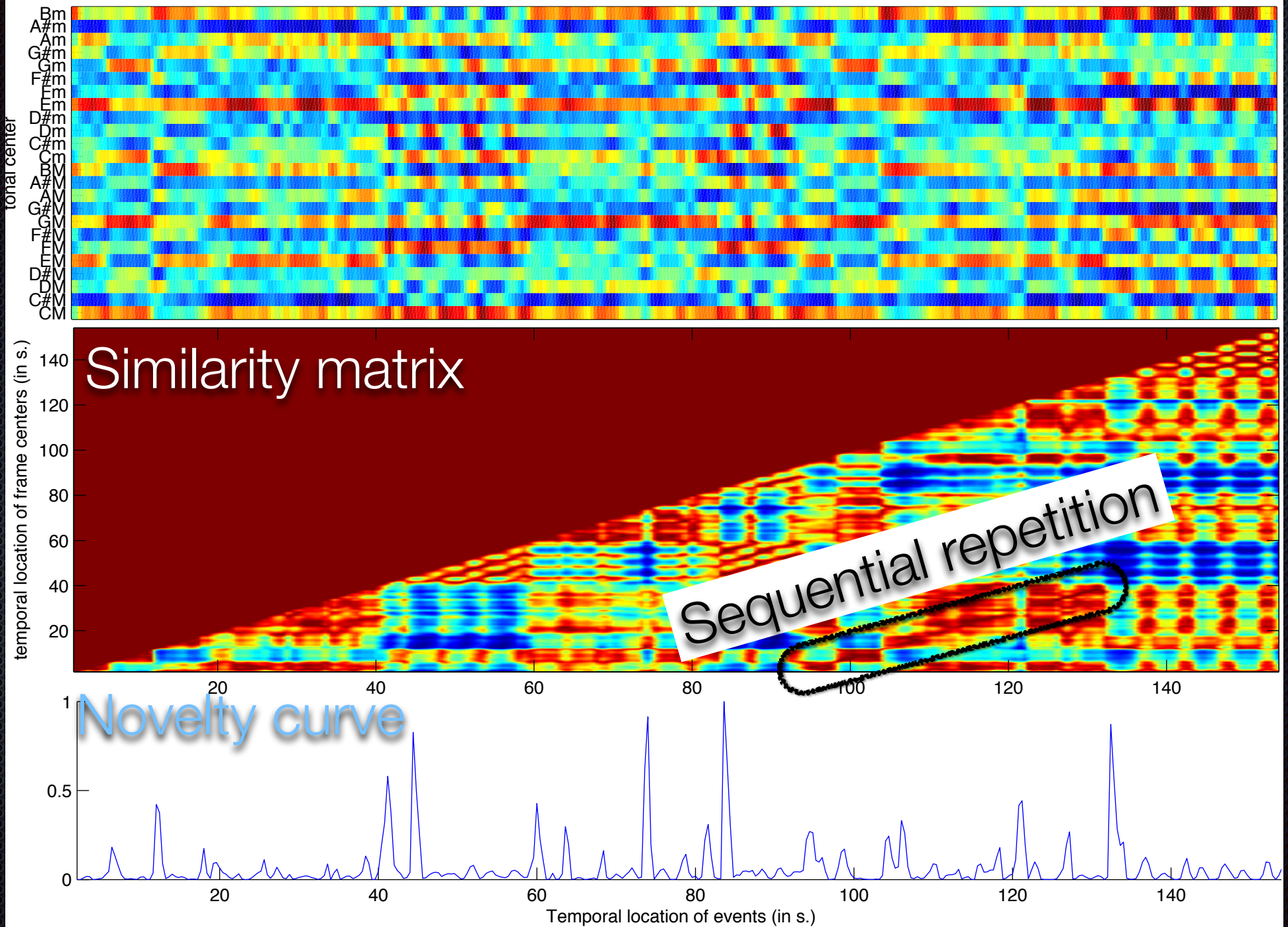
Lartillot, Cereghetti, Eliard, Grandjean. A simple, high-yield method for assessing structural novelty. International Conference on Music & Emotion (2013)

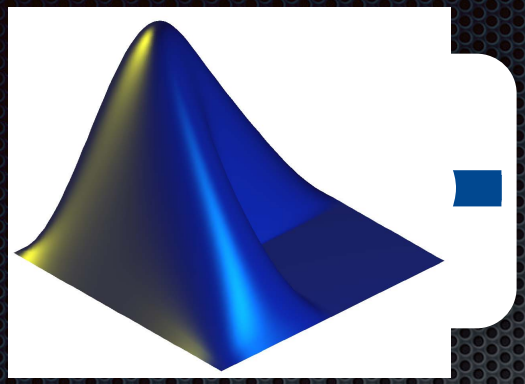
Timbral structure

Brahms, Symphony No.3 in F major, *Poco Allegretto*



Tonal structure Bazzini, *Dance of the Goblins*





MiRsuite

Groups
Segments
Mode
Metre
Motifs
Patterns
"Symbolic" level
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Timbre
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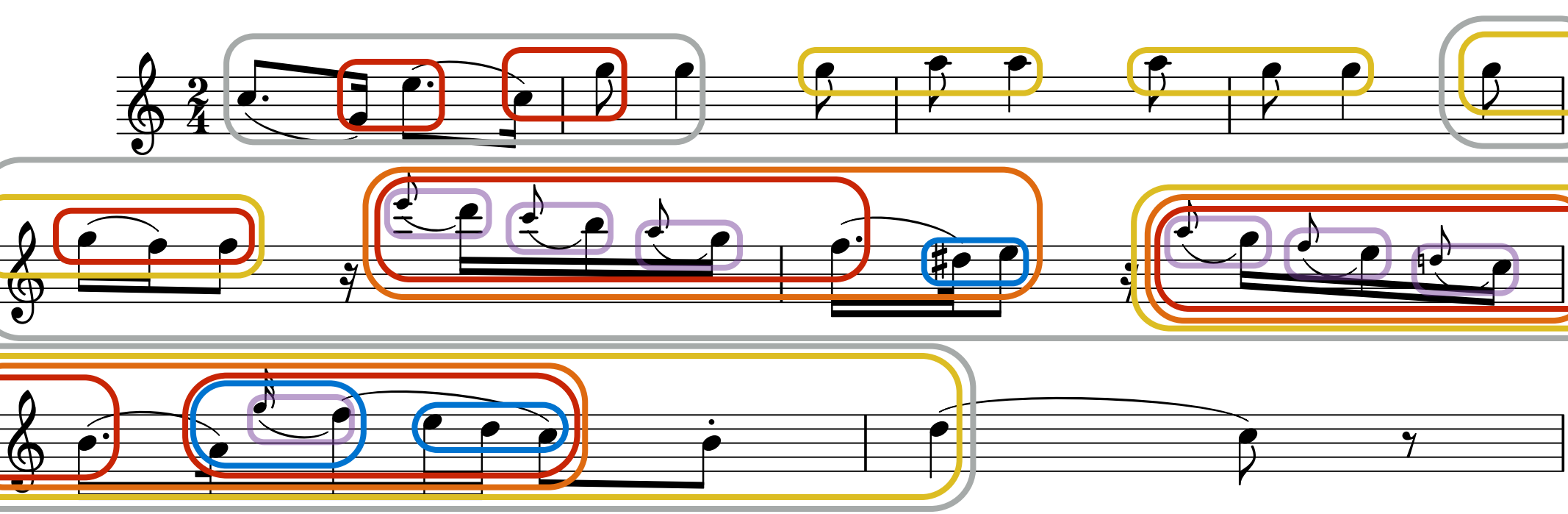
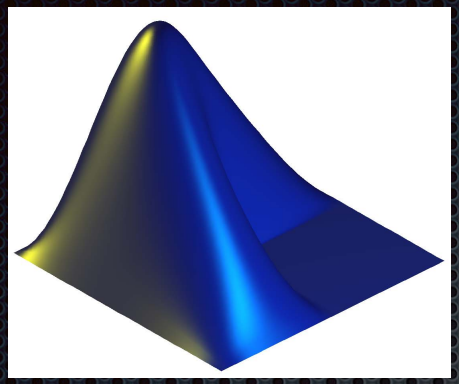
Sound

Local grouping



Mozart, Variation XI on "*Ah, vous dirai-je maman*", K.265/300e



MiningSuite

Groups
Segments

Ornament
reduction

"Symbolic" level

Notes

Dynamics

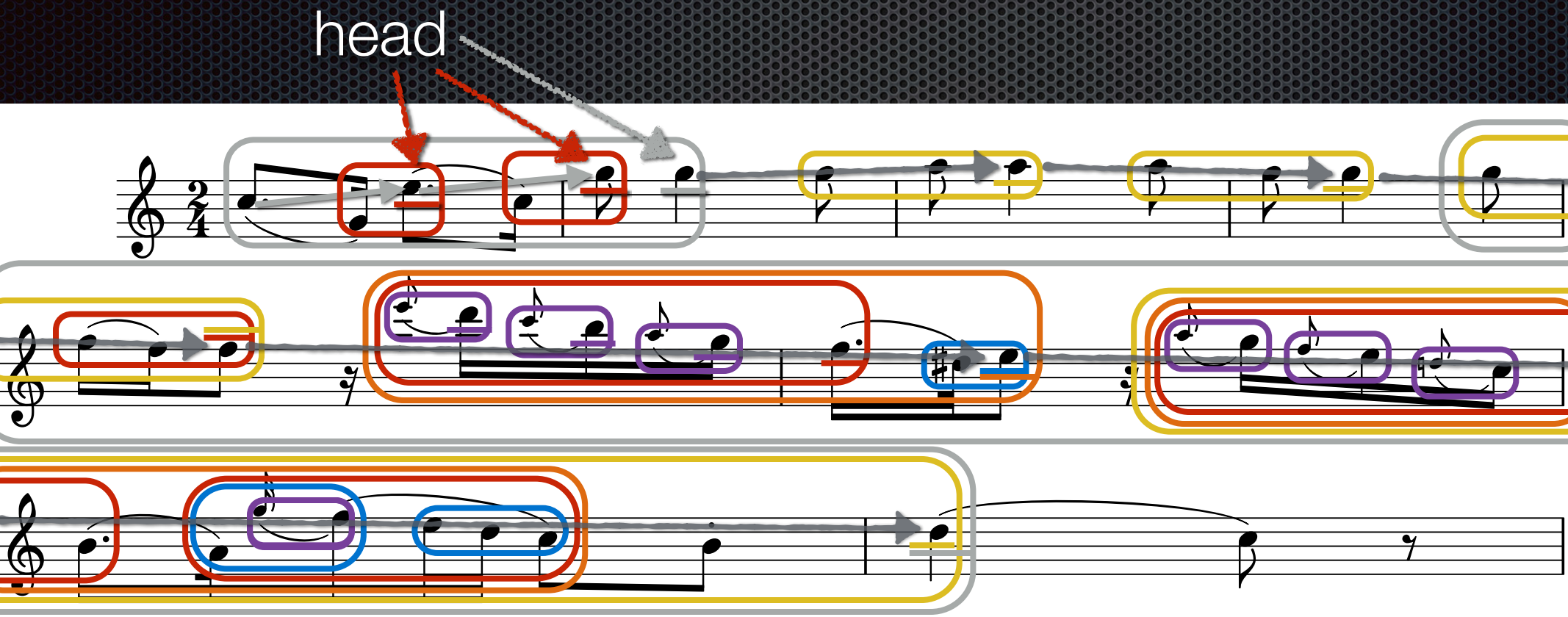
Timbre

Pitch

Audio level

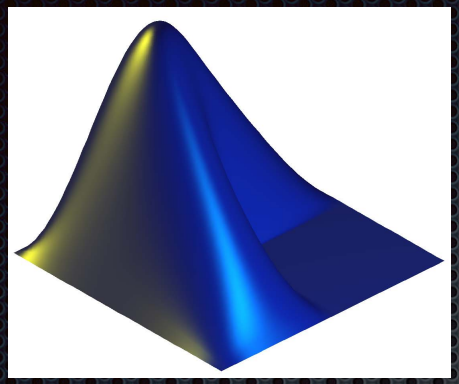
Sound

Ornamentation reduction



Mozart, Variation XI on "*Ah, vous dirai-je maman*", K.265/300e

- syntagmatic network



MiningSuite

Groups
Segments

Ornament
reduction

Motifs

Patterns

"Symbolic" level

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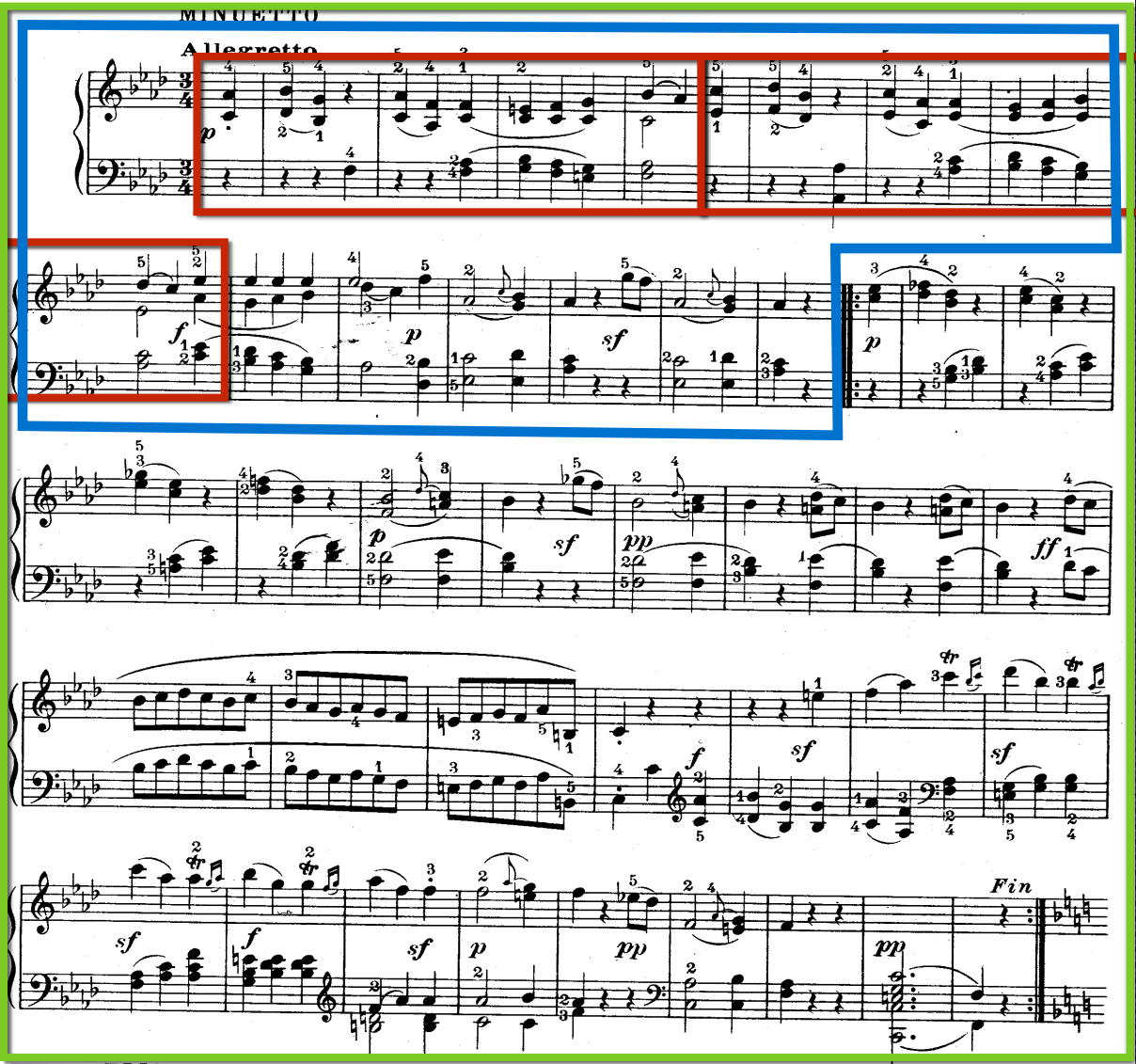
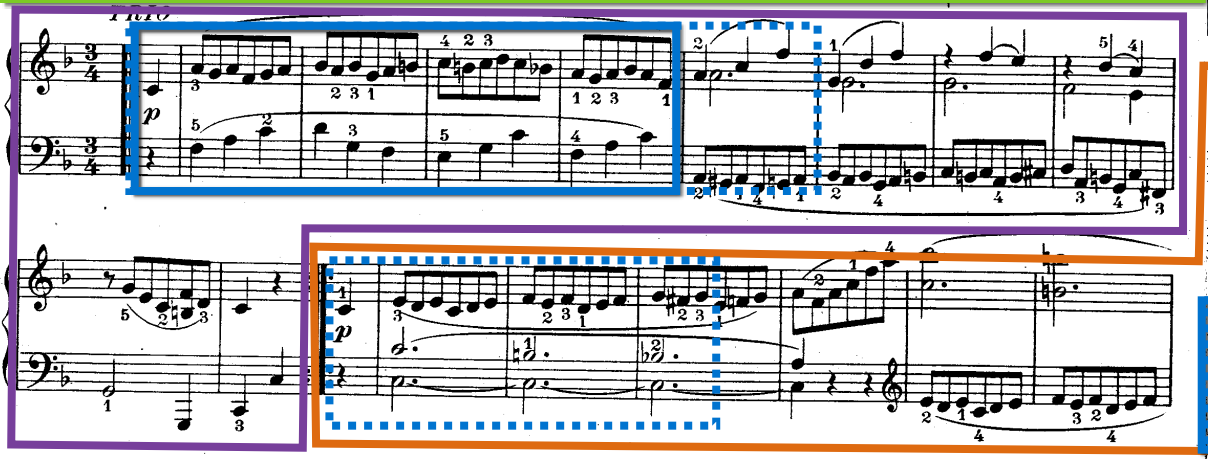
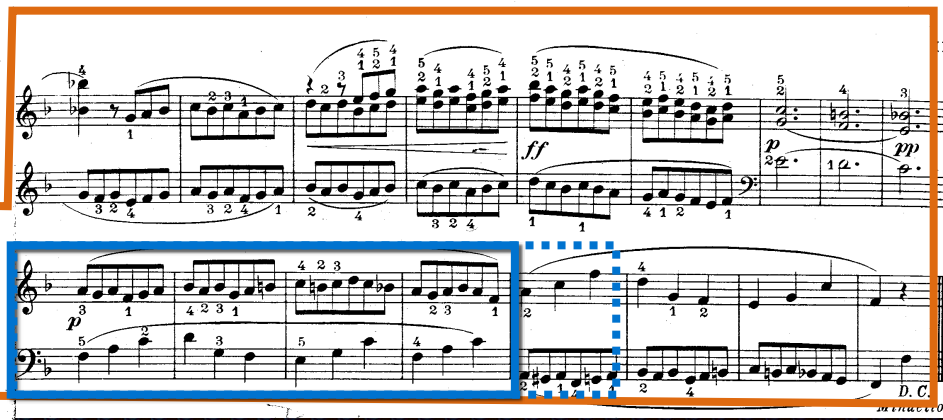
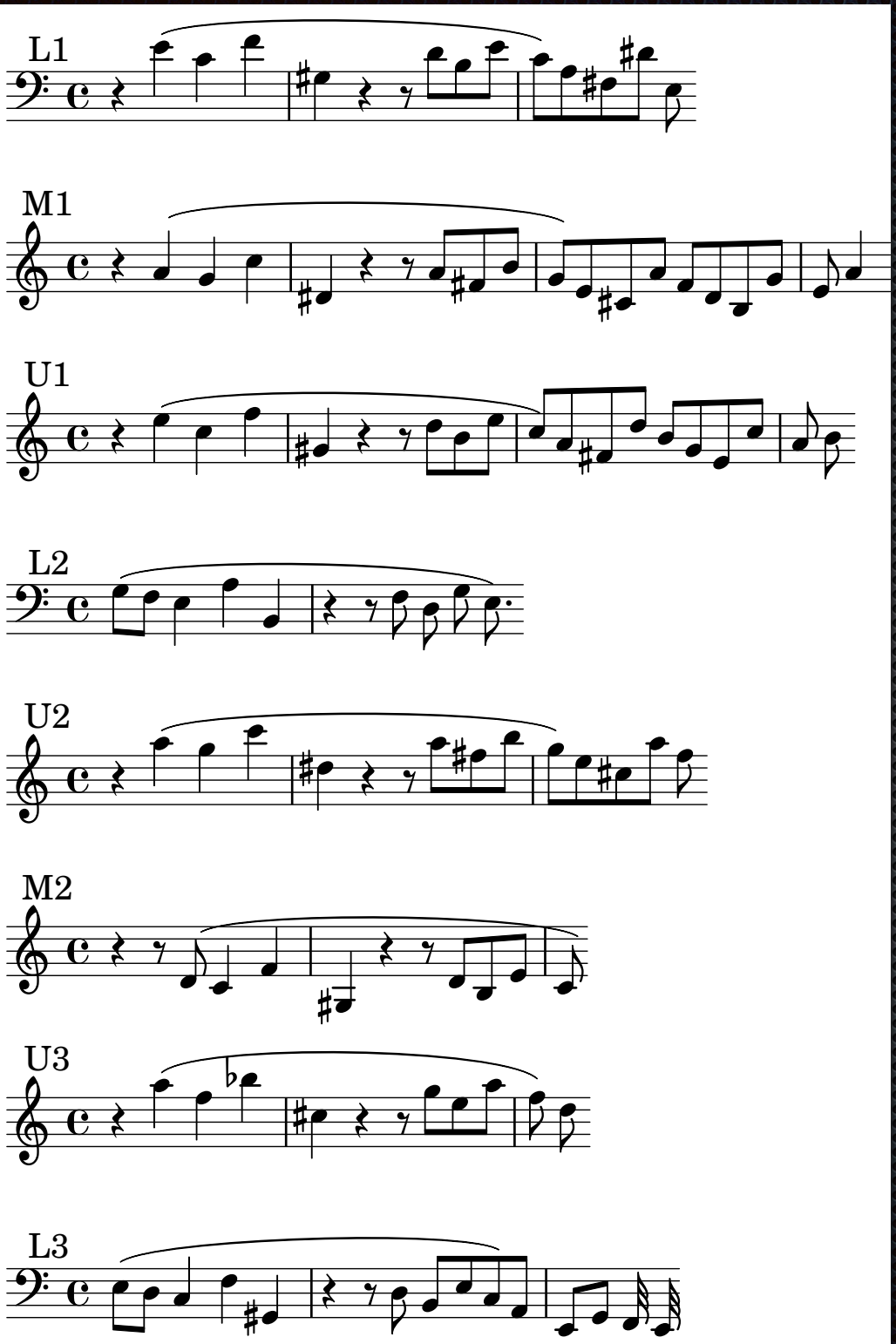


Barlow & Morgerstern A

Barlow & Morgerstern B

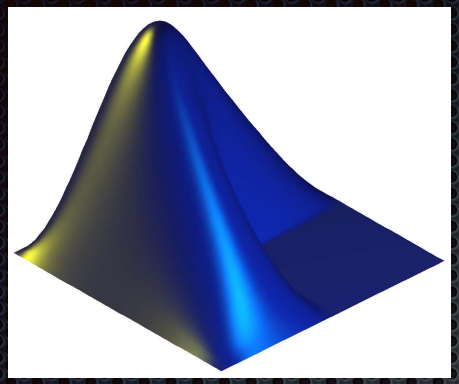






J.S. Bach, *Well-Tempered Clavier*, Book II, Fugue XX
Detected subject entries

Lartillot, ISMIR 2014



Mining

Emotion
Style
Form

Groups
Segments

Mode

Metre

Motifs

Ornament
reduction

"Symbolic" level

Notes

Patterns

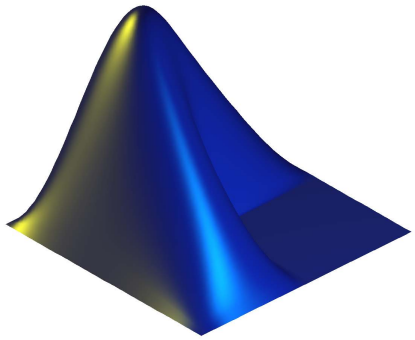
Dynamics

Timbre

Pitch

Audio level

Sound



MiningSuite

code.google.com/p/miningsuite

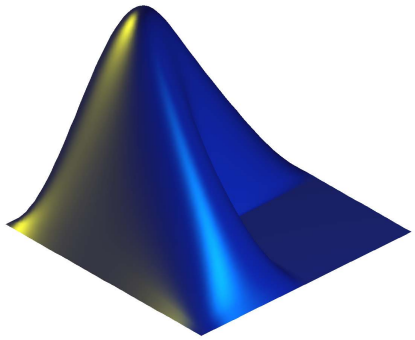
SIGMINR
signal processing

SEQMINR
sequence processing

AUDMINR
auditory modelling

PATMINR
pattern mining

MUSMINR
music analysis



MiningSuite

code.google.com/p/miningsuite

- New syntactic layer in the source code itself
  - Matlab optimisation & code readability
- Significantly optimised (in speed and memory) Fully rewritten using recent Matlab object-oriented programming capabilities
- Open source. Developers' community
- Tutorial at ISMIR 2014 conference