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Music Informatics

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Today

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- Paradigmatic analysis
- Analysing outside WTM

Admin

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- About to give feedback on unassessed assignment.
- Assessed coursework: ask questions at end of the lecture.

Automated music analysis enables in principle various forms of manipulation of musical structures:

- variation;
- coordination between performers;
- structuring machine improvisation;
- within algorithmic composition.

Paradigmatic analysis is a method that lends itself to implementation.

For a quick overview of computational aspects:

`http://preview.tinyurl.com/j4uyqfo`

Hint from anthropology

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Levi-Strauss did a comparative analysis of various myths, and found it useful to give an analysis in the form of a table that indicated:

- succession of events in time
  – by a reading in normal top/bottom (left/right) order
- and similarity of events, by ordering them in columns

This was a way to bring out internal structure and relationships between myths.
(C. Lévi-Strauss, Structural Anthropology, 1963)

Example

```
C seeks sister
                                        C kills dragon
                  S kill each other
                                                        Limping L
                  O kills father
                                                        left-handed L
                                                        O swollen foot
O marries mother
                  E kills brother


where  O = Oedipus        C = Cadmos    E = Eteocles
       S = Spartans       L = Laius
```

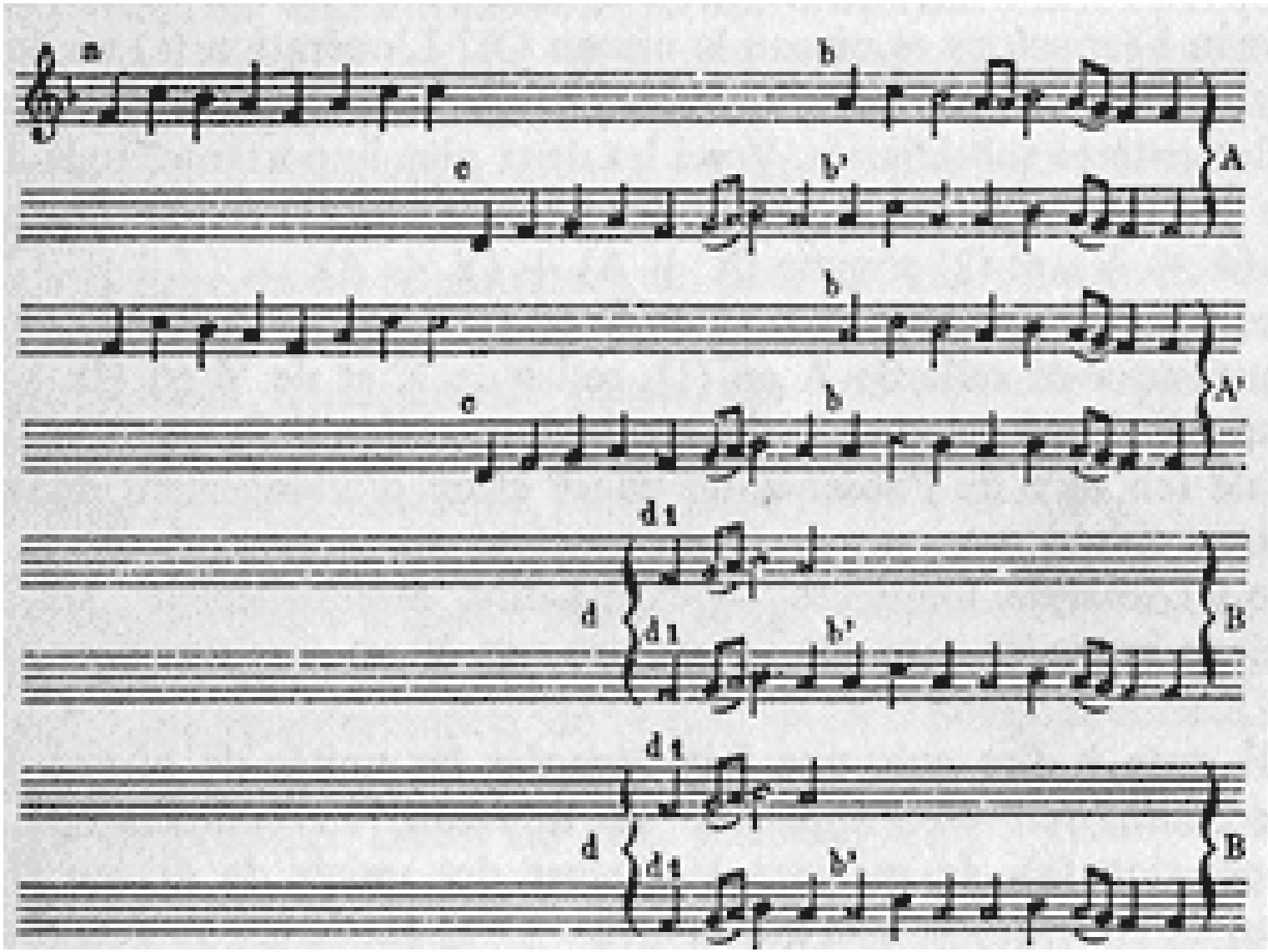
Ruwet used this as a model for analysis;
on-line discussion describing the background and a software tool is at

`http://tinyurl.com/yzfqso5`

Nicolas Donin and Jonathan Goldman,
Charting the Score in a Multimedia Context:
the Case of Paradigmatic Analysis,
at Music Theory On-line.

It is worth looking through the examples treated there to get an idea of the strenghths and weaknesses of the approach.

Ruwet example



How to automate?

As before, there is a lot to do in order to make sense of this sort of analysis to the point where it can be carried out automatically.
The two main questions are:

- what are the units that are being compared?
- what counts as musical similarity here?

The questions are *not* independent;
in looking for similarity, some bits of segmentation can be suggested. (We already saw this role of similarity in GTTM.)

Possible routes to Ruwet's analysis

The interaction between segmentation and similarity can be organised in different ways, eg

1. note segments A, A', B, B at large granularity;
2. alternatively, use a, b, b', c, d at medium granularity
3. or finer grained, with d_1 etc

This has an assumption that the segments are roughly similar size, in terms of duration. This is different from the case of myths, where time spent on a given episode is less relevant.

Size of units

Compare the toy analysis of the British national anthem in this way, depending on the size of the units compared.
Handout is from Music as Discourse, Agawu, Oxford University Press, 2009, pp 168–173 (in restricted access from course web page).

Hierarchy?

We can also see a version of hierarchy in terms of patterns of bunches of the segments:

- immediate repetition from same class will bunch together;
- immediate repetition of this bunch will bunch together.

This is fairly crude, but will work for popular music in recognise melodic echos and 8-bar structure, without minimal rhythmic or harmonic analysis.
The algorithm depends on parameters `N`,`M`, suitable small integers.

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Algorithm sketch

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Work by following the temporal structure of music in first instance:

```
* Identity: repeat:
  * Look for repetition of N notes
     * If found, extend as far as possible
     * now look for other instances in the
                              rest of the piece
     * tag as a class & remove from input
* Similarity: repeat
  * Look for similar passages of M notes
     * If found, extend as far as possible
     * now look for other instances in the
                              rest of the piece
     * tag as class & remove from input
* Anything left will be isolated segments
```

Similarity

The procedure obviously depends on what notion of similarity is used. Some metric is need, and this will make some use of the organisation involved in the style.
The claim is that similarity based on general cognitively salient aspects of musical sound can get us a long way, without eg notions of key:

- similarity in duration patterns
- similarity in melodic shape (rising, falling, stationary)

On the other hand, the analysis is not a plausible cognitive model of listening to the music in real time: segments far apart in time are related to each other, and the analysis is not incremental through time.

Example

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Listen to the first piece from Charles Ives' "Three Quarter Tone Pieces".
On-line performance can be found on you-tube,
with moving score.
This is for two pianos, tuned a quarter tone apart.
The harmonies used are not from WTM, yet some patterns are clear to listeners (I think).

This sort of music can be successfully given paradigmatic analysis using a simple algorithm and notion of similarity as described above.

Summary

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- Paradigmatic analysis from myth
- Applied to music
- Relatively independent from stylistic assumptions