Inner Metric Analysis

An approach to the analysis of metric structures.
Developed by Thomas Noll and Anja Volk (and maybe others).

Inner vs Outer

- Only the structure of the onset data is taken into consideration. The relation to external entities like bar lines or time signatures are not taken into consideration.
- Immune to notational (or data format) issues.
- Reveals accent patterns (positions of strong and weak pulses in a given metric framework)
- While time signatures often remain constant, inner metric analysis aims at being able to deal with metric structures that vary over time.

Meter and Rhythm

- Rhythmic characteristic of an onset locations depends on an underlying meter, while the meter is established by the locations of the onsets.
- A chicken and egg problem.

Free Meters

- Musical onsets are modeled by rational numbers $x \in \mathbb{Q}$ understood as a $\mathbb{Z}$-module.
- Each period δ generates a unique submodule δ in $\mathbb{Q}$.
- Given a period δ and a phase $0 \leq \phi < \delta$, the corresponding free meter is $\Phi(\delta, \phi) = \phi + \langle \delta \rangle$.

It's simple ....

Free Meters

From the introduction by Thomas Noll:

- ▶ Musical onsets are modeled by rational numbers $x \in \mathbb{Q}$ understood as a $\mathbb{Z}$-module.
- ▶ Each period δ generates a unique submodule δ in $\mathbb{Q}$.
- ▶ Given a period δ and a phase $0 \leq \phi < \delta$, the corresponding free meter is $\Phi(\delta, \phi) = \phi + \langle \delta \rangle$.

It's simple .... **if you say it in english and show it with examples**

Local Meters

- Any chain of equal durations with at least three elements forms a local meter.
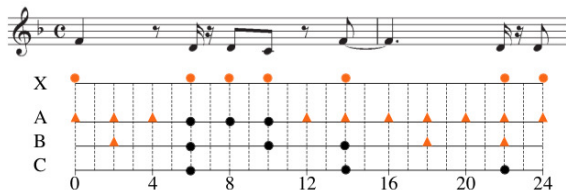- Chains of events with equal distant between them can have events between them.

Figure 1.   Local Meters in excerpt from "The Girl From Ipanema."

Metric Weights

- The metric weight is calculated by summing the squared length of all local meters that the given onset is contained in.
- The metric weights for the example are [0, 12, 4, 8, 8, 4].

Figure 1: Period Weight of Fuge C Minor from J.S.Bach's *Wohltemperiertes Klavier Part I*
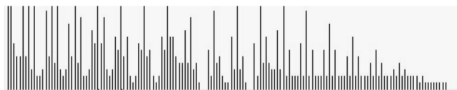

Figure 2: Period Weight of Fuge D Major from J.S.Bach's *Wohltemperiertes Klavier Part I*

Figure 3: Period Weight of a random set of Onsets

Spectral Weights

- In the spectral weight approach, each local meter contributes to the weight of onsets in its extension throughout the piece.
- Exists not only for note events, but also for rests
- not as sensitive to local changes in the inner meter as the metric weight.

(a) (b)
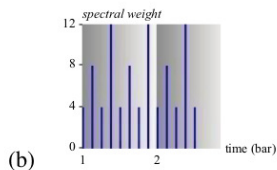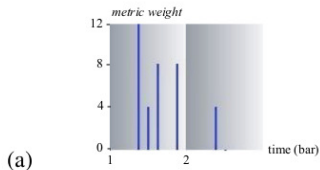
Relation to Metric Rulers

- Clarence Barlow's IDP calculation

Meter <2:`2:2>   4/4

Meter <`3:2>   3/4

Meter <2:`3,3,2>

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