The perceptual notation of musical time
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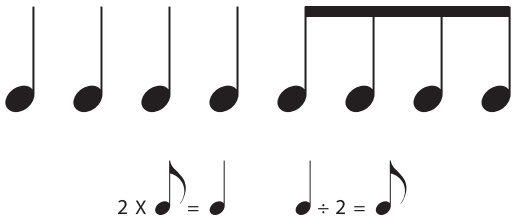
Before being discovered by Francisco Pizzaro, the Incas managed to build at least 23,000 kilometers of roads but missed to invent the wheel. This historical fact made me think that it might be precisely due to their unquestionable value that, sometimes, important, useful discoveries, postpone the quest for other viable alternatives to themselves: „what's the use of a wheel as long as we have good roads?", one may ask.

Indeed, what's the use of another perspective over musical time (i.e. theory and notation) as long as we benefit from the long and well established value of the bar-rhythmical system? Be it out of mere curiosity, but let us imagine what would have happened if, within a musical culture as biased towards complexification and speculative curiosity as ours, we simply missed to discover durational ratios:

ex. 1

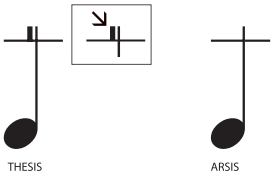


The 1:2 and 2:1 ratios represented here must be taken as a token of illustration. They stand for all the durational ratios common to musical practice (1:3, 2:3, 2:4 etc.) that we assume, as a working hypothesis, not to have discovered – save the 1:1 ratio that produces isochronous tempi.

Moreover, let us imagine that, despite this „mis-discovery", we were still able to notate and communicate in a literate fashion complex structures of discrete time. In fact, by eluding durational ratios, we can make a first idea about what kind of alternative „wheel" musicians failed to discover. First, let us see what remains of the bar-rhythmical theory once stripped of durational ratios.

A. Accents and non-accents (thesis and arsis)
As long as we do not benefit anymore from a metrical system to distribute accents *implicitly,* we should find new graphical symbols that would represent thesis and arsis values in an *explicit* way:

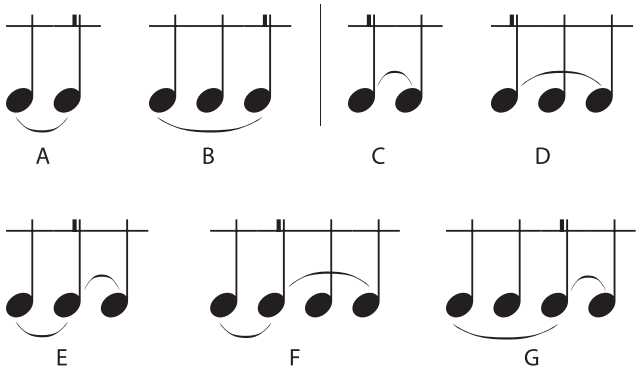
ex. 2



(The double stem above the horizontal line stands for all thesis values.)
Different symbols can be used to differentiate between different types of accentuation: agogical (or accent of duration), stress accent, prosodical, subjective, climactic, „top-down" and „bottom-up" accents etc.

B. Upbeat and downbeat-like (anacrusical and metacrusical) relationships
Similarly, we should be able to notate explicitly the upbeat or downbeat-like relationships that may be established between one thesis and one or more arsis values:

ex. 3



(All down-slurs represent anacrusical relationships. All up-slurs represent metacrusical relationships.)
Adjacent pulsations that do not create such relationships will simply not be slurred. Such non-related pulsations generally occur whenever we pass over the threshold of the perceptual integration between two stimuli (at around1500ms – *Pöppel, 1972; Michon, 1978; Fraisse, 1982)* or between the last pulsation of a grouped (chunked – *Kramer, 1988)* structure and the first pulsation of another grouped structure or, finally, whenever we deal with IOIs faster than the threshold of subjective rhythmization (i.e. faster than 100ms – *Bolton, 1894* et al.) that create the perceptual phenomenon of crepitus *(Fraisse, 1964* et al.).

In order to manage different durational values in the absence of durational relationships, a few prerequisites are necessary:

- knowing all the IOI-related perceptual thresholds
  (some of these thresholds are mustered below in ex. 4 to 10)
- telling which IOI belongs/relates to which threshold
  (that can be done directly as in ex. 4 to 10 or indirectly as in ex. 11)
- relational and then absolute memory for a whole range of IOI sequences
  (however, absolute memory can be achieved empirically too, by practice)
- knowing how to notate different IOI sequences upon hearing them
  (see ex. 4 to 11)
- performing and/or mentally imagining (elogizing) notated IOI sequences

The similarity with the way musicians assimilate the tonal (tempered dodecaphonic) system is apparent. There too we had to learn about intervals, chords and harmonic functions, to develop in time a relational (then absolute) memory for them, to know how to notate melodies and chords upon hearing them and how to render instrumentally (or just elogize) written music.

From personal experience I can tell that the best way to develop an educated perception and absolute memory for IOI categories is to juxtapose or overlap them in countless combinations and see how they interact one with another.

In the case of the perceptual notation of musical time, the mechanism by which we can achieve a specific literacy is the following:

A certain IOI triggers certain perceptual experiences, leading to...

▼

...an experimentally-defined perceptual phenomenon.

▼

Hence, recognition of experience = recognition of IOI.

▼

Recognition of IOI makes possible its graphical notation.

▼

Graphical notation makes possible first-sight production (or elogization).

and:

Apperception / educated perception for the
recognition/production of a wide range of IOIs needed.

Along the following paragraphs we shall muster a few specific IOIs, in order to see how this mechanism works and how different IOIs are being symbolized graphically by means of the perceptual (or zeuxilogic) notation.

ex. 4 (IOI ≈ 100ms / MM ≈ 600)

(The triple horizontal line defines IOIs faster than 200ms. The „100“ figure does not represent a precise value, but the perceptual phenomena that take place *around* this IOI value.)

Related perceptual phenomena for IOI ≈ 100ms:

- the beginning of the IOI range for the „central tendency for habitually perceived durations“ *(Fraisse, 1964)*
- the beginning of the „macro-temporal region that allows for the recognition of temporal features“ *(Roederer, 1975)*
- the threshold of subjective rhythmization *(Bolton, 1894)*
- the fastest compound tempo *(London, 2004)*

ex. 5 (IOI ≈ 200 / MM ≈ 300)

(The double horizontal line defines IOIs between 200ms and 350ms. Again, the „200“ figure does not represent a precise value, but the perceptual phenomena that take place *around* this IOI value. The same for the following examples.)

Related perceptual phenomena for IOI ≈ 200ms:

- the minimum duration of a „present moment“ *(Clynes, 1989)*
- the minimum acton *(Clynes, 1989)*
- the minimum duration of the perceptual present *(Pöppel, 1988)*
- the minimum interval between two stimuli for subjects to have enough time to transfer their attention from one stimulus to the other *(Feilgenhauer, 1912)*
- threshold of (note-to-note) synchronization *(Fraisse, 1982)*

ex. 6 (IOI ≈ 250 / MM ≈ 240)

Related perceptual phenomenon for IOI ≈ 250ms:

- the threshold between the holistic vs. analytical processing of durations *(Michon, 1964)*

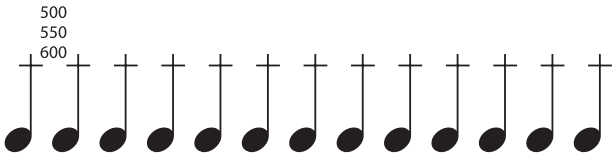
ex. 7 (IOI ≈ 420 / MM ≈ 143)

(The single horizontal line defines IOIs between 350ms and 500ms.)

Related perceptual phenomenon for IOI ≈ 420ms:

- sustainable rate of (continuous) attention shift *(Fraisse, 1964; Feilgenhauer, 1912)*

ex. 8 (IOI ≈ 500, 550, 600ms / MM ≈ 120, 109, 100)

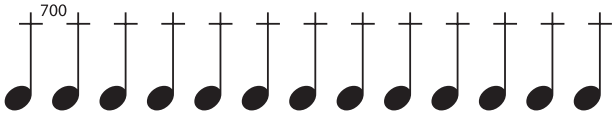


(The interrupted horizontal line defines all resonance-specific IOIs – see below.)

Related perceptual phenomena for IOI ≈ 500, 550, 600ms:

- (central nervous system) resonance-specific IOIs *(van Noorden & Moelants, 1999)*
- IOI 600ms – optimal rate of attention shift *(Mager, 1925)*

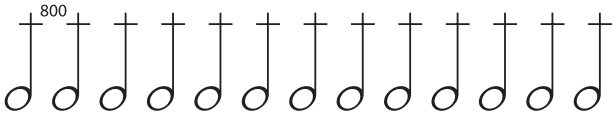
ex. 9 (IOI ≈ 700 / MM ≈ 86)



Related perceptual phenomena for IOI ≈ 700ms:

- the last non-gap defined IOI (ideal unit of perceptual present) *(Fraisse, 1964)*
- the optimum interval for immediate succession *(Oléron, 1952)*

ex. 10 (IOI ≈ 800 / MM ≈ 75)



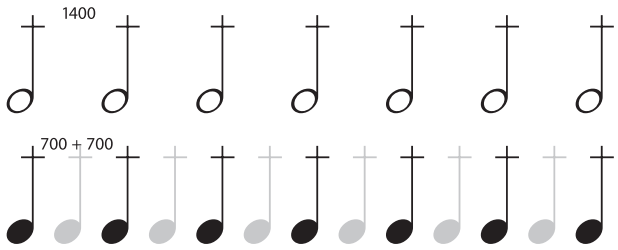
(The half-note-like notes and the interrupted horizontal line define all IOIs slower than 700ms and faster than 1500ms.)

Related perceptual phenomenon for IOI ≈ 800ms:

- the first gap defined IOI *(cf. Fraisse, 1964)*

As the temporal gap becomes the dominant feature for IOIs above 1000ms *(Fraisse, 1964),* all isochronous tempi with IOIs between 800 and 1500ms will be related to their divisional value (i.e. 1÷2):

ex. 11

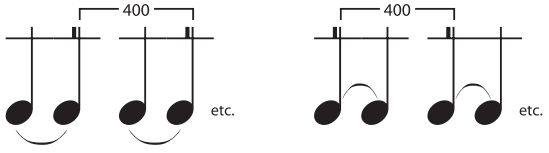


Although this example contradicts the supposition that we never discovered durational ratios other than 1:1, until specific perceptual phenomena between IOI 800 and 1500ms will be discovered, we have to rely on this durational artifice in order to achieve a relational memory for these large IOIs. Once an absolute memory is established, we may forget the 2:1 ratio that helped us acquire it.

Once apprehended and applied to music-making, the perceptual notation is subject to a series of syntactical rules *(mutatis mutandis,* much like the rules of classical harmony) that will not be commented upon in this brief presentation. However, the perceptual notation is not only about thesis and arsis values, upbeat and downbeat-like relationships or perceptually defined IOIs. Other types of pulsatory structures can be notated with this semiography:

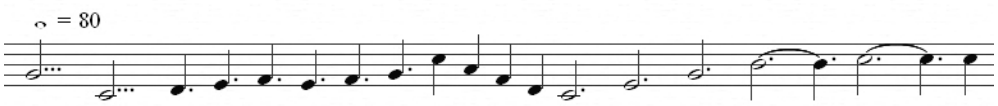
ex. 12 (Crushing notes)

ex. 13 („Dotted" structures)



The perceptual notation, here sketched out, opens up a possibility for a wholly (ap)perceptual approach towards discrete time: a non-metrical, non duration-relational representation of many musico-temporal structures:

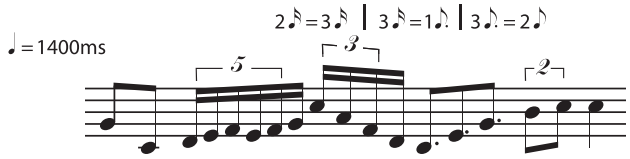
ex. 14a



In this example we have five consecutive IOIs written in a non-metrical, yet conventional notation, that

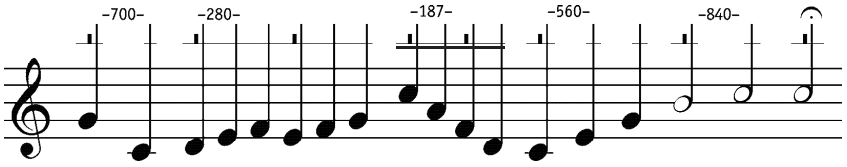
would pose a fair degree of difficulty for any performer trying to sight-read it at the indicated tempo, due to the fact that the performer would probably have to count fourth notes, in order to relate the various durations to a common denominator.

ex. 14b



In this example we have the same music, written in a non-conventional, yet still ratio-based notation. Needles to say that, although here we can have a better view over the way the five IOIs unfold, sight-reading this melodic line would pose the same degree of difficulty as that encountered in ex. 14a.

ex. 14c



Finally, in this example we have a transcription of the same music in perceptual notation. The figures designating the five IOIs (i.e. 700, 280, 187, 560 and 840ms) were deduced from the ratios, but perceptually notated music never operates with such clear-cut values. They can be rounded off as: 700, 300, 200, 550 and 850ms. But even these simplified figures are not important. What really matters here is the perceptual phenomena that lay behind them. (A detailed description of these can be found at www.zeuxilogy.home.ro – „A Matter of Perspective“.) For instance, in the case of the first tempo the performer of this music should know that 700ms represents the last non-gap defined IOI *(Fraisse, 1964)* or the optimum interval for immediate succession *(Oléron, 1952)* – or, indeed, other perception-related phenomena that would better define theoretically this specific pace. As such, the performer would simply retrieve from memory the specific pace and play the first two notes. The same with the remaining four tempi.

The performer should also have developed an educated sensitivity for such taxonomies (e.g. gap or non-gap defined time intervals) so that he or she can discern neighboring IOIs the way trained musicians can tell a natural major third from a tempered one. Other taxonomies are directly related to specific perceptual phenomena (see ex. 4 to 10) in such a way that a trained temporal perception would help us tell even if an IOI represents the peak of such a phenomenon or a slower vs. faster instance.

Of course, operating freely with a large scale of memorized IOIs takes a lot of practice and implies a painfully acquired educated perception in matters temporal. However, the effort eventually pays off as the musician submitting him- or herself to such an endeavor will discover that he or she speaks a new language with an interesting self-generated grammar – a kind of „Time-ish“ that would tell us a lot more about our overall discrete-temporal competence than the classical bar-rhythmical language was able to. However, we are too culturally imbued with the bar-rhythmical system and too accustomed to relate durations proportionally to change habits overnight and see durations as avatars of perceptual phenomena. Yet, the fact that this different perspective over musical time seems to be systemic and even iconic (due to the here presented notation) would probably make curious souls activate the funny habit of pushing things further.

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