20th century: Meter vs. Rhythm

Studying timing in music before the 20th century is a straightforward task of learning the grammar, checking for the specificity of the grammar of a particular historic period or national style, and then browsing the music literature, analyzing the compositions that contain the point of interest, understanding its compositional design, generalizing it, then looking for another sample, repeating the same procedure - until a certain archetype is constructed. Once it is formulated, it can be tested against those compositions that defy such device of design. The investigation of the limits for application of that device under question leads to effective definition of the particular mean of expression.

The musical lexicon of tonal music can be formulated quite intuitively - on historic basis. Thorough tracing of the developments in the field of how music is structured, according to the notions of the period music theory, will necessarily reveal the bulk of the arsenal of valid expressive means. Chances are that whatever the contemporaries found important to postulate was indeed involved into production of meaning from music. It is possible that certain features could slipped out from the attention of the period scholars. Such things do happen especially during the historic transitions from one system of cultural and aesthetic values to another. However, that which was not evident to the eye of an old-timer, usually picks an eye of the new-timer. In that case the beginning of a new historic period will be marked by the discussion of that which has passed unnoticed beforehand.

Study of expressive timing in the 20th century is impossible, if to follow this progressive and intuitive mode of investigation. The entire logic of historic development became severely disturbed some time before the 1st World War. There are many social and political reasons for changes in mass consciousness around that time, and there are likelihoods of such changes affecting the modus operandi of cognitive, motivational schemes and creative strategies. Whatever the underlying causes were, the outcomes are clear: most of the new developments in the field of composition are marked with strong experimental attitude. Composers became engaged into the war of fighting some other kind of music that they perceived as harmful or false, actively promoting their own kind. The notion of “artistic truth”, that often can contradict “common sense” of the listeners of the day, has become a commonplace. Today, in discussion of some shocking modernistic music, it is quite usual to hear an argument justifying the composer as “this is the way he hears” - very much along the same lines that were used by the first cubists: “this is how I see the reality”.

The confusion in the overall picture in the realm of composition is further increased by the antagonistic relationship between the composers pursuing the audiences in the concert halls with “conceptual” music that requires attention and comprehension - and the composers writing music for purely commercial purposes (films, pop concerts and records, dance halls etc.). As the 20th century progressed, the pressure of being original and in some way “better” than others has become an important factor to consider almost for every

composer. Composing music is a highly competitive occupation as never before. Such status quo encourages composers to come up with innovations in the way how they organize music. Sometimes innovations are justified by the kind of new content the composers seek to reflect on in their works. But more often they push and press for being noticed and build the edge over their colleagues. Some composers do form alliances to promote new values, but this is a lot less characteristic than in the beginning of the 20th century, and definitely exercising less formative power on the creative output of the allied composers. Most modern groups are rather informal.

Studying the grammar of the 20th century looks like an attempt to find order in Babel Tower. Every member of a user group for a particular language denounces other languages and insists on the rightfulness of his own. There is little overall communication between different groups. Everybody consumes what they find appealing and does not want to step out beyond the boundaries of what appears agreeing with him. Moreover, for a scholar who wants to form knowledge of the values within each group is forced to make adjustments for dozens of biases. Each group defines itself against the number of other groups, so that big part of values within the circle of its users are negative - they are defined by opposition to something else, something foreign to the group.

Numerous experimental studies suggest that in modern society people identify themselves motivated by two opposite motivations: a need for differentiation from others and a need for inclusion into a group. The interaction of both motivations defines a homeostatic model, in which the person continually seeks an optimal balance between the two. Thus, the person who perceives himself being very different from everybody else will look for a social identity that provides a greater sense of inclusion. Conversely, the person who feels that he does not receive enough attention in a large group will look for more distinctive social identities to satisfy needs for distinctiveness.[1]

In relation to the conceptual composer this model explains the tendency to marginalize himself into a very secluded cell of a unique authority in a self-proclaimed style of composition (or to share the authority with a handful of other colleagues). Such composers must not feel that special as a musician and therefore concerned with the need to increase their specialty by denouncing the merits of the wider group and adhering to some new experimental standards - that they themselves choose to formulate.

However, the renovation of standards requires formation of a new group of users. People who are likely to become interested in new conceptual music tend to be educated, sophisticated and ecologically sensitive. Complex social identity is connected to multiple social categorization. Therefore, such people usually are socially diverse, and pursue multiple interests. Their social world is characterized by multiple and cross-cutting group affiliations. Multiple membership is known to reduce the social bias, so a person who lives

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[1] Deaux, Kay (2000) - Models, Meanings and Motivations. In: Social Identity Processes: Trends in Theory and Research. D. Capozza & R.Brown ed., Sage publications, London, p.1-14.

in a complex dynamic society increases his chances for success by maintaining membership in multiple groups.[2]

However, for the small group of music fans it is detrimental to rely on such member base. The research shows that the greater are the ties to outside of the group, the less stable is the group. Members with diverse interests are also less homogenized - and groups with high variability have greater turnover. The network ties to other members of a modernistic musical group are not particularly strong for non-professionals in music. The contact frequency within the group is low for them. Ties to non-group members who themselves are tied to the other groups decreases membership duration even less. Finally, the field of the conceptual music is overfilled with groups that compete with each other in the closed space of available people resources, trying to draw members from other groups. As a result, it is impossible for a new modernistic group to retain membership long enough for the group to evolve in its social ranking. Moreover, the changing composition of the group and the shifting membership makes these adapters less group-like - leading to the demise of a group.[3]

This scenario is observed again and again with every new musical grammar launched. The most long-lasting of the innovative grammars proved to be serialism, but even though it had stronger social and aesthetic cohesion comparing to any following innovation, by the 1980's there was no major composer left who would keep working exclusively in this grammar. The base of fans for it also significantly shrunk. As Pierre Boulez, one of the apostles of serialism, put it in his 1999 interview: "Serialism is long time dead", and it "was killed by the same people who created it".[4]

The other modernistic "isms" either followed the same pursuit or are in the process of doing so. It appears that no other grammar than the traditional one is capable of making it to stay in the repertoire and to be actively used by the modern composers. The fifty years mark hit by serialism might be overtaken by minimalism, but the chances are that in fifty years no one will perform or compose minimalist music. The user base for minimalism is no different in its makeup than that of serialism - it is even less unified by the ideological ground.

The 20th century has instituted a "seasonal" algorithm for substitutions of grammars: a new wave of reformation comes to completely replace the previous wave. Nobody seems to be bothered by it - people take it like the changes of seasons. Composers look at it as a

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[2] Crisp R. J. & Hewstone M. (2006) - Multiple social categorization: Context, process, and social consequences. In: Multiple social categorization : processes, models, and applications, Psychology Press, New York, p.3-22.

[3] McPherson M. & Smith-Lovin L. (2002) - Cohesion and membership duration: Linking groups, relations and individuals in an ecology of affiliation. In: Group Cohesion, Trust and Solidarity (Advances in Group Processes) vol.19, S.R. Thye & E.J. Lawler ed., Emerald Group Publishing, Bingley UK, p. 1-36.

[4] Tommasini, Anthony (1999) - Boulez Gets a Chance To Make Converts. New York Times, November 14, 1999.

trade of the profession: one ought to stay “modern” - and dropping the “last season” grammar appears as a condition to stay up to time. When the user base for a new music things out, then it is about time to switch to something new. Modern conceptual composers routinely list four or five stylistic periods in their portfolio.

Such situation might be comfortable for modern composers, but makes the task of understanding the each new “ism” excruciatingly hard. In order to come up with the adequate description of the music system a scholar has to do the work of an ethnographer who discovered a new tribe: he has to define the user base, the purport they derive from the musical event, the relationship between the music structures and the impact on the audience, the method of organization of the structures and the roles of the composer and the performer - just to outline the theory of that music. This might not sound that discouraging to an ethnomusicologist, but would present a serious obstacle for any serious study of syntax.

The problem is that the grammar of new modernistic music is not natural, as it is in a newly discovered tribe. The shape of the modernistic grammar is determined not by the function of its usage, but by a single person, composer, based solely on his “vision”. The most reformative composers of the 19th century, like Wagner or Debussy, who also had an unusual “vision”, nevertheless still used the elementary structures of the traditional musical grammar. The modern day visionaries do not even consider this for an option. The opinion that writing new music to the old rules is an artistic capitulation is firmly established amongst the conceptual composers of today.

What determines “vision” for a modern composer in designing a new grammar? Unfortunately, there are dozens of reasons, often not directly related to the matters of expression. Choice for a particular principle of organization can be driven by the concerns for originality, by the need to oppose some previous “ism”, by the possibility to cover a group of musical aspects by the same general principle, by the sympathy to some style of music, by projection from the organization of some other musical aspect, by analogy to some non-musical principle, by implementation of a general idea of some philosophy, by chance, by formula - the list can go on and on. There could be multiple reasons mixed together, so that one is used as a factor for another. Pitch, rhythm, dynamics, timbre, texture, form - each can be structured in variety of formal units in a complex way. There are no limits for the taxonomy.

The only common denominator that investigation of the 20th century conceptual music allows to lay down is the experimental nature of the chain of innovations that the composers progressively have tied themselves in. It is quite consistent that they formulate some pioneering rules first, then make music according to them and see what happens. This is what constitutes the notion of “experimental” that from the 1940’s has been favorably accepted by those composers who did not want to comply to the rules of the old grammar.

The experimental character of the 20th century expressive means calls for the experimental character of its research. The study of a new music has to be grounded to the

study of the representative samples of that music. These samples ought to be experimentally tested on the subject how well the composer's theory corresponds to the final result of his work, and how exactly the listeners perceive the music. Then and only then the music theory should be formulated that would account for the syntactic organization of new music. Syntax does not exist by itself. To a large extent it is determined by pragmatics - the way how users make sense of music structures. Outlaying the syntactic rules without investigating the pragmatics is likely to lead to faulty theory.

The idea of making musicology experimental has already surfaced in the discussions of the place and method of music study today. A certain mistrust of musicians to the notion of experimentation originates in their fear of subjecting the intuitively driven artistic judgment to the cold logic of a scientific measurement. However, the truth of the matter is that musicians routinely conduct informal experiments: the performers evaluate alternative ways of interpretation for this or that element; concertmasters test different bowings; studio musicians experiment with various settings and arrangement in the recording session - and this is not to speak of the tests in ear-training familiar to every professional musician. What is missing are the "know-how" of a test design - the musicians would have to rely on psychologists or other scholars trained to set the experiments.[5]

The investigation of the expressive means in the music of the 20th century necessarily has to involve the supporting evidence from the research papers coming from the domain of life sciences, wherever possible - and where such papers are missing, the informal experiment ought to be conducted to examine the validity of the expression under question. It is surprising how much literature on the 20th century has been written without the most basic corroboration of the claims made by the creators of new music and the actual results of their work as they appear to an average listener. Musicologists are definitely aware of the difference between data and fact - and the patterns of investigation required to turn data into facts. Why don't they apply the criterion of replication in relation to the modernistic music? Why to take everything the composers state as a fact? If an observation is to be regarded as trustworthy, it should be possible to make it on different occasions, and with different people. There is no shortage of samples of modern music or subjects for testing - unlike some esoteric fragments from the Middle Ages. There is really no excuse for the musicology of new music not to be experimental.[6]

The field of temporal organization in the music of the 20th century presents enormous challenge for research. What makes matters even more difficult comparing to melodic or harmonic organization is lack of clarity in the understanding of musical time, meter and rhythm. There has been much written about these subjects in music theory - but piling up a theory on top of another theory from Ancient days to today has not been systemically evaluated by means of scientific investigation. The field of metric theory looks more like

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[5] Gjerdingen, Robert (1999) - An Experimental Music Theory? In: N. Cook and M. Everist (eds) Rethinking Music, Oxford: Oxford University Press, pp. 161–170.

[6] Clarke, Eric F. II. Cook, Nicholas (2004) - Introduction: What is Empirical Musicology. In: Empirical Musicology: Aims, Methods, Prospects; Oxford University Press, New York, p.3-23.

bunch of opinions by various authors, polemically connected with each other. This might not constitute a problem in studying the music created during the late 17th-19th centuries. Picking a theory by an authority figure for each kind of music might (provided the researcher himself is a musician and can produce this music) would bring fairly good results for understanding how exactly the music of that period is expressive. But such approach will poorly work for "new" music of the 20th century.

The criterion of music competence, specifically the ability to reproduce music from the score, helps so much in making sense of the traditional tonal music. When facing controversy in theoretical treatises or in a questionable performance, playing the music in question and examining the notated structures versus the sound, experimenting with different interpretations allows to resolve matters of controversy and come to a viable solution. However, such method, based on conventionality of musical expression, stops working the moment the musician switches to the atonal music. The experimental psychoacoustic research confirms that processing of the timing in atonal music is a lot more difficult task for a performing musician than that in tonal music.[7]

Relying on the authority figure presents a problem, because there are too many authorities which tend to disagree with each other, there is no clear consensus as which authority is greater, and a big distance between theoretical discussions of the authority figures and the practical needs of performers. If to take into consideration that not every authority figure is accurate and relevant in the theoretical explanations, that a great deal of theories are compromised by the concerns of promotion or negation of certain music, furthermore, that many theories completely disregard the practical matters of perceptibility or excitability - then it will give the gist of idea of what a performer or scholar has to go through to make knowledge of expression in the 20th century - especially after the 2nd World War.

A huge role in making the 20th century music look like "Chinese grammar" to people willing to understand it is played by the collapse of traditional metric organization in modernistic music. The metric arrangement of music has formed in the first half of the 17th century in parallel with tonality. It kept accompanying tonality in its elaboration towards the end of the 18th century and then followed the same course when both, tonality and meter were subjected to aberrations in the works by Romantic composers. The reforms of atonal music also affected both, tonality and meter - gradually leading to their complete demise in the works of Webern and his followers. Bar-lines and time signatures in post-Webernian serial music have purely cosmetic function of aiding musicians to keep playing in sync (according to the testimony of the composers of that music). Other post-modernistic styles, like aleatorics or minimalism, have not restored a traditional form-making function of meter, and went along the lines of creatively using the rhythmic structures that only resemble metric arrangement, whereas in fact, they are subjected to different principles of organization, such as of repetition or random chance.

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[7] C. L. MacKenzie, D. L. Vaneerd, E. D. Graham, D. B. Huron, B. L. Wills (1986) - The Effect of Tonal Structure on Rhythm in Piano Performance. Music Perception: An Interdisciplinary Journal, Vol. 4, No. 2 (Winter, 1986), pp. 215-225.

Weakening of meter in the music of the first wave of modernism (1913-1920's) and its dismissal during the second wave (late 1940-1970's) has serious implications for music compositions and music scholars. The uniformity of music timing becomes broken. This affects rhythm as well as tempo. The rhythmic duration is the only device left for the composer to generate contrasts in timing. Tempo becomes severely compromised at the absence of meter. In most post-modernistic works it is impossible to tell the tempo. Composers were well aware of this problem, and resolving the issue of monotony was one of the principal tasks set in new techniques of composition. A static contemplative unveiling of moderately paced sound events has turned into an archetype of post-modernistic composition, constituting a "sound-process" model.

The metric theories that were to cover the post-modernistic practices had to follow the same suit and replace the traditional uniformal concept of meter with some surrogate concept that would somehow address the methods of organization of time in the modernistic compositions. A good example of such revisionist theory is "Meter as Rhythm" by Christopher Hasty. [8]

The core of the book is dedicated to an attempt to prove that meter is in fact an aspect of rhythm and should not be held in opposition to it. Hasty sees the history of music theory as a primary force behind the traditional dichotomy of meter and rhythm. He remarks that a layman unfamiliar with the metric theory "may have more wisdom than the schooled musician" (p.5). He writes: "All our systematic theories of meter draw upon a conceptual framework grounded in the technology of metric notation" (p.6). The reality of timing in music, according to Hasty, has to do with the "processual" nature of the composition: listeners grasp the music structures as the music progresses, and no conclusion can be formed until the structure is over. Therefore, the experience of temporal organization is driven by the peculiarity of the structures: "the duration that is measured and the measuring itself must be related to present experience" (p.69). Measuring function traditionally acknowledged in meter is just a by-product of projection - the underlying capacity of meter as a particular type of rhythm. Metric aspect in composition is essentially projection into future while listening: metric abstraction predicts the outcome for the observed rhythmic motion. Fulfillment or deception of such projections constitute metric expression.

It is easy to see how "meter as rhythm" theory accommodates to the standards of post-modernistic music. The absence of unifying concept of meter leads to introduction of the principle of projection as the chief characteristic feature of meter. The hotchpotch of temporal techniques of composition known today is reflected by utmost generalization of the theory, so that it looks more like a philosophical treatise rather than practical guidelines for a musician. The eclecticism of all types of music that Hasty strives to cover with his theory corresponds to the "all-inclusiveness" of his theoretic discussion, where no "errors" are defined, no limits are drawn, and the issue of the end-results of the process of perception and interpretation of rhythm is carefully avoided, substituted by the all-allowing notion of "experience".

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[8] Hasty C.F. (1997) - Meter as Rhythm, Oxford University Press, New York.

The attempts to include every known type of modernistic grammar result in the theory so general that no student of performance or composition would find answers to question how the music is made in time. Experimental investigation of compositional grammars and sorting out those ones that are not shown to "work" - to convey certain expressions to variety of listeners - would have effectively narrowed down the assortment of time arrangements to be explained by the theory, and would have rendered the book a lot more practical.

Hasty looked into remarkably many fields of study - except the experimental research from cognitive sciences. And had he done so, his theory might have been formulated differently. During the past 20 years numerous studies have established the fact that metric pulsation is induced by the brain of the listener in response to the auditory stimulus. Meter is not abstract - it is a very material excitation of the putamen, pallidum, and caudate areas in the brain. Beat perception occurs spontaneously in most people, whether musically trained or not. The functional magnetic resonance imaging (fMRI) studies show that musicians have stronger experience of beat than non-musicians, presumably because of the motoric reflexes related to the performance. Production of the beat enables time intervals that coincide with the stimulus onsets to be encoded as multiples or subdivisions of the beat, rather than as unrelated intervals, which improves rhythm reproduction and discrimination.[9]

By no means meter is the product of notation - quite in contrary, the notation is the product of growing awareness of the regularity of beat production in the brain of a person making music or listening to it - an awareness that historically coincides with trend of self-reflection and rationalization characteristic to the Western European culture of the beginning of the 17th century (i.e. Descartes' Compendium Musicae).

Meter opposes rhythm as a matter of fact. Objectively, they originate in different domains: metric pulse is induced by the brain of a listener, whereas rhythmic pulse is triggered by real-time auditory events. Meter cannot be a kind of rhythm, because meter comes from "inside" of the mind, and rhythm comes from "outside". To be more specific, metric accent is not "hearing" of a sound event, neither it is an auditory illusion. Essentially, it is an increase in sensitivity to physical changes that coincide with the projected onset of the beat. The accompanying subjective sensation of an accent is merely a product of enhanced attention.[10]

The most recent neurophysiological research presents evidence that rhythm and meter are processed differently, involving different parts of the brain. The EEG study showed that in both, musicians and non-musicians, rhythmic changes are processed differently than metric violations. The attention-related difference suggested the existence of different

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[9] Grahn J.A. & Rowe J.B. (2009) - Feeling the Beat: Premotor and Striatal Interactions in Musicians and Nonmusicians during Beat Perception. The Journal of Neuroscience, 10 June 2009, 29 (23), p.7540-7548.

[10] Repp, Bruno (2010) - Do metrical accents create illusory phenomenal accents? Attention, Perception & Psychophysics. Jul2010, Vol. 72 Issue 5, p1390-1403.

neurophysiological processes underlying the auditory processing of meter and rhythm, where meter might rely on Gestalt phenomena, therefore taking longer to process.[11]

Another fMRI study examined the difference in perception of the duration of two successive time intervals as a function of the preceding irregular versus regular sequences of clicks. It was found that processing of beat and rhythm is dissociated in the brain, involving completely different areas in the brain: the cerebellum region subserving the perception of the absolute duration of time intervals, whereas the basal ganglia area mediating perception of time intervals relative to a regular beat. The results support two distinct timing mechanisms and underlying subsystems.[12]

Moreover, the brain circuit responsible for generation of beat is shown to keep working disregarding what type of auditory patterns are fed in - there is substantial evidence that metric circuit never really turns off. As long as there is an audio input, metric circuit keeps executing its function - generating the beat. Replicable physiological experiments demonstrate that the dedicated area in the brain is responsible for "subjective accenting" - generation of the experience of an accent at the absence of real accent in the auditory stream. The metric circuit appears to be defaulted at the binary accented structure with the trochaic pulse. The activities in the brain related to beat generation are shown to precede in time the stimulus that becomes connected to the beat: metric accent indeed anticipates rhythmic accent and has power to overwrite it.[13]

Again we see that the notion of "common time" that appears to be the product of the notation practice, in fact, is a reflection of the default mode of perception by the brain. The 4/4 time signature is called "common", because it actually is common in auditory perception. And the reality is that common time metric pulse is engaged whether the person is listening to the march or to the modernistic piece by Webern.

The difference of tones in pitch, duration, loudness, harmony and timbre are known to generate the perception of stress. While listening to the music, the brain attempts to find the algorithm of proportional distribution of stresses. The initial guess is a binary trochaic pulse: the brain locks into the perceived stress and predicts the location of the next stress. Successful prediction leads to enhanced processing of stimulus features. If the guess turned out to be wrong, then the brain increases the cache of the analyzed data and tries to find an alternative algorithm for the regular pulse. At this point the previous experience becomes relevant, and the brain might refrain to the memory of the past auditions in order to come

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[11] Geiser E, Ziegler E, Jancke L, and Meyer M. (2009) - Early electrophysiological correlates of meter and rhythm processing in music perception. Cortex, 45: 93–102, 2009.
[12] Sundeep Teki, Manon Grube, Sukhbinder Kumar, and Timothy D. Griffiths (2011) - Distinct Neural Substrates of Duration-Based and Beat-Based Auditory Timing The Journal of Neuroscience, 9 March 2011, 31(10): 3805-3812.
[13] Potter DD, Fenwick M, Abecasis D, Brochard R (2009) - Perceiving rhythm where none exists: event-related potential (ERP) correlates of subjective accenting. Cortex. 2009 Jan; 45(1), p.103-9.

up with the right scheme. That is why the continual prediction error is related to the large degree of activation seen for the volume non-beat conditions in EEG and fMRI studies. [14]

Interestingly enough, the task of finding the beat is executed concurrently with metric evaluation of the sounding music, and involves different brain structures, suggesting that metric circuit (a time-keeper) is reserved specifically for generation of the beat. The result of such separation of functions is great tolerance to systemic aberrations in the metric organization of music, such as prolonged syncopations - the listener keeps the clock undisturbed by the chain of wrong guesses for the beat placement.[15]

Yet another line of support for the metric determination in rhythm detection comes from computer science. All models of automatic transcription of audio recording into notated score involve quantization - application of metric grid onto the rhythmic content. First attempts towards the automatic transcription of polyphonic music were made in the 1970s by Moorer for two-part compositions. Since the beginning of 1990s, the interest in music transcription has grown rapidly, prompting the technological boost in software developers. Use of statistical methods and auditorily-motivated methods led to great progress in efficacy of detection. Although the state-of-the-art music transcription systems are still inferior to skilled musicians in accuracy and flexibility, automatic recognition might be a useful option for multi-part music of limited complexity.[16]

The truth of the matter is that the most ultra-modernistic music that was conceived with utmost rejection of the smallest trace of metric organization - nevertheless, is still heard in terms of traditional metric pulse, whether the composer likes it or not. And this fact forces the scholar to chose on which side does he stand: the composer or the listener. The choice would influence the validity of the scholar's research. This is not to say that the study of the composer's perspective is going to be necessarily invalid. It is not going to be scientifically valid, because it will reflect not the experience of every music user, but only the composer, and because the composer's experience will not be reproducible in other people over and over again. However that might not be the intention of the scholar. There are other goals in doing research as well: promotion of new ideas, critical evaluation of the aesthetic value, ethical aspect of music's influence, philosophical generalization - which are not bound to satisfy the criteria of a scientific method of investigation and act as expression of purely personal experience of the writer.

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[14] Grahn J.A. & Rowe J.B. (2009) - Feeling the Beat: Premotor and Striatal Interactions in Musicians and Nonmusicians during Beat Perception. The Journal of Neuroscience, 10 June 2009, 29 (23), p.7540-7548.

[15] Grahn J.A. & Rowe J.B. (2012) - Finding and feeling the musical beat: Striatal dissociations between detection and prediction of regularity, Cerebral Cortex Advance Access, Oxford University Press.

[16] Klapuri, Anssi (2006) - Introduction to music transcription. In: Klapuri, A. and Davy, M. (Editors), Signal Processing Methods for Music Transcription, Springer-Verlag, New York, p. 3-20.

What is important here, an objective evaluation of the modernistic music syntax is impossible without adopting the empirical style of investigation and taking into consideration the data from the fields of cognitive and life sciences.

There are indeed problems with the issue of perception of duration in different scientific disciplines. Thus, modern psychologists are firm in the conclusion that time duration cannot be experienced since there is no time sensing organ in human organism. Some of the philosophers hold that though direct experience of duration is not possible, it can be estimated via experience of persistence - awareness that something has lasted, been present, for some time. Psychologists, on another hand, are not interested in examining the category of persistence, since their interest focuses on human performance, and not on phenomenology. Philosophers, in opposite, see the performance research as not addressing the issue of what causes the feeling of persistence. However, the way to bridge the gap is to conduct the empirical investigation and design it to satisfy the criteria of both, philosophy and psychology.[17]

The promising direction of research on perception of duration is the unity of sensory perception of time and space. From a biological perspective, detection of change in both domains, space and time, is crucial to the animal's survival. It is well established that any spatiotemporal discontinuity is a potent stimulus for animal nervous systems. A number of notable scientists (i.e. Sperry or Rizzolatti) have suggested unification of perception and action. And perception of action is known to involve the temporal factor as well as spatial. The research on auditory perception demonstrates strong connection between localization in space and temporal discrimination. The most recent research of visual perception shows the role of the temporal dimension in vision. [18]

The most recent experimental study points in the same direction. In the series of trials, the visual point on the monitor was primed 100 ms earlier and later in relation to the tone, either to the left or to the right from the fixed center. Participants were asked to perform a duration judgment task while maintaining central fixation. The results were consistent: responses to short durations were faster when the auditory target was paired with left- than with right-sided primes, whereas responses to long durations were faster when paired with right- than with left-sided primes. Confirming previous studies on time–space interactions, the evidence suggests that temporal events are represented on a mental time line, spatially oriented from left to right. The possible explanation could be that space–time interactions depend on functional overlap between the representation of space and the

[17] Arsttila V. (2011) - Further Steps in the Science of Temporal Consciousness? In: Multidisciplinary Aspects of Time and Time Perception, Vatakis, A. et al ed., Springer-Verlag Berlin, p. 1-10.

[18] Khurana B. & Nijhawan R. (2011) - Space and time: the fabric of thought and reality. In: Space and time in perception and action, Cambridge University Press, Cambridge UK, p. 1-8.

time domains, which might be attributable to a shared neural substrate for magnitude coding.[19]

If this is the case, then the estimation of time duration in music must go similar to the estimations in proximity of things. Again, the taxonomy of organization becomes remarkably close to sight-reading of the standard notation: the vertical aspect representing the spatial relations between the pitches and the horizontal aspect reflecting on timing. The left-to-right horizontal direction is employed in all forms of historic notations within the Western tradition. It also is found in many non-Western music systems with very few exceptions like Far East and Arabic diaspora. Interestingly, the Hurrian notation was left-to-right despite the cuneiform script for all Mesopotamian civilizations was right-to-left.

Rahn, Jay (2010) - The Hurrian Pieces, ca. 1350 BCE: Part One—Notation and Analysis. Analytical Approaches to World Music, Volume 1, Number 1

The left-to-right notation practices alone are likely to reinforce the left-to-right temporal bias. The reading skills do not have to be high in order to the directional preference to develop, and wide groups of population have experience of basic note-reading, propagated through the school programs and church activities. Left-to-right languages further contribute to such bias.

What is the most noteworthy in relation to the notation practices is that historically they tend to generate spontaneous forms of arrangement called to facilitate the task of reading. Like linguistic text over centuries of circulation of printed materials has developed the rules of spacing, hyphenation and alignment, music notation also has formulated few spacing rules. It started by following the equidistant distribution of notes - obviously, the most space-conserving strategy, of big concern for the publisher, since it allows to reduce the amount of page turns and thereby ease up the process of performance.

However, despite a common sense, from approximately 1650's the scores demonstrate varying horizontal spacing: the distances between the notes become stretched out to accommodate the rhythmic values of notes, so that longer notes receive more space. Not only that, the notes in different parts in the score become synchronized in their spacing. This process of proportional representation leads to the establishment of principle of metric grid: as though each bar is subdivided into the invisible increments which designate the proper position for a note depending on its metric value. From about 1800 this arrangement becomes the standard in music printing. The very first musical autographs to exhibit an almost perfectly executed differentiated spacing are keyboard works by Froberger.

Talbot, Michael (2009) - The horizontal spacing of musical symbols: A brief historical overview. De musica disserenda, 5 (1) p33-41

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[19] Di Bono, M. G., Casarotti, M., Priftis, K., Gava, L., Umiltà, C., & Zorzi, M. (2012, May 7). Priming the Mental Time Line. Journal of Experimental Psychology: Human Perception and Performance. Advance online publication.

The driving force behind differentiated spacing is metric perception. Establishment of bar-lines and the general bass practices together made it obvious for the music reader that each bar contains a certain number of pulses. The changes of harmony provided very visual reference guide through the general bass figures: it made harmonic pulse obvious - as to how many times per bar the harmony changes. Where the changes constitute two or more times, they are likely to mark the beats or half-bars in complex meters. The integrative role of the harmony further collect the material of all parts, subverting its to the same pulse. Differentiated spacing just expresses the aligning power of harmony, as well as its inherent metric properties. The metric order receives the upper hand over the material of the parts.

The process of differentiation does not end on the metric organization. It expands to the hypermetric organization. Bars tend to be equally spaced, where the music follows the same metro-rhythmic algorithm. When the algorithm breaks and smaller rhythms are injected, the size of the bar accommodates for that. During bridges and cadences the bar sizes are less stable. If the music demonstrates strong periodicity, as it often happens in dances, the publishers favor the square distribution of bars per staff, so that the beginning of each period falls on the first bar in the staff.

Such arrangement is the best evidence of the omnipotence of metric principle. Even the works of the composers who have explicitly denounced metric organization in their compositional techniques (i.e. Boulez) - still conform to the differentiated spacing. Despite the composer's will. meter find the way to express its power - in full accordance with the reality: musicians play "non-metric" modernistic music by running a metronome in their head. They simply do not have other options, when there are more than one musician involved into the performance. So do the listeners: instinctively they try to make the music fit into the metric grid.

Rhythm and meter are firmly bound together in the phenomenon of musical time. A very clear outline of their relation is presented in the theory of musical time by the outstanding Russian philosopher Aleksey Losev (1893-1988) in his cardinal work "Music as a subject of Logics" (1927), written while he was teaching aesthetics in the Moscow Tchaikovsky Conservatory before his imprisonment by the communist authorities (for his religious believes), followed by the forty years ban on further publications. [20]

Losev defines time as an inherently dialectic notion that encompasses the general idea of lasting through correlation of two properties: changeability and permanence. The latter is crucial for understanding of time - if absolutely everything would change, it would not be possible to define that which lasts. It is true to state that the baby grew into the adolescent who then became old only if the changes of growing apply to the very same person: the permanence of observation is the condition for witnessing the change. Subsequently, time is integration of that which changes and that which stays.

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[20] Losev, Aleksey (1995) - Music as a subject of Logics [Muzyka kak predmet logiki]. In: Form. Style. Expression [Forma. Stil'. Vyrazheniye] Mysl', Moscow, p.405-570.

Number plays the role of a permanent factor in distinction of a particular period of time. When we cognize time, we perceive the observable changes against the numeric increments which maintain their sameness across our observation. Our mind takes these increments as a "cognitive sculpture" opposed to the observed moving objects. Hence, number is associated with order and proportionality. Time incorporates both, changeability of life and fixation of the order simultaneously, because essentially time is a coming-into-being of a number.

Music, according to Losev, is a codified form of realization of a number - "a number as a process". Losev sees this as the fundamental property of art music that was forged in Ancient Greece and has been progressively cultivated throughout the history of Western music - very much as an extension of the Pythagorean idea of a music tone as a "sounding number".

We hear a continuous stream of music tones which constitute the process of unveiling for a music work - against the nexus of incremental units partitioning this stream. This numeric realization is not a true mathematical operation, because it is perceived as organic part of listening rather than autonomous conception. Such numeric realization is purely musical - it comes into being as mental configuration of the music stream, prompted by the metro-rhythmic organization of music.

This sensually perceptible musical number ought to be called “life” in a true sense of the word - since life is a materialization of time per se. That is why the musical expression is so powerful. The life around us is exemplified in the life inside the music flow. This musical life speaks for itself, appeals to our senses and convinces us all by itself. It actually is its own reality, alternative to the one in which we live.

The term "meter" exactly refers to this "number" living its own life. In fact, modern neuro-physiological research remarkably supports Losev's insights. Our brains generate meter upon hearing the music flow. Disappearance of meter equates with disappearance of music. What is called "a-metric" in musicology, strictly speaking, is not absence of meter, but a peculiar form of irregular metric organization. Meter is the companion for any musical experience - a companion that cannot be rid off. Metric pulse is experimentally shown to accompany only auditory stimuli.[21]

Materialistically, there is no way for "meter" to become "rhythm", as proposed by Hasty. Rhythm is the actual "motion" contained in the music structures of a composition. Meter is the numerical realization of the musical life. Rhythm is the real thing. Meter is a mental projection. They cannot be identical: they belong to different realities. Besides, meter is a "number-in-process". Rhythm is not. It can be represented numerically, but its essence is locomotion. Any motion, including "rhythmic", is rather free - far from mathematical precision. This is supported by the evidence from performance practices: rhythmic values marked in the score are rarely if ever played accurately in time. They are exaggerated left

[21] Patel AD, Iversen JR, Chen Y, Repp BH (2005) - The influence of metricality and modality on synchronization with a beat. Experimental Brain Research. 2005 May;163(2): 226-38.

and right by most performers (except maybe the very beginners) in about any style of music. It would not be a big stretch to state that being the master performer is synonymous with playing the notated rhythms not exactly how they are written. Being the student, in contrary, is synonymous with trying to stay close to the score in timing the rhythms.[22]

The rhythmically accurate performances are perceived as "machine-like" and valued as less expressive by the listeners. [23]

Rhythmically accurate patterns are "less musical", because they are harder for musicians to synchronize to. Playing accurately to the metronome tick is a difficult task that requires practice even for the professionals, as shown in the number of experimental studies. Slight imprecisions, present in human performance, comfort the replication and make it easier for musicians to play together in the ensemble.[24]

There is evidence that imagining an ideal performance in head involves expressive timing. The imagination of expressive timing is under conscious control, at least to the same extent as expressive timing in performance - therefore an unimaginative person is likely to internalize an unimaginative performance. To achieve expressive timing, it may be necessary to imagine not just the sound of the music, but involve an extra effort of imagining a performing motion. However it is consistent that the imagined music is expressively timed in accordance with the expressive capacities of the person engaged into imagination.[25]

It is quite consistent that rhythm is associated with imprecision and instability, whereas meter is an embodiment of regularity and precision. Mind generates meter to conquer the score as it is converted into sounds by the skills and expertise of the performer. Meter cultivates rhythm in this scheme - in sake of making sense and appropriating the external information. Meter is the condition of turning sound events into coherent experience.

When a modernistic composer makes sure that no regular metric pulse is prompted by the progression of tones in his composition, in fact, he does not "cleanse" the meter out of his work - this is impossible. To kill the meter one has to drug out the brains of all the listeners. Meter is the way people hear music. All such composer achieves is that he makes the task of making sense of his music difficult, demanding more attention and cognitive

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[22] Repp, B.H. (1998) - Variations on a Theme by Chopin: Relations Between Perception and Production of Timing in Music. Journal of Experimental Psychology: Human Perception and Performance, 24, 791-811.

[23] Repp, B. H. (1998). A microcosm of musical expression. I. Quantitative analysis of pianists' timing in the initial measures of Chopin's Etude in E major. Journal of the Acoustical Society of America, 104(2, Pt. 1), p.1085–1100.

[24] Repp, Bruno (2001) - Effects of music perception and imagery on sensorimotor synchronization with complex timing patterns. Annals of the New York Academy of Sciences, June 2001, Vol. 930 Issue: Number 1 p409-411.

[25] Repp. Bruno (2001) - Expressive timing in the mind's ear. In. Godøy R. I., Jørgensen H. (Eds.), Musical imagery. Lisse: Swets and Zeitlinger. pp. 185–200.

effort from the performers and listeners in order to metrically digest his irregular construction. Subsequently, no matter how hard the composer tries to rid of meter in the score, the end result is still a stylization of meter: a peculiar way of distorting the metric pulse. Just as "chaos theory" of Henri Poincare is still a math theory, irregular and distorted meter is still meter.

In this "reference frame" capacity meter is similar to tonality - to which it has been historically connected. Listeners tend to find metric organization where it was "avoided" by the composer, just like they tend to project tonal connections in atonal progressions of pitches. [26]

The metric bias is evidently more powerful than the tonal one. Metrical interpretations are shown to emerge in the total absence of any cues, such as accents or auditory events. The mere isochronous pattern of perfectly uniform tones is usually heard as a ''tick-tock'' strong–weak pattern.[27]

There are few ways how metric bias affects the perception of rhythm. Listeners commonly stretch or shorten actual durations to round them up to simpler ratios between neighboring tones, as demonstrated in the experimental settings involving reproduction of patterns.[28]

Even highly skilled professional musicians simplify duration ratios when they identify rhythms. The rhythmic dictations of twenty five musicians contained reductions of rhythmic complexity. [29]

Listeners "get stuck" in their metric projections. Once listeners interpret a set of durations as a specific simple ratio, that interpretation persists even when the auditioned material exhibit noticeable temporal changes. The strategy of forming a metric grid and then forcing the music to fit into it is applied so consistently that it often can lead to metric misattribution. [30]

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[26] Krumhansl, Carol L. (2001) - Cognitive Foundations of Musical Pitch. Oxford University Press, New York, p.240-270.

[27] Brochard, R., Abecasis, D., Potter, D., Ragot, R., & Drake, C. (2003) - The ''ticktock'' of our internal clock: Direct brain evidence of subjective accents in isochronous sequences. Psychological Science, 14, 362–366.

[28] Essens, Peter (1986) - Hierarchical organization of temporal patterns. Perception & Psychophysics, 40, 69–73.

[29] Desain, P., & Honing, H. (2003) - The formation of rhythmic categories and metric priming. Perception, 32, 341–365.

[30] Large, E. W. (2000) - Rhythm categorization in context. In C. Woods, G. B. Luck, R. Brochard, S. A. O'Neill, & J. A. Sloboda (Eds.), Proceedings of the 6th international conference on music perception and cognition. Keele, Staffordshire, UK: Department of Psychology.

It is indisputable that meter has an upper hand over rhythm in human perception of music, no matter what kind of music is listened to. The trend of modernistic composers to look at metric organization as a vestige of some outdated past goes against the biological foundation of audition, and should be looked at as a cultural mannerism. Feeding the metrically oriented ear of a listener with metrically distorted flow of sounds is akin the fashion for skinny waste-line, that requires a restricted diet. Those few who stick to such diet receive cultural appreciation. However the bulk of population finds such dieting too rigid and malnourished. Similarly, modern audiences respect complex modernistic music works, but absolute majority of listeners reserve to different kind of music when it comes to satisfying one's craving for musical experience - in favor of styles with more clear metric organization.