MEANING IN MUSIC FROM A MUSICOLINGUISTIC PERSPECTIVE

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"Musicological investigation of meaning in music and perception of music have started to adopt the tools of linguistics since well-defined grammatical formalisms are devised within the field of Generative Linguistics. Grammatical representations of music have been revised and verified within the last 30 years after several successful attempts within the literature. Accordingly, further assumptions about the syntax and semantics of music can be based on these formal representations. Within this piece of work, the notion of musical meaning or interchangeably the semantics of music is discussed from a musicolinguistic perspective. The meaning of meaning in music is first clarified and distinguished from its concurrent usage within the domain of linguistics. It is argued that the meaning of music, if it exists, can only be explained as the successful parsing of the musical structure within a specific musical context. Therefore, it is shown that to attain a commonly accepted theory of musical meaning, well-structured and representative grammatical representations of the current musical corpus must be worked out while regarding the psychological limitations of musical perception. An example from an ongoing project of grammaticalization of timbres to capture a representation of the electro-acoustic music style will be presented in accordance with the recent evidences from neuroscience and psychology to elaborate and support the abovementioned arguments."

Analogous to language, music has a multi-layered structure. A lower-level representation of pitch, rhythm, tempo, contour, loudness, spatial location and timbre outlines the main characteristics of sound as a physical atomic unit of structured musical pieces. The relations between these atomic units psychologically or cognitively create higher-level representations of the heard structure as harmony, melody, meter and key. The explanatory gap between the raw heard musical stimulation and the mental grouping of these structures expose a problem about the syntactic and semantic dichotomy in music similar to the novel debates of linguistics.

Tonal music itself has concise and well-formed rules, which enables us to work out on the aforementioned gap just like natural languages. The nature of tonality (in other words the structure of tonal music) presents many similarities with the syntactic nature of language. Moreover, meaningful information can be observed to pinpoint the semantic content, when the problem is formalized as unfolding of expectations in real-time perception of the musical structure. Therefore, syntax and semantics of western tonal tradition pieces can be studied in correlation with the methods of linguistic research.

For instance, the structural nature of tonality has been grammatized regarding the distinctive internal dynamics of music. However, these generative grammars of music depend on the recursive rules of western tonality, which can only illustrate the fact about pitch discrimination. The timbral-space, which defines the quality or color of a sound as the difference of auditory sensation of two sounds having the same loudness and pitch, is exempted from these researches.

Accordingly, majority of the research is done on western tonality neglects the new perspective that is brought along with generative music and algorithmic composition. Especially

the electro-acoustic composition practice, which preferably organizes sounds within a time frame in correlation with each other instead of the culture dependent tonal systems, has not been systematically analyzed. Generative music, much of which is based on computer-based algorithmic composition methodologies, must also be taken into account as it proposes a new way of perceiving and composing music by relying on timbre as much as western tonality relies on pitch.

The multi-dimensional nature of timbral-space makes it hard to symbolically represent all aspects of timbre itself. Current literature is recently dominated by pitch-based theories of music, as the tonality highly depends on attribute which is defined as the ordering of sounds on a scale extending from soft to loud during auditory sensation. Though, timbre, one of the other prominent property of sound, lacks a proper formalization, which is suitable to capture the recursive nature of musical structures. If we could somehow come up with such formalization, the relationship between the strictly bound semantics and surface syntax of music can be precisely overlaid.

In this piece of work, first the interdisciplinary literature on syntax and semantics of music is briefly overviewed. It is argued that the syntax and semantics can be overlapped within a representation like combinatory categorical grammar. Consequently, it is asserted that the semantic gap is a problem of true parsing of the syntactic structure, which results in a strictly bound and inseparable representation of syntax and semantics of music. Therefore, successful parsing of the surface syntactic structures according to the learned expectations will yield an information content, which can be classified as the semantics of music. In correlation, a research scheme (namely a prototypical timbral grammar), which can provide the necessary empirical data for this stance is presented. The scope for this research scheme is selectively limited with electro-acoustic music, as this specific style of compositions does not carry cultural characteristics such as harmonic implications.

The so-called problem interacts with several distinct domains of research and most of the recent indings are complementary. Empirical data from the neuroscience literature can overlay a baseline for the correlations between language and music. The information theory approach outlines the accessibility of the information content throughout the process of listening. The linguistic literature, precisely the generative grammars provide basis for formalization of the syntax distinctively. Especially, when applied to music the recurrent rules of composition can be selectively represented. All these findings will be reviewed successively in the following sections.

Music and Language: How do they correlate?

The neuroscience literature provides valuable information about how the semantic and syntactic processing of music and language are related. Recent indings of fMIR and EEG literature asserts that both music and language are neurally processed indistinguishably. Apparently, the similarities between the categorization and formal representation of music and language must have a neural correlate to assure the validity of the assertions made by generative grammar theories. The current literature on neuroscience exposes notable empirical evidence for the strong interactions between music and language cognition regarding their syntactic (Levitin

and Menon 2003; Patel 2003) and semantic nature (Koelsch et al. 2004; Steinbeis and Koelsch 2008).

The semantic value of musical pieces and the way they are neurally processed is investigated within the EEG and fMRI literature. The current hypothesis underlines the fact that an evoked potential of N400 may be observed after an exposure to tonally incongruent target chord. In fact, this method is also traditionally used to identify how language is semantically processed. The experiment, tests how subjects react to incongruent words, when they are used within a series of semantically well-formed structures. Notably, a similar N400 formation can be observed in the EEG activity, when a musically trained subject hears an atonal chord within a hierarchically structured piece of music (Steinbeis and Koelsch 2008:3-6).

From a syntactic point of view, one of the best possible fMRI experimental set-up to test neural correlates of structural processing of music is to compare the brain responses of subjects hearing well-formed tonal music against the ones where they hear scrambled music. Precisely, other distinctive features of music such as pitch, loudness and timbre must be kept constant within this comparison. Notably, within the current literature a focal activation in the Broadmann Area 47 of the left inferior cortex (a region which is also associated with processing of linguistic syntax of auditory modality) is observed (Levitin and Menon 2003: 2146-2149). This finding may signify the hierarchical structure processing responsibility of BA 47. Therefore, it is possible to argue that the syntactic nature of language and music contains numerous similarities.

Information Theory Approach

The meaning in music is first related with the 'Information Theory' by Leonard Meyer back in 1950s. Throughout those years the empirical support for Meyer's project came from Joel Cohen's work on representing selected musical pieces from a corpus of Western Tonal Music (Meyer 1957; Cohen 1962).

Meyer proposed that the meaning in music can only become evident in two specifically designed situations. First setup outlines a referential theory, where the notion of meaning is constructed over a reference system, in which each and every musical event must refer or denote an object or concept which is not itself a musical entity. This is named as the 'designative meaning'. Meyer argued that Emotions induced after instant hearings of the organized hierarchical musical structures may be classified as a trace of meaning instances. The second situation, where musical structure contains a meaning is raised on the recurrent mutual interacts of the musical events. He defines it as the 'embodied meaning', where a stimulus, process or a musical entity indicating or referring to something, which is like itself in kind (Meyer 1957:413).

Actually, from Meyers point of view both of these two processes can be practiced by the listeners when they are exposed to musical pieces. Right now the first one (namely the designative meaning) will be left out of scope of this paper, which outlines the subjective character of a piece of music. The 'Theory of Emotions', which has been elaborated on the idea of 'designative meaning', is still being debated within the scope of philosophy of music in correlation with the empirical data provided by the neuroscience literature.

However, specifically the 'embodied meaning' definition will provide some valuable information for me while constructing the hypothesis of this piece of work. Accordingly, it is

pretty obvious that a music cognition research will rather be interested in investigating the underlying the mental processes, which are used to operate on culturally established norms to organize the stimuli rather than investigating the higher level style specific scales, modes or harmonies. Therefore, Meyer introduces the concept of expectations as a basis for formalizing the notion of 'embodied meaning'. If we go in depth, the expectations rise above the relationship between antecedent and consequent events, which are following each other successively, within a temporal frame. In other terms, from this point of view, musical meaning is constructed in dynamically in a real-time exposure to the musical structure itself. Meyer conceptualizes this antecedent-consequent relationship as a Markov Chain Process, where the structure carries information if the antecedent-consequent pair is an unexpected one (Meyer 1957: 415-417).

This theory of meaning in music, which is dependent on the entropy of the systems, is still placed centrally in current studies. Regarding that this approach is psychologically acceptable and easily verifiable in artificial system it could be a valuable contribution to model music in a flexible grammar formalism, which will also use theory of expectations as a semantic explanation. Several alternatives will be discussed in the next section.

Grammaticalization Approach

The notion of generative grammar describes a particular methodology to investigate syntactic nature of languages. The aim of this formalism is to capture the syntactic structure of the language over recursive use of rules. The set of rules, which define the grammar of that language must represent all the compositional and hierarchical properties. Namely, rewrite rules present the relationship between the syntactic categories of that language.

Generative grammars are based on symbolic representations of the syntactic categories and their interrelations. To come up with a well-formed grammar for a particular language, analysis of recurrence relations and componential complex structures must be carried out. This requires an extensive investigation of language segments. The symbolic categorization can be based on the surface syntactic categories, while producing such a grammar for natural languages. Likewise, nature of music also contains structural features such as metrics, rhythm and accents. Especially, tonal music has strict construction rules to govern the correctness of the composition. In *Generative Theory of Tonal Music*, Lerdahl and Jackendoff proposed a concise and well-defined grammatization of western tonal music, over these structural features of music (Lerdahl and Jackendoff 1983). Throughout their systematization, they demonstrate that the syntax of music can be studied together with language, because of their overlapping structures.

Generative Theory of Tonal Music is based on grouping structure, metrical categorization, harmonical investigation and reduction of the rules to attain well-formedness (Lerdahl and Jackendoff 1983). Firstly, structure grouping tries to segment the musical piece into perceivable subcategories. This analysis tries to come up with a classification of sections, motives and phrases, which have natural language correlates as paragraphs, sentences and words. Accordingly, metric evaluation of the piece by examining the time-slicing and rhythmic moves is essential for overlaying clear categorization of these structures. Moreover, pitch-based harmonical investigation of chord sequences tries to form an understanding of the

correlations between these syntactic categories. Briefly, consecutive analysis can yield a concise grammatization of hierarchical structures of music.

However, these formalizations do not provide an explanation for the direct interaction of semantics and syntax. The syntax and semantics are distinctively separated by two layers of representation, deep structure and surface structure. Surface structure, is a realization of the syntactic properties of a particular language, whereas deep structure is a representation of the underlying semantic relations. Although, these two different layers of representation are mapped to each other, the effects of the semantic deep structure cannot be clearly observed from the surface representation. In addition, the meaning components such as timbre (which can be inferred as the prosody of musical performance) cannot truly be represented.

On the other hand, Combinatory Categorial Grammars can provide a pure formalization of these two layers of representation as it allows bi-direction resolution of the rules. Combinatory Categorial Grammars are distinguishable from other formalisms as they adopt functional composition and type-raising schemes. Functional composition allows us to follow up an incremental derivation, where the syntactic type of the constituent formed throughout the derivation is determined according to all the words encountered so far (Steedman and Baldridge 2009). Furthermore, functional type raising allows us to complete a function application in both forward and backward directions.

When applied to music, Combinatory Categorial Grammar can capture the harmonic disposition rules successfully. Moreover, such formalism provides flexibility as it allows distinct derivations to represent a chord sequence. Nevertheless, the current literature on Combinatory Categorial Grammars can only provide loosely defined grammars. To increase the accuracy and well-formedness of musical grammars of this kind, it is still necessary to generate an inclusive theory, where each and every feature (rhythm, accent and even timbre) of building-block compositional elements are symbolically represented.

Timbral Grammar Project

Traditional western tonal music is based on three basic notions: composition, performance and auditor. Composition is the process of creating musical pieces according within the limits of the tonal rules. Performance mainly includes a musical piece being vocalized by generally a group of musicians and audience perceives this structured auditory, while being in direct interaction with the performer(s). Within this conception of production cycle, the musical piece that is created has two formal representations. First one is a pure notation like written language and the second is the sequence of sounds generated by the performer. Therefore, the composition and performance has to be individualized.

However, this conception is subjected to change after Pierre Schaeffer's manifestation of *musique concrete* in early 1940's. With the intrusion of electronic signal processing devices into the composition, the perceptual soundscape enlarged tremendously. The music instruments from this point on, such as synthesizers and oscillators could generate sounds in a diverse range, when compared to tonal classical music instruments. Accordingly, by methodologically formalizing concrete music, Pierre Schaeffer asserted alternative methods of organizing sound within a timeline, while not necessarily adopting the rules of Western tonal tradition. This is

because, the raw sound material, which can be used in structural music does not need to follow up the pitch dependent tonal rules. In fact, it would be better to reformulate the process of composition by trying to comprehend the nature of sound flawlessly.

Generative music and algorithmic composition methods provide such a complete conception. Briefly, algorithms (or in other words grammars) are used as commonly used to compose music currently. The formal procedures to make music are defined by the artist itself, and the general schema of the piece is outlined by using these procedures. Contemporary algorithmic composition techniques generally write grammars form rhythm, melody and organization of sounds within a specific period of time. The rules within these grammars are used generatively to create constituents of more complex structures. It is significant to note that this methodology frequently takes the timbral organization as the central notion of composition. Therefore, the attending audience mentally groups the musical structures according to timbres instead of tonal dependencies.

In view of that, a generative grammar of timbre can be created by deeply analyzing the nature of sound production, auditory perception and relations between the sounds in a composition. To accomplish this, first a symbolic representation must be devised for timbre. This is because generative grammars represent structural categories over symbolic rules. Consequently, the hierarchical categories for timbre must be resolved if there are any. It is predicted that timbre has direct implications on the syntax of music. For instance, a question-answer type musical collocation structure can only be expressed by using the changes in timbre. Therefore, it seems that there has to be a timbre-meaning mapping. These relations between timbre categories can be resolved by working on a small corpus-like collection of music pieces. This collection must preferably heavily involve samples from atonal compositions. Consequently, if these relations can be figured out it is planned to use them in Combinatory Categorial Grammar formalism. Bi-directional derivations of Combinatory Categorial Grammar could be unnecessary for grammatizing tonality. However, as generative music also adopts grammatical compositional techniques it will be essential to capture the structure as a whole.

Any formal research on timbre will be valuable from two distinct perspectives. First and foremost, it will provide a broader understanding of music from a linguistic perspective. A comparative study between musical structures and language can be carried out by using aforementioned grammar. The previous grammars of music did not include all the features of sound in their representation. This stands out odd, because such an approach is similar to leaving aside prosodic or phonologic research on languages. Furthermore, by just working on the compositions of tonal era, the complete picture of cognitive processes involved in music perception and generation cannot be revealed out. Pitch-based theories cannot explain the processing of an enormous collection of music, which does not adopt the rules of the tonal system. Outlined timbre grammar, can bring up its own methodologies of composition. Present day sound synthesis methods also need a tool to model timbre. Generation of new sounds in interrelation with each other according to the rules of timbre grammar can even be helpful in extending our current timbre space.

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