

Musical meaning and logical inference from the perspective of Peircean pragmatism

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Proceedings of the fourth Conference on Interdisciplinary Musicology (CIM08)
Thessaloniki, Greece, 3–6 July 2008, <http://web.auth.gr/cim08/>

Background in music theory. Music theory has established a large amount of work characterizing musical structure. Nevertheless, recently some efforts have been made to investigate musical function, especially regarding its perception and understanding. Beyond the precise and objective description of musical structure, e.g. concerning the various types of tonal cadences in Western music, music theory has great difficulties to investigate how a listener will deal with such structures. If we consider that a broader picture of musical structure is necessary for a deeper understanding and characterization of music, we believe that interdisciplinary musicology is worth doing, making it possible to go beyond a purely structural description, allying music theory with cognitive and philosophic studies.

Background in philosophy. Recently, especially in the area of logic of discovery, there is a renewed interest in the philosophy of Charles S. Peirce. The main assumption is that creative processes are driven by logical inferences, and that they can be investigated objectively. Peirce postulated that there are three species of logical inference forming the basis on which one deals with the world: abduction, induction and deduction. While induction and deduction are traditionally investigated thoroughly in philosophy, abduction seems to be less scrutinized, despite being one of the most important contributions of Peirce's Pragmatism. Basically, abduction is the kind of inference that generates explanatory hypotheses when anomalous facts are perceived. It is related to the presence of surprising or unexpected events. Peirce (CP 5.171) claims that abduction is the only way to increase knowledge about the world, creating hypotheses from which deduction can generate predictions while induction can verify their pertinence. Gonzalez & Haselager (2005) analyzed the role of abductive reasoning in the creative process specifically in relation to common-sense knowledge, furnishing the ground for the present proposal.

Aims. We aim at describing the process of signification in music, showing how such a process is constrained both by the listener's habits and musical structure. From a pragmatist, Peircean, perspective, we characterize musical meaning as a self-organized emergent process that operates mainly by means of three kinds of logical inference during the listening process.

This paper relates the concept of musical meaning to the notion of abductive reasoning as described in the pragmatics of C.S. Peirce¹. We argue that such logical notion could complement theories that have been developed by taking exclusively psychological elements into account. In the first part, we present the two main aesthetical perspectives of musical meaning: the theory of mimesis and the formalism of Hanslick. Then, we show how the psychological theory of Leonard Meyer on musical meaning tried to

overcome such a duality. Thirdly, we present the theory of musical expectation of David Huron, which brings an experimental and biological perspective into account. Even though, both theories have leaved room for hypothesis generation in listening music meaningfully, they do not explain how it could be done biologically, psychologically or logically. In this sense, we go on to consider the nature of the abductive reasoning and its role in the acquisition of knowledge. Finally, we present some examples in order to

illustrate how abduction could logically complement the current positions on musical meaning.

Philosophical and aesthetical background

Musical meaning is implicitly or explicitly involved in almost any work about music and philosophy. In the ancient times of pre-Socratic Greek philosophy, music was considered from the perspective of a cosmology that was sustained by the concept of number. Music and geometry was considered as different manifestations of such *arché*, or ordering principle, and music involved not only organized sound but also poetry and dance. Plato did not significantly alter this cosmological perspective on music as held by Pythagoras, limiting himself at discussing its ethic and esthetic character and its role in the *paideia*, the greek education; for Plato music was considered more a (perhaps pleasurable) threat than a virtue to a health society. In addition, in the Platonic metaphysics, music and art were taken as second-order copies of the ideal realm, as copies of the already mimetic domain of the appearances. Aristotle was less concerned with the hedonistic dangers of music or with its position in a metaphysical system than he was with its formal congruence and structure, and claimed that any art has its intrinsic pleasure by virtue of its harmonious configurations.

In later centuries, the Platonic and Pythagorean ideas of music were translated and adapted to the emerging Christian doctrine. Roughly, one can suggest that the theory of music as imitation and based on the concept of number underwent no further fundamental developments until the modern age, in spite of the growing development of musical theory and composition over the centuries. Another important fact was that music continued to be essentially associated with poetry, whether in Church or outside. The Copernican revolution, inaugurating the Modern Age and a new cosmology, brought new challenges to the philosophy and aesthetics of music (Scruton, 1997). Music was no longer supported by its relation to the

old unified and harmonious universe so its validity and importance had to be attributed to other factors. The doctrine of mimesis was sustained, but more and more attributed to passions rather than to nature or ideal reality. Bowman (1998) claims that the modern aesthetics of music, especially in Germany, sought for a principle within spirit, in the mind's ideas. With the continuously growing autonomy of music, the questions of musical meanings and significance paralleled the inquiries on origins and uses of language, though in music the philosophical problems were more. Philosophers were more concerned with situating music into a whole esthetic system coherent with the general epistemological systems they were creating than to attend specifically to the very appeal of music perception. Philosophically, music was completely analyzed in virtue of its adequacy in relation to the esthetic principles of modern metaphysics, as in Kant or Hegel for instance, rather than to its own perceptible structures and forms (see Schueller, 1953).

In the 19th century, when musicology was becoming a structured area, Edward Hanslick undertook the, against this background daring, task of defining and explaining musical beauty in terms of music itself. He also attempted to formulate a new point of view to all other issues of musical aesthetics. His negative thesis was that music is not the imitation of emotions or passions; his positive thesis was that music's content is its very form, its very notes shaped by the intellect (Hanslick, 1986). Music has to be understood in terms of its unfolding structures of musical ideas. Musical scholarship has to mirror the practices of natural sciences and seek for what necessarily takes part in its description and to break the appeal of common-sensical, yet unreasonable opinions. Any extra-musical connotation should not be considered part of the meanings of music, musical structure alone is sufficient for musical understanding, and relations of musical structures to emotional contents or reactions are at least misleading, if not "pathological" in aesthetical discussions. One can say that Hanslick threw out the baby with the bath water, but it was important in that time to undertake such a formalist approach for bringing music itself

more into the focus of esthetic discussion. Despite Hanslick's attempt to formulate a philosophical analysis based on formal elements, he did grant that musical meaning is grounded in perception, so musical meaning can be thought of in terms of the dynamical process of listening to music's phenomenal developments, in relation to expectations and frustrations. In Hanslick's words:

The most important factor in the mental process which accompanies the act of listening to music, and which converts it to a source of pleasure, is frequently overlooked. We here refer to the intellectual satisfaction which the listener derives from continually following and anticipating the composer's intentions—now, to see his expectations fulfilled, and now, to find himself agreeably mistaken. It is a matter of course that this intellectual flux and reflux, this perpetual giving and receiving takes place unconsciously, and with the rapidity of lightning-flashes.

However, as Meyer (1956, p. 4) mentioned, Hanslick's account lacks in explaining "the manner in which an abstract, non-referential succession of tones becomes meaningful."

Meyer's theory on musical meaning

Emotion and meaning are not mutually exclusive properties of musical listening or any other esthetic experience. Rather, the emotional response that accompanies musical listening was considered by Leonard Meyer as a direct consequence of the process of structural listening. In this sense, the key to understand how a succession of tones becomes meaningful and affective, synthesizing two traditionally opposite aesthetical perspectives, was to be found in the psychology of listening.

The main assumptions of Meyer's theory are the mental principles offered by Gestalt Psychology (e.g. Koffka, 1935). The Gestalt principles are general enough to be related to any mental process that involves perception and cognition of formal qualities and could help to explain how individual tones are grouped forming higher-level Forms. The basic Gestalt principle is the law of *prägnanz*,

a word best translated by conciseness, which can be described as the tendency of a (mental) system to always seek for the most concise, steady, regular, ordered, economic, simple form or process as possible (Kubovy, 2001). The law of *prägnanz* can be decomposed in more specific principles, e.g., good continuation, closure, similarity, symmetry, proximity, and figure-ground relations. Meyer employed such mental laws to sustain his theory of musical meaning and affect as resulting from the perception of musical form. The laws of Gestalt could be understood in connection with the notions of *habit* and *expectations*. The expectations are consequences of the habitual running of mind in accordance with the laws described in Gestalt Psychology.

Meyer's theoretical framework is composed of three distinct instances: hypothetical meaning, evident meaning, and determinate meaning. *Hypothetical meaning* is the unconscious generation of expectations related to and specific of a stimulus situation, that could be described by probabilistic relationships between antecedents and consequents. It is the manifestation of a system of aesthetical (learned and culturally dependent) beliefs and habits that drives that listening experience of a culturally embedded individual (see Aiken, 1951). In this view, a piece of music is meaningful only if the listener is able to expect specific consequents from specific antecedents — this is closely related to what Hanslick meant in the above quotation.

Evident meaning occurs when the consequent becomes "actualized as a concrete musical event", reaching a "new stage of meaning" (Meyer, 1956, p. 37). The evident meaning appears when that relation between antecedent and consequent is actually perceived. There can be a conflicting tension between the two meanings, especially when the expected consequent is delayed or deceptive. This dynamical process of signification could be visualized in a "causality chain", since each evident meaning turns into a hypothetical one in the unfolding of musical events, like

$$S_1 \dots C_1 S_2 \dots C_2 S_3 \dots,$$

where S_n means a specific stimulus and C_n a specific consequent (Meyer, 1956). The fact that an actual consequent could or could not confirm the hypothetical meaning does not modify the nature and operation of the process.ⁱⁱ The dynamic of hypothetical and evident meanings can be illustrated in the Figure 1.



Figure 1. The dynamic of hypothetical and evident meanings that might occur during the listening of J.S. Bach's Fugue in C minor from *Das Wohltemperierte Klavier I*, measures 9-11. The phrase under the x brace is the unexpected consequent, in relation to the antecedents in a sequential structure. (In: Meyer, 1956, p. 48)

Determinate meanings, Meyer said (1956, p. 38), "arise out of the relationships existing between hypothetical meaning, evident meaning, and the latter stages of the musical development." This kind of meaning has the distinctive characteristic of being manifest in the 'timeless work' of memory, when the relations among stimuli are comprehended in their totality.ⁱⁱⁱ It happens when musical meaning becomes objectified, a process that operates over an object of listener's consciousness. In Meyer's perspective, determinate meanings as objects of consciousness are due to perceived anomalies or when habitual responses are not suitable in dealing with specific sonic structures. Meyer said (1956, p. 39) that "if meaning is to be objectified at all, it will as a rule become so when difficulties are encountered that make normal, automatic behavior impossible."

In the perspective of Meyer's theory, musical meaning is a mental process driven by habitual (Gestalt-like) operations of mind in accordance with musical structure, in the process of musical listening. Such a theory is closely related to Hanslick's musical formalism; or it could be understood as a more comprehensive theory, taking necessarily under consideration both musical structure and listening (cultural and learned) habits. Meyer complemented Hanslick's

formalism with explanations in the psychological and phenomenological domain.

The same process, i.e., the inefficiency of habitual action, forges both the determinate meaning and the affective reaction to the music. The author justifies his position claiming that emotions and reflexive thought are not two distinct things, but different manifestations of the same psychological process: "both depend upon the same perceptive process, the same stylistic habits, the same models of mental organization; and the same musical processes give rise to and shape both types of experience" Meyer (1956). It seems that an emphasis on one aspect or other in musical experience is due to dispositions and beliefs regarding esthetic experience or formal musical training. When habitual operation works undisturbed, music listening and signification occurs in a quite unconscious manner, "following and anticipating the composer's [supposed] intentions."

It is clear that meaning and affect derives from the tension between predictability and surprise of music structures in listening.^{iv} And when the structures are strange enough the habitual operations of mind are perturbed and another process has to come into the scene to help turning a non-understandable chunk of musical information into a meaningful and comprehensible one. Meyer's theory was important because he furnished a fruitful hypothesis of how listening works and gives musical form to otherwise unrelated sound stimuli, permitting meaning and emotion to be accounted for in aesthetic musical experience.

David Huron's theory of expectation

The perspective Leonard Meyer has initiated has settled mainly through theoretical discourse and evidence collected in the practice of musical analysis. Conversely, David Huron (2006) has developed a theory of musical anticipation based in the practice of experimental psychology and statistical analysis. Despite their very different approaches, both theories are similar and also complementary. Huron offers a more

updated account of musical expectation, the basis of Meyer's theory, with a more detailed neuroanatomic correspondence with the psychological domain, and a more biological perspective on musically induced emotions.

"Accurate expectations are adaptive mental functions that allow organisms to prepare for appropriate action and perception" Huron (2006). Anticipations or expectations are present in all spheres of experience, and it seems that the generation of expectations is related to the human neocortex (Barlow, 2001).

Emotions are the counterpart of expectations, acting as motivators^v of the objectives and purposes of organisms (Frijda, 1987, 1986; Scherer & Ekman, 1984). Huron (2006, p. 4) synthesizes such a view saying that "emotions encourage organisms to pursue behaviors that are normally adaptive and to avoid behaviors that are normally maladaptive." The relation between anticipation and emotional state are at the kernel of Huron's theory. Briefly, when expectations failed in predicting a future outcome, and consequently the situation can be potentially dangerous to the organism, its emotional state is characterized by a negative valenced feeling, that through associative mechanisms becomes linked to that specific situation. In the opposite way, when the prediction is correct, there is a positive emotion state that acts as a sort of limbic reward for the organism's predictive success. Anatomically, two different neural pathways have been suggested that operate concomitantly and are correlated with the feelings of surprise. Figure 2 shows those neural circuits. On the one hand, the fast track results in always negative emotional states, and prepare the organism for quick action in an unpredictable situation—being surprised means having done the wrong predictions. On the other hand, the slow track involves cortical areas responsible for the contextualized but more time-consuming appraisal. The slow appraisal can reach a valence in contrast to the outcome of the fast track, for instance when the situation analysis reveals that the event besides surprising was not dangerous to the organism. The contrast between the always negative and the

potentially positive reinforces the final positive appraisal. Thus, positive emotions can come from two possibilities: (i) when the anticipation is correct (limbic reward); and (ii) when the anticipation is not correct but is also not dangerous (contrastive valence).

It should be noted that prediction in Huron's account is mainly a matter of probability, and as such the main mental process involved in generating prediction is *induction*. It is a way nature has developed to economically deal with future events as if it were similar to those encountered in previous situations; if a strategy ran fine once it might also run fine again. The past experiences can be understood driving the inductive behavior. Turning back to music, the past listening experience a person has is the basis for his or her expectation, and it could be adequately described by statistical analysis of a repertoire. Expectations reflect the statistical properties of the repertoire of a listener.

Huron has proposed four types of expectation: veridical, schematic, dynamic and conscious. Each expectation is related to a specific kind of memory. *Veridical expectations* are associated to specific listening situations of determined musical works, it is represented in episodic memory, which codes a sort of autobiography. *Schematic expectations* reflect general cultural patterns of music structures and forms; it is coded into schematic memory and gets learned by exposition to a certain cultural environment. *Dynamic expectations* involves information coded in short-term memory and are driven by the unfolding of musical structures, as the interaction of antecedents and consequents described by Meyer. Lastly, *conscious expectations* are verbal and explicit about what could happen next, similar to what Meyer called objectification of meaning. The three kinds of pre-verbal, unconscious expectations are responsible for the most situations during ordinary listening, when there is no necessity of deliberative reasoning and expectations are inductively applied.

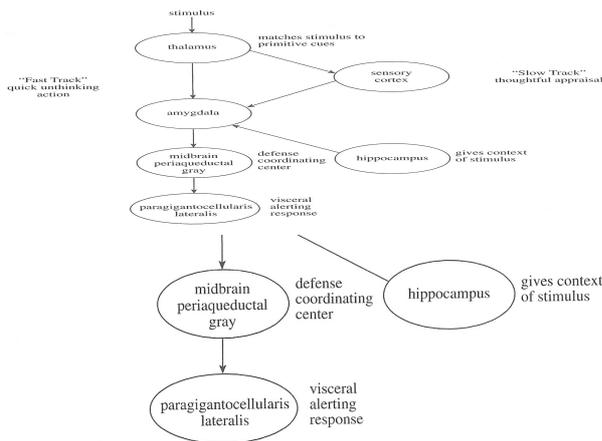


Figure 2. Schematic diagram of the neural pathways involved in emotional reactions of surprising events. The fast track is responsible for the always negative valence right after the perception of a surprising event. The slow track involves appraisal and could be positively, negatively or neutrally valenced. The contrastive interaction of both systems results in the most cases of surprise feelings. (In: Huron, 2006, p. 20)

Memory	Expectation	Description
episodic	veridical	reflect specific works and situations
semantic	schematic	reflect general cultural patterns, resulting from a lifespan of listening
short-term	dynamic	reflect responses to the very patterns real-time listening
working	conscious	Reflect conscious thought and explicitly knowledge

Table 1: Types of memories and musical expectations in Huron's theory.

To summarize, Hanslick (1986) envisioned that musical meaning should be understood in relation to musical form alone during listening. Meyer (1956) took this perspective and complemented it with a more detailed account of how in listening one could turn unrelated chunks of musical information into meaningful structures, by the dynamic process of contrasting hypothetical and evident and determinate meanings, by means of lawlike and habitual operations of mind. Huron (2006) has characterized expectation in terms of inductive reasoning as a sort of biological achievement through evolution, offering a more detailed picture of several types of musical expectation in a cultural specific environment. In spite of Hanslick's formalism, both Meyer and Huron put meaning and emotion as outcomes of a single

mental operation, overcoming the old aesthetical dichotomy between reason and emotion. Notwithstanding their many differences, both authors estimate the role surprise has in musical listening, resulting in affective responses by means of breaking the expectations, culminating in the objectification of meaning for the first and contrastive valence for the second, so both perspectives seem complementary rather than contradictory. However, when a listener's inductive and statistically learned schemas prove themselves wrong or inappropriate, a new schema should be generated, but none of the authors discussed so far has pointed how the new schemes come into existence, what kind of reasoning or lawlike operation of mind could be involved in such cases. Yet, this question seems especially important because surprising events are generally regarded as important factors in the meaningful and affective experience of music. In the final sections of this paper, we will provide a brief analysis of this problem based upon Charles S. Peirce's pragmatist perspective.

Logic of discovery, pragmatism and abduction

The emphasis on structural listening is one of the common points between Meyer and Huron's hypotheses on the emotional meaningful response that accompanies musical listening. As mentioned, the key to understand how a succession of tones becomes meaningful and affective, synthesizing two distinct aesthetical perspectives, was to be found in the psychology of listening. But, would there be any general *logical* principle underlying such a supposition?

One answer to the above question was given by pragmatists such as Charles S. Peirce, according to whom the main activity of any mindful or cognitive system is the production of habits. Stable habits, in turn, constitute beliefs from which the reality is apprehended. From this perspective, a mental system could be understood as a dynamic network of stable habits (or beliefs) from which novelties and anomalies are detected as surprising events. As stressed by Peirce, "... Belief, while

it lasts, is a strong habit, and as such, forces the man to believe until some surprise breaks up the habit" (CP 5.524).

Habits and beliefs give rise to expectations that allow the anticipation of future events. Given that expectations are not always successful, sometimes there is a conflict between the expectations of well-established habits and the dynamics of environmental events, producing a surprising effect.

From Peirce's logical perspective, there are two kinds of surprise: active and passive. Active surprises occur "when one perceives positively conflicts with expectations" (CP 8.315). Passive surprises occur "when having no positive expectation but only the absence of any suspicion of anything out the common, something quite unexpected occurs."

Studies of emotions that are often connected with these two kinds of surprise are the subject matter of psychology, but the analysis of the general structure of surprise belongs to the area of pragmatic logics. In this context, musical surprises will be often active, for, supposedly, listeners might have expectations even before the first note is heard. According to the logic of pragmatism, surprising situations require reformulation of beliefs and formation of new habits. Given the nature of beliefs, understood as stable assimilated habits, the mind seeks to overcome conflicting situations by creating new habits, which in turn may generate beliefs if they prove useful. Conflicts will persist until the mind forms a new set of beliefs, transforming the surprising situation into a "matter of course." Gonzalez & Haselager (2005) have considered the analysis of the process of generation of new beliefs as one the greatest contributions of Peirce in the logic study of creativity. Peirce (CP 5.189) offers a logic description of the process of creative reasoning, which he called abductive reasoning:

A surprising fact, C, is observed.
 But if H were true, C would be a matter of course.
 Hence, there is reason to suspect that H is true.

In spite of characterizing a logic form of reasoning, abduction is fallible – it does not provide certainties, as happens with deductive reasoning. Nevertheless, as pointed out by Peirce, abduction is very useful in guiding the mind when confronted with surprising events and anomalous facts, helping to free the mind from doubts. In this sense, Peirce (CP 5.173) suggests that Abduction is almost like an instinct:

This Faculty is at the same time of the general nature of Instinct, resembling the instincts of the animals in its so far surpassing the general powers of our reason and for its directing us as if we were in possession of facts that are entirely beyond the reach of our senses. It resembles instinct too in its small liability to error; for though it goes wrong oftener than right, yet the relative frequency with which it is right is on the whole the most wonderful thing in our constitution.

Additionally, what is more interesting here, is that abductive reasoning can be considered as a valuable tool for the expansion of knowledge, and its analysis can be useful for the understanding of the process of formulating new hypotheses.

Peirce considered that abduction's "only justification is that from its suggestion deduction can draw a prediction which can be tested by induction, and that, if we are ever to learn anything or to understand phenomena at all, it must be by abduction that this is to be brought about" (CP 5.171). In this sense, knowledge (be it scientific or artistic) is constructed by the integration of these three kinds of reasoning – deductive, inductive and abductive –, assuming the primary role that abduction plays in elaborating hypothesis and surpassing conflicting and uncertain situations.

From this brief summary of Peirce's view on the nature of abductive reasoning, it could be interesting to investigate the question concerning the possible existence of a general *logical* principle underlying the suppositions on the emotional meaningful response that accompanies musical listening. It seems that suppositions such as the existence of a lawlike quality of the principle of *prägnanz* of Gestalt psychology, which

states that the mind will always seek for the most steady, simple or coherent pattern (instead of the unstable and complex ones), could be understood as an instantiation of abductive reasoning. For, abduction could resolve a seemingly conflicting state of affairs by the formulation of a new hypothesis that would make a conflicting situation coherent. As indicated, Peirce understood that abduction is also involved in perceptual judgments, which despite their natural and possibly unconscious character, are hypothetical rather than definitive, a matter of habit rather than of unchanging fact.

In what follows illustrations of this hypothesis are provided in the domain of musical listening.

Abduction and musical meaning

In spite of his formalism, Hanslick realized that musical content could only be instantiated as the form of musical structures in the perceptive domain of listening. Leonard Meyer established the relation between expectation and musical meaning. As we have seen, he distinguished three kinds of meaning: hypothetical, evident and determinate. Rejecting both the old idea that music imitates through its sounds the emotions or affects of human soul, and also that music content could be objectively ascribed to musical structure alone, Meyer claimed that meaning in music should be sought in the listener's experience. Such experience was described by him as the (unconscious) relations between an object, something it points out, and an observer^{vi}. What is more important in Meyer's theory is that it establishes musical meaning as the dialectical confrontation of hypothesis and their possible corroborations in music structure, from a phenomenological perspective. This is the dynamical relation between hypothetical and evident meanings. Determinate meanings have another nature, being consequences of an objectifying process that operates over the dynamics of listening transformed into an object of conscious analysis. Thus, hypothetical meaning is the basis of musical expectations, and consequently, of any significantly experience of music.

There seems to be a correlation between emotional states and the efficiency of generated expectations in listening. Meyer pointed to that psychological correlation, but his theory did not establish effectively how it would be originated. It was Huron that fifty years later established the correspondence between expectations and emotions. However, psychology did not yet provide the conceptual means to investigate the generation of hypotheses that lead to expectations (meaningful experience) that, in turn, can result in affect during listening (emotional experience).

Logically, Huron's theory is constructed on the basis of the traditional deductive-inductive inferential form, explaining how musical listening operates in anticipating the upcoming events. Conversely, Meyer's account of musical meaning is not logically, but psychologically elaborated, and also fails at explaining how hypotheses are generated in perception.

It seems to us that precisely at this point the logic of discovery from the pragmatism of C.S. Peirce could be of relevance. It seems plausible to suggest a complementary relation between the psychological formulations from Meyer, the experimental and biological evidence from Huron, and the logic of discovery from Peirce, offering a hypothesis of how musical expectations are constructed during listening and result in emotion. In short, our thesis is that what Meyer called hypothetical meaning, which is the basis of the process of signification, is nothing but an instantiation of what Peirce called abductive reasoning, which forms the inferential basis of the process of acquisition of knowledge.

Musical meaning, or, better, musical signification, is a particular form of a general process of signification that is instantiated primarily and initially by means of abduction. Our perspective emphasizes the interaction between abduction, induction and deduction, suggesting that these three kinds of reasoning are manifested in a process of signification that could be thought of as an emergent process, reducible neither to the listener nor to the work alone.^{vii} The evident meaning discussed in Meyer's theory is

nothing but a case of inductive process of hypotheses verification; and his determinate meaning results mainly from deduction. However, hypotheses must have been generated somehow.

On the bases of the inductive argument there is a probabilistic perspective of understanding that would result merely from the exposition of a subject to works of a specific repertoire. But it seems that induction (and deduction) alone could not constitute the act of musically listening because the work does not tell us how it should be listened to even after several expositions to it. Even on very basic cognitive operations like grouping and segmenting the notes of a simple melody no rule results that could be instantiated aprioristically or apprehended by repetitive listening, as if the work would reveal its secrets after several listening sections. Segmentation or grouping are matters of hypothetical (and habitual) reasoning, that in turn is inductively verified against the sonic events, which constitute what we call a piece of music. In an extremely homogeneous musical scene, induction will be manifest much more regularly than abduction, and in such case expectation would be a case of probabilistic determination. Conversely, within a diverse musical environment, musical habits have to be generated and adapted more often. A stable and invariant set of habits would not be suitable for a meaningful experience over different stylistic repertoires – new listening habits might be generated every time a new musical style or system emerges.

This perspective could be related to transformations of conceptual spaces (Boden, 1996). A conceptual space is a multidimensional structure that contains the principles that constitute and unify any area of knowledge. Boden understands the tonal system as a generative system that could be described as a conceptual space. Explorations made by composers not only explore the possibilities of such a system, but occasionally also lead to transformations and expansion of its structures. The atonal transfiguration of the tonal system is one example of the transformation of a conceptual space in music (Boden, 1996, p.

81). Gonzalez & Haselager (2005) have proposed that abduction could be considered as the logical inference that makes the expansion and transformation of conceptual spaces possible.

Conceptual spaces are not only suitable to the description of the action of a composer, but to the habitual action of the listener as well. The set of habits that according to Peirce constitutes the beliefs of a person can be considered as a conceptual space. In this sense, listening habits and esthetics beliefs are elements of a music-conceptual space. In the perspective of listeners, their conceptual spaces are altered every time a new habit or belief is created in response to a new sort of music. The logical process of generating habits, from the perspective of pragmatism, as we have seen, is due to abduction. Thus, from the point of view we hold here, listening is a potentially creative action.

Imagine how the audition of Stravinsky's *Le Sacre du Printemps* may change the musical experience of a listener. We could illustrate our point of view in a still more radical way: electroacoustic music. For a listener familiarized to tonal music from the Baroque to the present, including Stravinsky's, a sonic experience of works like those of the early electronic composers could hardly be included in the category of music. The most extravagant of the *musique concrete* from Pierre Schaeffer and colleagues or the recent soundscapes would be even more disturbing. It is not rare to find (mostly common-sense) opinions refusing to accept contemporary music as music. One hypothesis is that listeners might have been trying to understand such music with the wrong habits. From the perspective offered by traditional habits, contemporary music will not make sense at all. The listener has to create new habits (and possibly new aesthetical beliefs) in order to establish meaningful relations over otherwise unrelated sonic events. The expansion of listener's conceptual space by abduction alters not only how he or she experiences new music, but also transforms the audition of well-familiar music. In this sense, (creatively) the act of music listening is always a new experience, for the listening habits and aesthetical beliefs

are constantly being altered by abductive reasoning.

Acknowledgements. The authors would like to acknowledge São Paulo State University, especially the Academic Group of Cognitive Studies (GAEC), and the people from the Nucleus of Studies on Sound Communication (NICS) of Campinas State University. The authors are also grateful for the anonymous referees for their valuable comments and suggestions. Luis Felipe Oliveira thanks FAPESP for the Ph.D. research support.

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- ⁱ There is a large amount of work about music and semiotics, employing very complex developments of the Peircean triadic sign system to analyse and describe music. Our perspective in this paper is not concerned with sign taxonomy or semiotic description, but rather with the logical characterization of meaningful listening.
- ⁱⁱ It is important to remember that the dynamics of hypothetical and evident meanings are not only to be conceived horizontally but vertically, or among architectonic levels, as Meyer said (1956, p. 38) as well.
- ⁱⁱⁱ By "timeless work" Meyer means that the operation of memory is not constrained by the temporal flux of perception.
- ^{iv} Meyer describes the relationship between surprise and predictable structures in terms of norms and deviations within a music style, which could only be a matter of dispositions and habits. Aiken (1947, p. 156) said that "we speak of "traditions," "styles of art," "meanings," and so on, as if these things had a kind of independent reality of their own which are eternally attached to works of art. But traditions and meanings are kept alive only through the dispositions and habits which form the subjective contexts of countless individuals. Works of aesthetic art, we must continually remind ourselves, exist only as objects of perception and feeling. There can be no aesthetic content whatever apart from the responses of individual men which gives it meaning."
- ^v There are uncountable many different theories of emotions, but there seems to be a congruence at understanding emotion as a kind of motivator for the organism (for a panoramic view see Oatley, 2001; Juslin & Västfäll, 2008, offer a general view on musically induced emotions).
- ^{vi} Translating into Peircean terms, there will be sign, object, and interpretant, respectively.
- ^{vii} By work we mean a set of sounds structured by any possible syntax and available phenomenologically for an observer; by listener we mean a system that has the appropriate sensory apparatus and is capable of dealing with and experiencing structured sounds as music. Both listeners and works are also determined or constrained by social aspects and embedded in a cultural environment.