

**Explanation and Reduction
in the Cognitive Neuroscience Approach
to the Musical Meaning Problem**

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Abstract. The aim of this chapter is to refer basic philosophical approaches to the problem of musical meaning and, on the other hand, to describe some examples of the research on musical meaning found in the field of cognitive neuroscience. By looking at those two approaches together it can be seen that there is still no agreement on how musical meaning should be understood, often due to several methodological problems of which the most important seem to be the possibility of inter-theoretical reduction and application of an accurate theory of explanation. I'm suggesting that the application of some form of the mechanistic model of explanation might be found useful for clarifying reductionism-antireductionism dispute concerning musical meaning, and more importantly, for providing some answers for the debate in music-as-language controversy.

Introduction

Music is everywhere where human is. No wonder then, that almost since the beginning of western philosophy, music became an interest of the philosophical thought. At least since Pythagoras, philosophers tried to understand and explain the role of music in the world and in the human mind. Until the 19th century, that is until the beginning of the development of sciences, the topics concerning music were mostly discussed by philosophers and composers. That situation began to change together with the development of (experimental) psychology and musicology as specialized disciplines. Using methods of empirical science, psychologists started to explain the phenomenon of music. In the recent twenty years, cognitive neuroscientists have begun to research the relations between language and music, in order to solve one of the oldest philosophical riddles concerning music: musical meaning. In analytical philosophy, the notion of meaning is hardly used out of linguistic context, what is obvious, given the necessity of semantic foundation of meaning. Therefore, for most of the classical analytic philosophers the concept of “musical meaning” would be at most a silly metaphor. For some philosophers of music and most neuroscientists concerned with the problem, however, the case is not that simple, as it seems that music and language show a lot in common. In this chapter, I am providing an overview of some philosophical and neuroscientific approaches to the musical meaning problem and trying to show how an understanding of the problem of explanation could provide a framework for giving the problem of musical meaning some space in

the contemporary debates in philosophy of mind concerned with the possibility of reduction.

The Problem of Musical Meaning in Philosophy

Why do we listen to music? Music takes such an important place in human life that it seems obvious it is almost everywhere around us. For some reason, however, humans create music and listen to it. What is the reason? Of course, music is around us while we dance, it is prevalent during religious or national ceremonies etc. Sometimes we listen to music just for the sake of listening to it. There should be some reason behind it. These considerations lay at the foundation of the musical meaning problem.

In philosophy, for centuries, several, quite different answers were provided to the questions why we listen to music and what might the musical meaning be. Starting from sophists, who claimed that we listen to music just for physical pleasure, similarly as we eat for the pleasure of eating, and ending on formalists, according to whom there is no musical meaning, or, if there is anything we listen to music for, it is its form, that is, its syntactical dependencies. Between those two radical views lays a wide spectrum of theories according to which music has or, at least, can have some form of meaning. How is that meaning defined and – maybe more importantly – how does it function, remains the subject of the main controversy. Therefore, generally, we can be speaking of two main questions within the musical meaning problem:

- 1) Can a piece of music have a meaning? If yes,
- 2) What is musical meaning?

In this form, the problem is being discussed – implicitly or explicitly – in the contemporary philosophy of music. Those two questions are naturally only the point of departure, here is a tentative list of extensions:

- 3) What is a piece music?
- 4) What is a meaning of a piece of music?
- 5) What does it mean, that a piece of music has a meaning?
- 6) What is the meaning of the word “meaning” in case of music?

To the above, it is worth to add – not very often seen in the literature but important for the understanding of the problem – two following metatheoretical questions:

- 7) What are the requirements for a good theory of musical meaning?
- 8) What is the character of musical meaning controversy?

The order of these questions to some level correlates with their importance for us in this chapter. Question (3) is beyond our interest in this work. For the sake of simplicity let's assume that a piece of music is whatever is used as musical stimuli in experiments in cognitive sciences. Questions (2) and (4) touch the core of the problem and in this version appear often in literature, most commonly taking the form of a discussion whether music can mean similarly to language or whether there are emotions expressed in music and music somehow contains or stays in relation to them. In this chapter, we are mostly concerned with questions (5)–(8), which might be considered – at least partially – more meta-problematic, but – in the perspective taken here – possible answers could be helpful with establishing a sketch of a model of musical meaning, which would incorporate some philosophical perspectives with some of the recent research in cognitive neuroscience.

Historically speaking, the problem of musical meaning has been present in philosophy since Pythagoras and found its development in works of Plato and Aristotle, who considered reasons of why people listen to music, but also why certain musical scales work differently on human emotions than others. The modern debate, however, is often considered to have started with the famous study of Eduard Hanslick, *On the Musical Beautiful* (1886) in which he expressed the formalistic approach to music, as opposed to the popular, rooted in romanticism, the thesis that music can express emotions. According to Hanslick, music does not express (or even worst – contain) emotions. We can be speaking of music as symbolizing emotional qualities, as tension, surprise or calmness, but it is only an analogy, based on the fact that music contains some dynamical elements. Music does not have any content, and what is substantial of music is its form. As Hanslick put it referring to Gluck famous air from *Orfeo ed Euridice*, where Orpheus sings: “I have lost my Euridice, nothing equals my misery!” the line could be substituted as well with “I found my Eurydice, nothing equals my happiness!” and the musical line would suit in the same way. Hence, concludes Hanslick, music itself cannot express emotions as that would lead to a contradiction. What is important in music is the structure

and not “emotional content”, as the latter we cannot even identify. This and similar views on musical meaning, or rather lack of musical meaning is called formalism and is still a popular view, at least among philosophers (e.g., Scruton 1999; Zangwill 2004). On the other end of the spectrum, we have the so-called linguistic paradigm, according to which, roughly, music is to some extent like language, and music possess meaning as (or similarly too) language. This concept is rooted in romanticism, and the view of music as the “language of emotions”. It was quite popular not only among composers but also philosophers. For example, Schopenhauer famously claimed:

“[music] does not express this or that individual or particular joy, this or that sorrow or pain or horror or exaltation or cheerfulness or peace of mind, but rather joy, sorrow, pain, horror, exaltation, cheerfulness and peace of mind as such in *themselves*, abstractly” (Schopenhauer 2011, 289).

One of the most interesting philosophical views on musical meaning can be found in Susanne Langer’s work *Philosophy in the New Key* (1979). In the chapter devoted primarily to music and its meaning, Langer developed a Wittgensteinian (i.e., based on Tractarian theory of meaning, not Wittgenstein’s views on music) concept of musical meaning. In her view music, similarly to language, is capable of symbolizing. The difference is that while linguistic symbols are representational, musical symbols are presentational, not descriptive or discursive. In this way, musical meanings are symboling in a more imaginary than representative way. Even though the concept of presentational symbol seems to be controversial, Langer’s arguments for connection of music with language are disputed until today and are often mentioned in discussions concerning musical meaning not only in philosophy (e.g., Koelsch 2012).

If we accept that music and language are somehow connected, then we usually mean that music expresses something, in a way somehow similar to how language expresses something. Obviously, the content of musical expression wouldn’t be understood as the content of linguistic expression. As in the statement “Laptop is on the table”, I can quite easily express my view on the actual state of being, it would be hard to express the same by means of music. Musical expressions are often – not only, however – about emotions. Here we meet another dimension of the problem of musical meaning. Having agreed that music has something to do with emotions, we need to know how this connection works. There are several answers to this problem, the main two being (a) cognitivism and (b) emotivism. Accord-

ing to cognitivism, we mainly recognize and understand musical emotions, and according to emotivism, we mainly feel emotions in music. I use the word “mainly” to indicate the point which makes the theories often opposite, it might be the case however that we both feel and understand musical emotional meanings.

Let’s think of Bach’s 2nd movement of the double violin concerto in D-minor. Some people would agree that we can hear some form of sadness. How can this happen? (1) Sadness can be in music; in other words, music would possess the sadness as emotional quality. This seems to be quite implausible though, given that sadness is a kind of emotion, which is a kind of a mental state. Other – not contradictory – possibilities: (2) The music makes us feel sad or (3) We imagine sadness or understand music as sad. This problem is another big controversy in the contemporary philosophy of music.

Summing up this short and selective overview, we can see that philosophers provided almost all possible answers to previously stated questions, starting from understanding music as not having any meanings, through formalism, symbolism, emotivism and ending with cognitivism. The discussion is still lively; it seems however that not much progress has been done in recent years on the grounds of the philosophy of music alone. There is a vast development in music research in cognitive sciences, particularly in cognitive neuroscience, however, so maybe it is worth to look out of philosophical playground for a while, to see if any empirical research could do any good, or any harm (and what assumptions need to be met for this to be possible) to any of the concepts mentioned.

Some Examples of Research on Musical Meaning in Cognitive Neuroscience

On the grounds of cognitive neuroscience, there seem to be two main approaches to the construction of a model of processing musical meaning: syntactical and semantical. While both are obviously important, as both are showing the similarities between language and music processing, it seems that the semantical side might be more interesting for a philosopher of music. Let’s start with syntax, however.

Fedorenko et al. (2009) offered a test of the hypothesis, according to which, language and music share cognitive resources used for syntactic

processing (SSIRH – shared syntactic integration resource hypothesis). By crossing the linguistic and musical phrases of different levels of difficulty (an object vs. subject extracted clause in English) and in-key vs. modified (e.g., with C# within C-major melody) musical phrase, authors shown that while processing more complicated (difficult) structures at the same time, both for language and music, the understanding of the linguistic phrase drops dramatically. From this fact, it's been generalized, that mind possibly operates on the same resources, when it comes to the online processing of musical and linguistic syntax. While this experiment shows an undoubtedly important connection between language and music processing, it still is about the structural-syntactic content, and might not be interesting for some philosophers concerned with the traditional understanding of “meaning”.

Stephan Koelsch in his earlier articles (e.g., 2004) and summarizing book (2012) developed a theory of musical meaning, which contains not only the syntactic but also the semantic element. The musical meaning, according to Koelsch, might be categorized as follows:

1. Extra-musical
 - 1.1. Iconic musical meaning that emerges from musical information resembling sounds of objects, qualities of objects, or qualities of abstract concepts.
 - 1.2. Indexical musical meaning emerges from signals indicating the inner state of an individual.
 - 1.3. Symbolic musical meaning that emerges from arbitrary extra-musical associations; the symbolic sign quality of musical information can be conventional or idiosyncratic.
2. Intra-musical
 - 2.1. Meaning [that] can also emerge from one musical element (or group of elements) pointing structurally to another musical element (or group of elements).
3. Musicogenic
 - 3.1. Meaning emerging from the interpretation of physical, emotional and personality-related effects elicited by music. (Koelsch 2012, 157–177)

It is important to add, that the third category – the musicogenic meaning – according to Koelsch, doesn't have a good foundation in data, and it's rather a speculative theory, so we will not include it in further considerations here. Given that, which of the above would be a good candidate for the musical meaning that philosophers discuss?

It seems that (1.1) contains mostly the onomatopoeic features, which is not our main concern in here; the resemblance of music to the “qualities of abstract concepts” seems intriguing, though. If music can be of any resemblance to an abstract concept, then it might also be a bearer of an abstract meaning. How this relation of resemblance works is another question.

(1.2) bears the main similarity to the concepts expressed by philosophers, especially in the emotivist paradigm, the problem here is that the concept of “signal”, rather than of “symbol” is used in the definition. The question whether signals (as opposed to symbols) can be “meaningful” arises. Point (1.3) suggests the possibility of an arbitrary musical meaning, and (2.1) the syntactic, but also referential (e.g., to the other parts of a musical piece).

It seems that all the categories proposed by Koelsch were in some way suggested before by philosophers. All of them, however – apart from (3) – are backed by some neuroscientific data. For example, in 2004, by the comparison of the electric brain activity, in reaction to the visually presented target word and semantically related and unrelated linguistic and musical phrases, Koelsch and others found out that the N400 ERP is elicited. N400 is widely recognized as a mark for semantic incongruity processed in the brain. Now the question arises – is the presence of semantic incongruity strong enough evidence to provide a foundation for the claim that “music can convey meaning, as language”? It seems that – currently in neurosciences – it is the best type of evidence we can have.

Reduction and the Philosophy of Cognitive (Neuro)Science

Let’s assume that music and musical meanings are mental phenomena, at least in some ways, similar to the other mental phenomena. It seems that the closest to music is the language, given its syntax, and more controversially – “semantics”. As such, music and language should operate on representations (as seen in the standard-old-fashioned view of cognition). While providing the theory of the representation of musical structures seems not impossible, it becomes problematic when we want to talk about musical representations, similarly to the mental representations. If we want to talk about musical meanings, however, we need to provide some form of a representation. Now, what is represented by musical piece, fragment or melody is another problem. Is it an aesthetic quality, e.g., beauty?

Is it a psychological object like emotion? Or musical quality like melody or harmony? Maybe composer's internal mental state? Just a structure? It seems, as aforementioned, that both philosophers and scientists deal with these questions. So, is it possible that philosophical musical meaning is the neuroscientific musical meaning? And if so, what is the consequence of such identity? This problem might be seen as a special case of the problem of reduction in the philosophy of science. The problem of reduction in the philosophy of science contains a set of questions concerning the relation between statements (and theories) of sciences (and natural language). In case of the reductionism concerning the language describing mental states (as representation, consciousness, but also emotion) the question is whether the folk-psychological, common sense (including, at least some, philosophical) statements describing mental states can be reduced (translated) into the statements of empirical sciences (neuroscience, but, as the final goal – physics). Most of the naturalistically oriented philosophers would welcome some type the reductionist explanation of given mental phenomena. The same should happen in the case of a reductive theory of musical meaning. One of the possibilities to provide such a reductionist approach would be reduction of musical representations. Here we go back to previously stated problem: what (if anything) is represented by music? The most common answer would be that it is emotions what music somehow represents. If we agree with such an answer, we meet another problem – broadly discussed in general philosophy of psychology (e.g., Feldmann Barret 2006) – are emotions natural kinds? To provide a good reductionist theory we need to know what we are reducing; if the object-to-be-reduced is not recognized as a natural kind, then the whole possibility of the reduction becomes suspicious. Because of such and other methodological problems not only some philosophers but also neuroscientists (Revonsuo 2001) do not agree with the reductionist approach, especially in the explanation of the higher cognitive functions.

Can Musical Meaning in Philosophy Be Musical Meaning in Neuroscience? Problems and Perspectives

As it has been said at the beginning of this chapter, many philosophical theories of musical meaning have been provided over centuries of philosophical thought. Generally speaking, if we were not to ignore the

cognitive sciences, it becomes out of question that there is some connection between music and language. One of the possibilities is that those two phenomena operate on representations and as such are – at least to some extent – symbolic. If that would be the case, then speaking of “musical meaning” is not that controversial as it seems to many more formalistically oriented philosophers. To create a unified theory of musical meaning is still behind the horizon, even if we consider the newest research in cognitive neuroscience. As we’ve seen in the example of the theory provided by Koelsch, there is a lot of data suggesting that musical meaning has many “dimensions” but some of them are still only speculative (philosophical?). It seems that to provide a bridge between higher and lower level theories, what would allow us to “translate” some concepts, we need to solve several serious problems, the most important being the question of the representational character of music and the status of emotions as natural kinds.

On the other hand, further work is needed to clarify which theory of explanation could be used in order to provide the best understanding of the musical meaning phenomenon. It is not controversial that the classical models, as Hempel-Oppenheim’s deductive-nomological, or simple causal models, do not work well when applied to the explanation of the mind. Currently, the mechanistic model proposed by William Bechtel is widely used to incorporate different levels of operation of the mechanism (and mind is also understood as an example of mechanism). According to Bechtel:

“A mechanism is a structure performing a function in virtue of its component parts, component operations, and their organization. The orchestrated functioning of the mechanism is responsible for one or more phenomena” (Bechtel 2005, 423).

If we understand the mind and cognition as suggested by this – very general – definition, we might imagine that music and language are two parts of one higher level mechanism, that is, the “meaning mechanism”, or the mechanism of representation. Such mechanism could be explained on different componential levels (neurobiological, cognitive, psychological, maybe evolutionary) but still stays one mechanism, where all parts play some – to be defined on a given explanatory level – role (not necessarily reducible).

Looking at our main problem with the perspective of new mechanicism, there is a chance that some of the philosophical approaches are still valid and, what’s more, are not incoherent with some of the neuroscientific data. Furthermore, given the tension between classical (anti-naturalist) philoso-

phers and philosophers searching to find the answers for some ancient philosophical questions in the empirical sciences, when applying (appropriately interpreted) new mechanicism, we might see that some of the discussions are referring to different levels, and some of the quarrels do not make much sense. In a very special take, such mechanicism might be anti-reductionist, in the sense that the translation of the explanations of different levels of mechanism might not be needed, or not possible, and at the same time – there is nothing to worry about! Or rather there is something to worry about only if we believe in the old-fashioned unity of science. Musical meaning is still an open problem in both scientific and philosophical approaches and both fields can provide some insight that might be helpful to its understanding, without the need of elimination or necessity of reduction.

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