Let's Listen to the Listener

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In 1972, the Danube Symposium on Neurology was held in Vienna. The topic was the "neurology of music". This was the first occasion where this topic had been submitted for serious discussion, although the sedative and even therapeutic effects of music had already been a field of study before. This Symposium resulted, among other things, in a book with the title: *Music and the Brain*[1] for which several of the best scientists that were involved in the study produced articles.

Twenty years earlier, around the year 1952, the questions about the perception of what basically is art-music, had already been posed. But the people posing these questions came from another side of the spectrum of knowledge acquisition. Here it concerned professional musicians, and their leading research tools were mostly their own, well trained ears. They were part of the post-war generation, and were allergic to terms like inspiration, beauty and sentiments in general. Their paradigm was that music was organised sound, and that this artform, when manipulated in an intelligent way, was able to have an intelligent listener experience a high form of mental order. The listener could, through such an experience, even become a better person, achieving lucid insights in the structures of the surrounding social reality.

Consequently, in the beginning of the sixties attempts were made by artists of different disciplines to bridge the gap between science and art. Of course, art is not the same as science, and cannot do much with terms like value-free research - but many of these artists were curious about the possibility of a common ground. Was it possible that this would lead to superior results in art? The answer to this question, we can now see with some degree of certainty, is: No.

Modernist artists of those days, were often appalled by the often superficial and outmoded artistic choices where the 'brainiacs' came up with. Apparently scientific and artistic interests were not a natural combination. On the other hand, in the eyes of the scientists, the modernists achieved but meagre results when they used computation to create an ordering in their compositional work. And their calculation errors appeared to have no relevant consequences for the musical results. And more problematic was, for the scientists and composers alike: the errors that the composers made in their computation were irrelevant to the artistic quality of the music that was produced.

After the modernist movement had lost its dominance in the arts, there was room again to think about the perception of music in a less strict, rational way. Older questions came up again, like: Why is music capable of moving us? Why is it sometimes so full of an ecstatic beauty? Why is it capable to mean so much to us, when we, for instance, all of a sudden hear a tune we know? And why are all these emotions possible, even if we as listeners know almost nothing about the 'clockwork' that allows music to 'tick'?

I was confronted, with all these questions by a simple remark, made by one of my professors. It was at the time I studied organ, composition and theory of music at the *Royal Conservatoire* in The Hague. This must have been around 1973. The professor's remark was something along the following lines:

> The only thing we are able to *know* about music is its organization. Music really is sound put in a specific order, waves of sound if you like, which we perceive, remember, and of which we appreciate the organization. All other ideas concerning music, the professor said, are based on associations - which only get in the way of pure musical perception.

At the time, I already felt his remark was wrong, but I could not yet say exactly why. Luckily, a few years later I took a cat, which helped me out.[2]

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Most of the time, the cat was asleep. He lay in a chair in the room where I was working. He would sleep through my wild piano improvisations, just as he slept through the loud music playing from the speakers. I often wondered whether the cat was perhaps just a little hard of hearing, so at some point I decided to do an experiment. One morning, I played, very softly, a CD with bird sounds and all of a sudden the cat woke up and stealthily sneaked towards the speaker from which the sounds emanated. After having circled the speaker three times without finding any birds to chase after, he decided that something was going on here that was beyond his comprehension and he quietly walked back to his chair. And at that point I realised what had just happened. These bird sounds had been sent into the room from the speakers as physical vibrations, an objective result of the vibrations of the speaker cones. But only until they were picked up by my cat's ear. So, he was not deaf after all, he had definitely heard my music – but since the music had no meaning to him, he had ignored it and his brain somehow demoted it to mere background noise. Bird sounds however, appealed to his hunting instincts and therefore had meaning to the cat. Thus, he woke up and started his investigation.

So, now the question has been made clear: what is such meaning, how does it work? And is it possible to substitute this rather broad term with less elusive concepts?

Meaning

Let us now look at the process of the perception of music step by step. The first part of this journey is pretty straightforward: something makes the air particles move in rather complicated, multifoliate patterns. This is picked up by the ear and is brought to the attention of the brain as electric impulses. Which, in turn, starts to process them. And this is the point where it becomes complicated. For what is perception in this context? This is where confusion can arise, because there is a big difference between perceiving sound ("Hey, there's noise coming from over there") and *listening* to sound ("Hey, that's somebody playing the clarinet"). When we are researching *listening* in this particular sense, we again must make a distinction. This time, between the comprehension of a trained listener[3] and listening within more general frameworks. Within this article, I aim explicitly to look at that first type of listening. Listening, as the only entrance to music as an art form.

So what is listening? The ordering of sounds in a logically comprehensible pattern, as the professor I quoted earlier has said, is only a small part of the processing of sounds in the brain. This is because divergent parts of the brain, each with different and specific roles, play a part in our comprehension of perceptions in general. This includes the areas of the brain where emotions originate from and where memories are stored. Another complicating factor is that listening to music, as a time-based art, is completely dependent on a well-functioning short-term sound memory. That means, a memory, capable of storing and retrieving the logically comprehensible pattern of any given music. This labyrinth of perceptions, musical memory and the emotional household in the brain determines our understanding of music.

Fortunately, people are not all that different from each other. Mentally, we are much more alike than we perhaps are willing to admit, from our need for individuality. By this I intend that there are not really eight billion, entirely different ways of listening to a given piece of music. Apart from our individual competences and histories, such as our musical skills and personal backgrounds, there is a lot to say about the way people listen to music in general terms. So, let us take a closer look at the listener in general: How is music understood?

In order to answer this question, we will access three areas of study:

Cognitive neuroscience of music: This is the discipline that studies the mechanism by which our brain recognises, perceives, understands and performs music.

Recognition of music within a system of social values: Music is here linked to its social function, it concerns the musical languages that are applied and developed, the musical traditions and their evolution, and the way music is appreciated and used in today's society.

Music understood from an individual perspective: Understanding of music through personal memories and the emotional relations that are construed between pieces of music and our personal memories.

Cognitive Neuroscience of Music

Music is capable of causing evident changes in the neurovascular system. Some of its building blocks can provoke strong emotional reactions, think of people holding their hands over their ears for protection to loud or sharp sounds. The most striking example of musical movements that can cause such a response is (loud) dissonance.

The most striking change in 20th-century music is the recalibration of the consonance/dissonance relationship. Up until the 20th century, dissonance was what spiced things up: without a good handling of dissonances, a composition was no good. It was the main expressive tool in musical composition, the natural expression for pain, for fear or sorrow. Within the Modernistic movement that started around the first World War, this 'spice' transformed from a means of expression to the default harmonic language. But for many listeners of that time, this emancipation of the dissonant was like having salt rubbed into their wounds. Composers like *Arnold Schönberg*, founder of the second Viennese School in the 1920's, were rather dismissive of this public rejection of their application of dissonances in their work. They thought it was perhaps just a matter of getting used to, or of simply teaching audiences to 'listen better'. But to this day, music in which dissonance is used as the main harmonic building block, without a special emotional purpose (as is done in scores to horror films), is not popular.

A pure physical explanation was given by *Hermann von Helmholtz* (1821–1894) He states, that the dissonant is a sound which cannot be processed correctly by the human ear and therefore has the association with feelings that cannot be processed easily.[4] Helmholtz explains the 'unpleasant' character of dissonance as beatings[5] between two simultaneous tones. When two root tones or overtones are within a critical bandwidth of each other, the beat causes the two tones to sound dissonant. Helmholtz called this: *rough sound.* For instance, the semitone b´–c´´ is 528 Hz – 495 Hz = 33 Hz or beatings per second. As result of these beatings, the tones themselves cannot coexist in the ear, without 'disturbing' each other's behaviour. They mutually check each other's uniform flow.

Helmholtz makes a reasonable case for the difference in perception of consonance and dissonance having a physical basis in biology. In this context he suggests that the neurology of our sense of hearing is not capable to properly process the beating within a certain bandwidth, because the two tones are constantly and strongly influencing each other. Or, is it simply a matter of getting used to as Schönberg suggested?

This suggestion of Schönberg brings us to the Nature/Nurture debate: the debate about whether an ability comes at birth by genetic inheritance or that it is acquired by education. Especially in the 1960s this was heated debate, especially when concerning sexual taboos and criminal behaviour. Both were often ascribed to a suppressive socialisation. Brain studies that I have consulted,[6] seem to suggest that today, Nature has won the argument in most cases.

Studies among children[7] between the ages of 6 to 10 months old, have shown that children of that age can already detect interval changes in short melodies. It is highly unlikely that children have already acquired musical knowledge at this early age. They are presumably still unaware of the musical conventions in Western culture. Both children and adults, as the studies showed, detect interval changes more easily when the relationships are simple, such as in a fifth (3:2) or a fourth (4:3), than when they are complicated, like in a tritone (45:32). The consonant intervals are not only processed more easily, but also influence the attention and the mood of the child that is listening. Music (for example, the mother singing) has a positive influence on the mood of babies. Research has shown that cortisone levels drop when a baby hears its mother singing. Apparently, music does this more effectively than speech. These research results suggest that children do not start life as musical *tabula rasa*. They are *predisposed* to notice and pay attention to melodies and rhythms in musical

patterns. They are attuned to consonant patterns, both melodic and harmonic, and to metric rhythms. Such predispositions confirm the existence of a biological basis for human musical perception, in the sense of understanding. They are specific for the ability that forms the basis of musical skill for people *from all cultures*.

Equally compelling are the results of the research done on animals.[8] Most young animal behaviour is not learned but appears to be the result of congenital imprints. One might say: pieces of a *collective memory*, that are present in the animals brain. For instance, young rabbits react fearfully to seeing the silhouette of a bird of prey; this fear subsequently urges them to flee and seek shelter. The young rabbits show this reaction of fear even if they had never yet encountered a bird of prey. Since the human brain biologically doesn't function differently than the brains of animals, we perhaps may assume the existence of certain *congenital imprints* in the human brain as well. Imprints which can be triggered by sounds and therefore also by music.

So, we need to look at the brain again and especially to the part where we process our emotions. Unfortunately, neurological research does not provide us with any clear-cut answers. Little is known as yet, about the neural processing of dissonant intervals. As it is, we only know for sure what parts of the brain react to dissonant sounds: we find these brain regions in the *amygdala*, a core of nerve cells that play a central part in processing revolting stimuli and in regulating fear. The function of another lobe in the processing of emotions, deep in the brain: the *gyrus parahippocampalis*, is less direct. This brain organ is part of the limbic system, where most of our emotional life can be traced back to. The right *gyrus parahippocampalis* and the right *precuneus* play a part in learning and memorising, but also in emotional processing.[9] Yet there is no viable research that indicates a clear neurological relation between emotions and dissonances.

But there is yet a different way to approach the consonant/dissonant dilemma. Composers started to write more often dissonant music from 1910 onward. Perhaps they were forced by a strong urge to express the dissonances and agitations of their time: the First World War was about to start and all the subsequent misery resulted in the Second World War. How can an artist ignore that suffering! This line of reasoning may be traced back to the philosopher George Wilhelm Friedrich Hegel.[10] Hegel writes about a development towards absolute freedom and truth of a reasoned *world spirit* or *world soul* (*Weltgeist).* This collective human evolution is caused by struggle. To put it simply: the history of humanity is like a slaughterhouse, wherein everything happens in order to reach this ultimate goal. The *World Spirit* is the secret mission of history. The relevance of the Arts to this evolutional process consists of its autonomy, its freedom of thought. Art is not a servant, it doesn't serve as entertainment, decoration or other. Art is the free expression of thought. The outward appearance of Art is not an irrelevant, meaningless illusion - but an appearance inherent to truth itself, comparable to the shadows in Plato's cave. The task Art has, according to Hegel, is no less than to make reality as truth visible in a sensory form. The true artist must be convinced that his absolute mission is to express the essence of his time. So, in a century that contains two World Wars, music cannot be pleasant.

From the perspective of the artist, however, this claim is untenable. Composers may have suffered under the circumstances of their time as human beings, but this doesn't mean they had to express that in their work. Composers, like the visual artists before them, were attracted to the new artistic languages because of the new possibilities these brought for doing art. For some it meant an important shift in their careers. If there is something like a *World Spirit*, it may well have been a spirit of optimism that gave rise to dissonant music: the new music would soon conquer concert halls and leave the old, dusty musical traditions behind. Schönberg never mentioned any connection between his music and the political situation of his day – though he served some time in the army during the First World War. He wrote:

> 'The insight, that consonance and dissonance differ not as opposites do, but only in point of degree; that consonances are the sounds closer to the fundamental (Root tone), dissonances those further

> away; that their comprehensibility is graduated accordingly, since the nearer ones are easier to comprehend than those further off'[11]

I must conclude that in the physical perception of dissonant and consonant tones differences can be found that explain the associations with pleasant and unpleasant feelings. However, art is not reality, and the portrayal of pain in music is something completely different to the pain that is perceived in one's own body. Art is a game, from which the participants can escape without harm and that makes the pain that was experienced in it an aesthetic 'pleasure'.

Music Understood from a System of Social Values

Let's have a closer look at the topic of the recognition of music within a value system that is accepted within a specific culture. In this area of study, we may distinguish three models.[12] Following Carl G. Jung[13], I call these models: 'musical archetypes'. An archetype is an idealised primal model that serves as the basis of later variants. According to Jung, such a model is present in man's subconscious as a symbolic representation. An archetype is often linked to emotion as well, such as the archetype of the Mother, or: the Sad Clown.

The First Archetype: Telling Stories

People love stories. They like telling and passing on traditions, legends, ballads about life, about love and war, the past (both the actual past or a fictitious past), and the future (based on either realistic or imaginary expectations). Religious cultures, for instance, have story telling at their basis. Nowadays, this general appetite for stories is satisfied by an unending stream of films and television series.

Since centuries ago, narration was linked to music. In the Ancient Mediterranean civilisation, the Greek *rhapsodists* were of great renown as singers/narrators of the Homeric epic poems. In the Celtic world there were the *bards* and in other parts of Northern Europe the era of the *scops* and *skalds* comes to mind. In China, the art of storytelling has been around for thousands of years as well. But today, it is no longer the nomadic singer/actor/instrumentalist that preserves this popular tradition, but it has become a state-controlled form of culture. In the Soviet Union a similar tradition was very much alive in the Ukraine particularly, before Stalin put a stop to it by having all the so-called *kobzars* massacred in 1932.[14]

These early types of narrative music always take the same form: a singer or actor tells a story, accompanied by a musical instrument played by an instrumentalist or played by himself. This later grew out into a group of multiple instruments and, taking a great leap in time, this leads us to today's pop music - with its endless stories on the theme of 'boy meets girl'.

In classical music the link between storytelling and music took an important turn when the singer was replaced by an instrumentalist, to tell the story. This happened in the early *Renaissance*. When exactly is unclear, but it probably happened in a home setting, where it was customary to make transcriptions of *frottolos*—madrigals and chansons—for strings, flutes, lute, or clavier.[15] Various forms that originally were developed to tell a narration, thus became purely musical forms. These song-forms evolved into the *sonata*, the *fantasia*, the *toccata* and from there on to the classic and romantic sonata and symphony.

This implies, that the musical language in which these musical forms are written apply a large number of formulas or gestures that suggest an emotion - or for a better word: an affect. In its most worked out form we find this in the *Affektenlehre*,[16] which highpoint of development is found in the *Baroque* era. The narrative quality of music in the *Classical* and *Romantic* period is still founded on this *Affektenlehre*, although this is never specifically mentioned by composers, because by that time, it already had become an integral part of the abstract musical language that composers took for granted.

The archetype of music as narrative is the most important and most beloved form of music. Even the abstract form of the fugue has always been a game of multiple characters or elements, chasing

after each other around a musical theme. The later form of the symphony has all the traits of a narrative too. A concert hall, where an audience gathers to listen to an extremely narrative *Mahler* symphony or to the symphonic poems of *Richard Strauss,* is in fact a scaling-up of the small group of listeners that had once gathered around a single singer, about to amuse them with a narrative in song.

The Second Archetype: Music for Dance

The connection between the immediate physical sensation of a musical pulse and the bodily energy it creates, is obvious. Ballet has been a vital part of the palette of classical music for centuries. Nowadays, music for dancing or just leaping about is a major commercial activity, expressed in a whole range of popular styles, such as *Dance*, *Disco* and *House* and evidenced by the wealth of certain DJs, who have succeeded in bringing large masses to ecstasy with their music. In the post-war Avant-Garde however, where metric patterns are usually avoided, this archetype has all but disappeared.

The motoric aspect of music has a direct influence on our bodies, as demonstrated by *G.* and *H. Harrer's* experiments (In *Music and the Brain)*:

> 'While the subject listens to a record of dance music the effect of the music goes, so to speak, "into the legs"; muscle action potentials increase sharply in the legs and relatively slightly in the frontalis muscles. A reverse effect is found during a silent arithmetical task, when there is a greater increase of muscular activity in the region of the brow than in the legs. Listening to *Bach's Brandenburg Concerto No. 6* enhances crural and, to a somewhat lesser degree, frontalis muscular activity. With temporary marked augmentation of the sound volume a very pronounced increase of muscle action potentials in both leg and forehead was noted. The subject had been asked not to move during the test and there was no muscular movement as far as one could judge from observation, even at the height of the EMG[17] discharges. A simultaneous recording of body movements showed no response.'[18]

When a pianist listens to piano music, his *motor cortices* is activated. It is possible to see this happening without the use of any EMG technique.

The direct relation between music and the physical response is also noted by the musicologist *Curt Sachs*[19], who subdivides dancing by 'primitive' people in *convulsive dancing* (non-motoric movements, which he regards as being in disharmony with the body and therefore evoking a special tension and expression in the eye of the spectator) and in *expansive dancing*, that finds its origin in an irrepressible urge to express oneself motorically (dancing in harmony with the body; dances that evoke great energy in the spectator).

The Third Archetype: Creation of Mystic Space

In various cultures we may find music that is based on long, sustained sounds, that in a certain sense interfere with each other, that has a religious or mystical context. One may experience this well-known phenomenon of interference in large, acoustically rich spaces. Romanesque, and especially Gothic churches provided medieval listeners with an overwhelming listening experience. The sound of religious chanting in such buildings, seems to be coming from all directions, filling the entire church. In the Middle Ages, such a mystical experience was nowhere else to be found - apart from the occasional cave - because cathedrals were the largest buildings of that time. The interfering sounds may have given the medieval listener with a feeling of security and awe: this is where God lives.

In general, interference evokes happy and calm moods in people. It has been suggested that this is related to our foetal state in the wombs of our mothers. The foetus experiences sound in this particular manner, because all sound is distorted by the amniotic fluids. Interesting in this regard is the huge success in the Netherlands of *Canto Ostinato* (1976-79), a piece of minimal music in mobile form for one to four keyboard instruments by *Simeon ten Holt* (1923-2012). Groups of admirers frequently attend performances of this work, which may last from between one to up to four hours, depending on the number of repetitions applied. The fans often lie down on mattresses on the floor and sometimes even assume a foetal position.

In churches today, the *voix celeste* can still be heard. This is an organ register consisting of two pipes per key that are slightly out of tune with each other. Choirs and string ensembles are also known for their soothing effect on our mental condition. Here, the interference is produced by a group of singers or string players, all producing the same tone at once. Since it is physically impossible to produce a tone with perfect accuracy, there will always be a little difference between tones each participant produces, thus producing interference. Also the use of vibrato produces interference. One can experience this phenomenon by taking a small sinus generator and moving it quickly in circles. The Doppler effect will produce a multiple of related, but differing sinuses, with interference as a result. This principle is used in old-school electronic organs to produce a friendly, full sound.

Conclusion

In general, the appreciation and understanding of music is strongly linked to the immediate recognisability of the three aforementioned archetypes. The sooner an archetype is recognised in a musical performance, the easier the communication between the music and listener is established. This power of communication brings a risk with it to music as an art form. Namely: music proves to be capable in manipulating the emotional state of the listener in the aforementioned ways. And that is made use of frequently in commercial music, military music, and film scores. I often refer to these types of music as *'exploitation'* music, in contrast to what the serious composer strives for: the '*exploration'* of music. In practice, these two aspects often mix, although it makes a huge difference which starting position an composer chooses: to be an '*exploiter'* or an '*explorer'*.

And yet another conclusion must be drawn here: the more abstract music becomes, in the sense that it detaches itself from its archetypical model, the more it becomes suited to the experienced, informed listener. From the second half of the eighteenth century onwards, academic circles have attached more and more value to abstraction and it became the main criterion for High or—as Mozart said—*gelehrte* art.

Perception and Recognition of Music through Personal Memories

For an art form that can only be perceived in time (unfolding over a period of time), a well-functioning memory capacity is vital. Musical experience does not offer much more than a memory, an experience that is laid out in time. As we know, our memory capacity has two important components: the short term memory and long term memory. Especially for music, as an art form wherein the immediate perception and understanding is constantly related to already heard and remembered listening experiences, from both immediate and long term past, the way these two types of memory capacities are intertwined is of great importance. As we may know, the long term memory capacity can be unreliable, as many recorded cases of 'false memory' have shown, especially in court cases[20]. One of the reasons for this is that our memory may be 'polluted' with all sorts of subjective, emotional information, which distort the factual recollection of objective events. For the noble art of music, this means that fragments of music can fasten themselves to personal memories of happy or sad times, mostly of a very situational character. So, when we listen to music at a certain moment in our lives, the short term memory capacity allows us to follow and understand that music in the same way we can understand a sentence and a 'text' in spoken language. But the intertwining of the short term and the long term memory capacity makes it difficult for us (in fact harder than in the case of spoken languages) to just listen to the actual music presented at that moment. And since music and emotions are by nature closely related, we thus may burst out into tears while listening to a certain piece of music, because it reminds us of a particular time in our lives. The intertwining of the two memory capacities build up a metaphorical *slide* in us, on which we glide towards different parts of our emotional memory archive. Sometimes there is no stopping this from happening, even if the music which triggers it, is by nature not very special in any way.

The Need for Meaning

We have now seen that there are specific cognitive and neurological processes in the human brain that respond in a defined manner to music. We may view these functions as a basic, biological sensitivity to sound. But sound, which consists exclusively of sonic phenomena – such as: metre, longevity, sustain, the sound of vacuum cleaners, thunder, the sea or sounds produced during orgasm – is generally not yet experienced as *music*. For that to become possible, we need the two other phenomena that I pointed to: the recognition of a narration, either in the form of story, dance or mystical events – and the functioning of our short term and long term memory. Within the latter two phenomena, the two types of memory, the concept of musicality can also be found.

A trained listener has developed a profound focus on the length and the detail of sounds. For humans, it is important that this focus provides us with information. In the event that this focus yields little references to what the listener knows of already, the listener will create his own meaning, which may very well be far removed from the composer's intentions. But in the best case, the listener will come some way towards the composer and use his own musicality to interpret the piece of music. It is fair to conclude that the final shape of a composition is formed, not just by the composer, but by the listener as well – using his, her or their entire personality.

This means that skill, knowledge and attitude are learned assets that make the understanding of a complex and serious piece of music possible. What the listener lacks in knowledge and skill may be learned if her, his or their *attitude* provides for that. In other words: a listener needs to be convinced that a piece of music can be understood as meaningful – and a listener needs to be eager to learn to understand what is done in that piece. This concerns in large the *form* of the piece and the way that form develops what has been done before in earlier pieces. The form itself, is also intelligible and open to a certain logic – even if it concerns 'abstract' notes that are produced by musical instruments that have no other meaning than being musical instruments. Here I am thinking of the narrative, the development, of the form in itself.

This also means, that the listener projects her, his or their own experiences, and what was learned from them, onto the perceived music. The memory of a personal history may be activated and re-actualized by the movements of the musical piece. This is rather difficult to pin down in general terms, and there may well be a certain subjectivity in the way this process happens. But there is also a quality in this activation of the personal and individual, that is really a shared understanding in all human beings. Herewith, I intend the way that certain qualities of musical structures, such as the interference that I have looked into here above, are understood by everybody in a manner that is much alike. In the experience of the feelings that such a quality of sound provokes in all, personal, subjective memories may be activated as well. For instance, feelings of belonging when one went to Church with one's parents when one was a child. Or the qualities of a grand sound that can, in a rather abstract sense, be related to wide and fast landscapes.

So, the autonomous qualities that are developed in the musical form, are connected to other pieces of music (the musical practice) ánd to general and personal experiences. The faculty of memory and the faculty of imagination are both activated whilst listening to, moreover comprehending, musical work. Next to the logic of the musical structures and the development they undergo during the performance of the piece, that is grasped.

Returning to the question I proposed in the introduction of this paper: What is meaning, how does it work? And is it possible to substitute this rather broad term with less elusive concepts?

Meaning appears to have a multifaceted quality. It appears in this paper as a structure that is built from many, rather unequal aspects: the neuro-biological, the cognitive and the psychological, as well as a historical, cultural phenomenon. There are biological, physical qualities that simply occur in our bodies and brains when we hear music. These occurrences are of such a quality, that it is fair to say they concern a deep, emotional experience of our existence. Of our being there. These responses are shared by individuals in all times and relate us to what is around us as well – to what exists like us. The cognitive aspects concern reason and logic, the recognition of patterns and their

developments. But also knowledge and skills, everything that we have learned as 'cultured' beings. Meaning, what we have learned about musical history, of the past and of the world nearby and far. In a more or less argumentative manner, relations are established between qualities of what is heard in music and to what we know of and understand. When we take the psychological aspects in account, the cognitive becomes related to the emotional and the personal experience.

So, meaning can be looked at from different angles, be approached from divergent aspects. I here propose that meaning is an umbrella term, that houses different aspects in it. Really, it can be approached as a structure of relations that are established from divergent perspectives: the neurobiological, the cognitive, the psychological and the historical. When it comes to comprehending a complex piece of music, that is in itself a structure made up of meaningful relations, the form and its developments need to become related to the listener's personality and knowledge. That is why, if we want to find the meaning of a musical piece, we must start by listening to the listener. And after all, the composer is just the first listener. The musicians, that perform the piece, are the second listeners. We are all listening. Only when we listen we may see.

Dordrecht, The Netherlands

Notes

[1] Macdonald Critchley and R.A. Henson, *Music and the Brain*, William Heinemann Medical Books, London, 1977.
[2] Peter-Jan Wagemans, *The Big Composers Cookery Book,* Deussmusic, The Hague, 2021, Chapter 1.
[3] I am not referring to a listener with a theoretical knowledge of music. I mean, comparatively speaking, an experienced restaurant visitor, who does not know the recipes for what he is eating.
[4] Herman von Helmholtz, *Die Lehre von den Tonempfindung als Physiologische Grundlagen für die Theorie der Musik*., Fr.Vieweg und Sohn, Braunschweig, 1896.
[5] In acoustics, a beat is an interference pattern between two sounds of different frequencies whose rate is the difference or sum of the two frequencies. Within the sounding of two tones, consonant or dissonant, these beatings always occur as a natural result, together with the two tones forming the interval.
[6] Ben van Cranenburgh, *Muziek en Brein*, Stichting ITON, Haarlem, 2018.
Critchley Macdonald and R.A. Henson: *Music and the Brain*, William Heinemann Medical Books, London, 1977.
Oliver Sachs, *Musicophilia*, *tales of Music and the Brain*, Alfred A Knopf, New York, 2007.
[7] Laurel Trainor and Becky Heinmiller: "Infants prefer to listen to consonance over dissonance" in *Infant Behaviour Development 21* December 1998, p. 77-88. DOI:10.1016/S0163-6383(98)90055-8.
[8] See Ethology in https://en.wikipedia.org/wiki/Ethology#Fixed_action_patterns.
[9] Maaike van Boven: *Actieve hersendelen bij de perceptie van dissonante muzikale intervallen*, 2012. https://www.scribd.com/document/80189111/Actieve-hersendelen-bij-de-perceptie-van-dissonante-muzikale-intervallen.
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