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NATURAL SOURCES OF MUSICAL MEANING PERCEPTION, MOTION, ARCHETYPAL EMOTIONS, AND THE ARTIFICIALITY OF LOGO-CENTRIC MEANING IN MUSIC[1]

Abstract

The contribution sketches a semiotic of music focused on dynamics and semiogenesis and pursues a naturalizing strategy in the tradition of René Thom's morphogenesis and semiophysics. We refer to three domains of musical meaning: perception, bodily motion, and emotion. The first dimension refers to individual aesthesis in human ecology, the second is psychophysically grounded in bodily motion and locomotion, and the third refers to an emotional space basic for human communication. Perception, specifically the aesthesis, is the immediate attention, reaction, and recognition triggered by our sense organs and sensory brain centers. Basic motion patterns like bipedal marching have been acquired in human evolution and unfold epigenetically in early childhood. They are the source of temporal patterns in dance and music. Basic emotional forces, or "ancestral passions", are another origin of music's meaning. The articulation of these dimensions in human musical perception and performance is specified, and some examples of musical phenomena are given.

Eventually, the logo-centric meaning in music in a motet by J.S. Bach is analyzed as an artificial limit case demonstrating the difference between language and music.

[1] This article is an augmented version of the author's contribution to the 15th International Congress on Musical Signification, Barcelona (15.-19. June 2022). The semiotics of music are treated in Wildgen (2018; in German); some aspects are elaborated in the context of the morphogenesis of symbolic foms (music,art, myth/religion, and language) in Wildgen (forthcoming 2023a; in English).

1. Introduction: The embodiment of music and ecological semantics

The analyses of meaning in language and other symbolic forms, e.g., music and visual art, have evolved the last decennia from descriptive treatments to consideration of cognitive aspects, space (the spatial turn), and aspects of embodiment, i.e., consideration of the whole body and not just the brain as relevant background. However, the human body (and brain) is in an evolutionary continuity with other animals and dependent on the ecology, climate, and physical context, in terms of Gibson, the affordances these contexts provide. The meaning of utterances, music, or visual designs goes beyond "construals" in the human mind and more or less arbitrary attributions of contents to linguistic or musical signs (cf. the "arbitraire du signe" as a central characteristic of language for de Saussure). For René Thom, the French mathematician and philosopher, the physical world, the body / the brain, and symbolic forms like language and music stand in the continuity of cause and effect. Scientific theories in this field should be able to cover this continuum. He proposed the name "semiophysics" for such an endeavor. It chooses a strict naturalizing strategy. In the case of music, this means a preference for aspects of musical meaning that can be connected to natural phenomena lying outside the proper domain of music and thus promising candidates for the explanation of musical meaning. Three foundational domains are considered: the transition from affordances in the ecology of humans to musical perception and performance, bodily motion (linked to physical kinematics) and temporal patterns of music, and archetypal emotions as basic motivations of musical meaning and musical communication.

2. Musical perception and the first semiotic level: aesthesis

To find the meaning of musical signs, we must first ask for the fundamental meanings of acoustic signs in the context of human hearing. Since this was optimized in evolutionary history in certain directions, questions of the function and the biological impact of hearing arise. In the evolution of hearing in the animal kingdom, two lines are to be distinguished, which are also manifested in the construction of the human inner ear.

1) The balance organ is primarily responsible for the adjustment to gravity (top-bottom) but also corresponds to frequencies from 100 to 500 Hz at a sound pressure of 70 to 80 decibels. Deep and loud sounds and prominent rhythms, such as in dance music, lead to "hearing" with this organ.
2) The cochlea was developed in land-living animals in the Devon period about 380 million years ago (see Todd, 2016: 32). It has a broad spectrum of hearing in humans and very high sensitivity.

2.1.The perception of bass tones and rhythms (regarding the organ of balance)

The bourdon produces rather static, mostly deep sounds, which serve as a reference point for the melody line. They are often built into the instrument, such as the bagpipe or the hurdy-gurdy. Mostly they are tuned to the basic tone of a chord or the fifth. In Western music history, the basso continuo or ostinato played an important role in the 17th and 18th centuries, and modern rock and pop music rely on very intense bass tones. It is this component of music that strongly motivates body movements. This music component is closely linked to whole-body responses in the individual and the collective attunement to a simple, repetitive motion stimulus. The musical sign refers to the physical/physiological effects on the individual body.

Secondarily it serves the coordination of movements in the group, for instance, in dance, at work, or in a battle. The Scottish bagpipe, for instance, was a typical accompanying instrument in a battle, and "drums and pipes" continue to be an attraction for the modern public. In the Napoleonic battles, "Fifres et Tambours" (pipes and drums) were also the essential elements of the "Garde Impériale" (imperial guard). This intensive and loud music with a repetitive pattern bundles the attention and thus reduces the general stimulus and information flow. This characteristic has the opposite effect compared to discourse or conversation.

2.2.Musical perception linked to the human ear

The cochlea (in the inner ear) and auditory stimulus processing are characterized by their frequency domain (20-20,000 Hz), their sensitivity, the rapid processing of very complex sounds, and polyphonic or polyrhythmic structures. This feature is a prerequisite for the rich musical traditions which have arisen in almost all world cultures. The invariants behind this cultural wealth are in the laws of physical and auditory acoustics. Consequently, auditory perception has been tuned to these laws. The ecology of hearing unfolds the "affordances" of the natural context of humans (see ecological psychology and Gibson, 1966).

The physics of overtones in the human voice and musical instruments is an important pillar of human perception and controller of musical forms. The overtones define a space of simultaneity and have a regular physical (and physiological) equivalent. The human vocal tract roughly corresponds to an open tube on one side. Essential for the tube are, firstly, the vibration depends on the length of the tube. Secondly, the sound shows the simultaneous presence of harmonics, whose intensity decreases with frequency. This results in the so-called natural tone series, based on a division of the tube length by the natural numbers 1, 2, 3, 4, 5, 6, 7, 8, etc. Intervals naturally become smaller and smaller until they reach the threshold of human interval perception and perceptual intensity. A natural tendency in the cultural expression was a limitation of the admitted dividers to 1, 2, 3, 4 (Pythagorean scale).[2] On the world scale, many different scales and intervals can be found; this diversity points to the cultural nature of musical sign forms (cf. for the notion of "experiential meaning potential" in social semiotics Kress and van Leeuven, 2001: 75).

At the same time, this paradigm can be stretched in time, i.e., the resonating overtones can be "spelled out" as elements of a melody. As a result, the syntagmatic (sequential) order inherits the natural ordering system of the overtones. This feature can be seen in the tonic scale steps (I to VII) and the important tonic levels: Tonic (I), Dominant (V), and Subdominant (IV), which show up most clearly in the classical final sequence (cadence) I – IV – V. An insight into the conventionality of this system prepared its abolition in the so-called atonal or pan-tonal music of the 20th century. The space of possible auditory distinctions is huge at this primitive level. For example, Sundberg (1991: 62) computes a maximum of 1400 pitch distinctions and 280 distinctions of loudness. This wealth amounts to a space of c.a. 400.000 distinctions.

[2] Didymus (1st century BC) added the prime number 5 (and divisors with five as a base), but all higher prime numbers, i.e., 7, 11, 13, 17 ... and their multiples were excluded as divisors. The restrictions imposed by Pythagoras and Didymus were the expression of cultural (conventional, artificial) design and the transitions from natural to symbolic forms. Nevertheless, no consistent transposable scale can be set up regarding number theory.

As a consequence of these conditions of sound perception in humans emerges the phenomenon of categorical perception, i.e., the transitions from continuous scales (in physics) to boundaries imposed on this continuum, together with a radical reduction of the space of choices in musical perception.[3] Musical perception does not only concern single musical sounds but simultaneous complexes (cords) and sequences (themes, melodies). The physical and physiological interaction of single sounds with their array of overtones (contrary to sinus weaves) produces auditory effects called rough timbre or ugly combinations (cf. Sundberg, 1991: 70). These phenomena can be modeled in dynamic systems theory as periodic, quasi-periodic, and chaotic dynamic patterns.[4] The holistic feature of consonance and dissonance is an immediate effect of these natural, non-conventional patterns of musical perception. Aesthesis, i.e., the immediate gestalt characteristics of musical perception, emerge from the physical and physiological laws and their correlation due to evolutionary processes. The dynamics of aesthesis build the immediate ground of musical meaning and open the mind's window for it. [5]

3. Patterns and forces of human motion and their mapping into musical meanings[6]

Intra-corporal multimodal references provide a second level of musical meaning.[7] A central field of such references concerns bodily motion and locomotion. Many authors in the tradition of Lakoff and Johnson (1980) argue that the connection is a kind of metaphor:

> Musical motion must be some metaphorical motion that takes place within a metaphorical space. One purpose of this chapter is to explain the metaphoric structure and logic of such motion and to ask what this means for how we experience and understand music.
> (Larson 2012: 63)

"Metaphor" is a traditional concept issued in antique rhetoric and poetic. It is a high-level concept for analyzing artful language uses and cannot clarify basic cognitive or even physiological processes underlying the performance and comprehension of music. Human motion and locomotion are first linked to physical processes in space/time; second, they exhibit motor processes of the body controlled by cognitive dynamics and specified in basic learning processes. They are not high-level functions of human creativity or poetic refinement. Third, in multimodal processes, for instance, dance, music is linked to human motion, induces or coordinates motion. At a sophisticated level of interpretation, even unimodal music, e.g., a melody, may be associated with motion (of humans, animals, water, etc.).[8] The theoretical background of the naturalizing strategy is the concept of morphogenesis specified in Thom (1972) and its elaboration to a "semiophysics" of symbolic forms. Some remarks may clarify the background of our analysis.

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[3] This transition is the classical topic of catastrophe theory and is encountered on many levels of semiosis. Cf. Wildgen (1982) for catastrophe theoretic semantics

[4] Sundberg (1991) mentions that if one adds a bass tone this may "mask these ugly combinations" (ibidem: 70)

[5] Salience („saillance") and vital relevance ("prégnance") point to the natural, invariant part of semiosis and the culturally basic aspect of meaning; cf. Thom (1988) and Wildgen (2010).

[6] In this section, we took profit of the literature assembled and commented on in Han (2021), a doctoral dissertation at the University of Sidney that we reviewed in May 2022.

[7] The coordination of aesthesis and motion with other persons eventually leads to social semiotics in the sense of van Leeuven (2005). we cannot cover this large collective "meaning-making" field in this short contribution.

[8] The epistemological issue of a naturalization of theories in the humanities is a concern of Wildgen (2023a, forthcoming), mainly in chapters 1.4 and 7.

Thom took up Aristotle's idea of "genus" (type) and introduced the terms "prégnance" and "saillance", which make up the heart of his "Semiophysics" (cf. Thom, 1988; Petitot, 1992, and Wildgen 2010b). Similar developments were at the heart of Hermann Haken's "Synergetics" and the models of the neuroscientist Scott Kelso (1995; Dynamic patterns: the self-organization of brain and behavior). The shared strategy of these groups may be called "From matter to mind", i.e., the theories of the human mind are systematically founded on biological and physical systems theory and focus on the continuity between the natural and the human sciences.

In his book Esquisse d'une sémiophysique (Sketch of a semiophysics, published in 1988 and translated to English in 1989), Thom tried to link the forces of the morphogenesis of meaning (semiogenesis) to primary magnitudes known from physics, i.e., gravitation, radiation (light), etc. These universal fields embed the living beings and govern their environment (ecology). They are naturally the background of all perceptual and motor processes. In perception, light is at the basis of our visual perception; gravitation underlies human and animal motor processes and the sensation of pressure and weight; the ear registers sound waves, and the diffusion of chemical substances evokes reactions of our taste and smell organs.

As the dynamics of such fields (e.g., light) have been the topics of physics since Newton and wave dynamics the subject of specific mathematical treatments since Maxwell, it was apparent for Thom to postulate a particular field registered and filtered by our sensory organs. He called it "saillance". The psychophysical field selects these effects as the most informative. Thom's program was to extract as much systematic content as possible from the analogy between physical and perceptual fields. Perception is the primary stratum of semiosis, and any perceptually based symbolic structure elaborates it. Although this strategy from physics to semiotics allows for the transfer of many mathematical techniques, there remains a large gap between psychophysics (the level of perception) and linguistics (or cultural semiotics). The term "prégnance" had to fill this gap and explain the transition from perceptual reactions to symbolic forms (culture).[9] The dichotomy "prégnance" (perceptual relevance) versus "saillance" (vital importance) introduced by Thom has a precursor in Aristotelian philosophy. The corresponding notions for this duality are *dynamis* (δύναμις) or *energeia* (ἐνέργεια) versus *morphe* (μορφή) and *typos* (τύπος); cf. for more details Wildgen (2023a: Chapters 1.4., 6.8., and 7.5.

3.1.Tempo, rhythm, and directed motion as references in musical semantics

The human gait in walking and running is a major source of rhythm in music. It appears in multimodal phenomena involving music like a march- or dance music. The double meter

[9] In linguistics, responses to Thom's proposals were either simple repetitions or purely meta-theoretical. However, Thom's ideas were rather meant as stimulation for further research (comparable to his conjecture of a classification of unfolding dynamical systems that led to the mathematically elaborated classification theorem of singularity theory). After a phase of vague acceptance, linguists (in Europe) returned to the fleshpots of structuralism and its phenomenological epistemology. Cf. the critical comments on catastrophe theory in Piotrowski and Visetti (2017: 25f).

seems to dominate, but the triple meter is quite frequent.[10] Walking and dancing are subject to coordination dynamics, i.e., the motion of the right and the left leg are coordinated. In horses, the speed of locomotion changes the motion pattern abruptly. In a simple experiment, the in-parallel motion of fingers changes to an antiparallel due to higher speed (cf. Haken, 1996: 69). Kelso (2021) uses the model Kelso-Haken-Bunz in Synergetics to describe such coordination processes generalized for different levels "From Matter to Mind". In this line, musical rhythms can refer to coordination patterns in the auditory brain, among groups of different muscles, and finally between physical subsystems in a cooperative mode (Hermann Haken took the basic mechanism from Laser-physics, other classical mechanisms are coupled oscillators).[11]

A side effect of this correspondence is that the rhythm can be implemented technically by a rhythm machine or be controlled by a metronome. A detailed analysis of natural performances shows that professional musicians deviate from mechanical rhythms. Symmetries are broken, and fractal patterns are generated; the musician deviates minimally from a given pattern in every repetition. The highly regular pattern that theorists since Pythagoras found in music is only half of the truth. Stochastic or chaotic deviations are omnipresent. Cf. Wildgen (2018: 167f) for this topic.

Different parameters can characterize the forces operative in human motion and locomotion, for instance, intensity (strong – light), tempo (fast – slow), direction (directed – non-directed), and others; cf. Han (2021). In music, we can distinguish parallel qualities that correspond with motion parameters: (loud – soft) is correlated with the intensity of motion; adjectives like adagio, presto, etc. refer to tempo. Directed motion is mapped to musical patterns that strive to a final or intermediary end, e.g., marked by cadence or a finalizing formula in a symphony (stretto or closure). Undirected motion patterns can be recognized in variations and decorations of a musical theme. This level of musical meaning can still be called natural or indexical (in terms of Peirce). It does not presuppose traditions, cultural codes, or extensive learning. In its semiogenesis, it is sufficient that the general dynamic patterns are mapped into the space of musical perception and performance. The mapping from bodily motion to musical patterns is a bodily process that does not need higher cognitive processes or language. It is prevalent in sound perception and performance in the animal world. Humans share this dimension of "natural" meanings with animals. This explains why human music and the "music" of birds or even the "music" of wind and weather are so near to one another (cf. Camille Saint-Saëns and his composition: The Carnival of Animals).[12]

[10] In social semiotics (cf. van Leeuven, 1999: 48f.), the duple meter is associated with the meaning "collectivity" (cf. marching or dancing in groups), and the triple meter with "artificiality/ nobility".

[11] Human motion was already a topic for Galilei, the founder of modern kinematics and dynamics. In Synergetics, an interdiscipline based on laser physics and thermodynamics, the gaits of animals and the coordinated motion of humans are analyzed on par with other spatio-temporal patterns in the inanimate world; cf. Haken (1996: Part II: Behavior).

[12] Such a mapping should be separated from the linguistically and rhetorically mediated "metaphors" that many analysts take as the basic dynamics in the construal of meaning (cf. Johnson, 1987).

The gesture is a particular form of movement that emerges from bodily movement.[13] It contains an intentional momentum, e.g., nodding, pointing, or eye-gazing. A melody may be decomposed into several gestures, some of which are within the boundaries of beats, some exceeding them. Indirectly gestures establish an external reference, i.e., the sphere of musical meanings goes beyond ("transcends") intra-body references and their empathic transfer to other bodies. A musical gesture can be a short melody or a phrase in a larger piece of music. A higher level of organization is reached by "phrase groups". At this level, conflicts may appear. Drums or other rhythm instruments can express the dimension of the body-based meter. Thus, Bob Dylan performed the rhythm on his guitar and sang the song; sometimes, he added a melodic phase played with his harp. His singing, however, depends on the phrase structure of the text. In the coordination of both dimensions, a rich field of interactions appears, which is further complicated by microstructures, i.e., small deviations, often characteristic of the style or the performance of a singer/musician. Eventually, quasi-rhetoric patterns appear in the sequential schema of Exposition, Development, Recapitulation, and Coda. The art of sequential organization can be admired in Bach's work on fugues and the tradition of counterpoint. Although such sequential patterns may allude to syntax in human languages, a denotative, descriptive, narrative, or even argumentative organization of meanings and referential intentions is lacking. This is not a shortage but a virtue of musical communication. The complementary nature of musical versus linguistic meaning opens the field for enhancing interactions between language and music in multimodal performances.

3.1.Musical meaning understood as the result of forces

Physical forces apply when a movement is redirected (change of direction), accelerated, or decelerated. Larson (2012) refers to three physical forces, e.g., gravity, magnetism, and inertia, and he "sees musical meaning as (at least in part) an emergent property of musical forces" (ibidem 313). However, Larson understands "musical forces" in the sense of Talmy's "force dynamics", i.e., as a musical theory linked only metaphorically to physical theory, whereby the transition level of psychophysics is ignored. In our semiophysical view, musical forces are embodied physical forces. Three types of musical phenomena can be linked to embodied forces:

1. The *rhythm* can be doubled, varied, speeded up, or slowed down.[14] Maxima (minima) of force effects can be reached and left again. The profile of maxima and minima gives a dynamic profile characteristic of the piece of music. The acceleration and deceleration are indexical to mental or emotional movements (based on imagined physical movements). The audience is moved (accelerated, decelerated), goes along, or is synchronized with the rhythm of the music. Often a balance is sought over a longer period; acceleration is followed by deceleration.
2. The *melodic* structure of a song can start from the main tonic level and end with it. In the intermediate field, dominant and subdominant transitional fields build a tension of difference. In piano playing, the two hands can have different melody lines, or one hand

[13] Donald (2001) calls gesture a "pre-linguistic stage of development". Cf. also Hatten (2017) for a description of the role of gesture in the analysis of music. He refers to the research on coordination by Kelso and others (ibidem 99),

[14] Messiaen (1944) proposed complex transformations of the rhythm. For example, adding an eighth note or the punctuation of a note produces the modified rhythms: 3/4 → 13/16 or 2/4 → 5/16 (see Bogue, 2003: 26

can have an accompanying and decorating function. The same applies to the choir (canon or polyphonic singing) and orchestral music. The art of counterpoint exploits the tension between the main motive (Dux and its variations) and the countermovement (Comes). The iconic reference to gestures (e.g., visible in dance) implies a gestural dynamic consisting of accelerated/slowed gestures, stagnation, complication phases, and intensity maxima.

3. Melody and pitch movements are paths in the landscape where the dissonance minima are points of rest. They are "attractors" (here, the movement seizes), dissonance maxima are avoided, and they are "repellors" in the terminology of dynamic systems theory. Moderate dissonances serve as transition zones. All these movements generate tensions, which can contribute to a specific musical meaning.

The mathematician and physicist Leonhard Euler (1707-1783) had dealt with the determination of dissonance/consonance as early as 1739, setting up a sequence of consonances: prime > fifth > fourth > major third / major sixth > minor third / minor sixth / great second > minor seventh > major seventh > minor second, and the Tritonus (see Mazzola, 1990: 57). In general, musical intervals can be described by a landscape of attractors (sinks of a potential). Figure 1 describes a potential landscape of musical "pleasantness" in Chella (2015: 196); cf. for further information Mazzola (1990: 61).

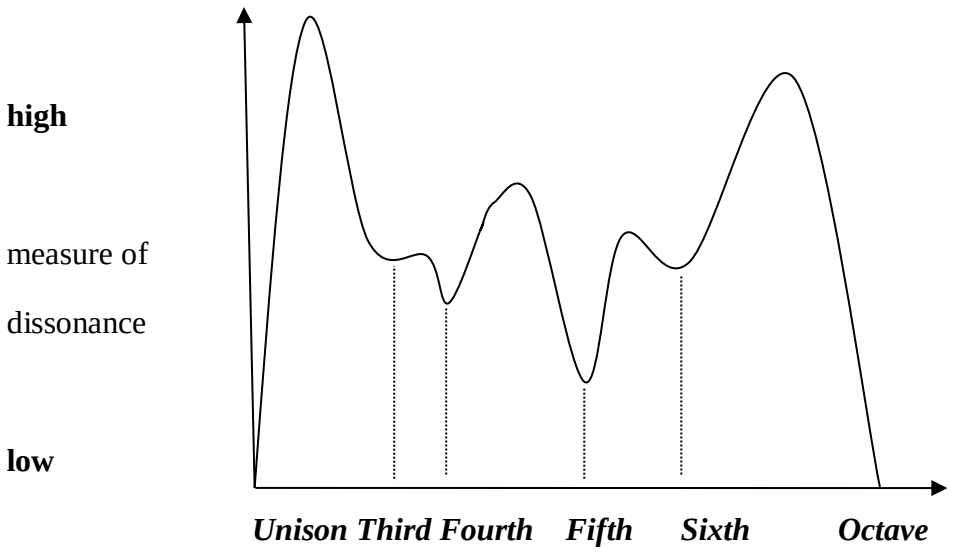

Figure 1 Degrees of dissonance according to Chella (2015: 196)

3.2. Melody and motion in a musical space

Melody can be memorized, stimulate repetition and, as a whole, justify attention and appreciation. In larger pieces of music, different melodies or a family of roughly similar melodies show up as motifs. The melody or motif can be repeated, varied, and transposed. It usually has a frame in the form of a vocal range, e.g., when the song is related to the comfortable tonal space of a male / female voice. An upper and lower edge specifies the space of tonal "gravity", and the middle, the intermediate or balanced zone. The melody can go from the bottom to the top, stay in the middle for some time, progress step by step, or move

variably back and forth.[15] In addition to a general up-and-down movement, one can also observe fast-changing variations of the melodic line, as they often occur in jazz variations. Finally, the experienced instrumentalist "decorates" the melody line with further movements and trills.

The course of the melody has a center that can be used as a standard or as a zero expectation of melody progression. The current melody is the deformation of this standard, and the amount of deviation from the center determines the deformation energy. Some songs in the field of folk music and songwriters have a flat melody curve that approximates the intonation in a linguistic utterance. The curve then descends towards the end of the line or stanza or increases (as in the intonation of questions). Leyton (2004) interprets these deformations as a "memory", i.e., as a piece of information about forces that have become effective and have influenced the design of the melody. For the performer, such as the singer, these forces correspond to the voice's efforts to produce and control higher or lower notes. One can assume similar forces for the listener: perceiving, recognizing, and processing tones. Powerful and low-energy passages can alternate in a song or music. The final result may be balanced, or the ascending or descending forces predominate. These movements are perceived as sign shapes and may be associated with an emotional meaning, cf. next section A downward movement may, e.g., express sadness or resignation; an ascending movement, on the other hand, exultation or hope.

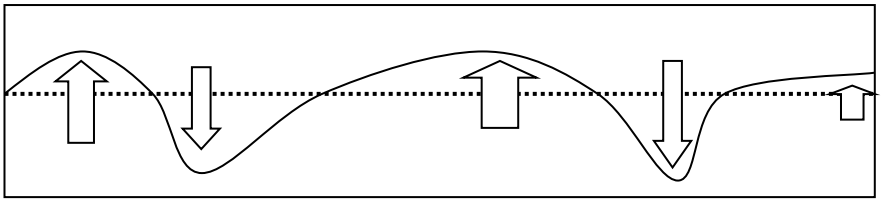

Figure 2 The melodic line as the outcome of forces (cf. Wildgen, 2018: 171))

The partial movements of the melody can also be assigned to a chord scheme, i.e., they realize in time the consonant notes of a chord or a dissonant combination of pitches. These movements and tensions (which refer to forces) thus represent the basic line in the meaning of a melody.[16]

Example 1: Melodic moves in the song "Halleluja" by Leonard Cohen

[15] In jazz "giant steps" are characteristic for some styles; cf. Brandt (2015: 258).

[16] The duration of individual notes also plays a crucial role. In the late Middle Ages (13th and 14th century in Europe), the duration of the notes, which were originally based on the length of the syllables (long vs. short), was further differentiated. The mensural notation facilitated the fixation of this innovation. In polyphonic music since Renaissance, one voice could be noted in longer note values (for example, the bass), while the other voices used much smaller note values, that is, a faster movement.

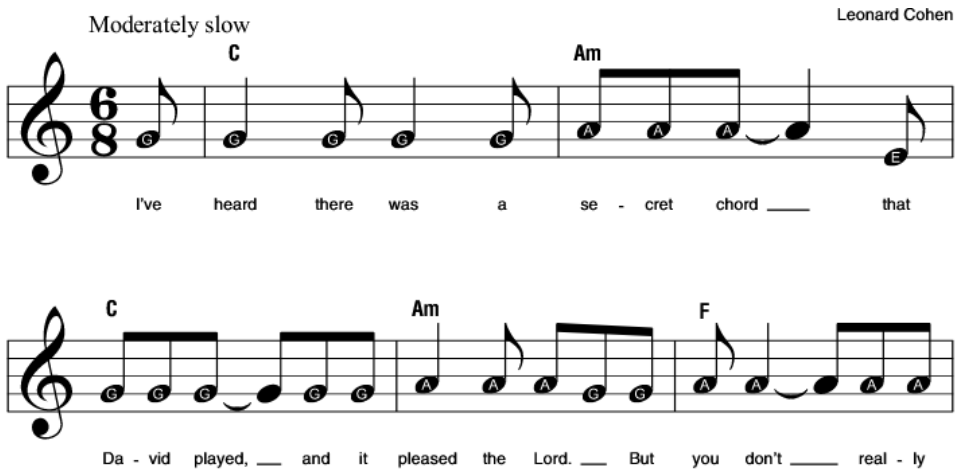

Figure 3 First two lines of the score of the song "Halleluja "by Leonard Cohen

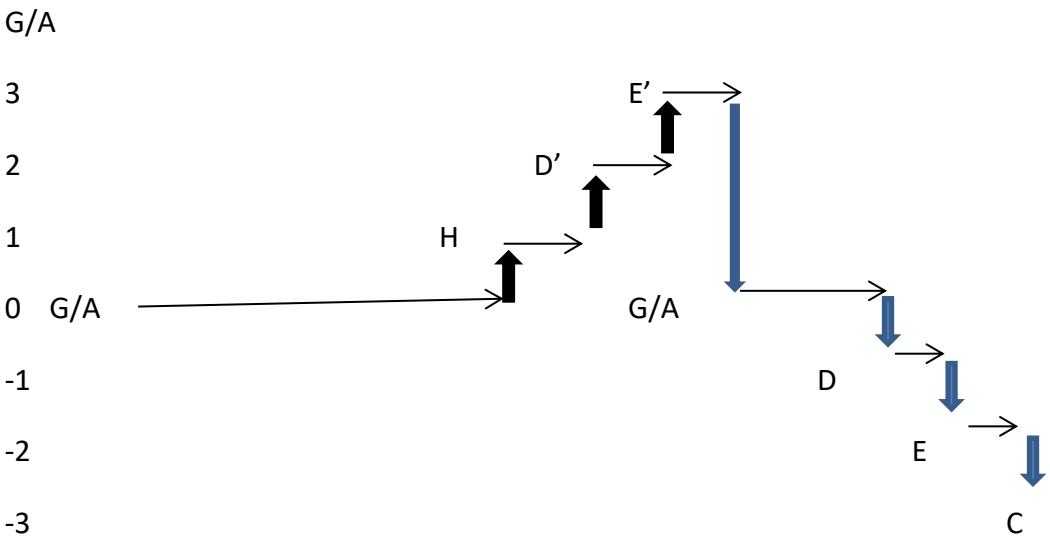

Figure 4 Motion and force in the song "Hallelujah" by Leonard Cohen

The melody moves in a flat curve around G / A in the first ten beats. After "It goes like this", it climbs up in steps until it reaches the E', more than one octave above the resting point C, which is also the standard of the chord in which the song is written: C / A_m . The repeated "Halleluja" descends in a wave-like movement until it reaches the lower and final C, the resting point (the song is written in C). Cf. the analysis in Wildgen (2023a, forthcoming: Chapter 3.5.1.).

Professional singers can range up to two octaves. The normal range of a male singer is little more than one octave. Leonard Cohen starts on a deep level (like a bass). Thus he can master the range between the low C (the final note) and the high E' without difficulty. For many lay singers, the range of this song asks for special effort. The central area between C(low) and E high is around G/A.

4. The space of emotions as a source of musical meaning

Until recently, emotions could only be described intuitively, i.e., no new sources of experience enabled going beyond the classifications of antiquity. This situation has changed with modern comparative and evolutionary neurology. Damasio (2000: 79) writes:

> The substrate for the representation of emotions is a collection of neural dispositions in a number of brain regions located largely in subcortical nuclei and in the brain stem, hypothalamus, basal forebrain, and amygdala. In keeping with their dispositional status, these representations are implicit, dormant, and not available to consciousness. They exist rather as potential patterns of activity arising within neural ensembles.

He adds (ibidem 81): "For an organism to know that it has a feeling, it is necessary to add the process of consciousness in the aftermath of the processes of emotion and feeling". In the case of music, the unconscious aspects of emotion are the primary candidates for musical meaning. The listener or musician may become aware of his feeling in hearing/playing a piece of music. However, these associations are only secondary meanings of music (compare the "attribution of causality" in gestalt psychology of perception launched by Heider, 1944).

Based on neurological observations (brain scans, local stimulations) and experiments (mainly with animals), Panksepp and Biven (2012) propose "ancestral passions", i.e., evolutionarily fundamental emotional reactions.

1. SEEKING: "The SEEKING system wants to motivate her [the mother] to find food and shelter" (ibid.: 25).
2. AGGRESSION / FEAR, or LUST / PLEASURE.
3. PANIC / GRIEF: It is evident in separation distress and is closely linked to CARE.
4. PLAY. The field of available behavior is systematically explored in the play/game. This emotion develops in childhood and gains importance in adolescent individuals.

For example, the passion called PLAY which is central in the case of music, may be illustrated in Bach's work on fugues. An important aspect of PLAY is the feature "experience-expectant", i.e., the participants are in a state of expectation of a joyful, pleasurable experience. Therefore, they expect certain moves, are surprised when different ones surface and build up new expectations.[17]

Example: Bach's fugues and the PLAY of pursuit/escape

The name fugue derives from the Latin Fuga, escape. The process of fleeing is presented in such a way that a theme is introduced (in one voice, e.g., in the tenor), and this is picked up by another voice, which carries the theme further and passes it on to another voice, the voices already introduced are continued; they follow the "stolen" subject. A simple form of this

[17] The expectancy normally presupposes a framework; in classical Western music, for instance, the tonal framework. The play in music may refer to other play modes, such as dance as a play, or specific contexts, such as dance in the Imperial Palace in Vienna in the case of Mozart.

game is the popular canon; while one part of the chorus continues singing, the other part begins the melody at a different time. In the end, all chorus parts end on a final chord. The basic motions and forces have an analog in the children's game pursuit and, since the 20th century, in very frequent movie scenarios (mainly in Western movies and detective stories; cf. Wildgen 2016 for "movie physics").

The escape/pursuit consists of two moving people walking the same way but at different times and places.

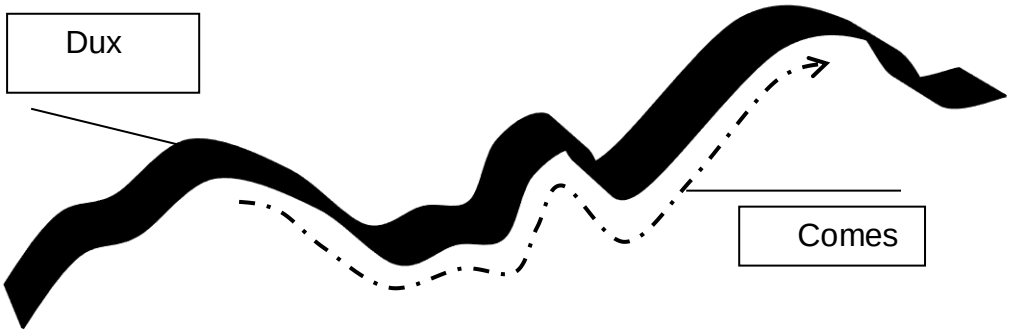

Figure 5 Track of a pursuit/escape as a model of motion and force in the fugue

In addition to the Dux (subject 1) and the Comes (subject 2), a countersubject can complement the first subject and the second, and free voices and interludes can be inserted. The macrostructure can be divided into an exposition, a development, and a stretto with a cadence.

As seen from the preceding, musical meanings can be interpreted as movements in an emotional space. In some cases, subspaces may also come into play. For example, a battle song or musical accompaniment in a battle (e.g., in Napoleonic times) mainly activates the RAGE dimension (and possibly, the enemy's FEAR dimension). By contrast, the songs for children and lullabies are more likely to affect the CARE dimension. Generally, however, the PLAY dimension dominates. The PLAY dimension can be culturally elaborated, cf. ball plays, chess, and others. Wittgenstein showed that even a language could be understood as a play ("Sprachspiel"; cf. Wittgenstein, 2003: § 66). In a play, motion patterns in joyful locomotion and gesturing are coordinated with the emotional motivations in the experience of behavioral variants and innovations. Thus, motion and emotion are coordinated into one behavioral habitus.

5. "Preaching" music, or J.S. Bach as a semiotician of music on par with Peirce

Diagrams are one type of iconic sign (other types are images and metaphors); Peirce speaks of "hypoicons". The most important relationship is resemblance: "It is a sign related to the object only by virtue of its own characteristics" (Peirce CP 2.247, quoted in Brunner, 2009: 345). In this sense, musical notation is a diagram since the lines show the passage of time, and the positions of the note heads show the pitch concerning a pitch scale.[18] Further symbolic markings are added. The performer translates these diagrammatic signs into finger

[18] See Wildgen (forthcoming 2023b) for a discussion on diagrams in linguistics and semiotics with a focus on the diagrammatic representation of dynamical features.

and arm movements (in the case of the violin and piano). The corresponding movement figures are, in turn, diagrams of the notation. However, is the music itself a diagram? What is the structural similarity, and what extra-musical structure does it contain? We want to use an example to explain the possibility of a systematic structural similarity between the music and the lyrics, i.e., the statement of a song text.

A special kind of diagrammatic image relationship exists between lyrics and melody. In a hymn or motet, the text provides the basis of content; the musical statement can depict, imitate, and represent in a diagrammatic mode at least selected words of the lyrics. A concise example is J.S. Bach's motet, "Jesu, meine Freude" (Jesus, my delight), BWV 227. The first line in the verse below contains a negation pronoun *nichts* (nothing), and a negation particle *nicht* (not) in the third line. The meaning of these words is reflected with musical means and thus strengthened in the bimodal performance (music and lyrics). For example, in the score of the line "Now there is nothing damnable about those", it is noticeable that with the word: "nothing", all four voices make two half pauses (▬ ▬), a clear interruption that has the effect of a signal, especially after the "nothing" has been repeated.

Now there is nothing damnable about those

who are in Christ Jesus

who do not walk after the flesh,

but according to the spirit.

(Translation W.W.)

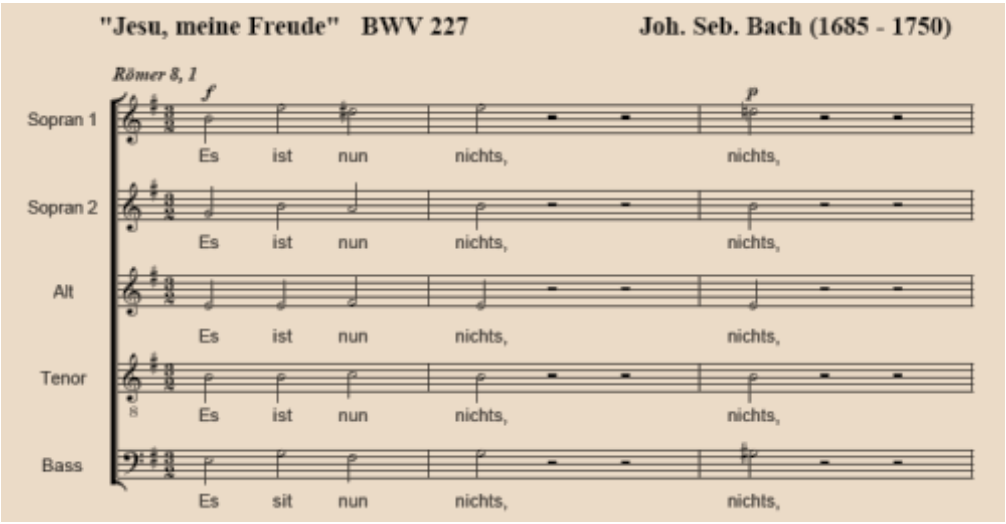

Table 1 Beginning of the first line in the motet "Jesu, meine Freude"

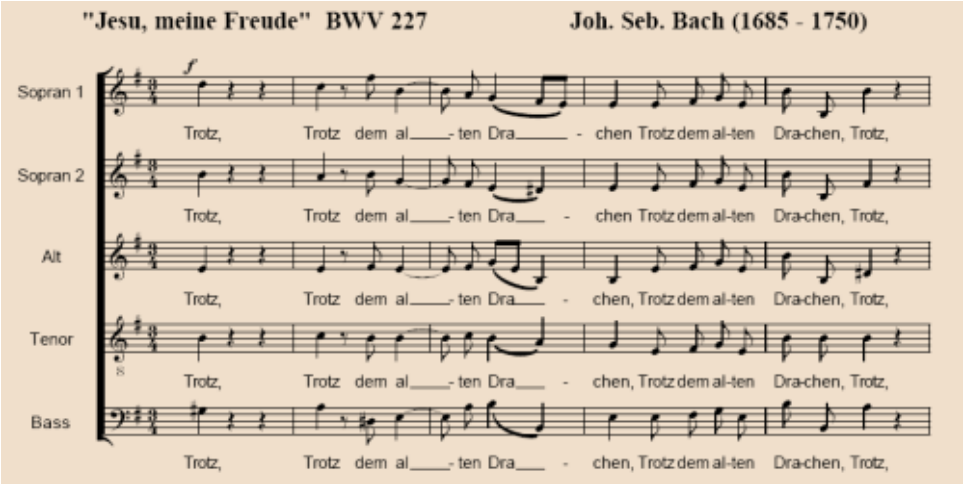

Table 2 Second section of the motet "Jesus, meine Freude" (first line)

Despite the old dragon

despite death's throat,

despite the fear of it!

Cavort, world, and jump;

I stand here and sing

in absolute peace!

(Translation by W.W.)

The second verse reproduced above demonstrates the same type of "translation" of the linguistic part into a musical effect. The triple appearance of "despite" is marked by two short pauses (𝄽, 𝄽). Brief interruptions (in all four voices) occur again after *tobe* (cavort), i.e., the musical device of the interruption or pause so conspicuously introduced in the first verse is continued as a motif but weakened. This technique is an astonishing invention by Bach, and he may be compared to the innovative proposal for diagrammatic logic by the semiotician Peirce. Consequently, J. S. Bach can be considered a precursor of Ch. S. Peirce, the father of modern semiotics.

Like conjunction and disjunction, negation is a central element of propositional logic, and Peirce introduced graphic correlates of propositional logic in his diagrammatic logic. The conjunction corresponds to the simultaneous presence of two (or more) markings on the "statement sheet". On the sheet of music or the musical "expression sheet", two motifs that appear in the score are connected by conjunctions. Peirce represents the negation by graphically encircling and thus separating it from the context (it is a "cut); cf. Peirce (1907). Bach links the negation pronoun (*nichts*, nothing) or the contrary preposition (*trotz*, despite) with pauses; he separates/cuts them from the continuous action of the polyphonic song. In this context, one can speak of an iconic (diagrammatic) representation of the negation or the restrictive preposition. At least on the level of propositional logic, the logic of musical form can be established in analogy to Peirce's diagrammatic logic. When applied, however, this requires collateral knowledge (cf. Brunner, 2009: 355). The fundamental difference to

propositional logic is that reference is not made to a world (facts of the world) but to the space of musical meaning described in sections 2, 3, and 4.

6. Three major root systems of musical meaning

Most authors in the field of music agree that the reference to objective states of affairs in musical communication is absent or very vague, variable, or marginal. In Peirce's classification of signs, the indexical (or existential) relation between the sign body (representamen) and the sign object may exist in the ecology (world) of the sign user. However, they can also be culturally fixed contents experienced in artifacts, rituals, music, paintings, etc. This "existence" can be opaque to human consciousness and only have roots, feeding channels related to archetypal and therefore shared contents in the minds of sign-users.[19] Semiotic entities are not the mirror of a world outside human communication. Nevertheless, root systems can feed the sign system (linguistic, visual, or musical) with the necessary ingredients to keep it alive, functional, and relevant in human ecology.

In the case of music, we found three different subsystems of referential (existential) roots:

1. The immediate perceptual reaction to sound cues on two levels, the balance organ and the cochlea (and other neural centers).
2. The instinctive and learned patterns of motion and locomotion, human action, and reaction. They respect the laws of kinematics and dynamics, i.e., the physics of the external world indirectly via the principles of sensory and neural mechanisms. They appear in bodily rhythms controlled by music, such as dance and cooperative action.[20]
3. The emotional root system is based on whole-body reactions to the ambient world and specific cognitive relay stations in the human brain, such as the hypothalamus, the amygdala, the limbic system, and, more generally, the psychosomatic functions of the human body. These unconscious mechanisms (emotions) can emerge in human consciousness (feelings) and lead to elaborated musical meanings in culturally unfolded music.

Meanings characteristic of linguistic forms open to reflection and interpretative reorganization (rationalization) are not basic for musical meaning. In special cases, the composer can introduce implicit cues that link linguistic content (in the lyrics) to a musical feature; this was demonstrated in the case of Bach's motet. An easier alternative consists of attributing musical forms to linguistic forms via multimodal performances where musical and linguistic forms coexist with visual and enactive performances on stage. Similar multimodal sign complexes are characteristic of visual/linguistic narratives parallel to film scores or multimedia performances in general. In the 19th century, symphonies and symphonic poems (Beethoven and Smetana) tried to give referential content to music (indirectly political function as in Smetana and Wagner). In social semiotics, such aspects of meaning are put to the fore. However, such elaborations approach the limits of musical communication. Therefore,

[19] Many models of meaning in 20th-century structuralism viewed meaning as a shadow of the sign form experienced (heard or seen). This view alludes to the religious model that understands the soul as something accompanying the body like a shadow. This problematic conception is further discussed in the chapter of Wildgen (2021: 92-95) on "Religion as search for the soul" (in German). Structural linguistics in the tradition of Bloomfield and Harris implicitly refer to the empiristic view of meaning in behaviorism, where the consideration of meaning and reference is labeled as a metaphysical question and neglected being beyond scientific concerns.

[20] The psychophysical and physical roots of human communication are foregrounded in the "Semiophysics" advocated by Thom (1988), elaborated in Petitot (1992), and applied to film semiotics in Wildgen (2016).

linguistic semiosis is neither a precondition nor a natural source of musical meaning.

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