

FROM THE CONCEPTUALIZATION TO THE FORMALIZATION
OF MUSICAL ELEMENTS
OD KONCEPTUALIZACIJE DO FORMALIZACIJE GLASBENIH ELEMENTOV

LORENA MIHELAC
Šolski center Novo mesto, SGLVŠ
Fakulteta za informacijske študije, Novo mesto
lorena.mihelac@sc-nm.si

Abstract: This article attempts to define and categorize musical constituent elements. There are three key topics that are covered in this article. The first one, the utilization of the musical 'language', examines the interchangeable usage of terms used in music as well as the employment of similar concepts beyond the realms of music, in art and science. The second topic examines the concept of primary and secondary musical elements in music theory. In addition, a hierarchical scheme of primary musical elements is suggested as well. The third topic of this article focuses on musical space, and it discusses the role that different musical elements play within the context of a two (three) dimensional plane.

Keywords: musical elements, conceptualization, formalization, musical space, hierarchical musical elements

Izvleček: Pričujoči članek poskuša opredeliti in kategorizirati primarne glasbene elemente. V tem članku so obravnavane tri ključne teme. Prva tema, uporaba glasbenega »jezika«, preučuje medsebojno zamenljivo rabo izrazov, ki se uporabljajo v glasbi, kot tudi uporabo podobnih konceptov zunaj področja glasbe, in sicer v umetnosti in znanosti. Druga tema obravnava koncept primarnih in sekundarnih glasbenih prvin v glasbeni teoriji. Poleg tega je predlagana tudi hierarhična shema primarnih glasbenih elementov. Tretja tema članka se osredotoča na glasbeni prostor in razpravlja o vlogi, ki jo imajo različni glasbeni elementi v kontekstu dvodimenzionalnega oziroma tridimenzionalnega prostora.

Ključne besede: glasbeni elementi, konceptualizacija, formalizacija, glasbeni prostor, hierarhija glasbenih elementov

THE FORMALIZATION OF CONCEPTS IN MUSIC

In his paper Morgan states that 'Without concepts we are overwhelmed by formlessness ... Until we have at least in some degree conceptualized our world, we really have no world at all' (Morgan, 1968). Music is not an excep-

tion. We need concepts in music to establish a bridge between the listener and music. We need concepts to identify what was heard in music.

We need concepts to model, to formalize them into terms, and use them in a musical 'language': to *discuss* and *write* about music. This can be exceedingly problematic, however. Even in a small group, there is a possibility that there will be no consensus on the formalization of a concept into a singular term.

One plausible reason is that the notion of a one-to-one correspondence between a concept and a term is actually impossible, as it is difficult to capture a concept that is passing through the mind of one individual at a particular moment and expect it to pass through the mind of another individual at the same or a different moment (Kant, 1800, p. II, 103).

Individuals do not follow specific principles or instructions when constructing terms, which is another (plausible) reason. Furthermore, the *collectivity* determines how the concept is formalized into a term and used, as concepts cannot determine which term is most appropriate for themselves (Barnes, 1942).

Tocqueville states that the human mind more easily forms concepts than words (de Tocqueville, 1835, p. II, 264). Sartori (1984, p. 35) points to the fact that we humans have at our disposal more concepts in mind than words (terms). Marradi argues that different terms that indicate the same thing are continuously created, and that there is no rigid connection between something as perceptible—by sight or hearing—as a term, and something as fluid and intangible as a concept (Marradi, 2012, pp. 39–40).

How would one then formalize a 'collection' of music's constituent elements? Should we use *elements*, *parameters*, *dimensions*, *components*, *attributes*, or should we use something else? Which is the most applicable term? Are all of these terms' meanings the same? Furthermore, should terms be borrowed from science or the arts if there is no suitable term in music or if there is no consensus regarding the formalization of a concept into a specific musical term?

Already in 1925, Antcliffe (1980) noted that there are numerous analogies between the arts and between the arts and the sciences, and that such analogies are unavoidable in music because music has never developed a completely independent vocabulary, instead borrowing terms from other arts and sciences. According to internet sources and numerous recent studies, the statement made by Antcliffe appears to be very accurate in musical society today.

Musicians frequently borrow terminology from disciplines outside of music. The topic of terminology is provocative and never-ending. On the one hand, it brings order to science/art/music, but on the other, it can lead to confusion within a field (Petrović & Golubović, 2018). Therefore, it is not surprising that certain terms, such as musical *components*, musical *elements*, musical *parameters*, and musical *dimensions*, appear not only to have been borrowed from other fields, but also to be used interchangeably, as is evident when searching for these terms on the Internet.

According to Bachman et al. (2006), information is most likely the greatest benefit that the Internet offers its users. However, the vast quantity of information results in information overload (Roetzel, 2019). With an infinite number of sources, it is easy to become confused. The online sources can be both helpful and harmful, as there is no process for accurately verifying information and the majority of online content is not reviewed. Furthermore, on the Internet, anyone can publish content independently of a publisher. The web pages may be created by a professional, an inexperienced person, or even by children. It is therefore not surprising that a search for sources defining *musical elements* returns a large number of confusing results: ‘musical components’, ‘musical dimensions’, and even ‘musical parameters’.

The question that arises is, whether or not there is a distinction between these terms, and what they precisely denote, having in mind also that musical terminology in different time periods contains words/phrases that are not only generally accepted and familiar but also other, more temporary, expressions which belong to the jargon of a narrower circle of people (Borthwick, 1967). However, if ‘musical’ is removed and only the terms *parameter*, *dimension*, *component*, and *element* are used, it is possible to discern subtle distinctions based on their etymologies or general descriptions.

A *parameter* (from Ancient Greek παρά (pará), ‘beside, subsidiary’, and μέτρον (métron) ‘measure’), is any quality that contributes to the definition or categorization of a certain system. In other words, a parameter is *a component of a system* that is helpful or essential in the process of identifying the system or assessing its performance, status, condition, or any other attributes. The term is used within many different fields of study, mostly in mathematics, statistics, computer programming, engineering, physics, logic, and linguistics, less in the field of music.

The Oxford Companion to Music (Latham, 2011) defines parameter as ‘any compositional variable, e.g. pitch, note duration, instrumentation, loudness’, adding that the term was derived from physics and later employed in music when Boulez, Stockhausen, and other composers submitted parameters to serial control. The term parameter, introduced in music by Stockhausen and other serialist composers and interpreted more as a mathematical variable, widened the scope for understanding and analysing musical structure from a new angle (Nørgaard, 1962, cited by Bergstrøm-Nielsen, 2006): ‘... by the aid of the parameters, [one] can circumnavigate the rocks that always emerge when the perspective grows’.

The term *dimension* is roughly defined as a ‘measure’, ‘measurable extent of a particular kind’, ‘form or shape (something) to specific measurements’, and as ‘an aspect or feature of a situation/something’, i.e. ‘the size and extent of a situation’ (Cambridge University Press & Assessment, n.d.a). In mathematical

science, 'dimensions' means the axes in a coordinate system;¹ however, after its first (official) introduction, and especially after Einstein's introduction of relativity as the fourth dimension (Kennedy, 2013), the term has been widely used in contexts unrelated to its actual technical meaning, for example, as a metaphor for anything unreachable,² as expressions referring to a different aspect or perspective,³ as a 'parallel universe' and so on.⁴

In the area of music, a clear definition of musical dimensions or just dimensions is not to be found in any of the music dictionaries. Surprisingly, the term is included in the United Kingdom's Department for Education's published music curriculum for Key Stages 1, 2, and 3. Musical dimensions are described as the ways in which each sound may be *characterized* and *altered* to create distinct musical effects (Department for Education, 2021). The fact that (musical) dimensions are hardly described or included in music dictionaries/lexicons, etc. is because the idea of 'dimensionality' is so ingrained in the way music theorists think, that it often goes unnoticed and it is only occasionally mentioned or looked at closely, i.e. considered as obvious, whenever we talk about musical parameters (Yust, 2018, p. 5).

McAdams (1989) argues that a musical structure is based on *dimensions* which can be divided into four *categories*: classes of pitch, duration, dynamics, and timbral identity, and that these dimensions are found in many cultures. The purpose of these categories is to provide optimum information with minimal cognitive effort, which is achieved when information from a particular dimension within a category is perceived as similar and dissimilar to information from another category.

An *element* is considered as 'a necessary or typical part of something; one of several parts that something contains' (Oxford Learner's Dictionaries, n.d.). The term is defined in a similar way in the *Cambridge Dictionary* (Cambridge University Press & Assessment, n.d.b). Plato is believed to have used this term for the first time in his dialogues in *Theaetetus*, in which he investigates the nature of knowledge (episteme) and introduces his theory of the elements,

- 1 René Descartes introduced the two-dimensional Cartesian coordinate system in 1637, which represents the independent variable along the vertical axis (Y coordinate) and the dependent variable along the horizontal axis (X coordinate). See Lafleur (1960).
- 2 See Elsa Barker's book *The Son of Mary Bethel* (1909, p. 204): 'And the golden sun was like a window through which he looked into another dimension of space, a universe within, and yet unmixed with our visible universe ... In the darkness behind my eyelids I beheld Him; then must that inner region coexist with the universe of matter, interpenetrating it, as another dimension of space.'
- 3 'It would permit us to attain a higher view—from another dimension,—which would allow us to look down' (Carrington, 1920, p. 164).
- 4 In his earlier works, H. G. Wells did not employ the term 'dimension' in the sense of a parallel universe, but rather as a property. The term parallel universe first appeared in his 1923 novel *Men Like Gods*.

according to which elements are *components* of a structured whole (Druart, 1968, p. 424). As musical dimension, musical element is found in different music curriculums worldwide, denoting in a similar way pitch, duration, timbre, loudness, (sonic) texture, etc., as the most important constituent components of a musical structure.

Evidently, elements, parameters, and dimensions are used interchangeably in music, either due to their general popularity/acceptance among narrower groups or because individuals choose words based on their personal experiences and ‘keep’ those with which they are familiar. Different media/literature usage or usage within a specific language/culture can also influence interchangeable usage. Last but not least, one could mention the interchangeability of acoustic and psychological terms, the ambiguity of contemporary musical terminology, and the lack of a universally accepted musical vocabulary.

The meanings of these terms (direct/indirect) are comparable in some respects. When ‘musical’ is removed and the etymological origins of element, parameter, and dimension are examined, subtle distinctions become apparent. A *musical element* can be understood as the most fundamental component of a musical composition. As it is measurable, it is considered a *musical parameter*, and as it has a specific virtual/non-virtual shape within the musical composition, it is considered a *musical dimension*.⁵ From this point of view, musical elements, musical parameter, and musical dimension, used to describe the constitutive musical components, are interrelated but not interchangeable.⁶

DEFINING PRIMARY AND SECONDARY ELEMENTS OF MUSIC

Which are the musical elements of music? Burton writes in his paper: ‘If a student were to ask what the elements of music are, the most accurate response would be [that] no one seems to know for sure’ (Burton, 2015, p. 22). This is maybe because of the fact that ‘music is not simply a generic sonic mass, but rather a complex chemistry of controllable elements’, and that what serves as a primary component in one taxonomy is considered as a subcomponent in another (Bruner, 1990, p. 94).

Most musicians denote pitch and duration as the basic musical *components*, in the same sense as physicists define sound as two-dimensional, with the physical parameters amplitude and time as the most important dimensions of a sound signal (Yust, 2018). Recently, (sonic) texture has been added to pitch

5 In this paper ‘virtual shape’ refers to the (virtual) cognitive representation of a musical element in a musical space (musical piece), whereas ‘non-virtual shape’ refers to the visual presentation of a musical element in a musical score.

6 Due to their interchangeable use in various musical studies, ‘musical element’, ‘parameter’, and ‘dimension’ will be used with the same meaning in the remainder of this paper.

and duration as a third primary musical element, as pitch and duration can obviously function either horizontally or vertically (Bruner, 1990).⁷

Yet, as there is no consensus over which of the musical elements should be considered the most essential, the lists of musical constituent components vary considerably. Some musical elements, such as duration, are excluded (Castellini, 1962), while others are added to the most fundamental one, pitch, such as timbre, intensity, and duration (Owen, 2000).

Burton (2015) defines pitch, duration, loudness, timbre, sonic texture, and spatial location as musical components, regardless of their purpose, when music is referred to as the art of sound, as sound consists of six fundamental elements. However, due to the fact that music requires more than just sound, the elements of music are (not only) sound, but also structure and artistic intent (Burton, 2015).

The fact that music and (visual) art have many common aspects, concepts, principles, procedures, and even terminologies makes it noteworthy that the most fundamental elements of music (for example, (sonic) texture, form, colour, harmony, rhythm) are compared to art (Barrett et al., 1997; Bohannon & McDowell, 2010; Estrada & May, 2019).

According to Hopkins (1990), there are *independent* and *dependent variables* in music. Pitch, harmony, and dynamics are defined as the primary components of music, *independent variables*, and hence can be considered as *parameters*. Rhythm is seen as a 'summarizing property' as it is determined by other interacting parameters (e.g. harmony, pitch, duration, dynamics), and is therefore not a parameter, but a *dependent variable*, depending on other variables (Hopkins 1990, p. 29).

McAdams (1989) emphasizes the significance of listeners' ability to encode events in one *dimension* (e.g. pitch) in conjunction with changes in another dimension (e.g. duration, timbre, loudness). From this perspective, he asserts that time and pitch are the most significant dimensions, as listeners readily recognize similarities in musical structures. The strength of the timbre dimensions would be moderate, whereas the vibrato rate and spatial location would be weak.

Using a computational approach to represent the most fundamental aspects of a musical structure can be interesting, especially when considering a constituent musical element in terms of a *function* with a certain *domain* and a *set of values*. Thus, both pitch and duration (which scientists believe are the most essential musical elements), can be considered as a 'function' with a 'domain' from which other musical elements (set of values) can be generated or *derived* (Pearce, 2005, 2018).

Composers, music theorists, music psychologists, and musicologists often employ *primary* and *secondary* musical elements, for example, in explaining how motivic categorization occurs (e.g. Eitan & Granot, 2009), in explaining

7 The decision to use *sonic* texture is intended to differentiate it from visual, tactile, and other types of texture, as it refers to *sound* produced by combining tones or lines.

and clarifying the historical backgrounds and ideas of parameter analysis (e.g. Bergstrøm-Nielsen, 2006; Bauer, 2001; Hopkins, 1990; Meyer, 1989), in the perception of music (e.g. Mihelač et al., 2021; Snyder, 2000; Tan et al., 2010) and so on. Intriguingly, these studies do not appear to have reached an overall agreement on how to make a clear distinction between primary and secondary musical elements, and the age-old question still remains: which of these musical elements are regarded as primary or secondary, and how do they interact?

Bergstrøm-Nielsen (2006, p. 7) outlines that '[i]n music history, first pitch, then duration, then dynamics, later timbre (color) became dimensions which were elaborated compositionally in detail – at least when judging from Western written sources during the last thousand years.' A traditional approach to the question what exactly is (or should be) considered a primary/secondary musical element, is presented in the following very humoristic quotation by De la Motte, obtained during a discussion between German musicologists (Stephan, 1969, p. 70):

I just got appetite and so something occurred to me around the theme of eating ... In art, there are basic articles of food comparable to potatoes, vegetables, rice or noodles. Then there exists also embellishments, stimulation foods: curry, paprika, sambal-oelek and other sambals...Timbre corresponds to sambal or to spice, pitch and rhythm to rice or potatoes. I can imagine no work lasting two or three hours, for instance an opera, which has been composed with sambal. I can stand that for ten minutes, and then I have to eat a decent 'potato'. A little more seriously formulated the question would sound: is timbre really a parameter equal to pitch and time duration? I believe not.

According to Meyer (1989), primary parameters are considered to be pitch and duration. Colour, loudness, tempo, and articulation are regarded as secondary musical parameters, as presented in his influential book *Style and Music: Theory, History, and Ideology*. Meyer describes primary musical parameters as those that can be segmented into 'discrete, non-uniform relationship so that similarities and differences between them are definable, constant, and proportional', and secondary parameters as parameters that create 'statistical' and 'processive' relationships and are defined *and* dependent on primary parameters (Meyer, 1989, p. 14). Meyer argues that pitch and duration are the only trans-cultural parameters that are capable of performing a structural function in music. This is supported by the fact that pitch and duration have long held a dominant position in the Western classical tradition.

Morgan (1984) agrees with Meyer's concept of primary and secondary parameters and their interaction. Both the laws of perception and cognition, and the rules of historically contingent convention, apply equally to primary parameters and the syntactical rules they establish. In Meyer's theory, the division between primary parameters (the 'background structure') and secondary parameters (the 'foreground structure') is governed by probable strategies and

compositional decisions determined by the norms of a specific style (Bauer, 2001). This accords also with Hopkin's opinion about the primary and secondary parameters, while highlighting the significance of secondary parameters as 'organizing forces' in tonal music when primary parameters remain unchanged (Hopkins, 1990).

According to Snyder (2000), there is no clear distinction between primary and secondary musical parameters, nor are primary musical parameters more important than secondary parameters; they serve distinct purposes. What makes musical elements 'primary' is their 'fixed proportion', which allows for their categorization, recognition, and identification when repeated, even in various forms. In contrast, secondary parameters cannot be distinctly recognized and identified across a variety of auditory experiences. Tempo is an example; even when a repeating melodic or rhythmic pattern is recognizable, it is difficult to identify the 'same amount' (of tempo) if the patterns are separated in time.

Snyder states that pitch is the clearest example of a primary parameter, as it can be classified according to tuning systems and scales and identified when used in different forms. Pitch interval and pitch motion (contour) are primary parameters as well, as they are considered as the 'variable aspects of pitch patterns'. Harmony, based on pitch, and involving various combinations of simultaneous pitches (chords) is an example of a *higher-level primary parameter*, as the *combinations of pitches* (within a chord) can be recognized and identified. Rhythm is another primary parameter, as it is constructed from identifiable and recognizable patterns. In contrast, loudness and tempo, for example, are regarded as secondary parameters because it is impossible to assign a distinct category to these musical elements when they are repeated.

A PROPOSAL FOR THE HIERARCHICAL APPROACH TO PRIMARY MUSICAL ELEMENTS

In the beginning there was sound (Goldsmith, 2015), just as 'electricity was there from the beginning ... before we discovered it' (Busoni, 1957, p. 197). Given there is always a (human) desire to develop a term to comprehend an idea, it is not surprising that sound has been employed in several and similar definitions of music, such as, 'Music is the art of sound in time' (Alperson, 1990).⁸ If we use *sound* as the 'begin' of 'all the beginnings', then we have to ask ourselves, what is sound?

A very brief, generic, and simplified definition of sound is that it is an energy wave that travels through a medium (e.g. air, water) and causes molecular oscillation. The consequence is a sound wave, a 'physical phenomenon that is capable of exciting the auditory mechanism so that a living organism percei-

8 According to Sauvage (1953), all arts might be considered to be arts of time. *Musical* time refers in this paper to the perception of temporal features in music. See Alperson (1990).

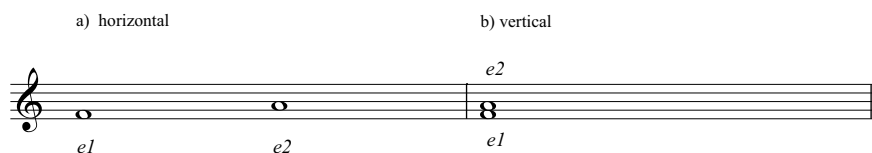
ves a sound' (Tan et al., 2010, p. 10). Sound waves have *physical* properties, frequency, amplitude, and complexity, which correspond to the *psychological* qualities: pitch, loudness, and colour. Duration is another psychological quality, as an acoustic/auditory event must occur across time.

At the musical surface, which corresponds to the level of discrete musical events (the note level in a musical structure), each event (tone), e.g. 'e1' (see Figure 1), can have all or at least one of the basic properties (attributes): pitch, loudness, colour, and duration. As all these properties are *measurable*, we may refer to them as *parameters*.

If an additional event *e2* is added to an existing event *e1*, it is possible to apply *sonic texture* and to apply these two events horizontally or vertically as depicted in Figure 1. Simply combining two occurrences of events yields an essential building component, an *interval*, which can be represented sequentially (horizontal) or simultaneously (vertical).

Figure 1

Sonic texture depicted horizontally and vertically



For each interval:

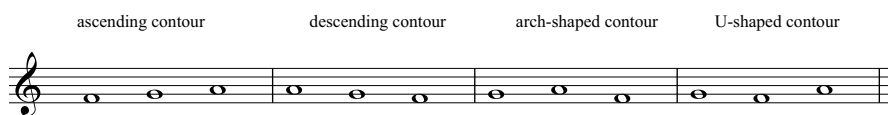
- pitch is fundamental to its creation, and
- pitch can be determined for both horizontal and vertical occurrences.

From this perspective, interval can be regarded as a 'value' within the pitch 'domain'.

If adding at least two events (e.g. *e2* and *e3*) to the first event *e1*, and if at least two of three events have a different pitch, then, putting these events in a horizontal way, a succession of events is obtained, defined as *contour*. The contour of these three events can be ascending, descending, arch-shaped, and U-shaped (see Figure 2).

Figure 2

The representation of contour



Putting three events simultaneously (Figure 3), a *chord* is obtained, often defined as *harmony*.⁹

Figure 3
Chord (harmony)



Similarly to interval,

- pitch is essential to the creation of contour and harmony, and
- pitch can be defined for each event in contour and harmony.

Thus, both contour and harmony can be viewed as ‘values’ in the ‘domain’ of pitch from this perspective.

Colour is a quality of sound produced:

- only if there is a particular musical source (e.g. instrument or human voice), and
- is obtained by combining different sound waves.¹⁰

As the colour of a sound is comprised of a fundamental pitch (fundamental frequency), and several other frequencies (harmonics or overtones), colour can also be considered as a ‘value’ in the domain of pitch.

Musical tones (musical events) differ in *loudness*. ‘The more energetic the pressure wave ... the louder will be the sound heard as the wave impacts on the ear’ (Tan et al., 2010: 34). Under the context of everyday listening, loudness is not only perceived as the energy (intensity) of a sound wave, but also as the *frequency* of that sound wave. As frequency (the physical property of sound that corresponds to the psychological quality pitch), loudness can be classified as a value inside the scope of the domain of pitch.

Does music *unfold* in time (Alperson, 1990) or does music *create* time? The fact is, that ‘every event must occur, and each occurrence must have some duration’ (Lantz et al., 2020, p. 2). Furthermore, time does not change, but *events* do. As music is a sequence of events that not only *contain* but also *shape* time, music *creates* time (Kramer, 1988), which is virtual, ‘radically different from the time in which our public and practical life proceeds’ (Langer, 1953, p. 109).

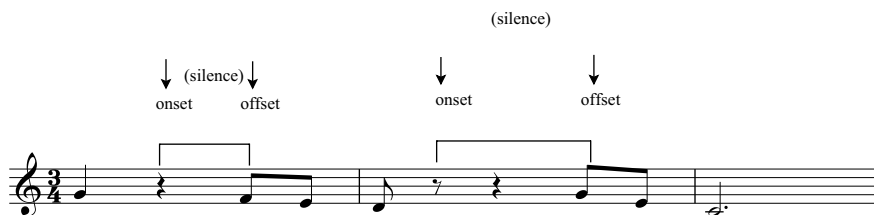
9 Chord and harmony are often used interchangeably. The concept of chord and harmony is presented by Schoenberg (1978: 13): ‘Harmony (is) the study of simultaneous sounds (chords) and how they may be joined with respect to their architectonic, melodic, and rhythmic values and their significance – their weight relative to one another’. Harmony is obtained when two or more notes sound at same time, and the simultaneous sounding of at least three notes forms a chord.

10 The sound of a tuning fork is an example of a tone without colour as there is only one frequency of vibration (a sine wave, often called a ‘pure’ tone).

A crucial question arises: can duration, as interval, contour, harmony, and colour, also be considered as part of the pitch domain? Each event with a single frequency has a specific duration, and each event with a specific duration has a specific pitch. From this viewpoint, pitch and duration can be considered as *interdependent* musical elements. However, following only one or more events, it is possible to insert a rest (or rests) defined as periods of acoustic silence, from onset to offset, in which no pitch or pitch-related values are present (see Figure 4). From this perspective, duration can be considered a *unique musical element*.

Figure 4

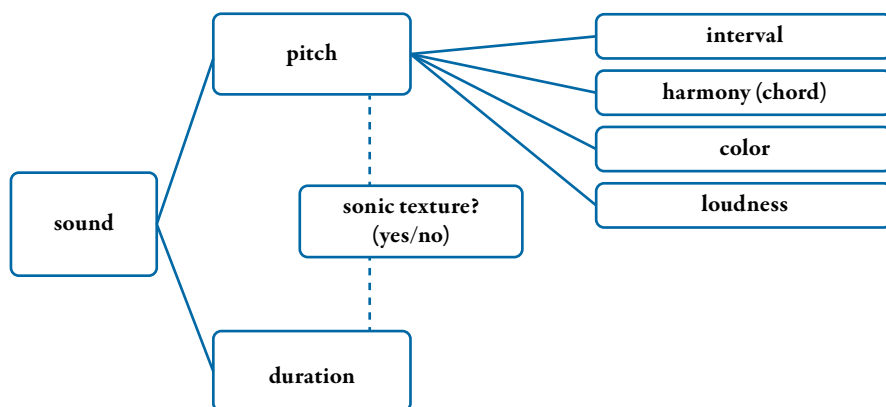
Rests, periods of acoustic silence (from onset to offset), in which no pitch or pitch-related values are presented.



In a summary of the hierarchical approach proposed in this section, in which ‘the beginning of all beginnings’ is the sound, i.e. the ‘source’, and the two most important primary musical elements are pitch and duration (as a unique musical element), Figure 5 illustrates the proposed scheme of the primary musical elements. As can be seen in Figure 5, melody and harmony are not placed in this scheme, and are considered to be on a higher hierarchical organizational level, up from the moment when more events are used combined, horizontally, or vertically in a certain structure, i.e. form.

Figure 5

A scheme of primary musical elements using a hierarchical approach.



Philosophical speculation on the nature of space in general has a long and illustrious history in Western thought, and ideas about *musical space* have a deep and abiding place within that tradition. Whether we are aware of it or not, the concept of space is ever-present in the world of music, understood either in the manner of Plato as a 'container for objects located within it' (Casey, 1996, pp. 13–52), Stockhausen's understanding of space as the *direction* from which sounds originate (Stockhausen, 1996), or as an abstract concept of emptiness that can be represented by a two- or three-dimensional space.

Discussions about the 'placement' of musical elements in a two-dimensional space and their interaction is not novel. The idea that physical space correlates with musical structure (musical space) is found in Helmholtz (1865). Wagner embedded instances of horizontal-vertical into his *Tristan* Prelude (Forte, 1988); Schoenberg, in his lecture 'Composition with Twelve Tones', presented his 'law' of a unified musical space in which the horizontal and vertical presentation of ideas are equivalent; Scriabin considered melody to be harmony in horizontal form and harmony to be melody in vertical form (Bowers, 1969).

Reybrouck proposes two levels which can be distinguished in a musical space: the level of pitch and the level of time, both defined as continua, 'the pitch continuum and the time continuum' (Reybrouck, 1998, p. 63). Both verticality and horizontality are regarded as fundamental musical characteristics in Chomiński's (1968) and Rosch's research (1975, 1978).

Chomiński (1968) equates verticality and horizontality with harmony and melody, respectively. However, in relation to the analysis of auditory sequences, he states that verticality/horizontality is a cognitive term rather than a structural one. Therefore, in order to comprehend the functions of verticality and horizontality in music, we must first investigate these characteristics as cognitive phenomena. After recognizing them as auditory objects, we can perceive their structural properties.

Rosch describes verticality and horizontality as a fundamental (music) 'category', i.e. the collection of objects that are regarded as equivalent (Rosch, 1978, p. 4). Horizontality refers to the dispersion of distinct examples within the same unit, such that the category remains recognizable regardless of the degree of deviation from the model. Verticality identifies the relationships between categories, which leads to the notion of a hierarchy.

Interestingly, only melody and harmony, as musical elements on a higher organizational level, are 'placed' in the musical space: harmony in the vertical and melody in the horizontal plane, whereas the contribution of musical ele-

ments on a lower organizational level to the ‘construction’ of the musical space is not explicitly outlined.

Should pitch be placed in a horizontal or vertical plane? What about duration? Moreover, is verticality and horizontality sufficient to define the musical space if colour and loudness are ‘filling’ this space in a third dimension – ‘depth’ – as postulated by Marks (1978), McDermott (1972), and Morgan (1980)?

Kokkonen (1988) argues that ‘every generation of composers, every single composer, has been forced to address the problem of how to combine the vertical and horizontal elements of music, either deliberately or unconsciously.’¹¹ Interestingly, he is aware that each composer gives more attention to certain musical elements than others, but that a satisfactory balance between the ‘horizontal’ and ‘vertical’ dimensions can only be achieved if all primary musical elements are included.

Nikolsky states that musical elements are not *abstract auditory signals* but rather *spatial constructs* on a *three-dimensional plane* (time/pitch/(sonic) texture) that imply fictitious movement whenever tones are bonded together by tonal tension. The construction of quasi-spatial interactions between musical components (elements) is a fundamental aspect of music, and takes its ‘cues’ from the relationships that exist between physical items. Nikolsky suggests that musical elements are constructing a *musical space* which is defined by vertical and horizontal *axes* and is *virtual*, as it exists only in the listener’s mind. The latter does not mean that musical space is subjective in the sense that each listener perceives tonal tension arbitrarily (Nikolsky 2015).

McDermott sees the musical space as a ‘conceptual tool’, a structure that is formed and shaped by the sounds that make up a piece of music as well as by the manner in which we organize and make sense of these sounds. The (musical) space is extraordinarily complex, and its components (pitch, colour, dynamic, duration, every rest, group of tones, etc.) contribute to it in substantial or insignificant ways, not as independent ‘building blocks’ but as intricately interconnected entities (McDermott, 1972, pp. 489–491).

This is consistent with the viewpoints outlined in the study by Prince et al. (2009) and Mihelač and Povh (2020), which suggest that musical elements are never found in isolation; rather, they continually interact (more or less) with one another in the ‘musical space’, either in a vertical plane, when the relationships between notes are presented simultaneously, or in a horizontal plane when notes are presented sequentially.

The musical space is referred to as ‘sound space’ by Kaper and Tipei (1999), a *multidimensional vector space* whose elements are *functions* of numerous variables. After assigning values to variables, the position and perceived qualities of an ‘object’ (musical element) are completely determined in sound space. In the

11 Kokkonen mentions only four ‘musical elements’ (rhythm, melody, harmony, and tone), which include concepts such as form, and polyphonic or homophonic construction.

sound space, vectors serve as a non-unique 'basis' that represents a sound relative to a specific basis. The composer assigns values to the 'coordinates', i.e. determines which aspects of the sounds will be incorporated into the sound space.

If musical elements are considered to be spatial constructs and (according to numerous studies), are interrelated, and can be combined in an infinite number of ways in the composer's 'playground', i.e. musical space, then it is evident that using only verticality or horizontality in the placement of musical elements in a musical space is simply insufficient.

The understanding of the spatial organization can serve only as a partial description and explanation of the compositions' structure, as well as a partial explanation of why we comprehend it the way we do, whether we comprehend a piece in performance, when reading the score, or when considering it retrospectively (McDermott, 1972).

SUMMARY AND CONCLUDING REMARKS

This article discusses the lack of defined standards for formalizing musical elements; the interchangeability of various terms demonstrates the absence of a distinct formalization of musical concepts. Assuming that a listener's primary interest is in listening to a musical work, ambiguous information can be problematic when discussing what was heard in a more general or detailed (analytical) manner. This is especially true in written communication, where nonverbal cues are absent and there is no immediate feedback to elucidate the meaning of a particular term.¹²

To avoid misunderstandings resulting from ambiguity, it is essential to strive for clarity in the use of musical terms, which entails employing precise and clear definitions while being, of course, attentive to alternative interpretations. According to Rahn (1979), the formation of a concept typically entails the formulation of a definition. Rahn argues that a definition should be (i) *eliminable*, i.e. that the defined expression can be replaced by the defining phrase in any and all contexts without changing the value of the truth that it represents, and (ii) *non-creative*, which implies that the definition does not generate any new 'theories' in which the defined term does not appear (Rahn, 1979, p. 115).

The comparison of musical element, musical parameter, and musical dimension has demonstrated that these terms are used loosely and interchangeably in music studies and in the wider community, despite the fact that element, parameter, and dimension do not have the same meaning. According to Rahn (1979) and his proposed conditions for a definition, none of the existing

12 This does not mean that even in verbal communication ambiguity cannot arise due to word choice.

definitions/descriptions for musical element, musical parameter, and musical dimension satisfy the proposed criteria of 'eliminability' and 'non-creativity'.

Whether one views music as art using a collection of sounds or as an auditory (cultural) activity, the truth is that sounds must be organized in some way, from simple entities (one tone) to more complex patterns, up to a final structure (form) that allows the composer (creator) to express their own ideas and emotions. During the process of composing a piece of music, the composer has access to music material, to musical elements, which can be utilized in a variety of ways.

It is highly unlikely that these musical elements will be used 'by chance' or be unorganized. Each composer considers at some point which musical elements to use, how to use them, and how to combine them, but is not overly concerned with the question of which of these elements is the *primary* or *secondary* element. The latter becomes interesting/important, for example, during the process of 'decomposing' (segmenting) the musical piece (structure) into its constituent elements, i.e. during its analysis, in a pure theoretical-musicological manner.

Last but not least, it would be beneficial in the field of music education to make a clear distinction between primary and secondary musical elements. This would be helpful for a number of reasons, including the following: (i) to clarify for students how musical elements are co-creating a piece of music; (ii) to determine which of these elements is considered to be the most fundamental one, from which more complex elements can be created.

The hierarchical approach to classifying fundamental musical elements detailed in Section 3 is merely a proposal. The purpose of (re)listing, i.e. (re)categorizing, these musical elements was to demonstrate that new efforts should be made to categorize musical elements in a manner that would be generally acceptable in the field of music theory and would consequently give a more understandable classification to the wider community interested in music.

The placement of musical elements in a two-dimensional or even three-dimensional musical space is intriguing and offers a different perspective from which to comprehend the interaction of musical elements. Using horizontality, verticality, and depth (or mathematically, width) enables the formalization of musical elements in the musical space according to mathematical requirements. However, such a formalization necessarily entails a *transformation* because it calls for a *reworking* of the initial musical theory in order to make it conform to the mathematical theory. This is necessary in order to ensure that both theories are satisfied (Nicolas, 2009, p. 2).

The question to be asked is whether such 'transformation' that serves mathematics rather than music is necessary. The assumption is that a 'typical' musician is more concerned about the musical structure, content, and its interpretation, and is hardly worried about whether a particular musical element is located horizontally or vertically in the musical space, or how to define the de-

pth of a musical element. However, this does not mean that mathematically theorizing music is not appealing to musicians, particularly when attempting to solve a musicological problem by applying a mathematical model.

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Povzetek

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Članek obravnava konceptualizacijo in formalizacijo glasbenih elementov. Medsebojna zamenljivost različnih izrazov kaže na odsotnost formalizacije glasbenih pojmov. Da bi se izognili nesporazumom, ki izhajajo iz pomenskih dvoumnosti, si moramo prizadevati za jasnost pri uporabi glasbenih izrazov, kar pomeni uporabo natančnih in jasnih definicij, pri čemer je treba biti seveda pozoren na alternativne interpretacije.

Članek primerja pojme, kot so glasbeni element, glasbeni parameter in glasbena dimenzija, ter izpostavlja, da se le-ti v glasbenih krogih in v širši skupnosti uporabljajo ohlapno in zamenljivo, čeprav nimajo enakega pomena.

V članku je izpostavljena tudi problematika kategorizacije primarnih glasbenih elementov, in sicer določitev le-teh in kateri med temi glasbenimi elementi se najpogosteje uporabljajo. Predstavljen je tudi predlog kategorizacije primarnih glasbenih elementov. Namen te kategorizacije je, da se postavijo jasnejši temelji, tj. kategorije primarnih glasbenih elementov, ki bi bile splošno sprejemljive na področju glasbene teorije in bi posledično nudile tudi razumljivejšo kategorizacijo širši skupnosti, ki jo zanima glasba.

Članek obravnava še umestitev glasbenih elementov v dvodimenzionalni ali celo tridimenzionalni glasbeni prostor, kar je zanimivo, ker ponuja drugačno perspektivo dojemanja interakcije glasbenih elementov. Uporaba horizontalnosti, vertikalnosti in globine (ali matematično širine) omogoča formalizacijo glasbenih elementov v glasbenem prostoru v skladu z matematičnimi zahtevami.

Vendar pa takšna formalizacija nujno vključuje preobrazbo, tj. transformacijo, ker zahteva predelavo začetne glasbene teorije, da bi se uskladila z matematično teorijo. To je potrebno za zagotovitev, da sta obe teoriji izpolnjeni. Seveda se postavlja vprašanje, ali je takšna »transformacija«, ki služi matematiki in ne glasbi, potrebna. Predpostavka je, da je »tipični« glasbenik bolj zaskrbljen zaradi glasbene strukture, vsebine in njene interpretacije ter ga skoraj ne skrbi, ali se določen glasbeni element v glasbenem prostoru nahaja horizontalno ali vertikalno ali kako definirati globino glasbenega elementa. Vendar to ne pomeni, da matematično teoretiziranje glasbe ni privlačno za glasbenike, zlasti ko poskušajo rešiti muzikološki problem z uporabo matematičnega modela.