

## Structural Elements of the Gamelan Orchestra: A Contemporary Approach

**Abstract.** In order to understand the principles of the gamelan orchestra, and to be able to apply them in creative practice, we need a special method of orchestral analysis, common criteria that can be used to reveal the essential features and principles of orchestras of different types and cultures. By using a common analytical tool, we can more easily compare orchestras with each other, anticipate the possibilities of their interaction, and see them in the context of different orchestral cultures. This study reveals a new approach to the structure and principles of the gamelan orchestra, based on the system of structural elements of the orchestra. As a result of this analysis, we are able to establish a number of important principles.

The structural unit of the gamelan serves as a model for the entire composition. *Balungan*, the structural-melodic core of the orchestra, could be seen as a structural unit. Unlike the symphony orchestra, the gamelan has a comprehensive structural unit that is divided both vertically (layered with the help of instrumental groups and textures) and horizontally (given a musical form) in the process of composition. Such a structural unit has the characteristics of a macro-unit and is seen through one main musical parameter—the melodic line. The instruments of this orchestra are grouped according to their musical function, so that the entire orchestra can be divided into standard, unchangeable groups.

The relationship among these groups is based on functional complementarity. The interplay between groups is determined from the beginning and maintained throughout the work. The functional distribution of the instrumental groups determines the layering of the texture according to its function. The texture is layered in a hierarchical manner, beginning with the most important layers and ending with the superficial, decorative ones. The overall timbre of the gamelan is dominated by metallic percussion instruments, which provide timbre stability. The timbral distribution of the orchestra is also very stable and almost unchanging. This brings us to the main principle of the organization of the gamelan orchestra, which can be formulated as *orchestra as an expansion of a melodic core*.

The paper discusses all the major aspects of the above-mentioned features and principles and suggests their systematic relationships.

**Keywords:** gamelan, orchestra, musical cultures, orchestral structure, structural elements, composition.

### Introduction

The analysis of orchestras from non-European cultures holds great potential for revealing new structural models, compositional strategies, and possible ways of interaction with European orchestral models. Therefore, this is an important step toward a more comprehensive understanding of the orchestral phenomenon. However, this raises certain questions and potential challenges. When attempting to analyze the gamelan orchestra, the question arises as to whether the analytical methods and tools that are well-suited for analyzing the principles of a symphony orchestra can also be applied to an orchestra from another culture. Moreover, it is not clear that the gamelan can be analyzed as an orchestra in isolation, separated from the cultural framework that gives it meaning.

This issue is heightened by the fact that the very notion of “analysis” is rooted in a Western worldview. It is no secret that the gamelan orchestra has evolved and flourished in an entirely different cultural environment with a fundamentally different worldview. It is also important to consider that for many readers, the gamelan orchestra, its terminology, and musical concepts are relatively unfamiliar. When discussing a symphony orchestra, certain aspects are considered familiar and self-evident. However, when it comes to gamelan, such aspects practically do not exist.

To overcome these challenges as effectively as possible, the analysis of gamelan will be conducted in two stages. First, the fundamental concepts of gamelan music will be systematically discussed to facilitate an understanding of the structure, rules, and—most importantly—the key concepts and terminology of gamelan music. The second stage provides a detailed analysis of the orchestral elements based on the discussed contexts. A Javanese gamelan has been selected for the analysis, but for the purpose of broadening the context, some other gamelan regions are also included.

It is also important to emphasize that in order to understand the principles of the gamelan orchestra and to be able to apply them in creative practice, we need a special method of orchestral analysis—common criteria that can be used to reveal the essential features and principles of orchestras of different types and cultures. Using a common analytical tool makes it easier to compare orchestras, anticipate how they might interact, and view them in the context of different orchestral cultures. The *system of structural elements of the orchestra* is used to conduct a thorough and multifaceted analysis of gamelan. This system identifies the orchestra's

primary structural components and establishes systematic relationships between its elements<sup>1</sup>. The following elements are required to define an orchestra:

- a) structural unit;
- b) three elements of the orchestral vertical: the principle of formation of orchestral groups; the interrelation between orchestral groups; the layers of orchestral texture;
- c) three elements of the orchestral horizontal: orchestral dramaturgy; factors of timbre stability; dominant musical parameters.

The following additional factors are provided to achieve a more comprehensive definition and to balance the elements of the system: intergroup interrelation between elements, intergroup shift, and the level of significance of the element (Baranauskas 2019, 22–34). A comprehensive view of the system is shown in diagram 1.

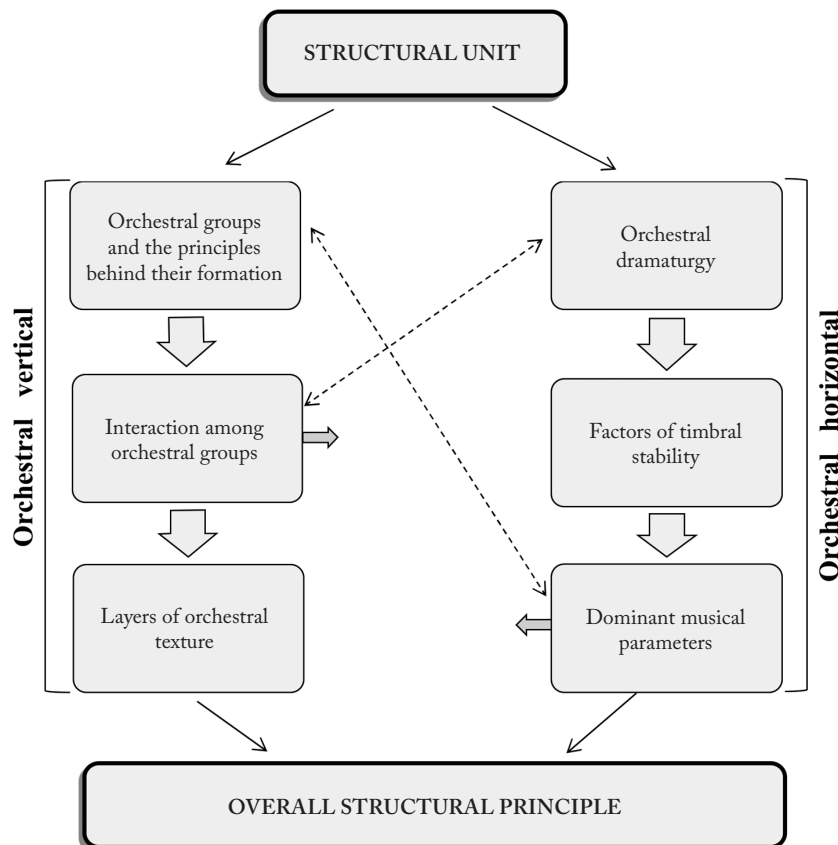


Diagram 1. A comprehensive view of orchestral structural elements

Using the aforementioned tools, this study aims to address the following key questions:

- Can a structural analysis of gamelan be effective and reveal the orchestra's fundamental principles?
- What are the traditional musical concepts and terms of gamelan, and how do they combine to form a coherent systemic picture? Do they relate to the structural elements of the orchestra?
- What are the main structural elements of the gamelan orchestra, and how do they combine to form a unified system?
- Is the proposed system of structural elements suitable for analyzing the gamelan orchestra? Can it reveal the orchestra's structure and principles, as well as illuminating compositional strategies that could inspire contemporary composers?

<sup>1</sup> The system of structural elements was developed by the author of this article as a tool for analyzing orchestral music, distinguishing between different types of orchestral concepts. It can also be used as a compositional tool. Despite the diversity of orchestral music and concepts, a universal system of orchestral structural elements may be possible. For more on this topic, see Baranauskas (2019, 22–34; 2020).

### 1. A framework of gamelan musical concepts and their influence on orchestral structure

In order to examine gamelan from the perspective of orchestral structure and function, and to apply the proposed model of orchestral structural elements, it is necessary to provide a brief, systematic overview of traditional gamelan musical terms and concepts. Only in light of their entirety can we discern the characteristics of gamelan as an orchestral phenomenon.

#### 1.1. An overview of traditional gamelan musical concepts

Over the course of history, the gamelan tradition has developed a complex, highly distinctive, and unique system of music theory. A separate study could be devoted to the examination of this very broad topic; therefore, only the essential theoretical concepts of gamelan will be presented here, primarily based on the example of Javanese gamelan. They form the core of the entire theoretical system and help to better understand the structural principles of gamelan as an orchestral phenomenon.

One of the most fundamental aspects of gamelan is the concept of *lara*. This is a comprehensive system of instrument tuning and formation of modes, consisting of two main tuning systems: *slendro* (five-tone) and *pelog* (seven-tone).<sup>2</sup> In the 19th century, these two systems merged into a single orchestra, and today most Javanese gamelan orchestras are dual-system. To ensure a smooth transition between these two tuning systems, they must share a common tone, known as *tumbuk*. In figure 1 (Brinner 2001, 314), we see several possible relationships between the *slendro* and *pelog* sections of the orchestra, using different common tones.

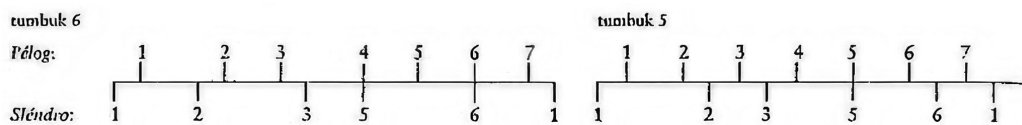


Figure 1. Several possible relationships between the *slendro* and *pelog* sections of the orchestra (Brinner 2001, 314)

In the following example (figure 2), we see the relationship between the different orchestral sections expressed as frequencies in hertz, with the underlined frequencies indicating the common *tumbuk* tones (Brinner 2001, 314). The figure presents examples from three different gamelan ensembles. In every pairing, there is at least one—and sometimes two—shared tones, which provide a point of connection between the tuning systems. The remaining tones, which do not coincide, create a contrasting effect.

	A: tumbuk 2		B: tumbuk 5		C: tumbuk 6	
Pitch	S	P	S	P	S	P
7		507		513		523
6	476	462	493	464	<u>472</u>	<u>474</u>
5	414	433	<u>429</u>	430	413	443
4		397		406		412
3	359	338	372	338	358	351
2	<u>311</u>	<u>311</u>	322	317	312	323
1	<u>274</u>	293	281	292	273	298

Tunings from Surjodiningrat et al 1972, pp. 51 and 53.

S = *slendro* P = *pelog*

A = Gamelan Landung, Universitas Gajah Mada

B = Gamelan Manisrengga and Gamelan Kadukmanis, Kraton Surakarta

C = Gamelan Rarasarum and Gamelan Rumingraras, Paku Alaman, Yogyakarta

Figure 2. Three pairs of combinations of *pelog* and *slendro* (Brinner 2001, 314)

<sup>2</sup> These tuning systems form a binary pair, where each member has its own distinct functional purpose, is associated with different contexts, and is perceived as the opposite of the other: masculine versus feminine, earthly versus heavenly principles. While *pelog* is more closely associated with the earthly sphere, *slendro* more strongly symbolizes the divine principle (Sorrell 1990).

The tuning systems described above, which serve as the tonal material, take on concrete musical form when organized into different *pathet*, a concept that partly corresponds to the idea of mode. The *pathet* are grouped into two sets of three: the *slendro* system includes *pathet nem*, *pathet sanga*, and *pathet manyura*, while the *pelog* system comprises *pathet lima*, *pathet nem*, and *pathet barang*. All six are shown in the table compiled by W. P. Malm (figure 3), where the tuning systems and their characteristic modes are also compared with European equal temperament (Malm 1977, 46). The *pathet* system itself reflects a binary mode of organization, which stems from the duality inherent in the concept of *lara*.

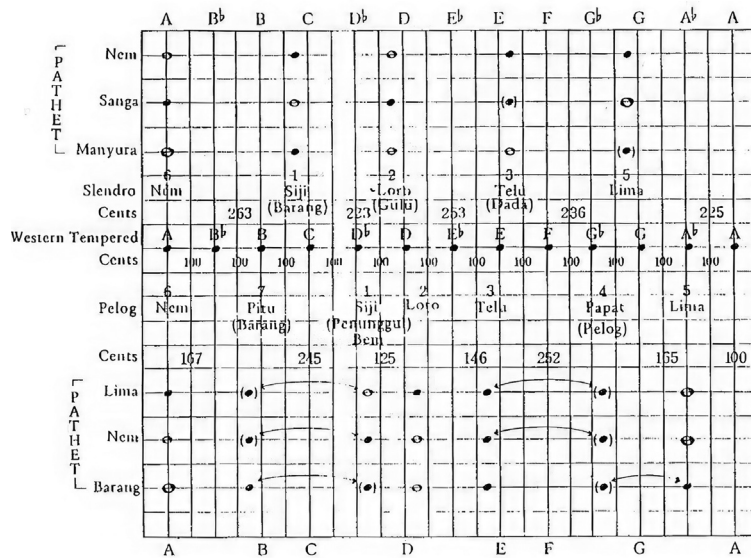


Figure 3. Gamelan tuning systems and their characteristic modes (Malm 1977, 46)

The third major concept in gamelan music theory, *balungan*, alongside *lara*, is one of the most fundamental. It represents a further, more detailed level of pitch organization: the concrete realization of a *pathet* (mode) based on one of the two tuning systems (*lara*) within a specific composition. *Balungan* refers to the melodic core that functions as the structural skeleton and point of departure for a composition. Sorrell notes that it serves as the central melodic thread that determines the parts of all instruments, and experienced musicians will know how to adapt their parts to the information provided by the *balungan*. Therefore, it is the only element that must be preserved. The notation in the written collections of gamelan pieces contains only the *balungan*, along with a few additional indications regarding form and accentuation (Sorrell 1990, 62). In a musical composition, the *balungan* is divided into groups (*gatra*), each consisting of four beats, with the fourth and final beat being the most significant. The concept of *balungan* is realized in the composition through the use of *gatra* groups, and this provides a natural transition from the first three concepts (*pathet*, *lara*, *balungan*), which describe the pitch system, to the next three, which concern principles of form and temporal organization.

The concept of *irama* describes the tempo relationships between individual orchestral groups. Drummond defines it as a concept of melodic tempo and relationships of density between the pulse of the elaborating parts and the beat of the basic melody and *gong* structure (Drummond n.d., 6). Simply put, *irama* is the tempo relationship between the instrument *peking* and the melodic core of the *balungan*. This relationship can be expressed through five levels of density (table 1) (Sorrell 1990, 66).

Table 1. *Irama* tempo relationships (Sorrell 1990, 66)

Rhythm	Number of <i>peking</i> sounds per 1 <i>balungan</i> sound
Lancar	1
Tanggung	2
Dados	4
Wiled	8
Rangkep	16

Another term used to describe musical form is *bentuk*, which refers to the organization of the melodic core (*balungan*) into larger sections and complete compositions. There are several standard forms (*bentuk*) that can serve as the basis for many pieces and that describe the type of melodic line, the structure of phrases, and the underlying colotomic<sup>3</sup> structure. Smaller forms have names, and the most common are: *lancaran*, *ketawang*, *ladrang*, *ayak-ayakan*, *srepegan*, and *sampak*. For clarity, let's look at one of them in more detail. *Sampak* is the densest form. Its pulse is maintained by the *kenong*, along with the melodic instruments *saron* and *slenthem*, which play parts that complement each other. In diagram 2, compiled by Drummond (n.d.), we can see the structure of this form.

	+ P + P + P + P	+ P + P + P + P	+ P + P + P + G
	NN NN NN NN	NN NN NN NN	NN NN NN NN
<i>Saron:</i>	2 2 2 2	3 3 3 3	1 1 1 1
<i>Slenthem:</i>	3 3 3 3	5 5 5 5	2 2 2 2

[Symbols representing instruments: **G** – *Gong*, **N** – *Kenong*, **P** – *Kempul*, **+** – *Ketuk*]

Diagram 2. Structure of the *Sampak* musical form (Drummond n.d., 10)

Without delving too deeply into the nuances of form, we can make a few important observations. The structural organization of the piece is colotomic, and the form is characterized by cyclicity. Lindsay emphasizes this point in particular, noting that the cyclical structure of the music is one of the most important concepts for understanding the structure of Javanese gamelan (Lindsay 1992, 47).

Another gamelan concept, *padhang-ulihan*,<sup>4</sup> describes the phrase structure of compositions. The *balungan* (melodic core) is organized so that its *padhang-ulihan* structure follows the rules of the *pathet* and determines the *bentuk* (form) (Sorrell 1990, 73). This reveals a close causal relationship between the different structural levels. While *bentuk* describes the type of overall form, *padhang-ulihan* shapes the structure of its smaller sections by organizing the melodic core (*balungan*) in time.

Another theoretical concept relates both to music theory and to performance practice. In short, the term *garap* describes the way musicians shape their individual parts on the basis of the melodic core (*balungan*).<sup>5</sup> Thus, *garap* can be understood as a form of improvisation based on certain rules. This process requires the ability to analyze music during performance. The concept of *garap* illustrates the organic and inseparable relationship between theory and practice within the gamelan orchestra. We can assume that in the syncretic thinking of gamelan culture, music theory, and performance practice cannot be separated and treated independently. The final concept worth mentioning is associated exclusively with performance practice. It is characteristic of the gamelan playing technique known as *kotekan*<sup>6</sup> in which two groups of instruments of the same type complement one another by playing interlocking rhythmic and melodic patterns that together form a single, fast, and unified texture or melody.

## 1.2. A systemic view of gamelan concepts

In summary, a brief overview of the main theoretical concepts of gamelan reveals several important points. We can identify a number of fundamentals in gamelan music theory:

- 1) There are two tuning systems (*slendro* and *pelog*), united under the concept of *lara* and organized according to a binary principle. The concept of *lara* serves as the starting point for the entire gamelan pitch system.

<sup>3</sup> The term *colotomic structure*, introduced by Kunst, describes the division of time according to the order in which specific instruments enter. In this way, musical time is divided into sections, and this also serves as a guide for the parts of other instruments (Kunst 1973).

<sup>4</sup> *Padhang-ulihan* can be translated literally as “what comes before—what comes after.” This concept applies not only to music but also to many aspects of Javanese life, including dance, conversation, and social behavior (Sorrell 1990, 73).

<sup>5</sup> Sorrell notes that understanding *garap* means understanding how Javanese musicians approach music and ensure its enduring vitality and creativity (Sorrell 1990, 75).

<sup>6</sup> Although the concept of *kotekan* is characteristic of Balinese gamelan, Javanese gamelan uses a more or less analogous playing technique called *imbal*, making it a universal element of gamelan music.

- 2) The primary structural framework of a gamelan composition is the *balungan* (melodic core). Drawing on the *balungan* and established general principles, a composition takes shape, and the parts for all orchestral instruments—as well as the musical form—are derived from it. The musical form (*bentuk*) of a gamelan piece is characterized by a colotomic structure and cyclicity, which in turn partly determine the orchestral instrumentation.

It is also important to note that all the theoretical concepts discussed form a highly organic and causally interconnected whole. This is illustrated in diagram 3.

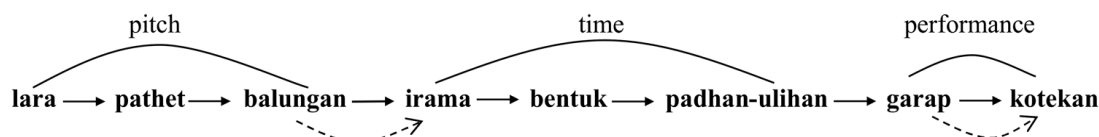


Diagram 3. An overview of the interrelationships among gamelan musical concepts

We can combine the theoretical concepts of gamelan discussed above into a single chain. Three groups are evident: concepts of pitch (*lara*, *pathet*, and *balungan*), concepts of time division or form (*irama*, *bentuk*, and *padhan-ulihan*), and concepts of performance practice—*garap* and *kotekan*. We can notice that the concept of *balungan* serves as a connecting link leading into the sphere of musical time, while the concept of *garap* leads into the realm of musical performance practice. A clear trend toward the standardization of theoretical systems is evident. Many of the concepts discussed present stable models and rules that have remained virtually unchanged throughout history. At the same time, within the boundaries of these rules, performers retain a considerable degree of interpretive freedom. It is likely that due to the standardization of the most important rules, gamelan culture did not require notation, and the essential core of the orchestra was preserved throughout its entire historical development.

Although the musical concepts discussed are not strictly aimed at describing the orchestral phenomenon but instead encompass virtually all stages of gamelan composition and practice, we can nevertheless observe varying degrees of correlation between these concepts and the *system of orchestral structural elements* applied in this study. First, it is important to note that the directions of orchestral vertical and horizontal expansion are embedded within the broader system of gamelan theoretical concepts: the pitch group expands primarily in the vertical dimension, while the time-division group underpins the horizontal expansion of gamelan. The first two concepts (*lara*, *pathet*) describe the pitch system and do not have a significant influence on the orchestral structure.<sup>7</sup> Meanwhile, the concept of *irama*, which describes the tempo relationships between individual orchestral groups, is directly linked to the elements of orchestral groups and textural layers, and most clearly reveals the nature of interaction among these groups. Its distinctiveness lies in the fact that *irama* describes interaction solely in terms of rhythmic relationships between sections and possesses a somewhat more horizontal character than the three aforementioned structural elements of the orchestral vertical with which it is associated (the formation of orchestral groups, the relationships between them, and the textural layers). Elements of orchestral dramaturgy are reflected in the concepts of *bentuk* (major sections) and *padhang-ulihan* (minor sections). Meanwhile, the performance concepts *garap* and *kotekan* reveal an even finer-grained organization of orchestral groups and the interrelationships among instrumental parts. Most importantly, all of the aforementioned concepts—except for the first two (*lara*, *pathet*)—develop the melodic core, *balungan*, in different ways and at different structural levels. Therefore, we can see that *balungan* serves as the foundation and point of departure for the entire system of musical organization, the axis around which all gamelan compositions are structured. Consequently, this concept could meet the criteria for an orchestral structural unit.

<sup>7</sup> Nevertheless, a certain influence on the orchestral structure can be observed in situations where dual tuning is present—when one half of the orchestra is tuned to the *pelog* system and the other half to *slendro*.

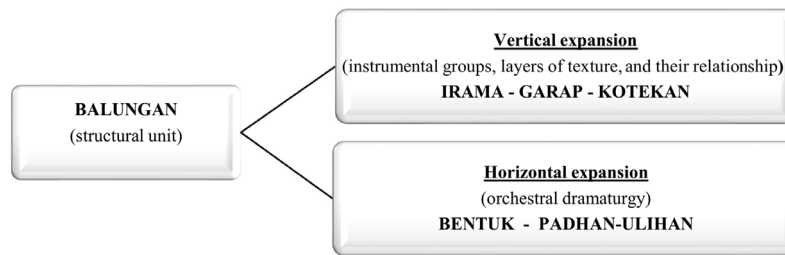


Diagram 4. The relationship between gamelan music concepts based on correlation with the system of orchestral structural elements

Diagram 4 illustrates the relationship between gamelan music concepts based on how they correlate with the *system of structural elements of the orchestra*. Vertical *balungan* development is grounded in the concepts of *irama*, *garap*, and *kotekan*, while horizontal development reflects the concepts of *bentuk* and *padhang-ulihan*. It is worth noting, however, that in the context of gamelan musical concepts, the distinction between vertical and horizontal expansion is not entirely clear-cut. Most concepts encompass aspects of both directions, even though a certain predominance of one or the other can still be discerned.

## 2. Structural elements of the gamelan orchestra and the principles of its formation

A comprehensive overview of theoretical gamelan concepts and their correlations with the structural elements of the orchestra makes it possible to examine the functioning of these elements in a more precise, focused, and authentic manner, without departing from the essence of the orchestra itself. In this chapter, the system of orchestral structural elements will be employed as a tool for a multifaceted exploration and characterization of gamelan as an orchestral phenomenon.

### 2.1. The structural unit as a model of composition

The syncretic mindset characteristic of gamelan culture—the merging of all areas of music-making into an indivisible whole—and the specific ways in which musical concepts function within gamelan composition suggest that the structural unit should reflect the model of the composition as a whole, rather than a small detail of it, as is typical in European orchestral models. In this sense, the *balungan* may be identified as the structural unit of the orchestra: the melodic core from which the entire gamelan composition emanates.<sup>8</sup> It meets all the criteria of a structural unit:

- a) it is a unified entity and functions as an indivisible unit;
- b) it retains all its fundamental characteristics throughout the piece and is stable;
- c) it clearly dominates the musical structure as the main element;
- d) it serves as the foundation for the formation of the orchestral vertical and horizontal dimensions.

Here we see a fundamental difference from European orchestral models, in which the structural unit consists of a smaller element that is subsequently multiplied in various ways and according to various principles—the whole is constructed from its details.<sup>9</sup> In the case of gamelan, the structural unit encompasses the whole, containing within itself the complete outline of the composition. In the process of constructing the orchestra, this unit is unfolded both vertically—through the layering of instrumental groups and orchestral textures—and horizontally, as it unfolds into a musical form. Because gamelan's structural unit embodies the entirety of the piece and is subsequently divided into separate segments, it exhibits all the characteristics of a *macro-unit*.<sup>10</sup>

<sup>8</sup> Sorrell notes that modern gamelan notation records only the *balungan* and its colotomic support, which is entirely sufficient to unfold the entire composition (Sorrell 1990, 107). This once again confirms the function of the *balungan* as the essential model for the entire work and as the point of departure for the composition as a whole.

<sup>9</sup> More on the principles of the European orchestra: Baranauskas (2016, 33–42), Baranauskas (2020).

<sup>10</sup> A *micro structural unit* is a relatively small formation, the multiplication of which allows the shaping of orchestral structure as well as a concrete work; i.e., this structural unit is much smaller than the entire work and is expanded using the principle of multiplication or repetition. A *macro structural unit* is a uniform formation that encompasses the entire scope of the work or its major part which is developed by the method of division; i.e., this structural unit holds the entire scope (or a major part) of the work and is divided into smaller sections. While the logic of a *micro* structural unit allows small details to form the entire work, in the case of a *macro* unit, one large detail is divided into smaller parts (Baranauskas 2019, 25).

The main component of this structural unit is a single musical parameter—a sequence of specific pitches that forms the melodic line. In this case, we can refer to it as a *monoparametric* element possessing a single melodic characteristic. The expansion of the structural unit is more pronounced in the vertical than in the horizontal direction of the orchestral texture, thus revealing a tendency toward vertical spread. In summary, the *balungan* structural unit can be characterized as a macro-monoparametric entity with a pronounced tendency toward vertical expansion. Such a structural unit serves as a concentrated model of the gamelan composition as a whole. One instance of a *balungan* is shown in figure 4. Here, the melodic core of the gamelan piece *Ladrang Wilujeng* is presented separately (Sorrell 1990, 80).



Figure 4. The melodic core of the gamelan piece *Ladrang Wilujeng*

This melodic sequence, in its concentrated form, contains the entire piece from beginning to end. It is performed by a distinct group of *balungan* instruments. As it develops further in the vertical dimension, additional orchestral instrumental groups emerge. At the same time, as it unfolds horizontally, it generates the distinct formal sections, thereby shaping the orchestral dramaturgy and the overall development of musical form.

It is important to note that gamelan orchestras from all regions, regardless of their function or instrumental composition, share the same foundational musical concepts discussed in the previous section. Consequently, they all follow the same principle of unfolding the melodic core. We may therefore assume that, despite the great variety of subtypes and forms of gamelan orchestras, their structures are based on a structural unit of the same nature. Since the definition of distinct types of orchestral structure presupposes the existence of fundamentally different structural units, in this case we can conclude that there is only one type of orchestral structure characteristic of the entire gamelan tradition, albeit with potentially numerous subtypes.<sup>11</sup> Additionally, it should be noted that highlighting individual gamelan subtypes would be difficult due to the vast number of orchestral forms. It would require too much space and would not contribute to achieving the objectives of this work. Therefore, this was not included in the scope of this paper. Meanwhile, the general trends in the development of the aforementioned structural unit are explored in greater detail in the following subsections.

## 2.2. Distribution of vertical and horizontal elements

The instruments in the orchestra are grouped according to their musical function rather than their timbral characteristics, resulting in clear and standardized groupings. The relationships among these groups can be described as functionally complementary. Each of the instrumental groups performs its own stable and unchanging function, coming together to form a unified orchestral fabric. Throughout the piece, these groups do not exert any obvious influence on one another, nor do they alter the nature of each other's functioning. Thus, the aforementioned interaction is established from the very beginning of the piece and remains stable throughout its course.

The instrumental structure of the gamelan orchestra is characterized by a binary duality. As already mentioned, the modern gamelan orchestra is often binary—one half is tuned to the *slendro* scale, the other to the *pelog*. An even more pronounced duality is evident in the fact that many instrumental groups themselves are

<sup>11</sup> Various criteria are possible for the potential differentiation of subtypes: structural (differences in vertical and horizontal expansion, different segmentation of the melodic core in Bali, Java, and other regions); instrumental (significant differences in instrumental composition and the resulting characteristics of the orchestral structure); functional (differences in the functional purpose of the orchestra); geographical (specifics of orchestra usage in individual regions).

dual. Some instruments are tuned slightly higher, representing the male instruments, and others are tuned slightly lower, symbolizing the female instruments. This creates a rough, vibrating “unison” effect.<sup>12</sup>

Nevertheless, one of the most significant features of the instrumental structure is the grouping of instruments according to their musical function. Moreover, there is a close relationship between these functional groups and the structure of the music being performed. The standard functions of the instruments remain largely consistent from one piece to another, and these functions are determined by the fundamental elements that constitute gamelan music (as discussed in the previous section).

Different researchers classify instrumental functional groups in slightly different ways. Sorrell distinguishes three main groups based on the role they play in the structure of a piece (Sorrell 1990):

- a) instruments playing the *balungan*,
- b) instruments that emphasize the colotomic structure,
- c) instruments performing the function of melodic elaboration.

Susilo also identifies these three groups, while separately distinguishing the rhythmic group of drums (Susilo n.d., 1). Meanwhile, Sumarsam presents the following classification (Sumarsam 2023, 6):

1. Instruments and vocalists performing the melody:
  - a) instruments and vocalists presenting elaborated melodies,
  - b) instruments playing a melodic abstraction (*balungan*),
  - c) instruments that melodically mediate between groups a) and b).
2. Instruments regulating musical time.
3. Instruments emphasizing musical structure.

As we can see, the aforementioned classifications of instrumental groups differ only in their details and the somewhat different sub-groups they distinguish. Meanwhile, the essential aspects based on the specific structure of gamelan music remain the same. Thus, based on researchers’ data, we can classify the main instruments of the gamelan orchestra into three primary functional groups: melodic, colotomic, and rhythmic. All of this is shown in table 2.

Table 2. Gamelan instruments grouped by function

Melodic function	Melodic core ( <i>balungan</i> )	<i>Saron, demung, peking, slentem</i>
	Elaborated melody	<i>Bonang, gambang, gender, siter, rebab, suling, human voice</i>
Colotomic function		<i>Gong ageng, kempul, kempyang, kenong, ketuk</i>
Rhythmic function		<i>Bedug, kendang</i>

All three groups perform fundamentally different functions. Instruments belonging to the melodic group play the core of the piece—the *balungan*—and elaborate or embellish it melodically. The colotomic group marks the essential structural divisions of the form. The rhythmic group functions as an audible conductor. The primary factor ensuring the orchestra’s coordination is clearly the presence of this audible conductor (the rhythmic functional group). In addition, the colotomic instruments and the strict formal structure of the pieces also contribute to coordination among the players.

In figure 5 (Kunst 1973, 484–485), we see an instance of the functional distribution of instruments. Because the functions of the instruments remain constant, the textural layers of the music essentially correspond to the instrumental groups. The functional distribution of the groups determines the layering of the texture according to functions. The texture is organized hierarchically, from the most essential layers to the more decorative and peripheral ones, and each layer retains its stable function. There are four distinct layers: rhythmic, colotomic, *balungan*, and elaborated *balungan*. The latter layer is further divided into two groups: the first consisting of pitched percussion instruments, and the second of wind instruments. Complementarity in rhythm and harmony also becomes apparent when a group of instruments is split into two identical timbral

<sup>12</sup> Malm writes that the Balinese gamelan instruments *gender* or *gansa* are constructed in pairs or sets of four for each octave. Although all instruments in the set are in the same tuning, half are “female” instruments, which are tuned slightly lower than their “male” counterparts (Malm 1977, 48). This tendency is no less pronounced in the gamelans of Java and Madura. It is particularly characteristic of the gong and drum groups. Orchestras typically have “one *kenthuk bine* (large gong), one *kenthuk lake* (small gong), one *kendhang bine* (double-headed drum), and one *kendhang lake*” (Crawford 2001, 331). Here, *bine* means “feminine,” and *lake* means “masculine.”

parts that perform contrasting rhythms and harmonies. Although the textural layers generally correspond to the instrumental groups, additional micro-layers can be observed within each one—a form of internal textural stratification within a single instrumental group. For example, the *balungan* instruments form two slightly distinct layers, and the elaborating *balungan* group divides into at least five layers of differing texture and timbre. This reveals a subtle yet meaningful distinction between the formation of orchestral groups and the formation of textural layers.

The image shows a musical score for Gamelan Bawa, composed by Sekar Chondra Wilasita. The score is organized into four main sections, each with its own set of staves:

- Elaborated Balungan:** Includes staves for Suling, Singdén, Rebab, Gendér penerus, Gendér barung, Gambang kayu, Bonang penerus, and Bonang barung.
- Balungan:** Includes staves for Saron penerus, Saron barung Demung, and Slentem.
- Colotomic:** Includes staves for Kempyang Ketuk, Kenong Kempul, and Gong ageng.
- Rhythmic:** Includes staves for Ketipung and Kendang gending.

On the right side of the image, there is a separate set of staves for instruments: Su., Si., R., G.p., G.j., G.k., B.p., B.b., S.p., S.b., Dem., Si., Kempyang Ketuk, Kenong Kempul, Gong ag., Ketip., and K.gend.

Figure 5. Gamelan Bawa (Sekar Chondra wilasita)

Dominant timbres and timbral stability are shaped by the fact that the overall timbral palette of the gamelan is dominated by metallic pitched percussion instruments (idiophones). All the main instruments of the Javanese gamelan are listed in table 3.

Table 3. Gamelan orchestra instruments by construction and timbre

Percussion	Gongs	Vertical: <i>gong ageng, gong suwukan (siyem), kempul</i> ; Horizontal: <i>kenong, ketuk, kempyang</i> ; Gongs-bells ( <i>bonang</i> ): <i>barung, penerus</i>
	Metallophones	<i>Saron: demung, barung, penerus (peking), slentem</i> ; <i>Gender: barung, penerus</i>
	Xylophones	<i>Gambang</i>
	Drums	<i>Kendang gending, kendang ketipung, kendang batangan (ciblon)</i>
String	<i>Siter (citra), rebab (violin)</i>	
Wind	<i>Suling (transverse flute)</i>	
Voice	<i>Pesinden (female voice), gerong (choir)</i>	

The resulting sound clearly indicates the unambiguous dominance of percussion instruments. The groups of gongs and metallophones (pitched idiophones) stand out particularly here.<sup>13</sup>

Despite the predominance of percussion instruments in the orchestra's overall instrumentation, it is difficult to identify a single timbre that clearly dominates the ensemble. In some cases, the human voice (when

<sup>13</sup> Sorrell presents a slightly different idea for classifying instruments, which is likely closer to the understanding of instruments in gamelan culture. He suggests dividing instruments into two groups—those that are held by the performer and those that are not. In this case, held instruments serve as a sort of extension of the human body, while those not held are not associated with human individuality and carry a sacred connotation. He points out that the gamelan is, in fact, almost entirely untouchable. Contact is made through mallets, and hands are used only for certain instruments, mostly for a secondary muting function (Sorrell 1990, 20).



This musical score is for the first part of *Gamelan Ladrang Wilujeng*. It features multiple staves for different instruments and vocal parts. The instruments include Rebab, Gender Pancer, Gender Barung, Gambang, Bonang Pancer, Bonang Barung, Sindhen, Gongsang, Peking, Saron Barung, Demung, Sindhen, Kempyang, Kratik, Kenong, Kempul, Gong Ageng, and Keothang II. The vocal parts are labeled as Suwah. The score includes rhythmic notation with numbers below the notes, and specific shapes (triangles and diamonds) are used to mark colotomic beats. The lyrics are written in Indonesian.

This musical score is for the second part (Lik) of *Gamelan Ladrang Wilujeng*. It features the same instruments and vocal parts as the first part. The notation includes rhythmic markings and colotomic beat indicators (triangles and diamonds) for the various instruments. The lyrics are written in Indonesian.

Figure 6. Gamelan *Ladrang Wilujeng* (second part *Lik*) (Sorrell 1990, 107–112). Colotomic beats of different levels are marked using different shapes

Furthermore, this entire section is divided into four smaller sections, which are structurally identical in length (eight beats of the colotomic instruments). These sections are marked by strikes of the *gong kenong*. Meanwhile, the *kempul* divides this structure in half again (the duration of four colotomic beats), while the *kempyang* and *ketuk* provide the finest division of time. This is more clearly seen in diagram 5.

	1		2		3		4		
	1	2	3	4	5	6	7	8	
△ Kempyang:	+	+	+	+	+	+	+	+	
◇ Kentuk:		+		+		+		+	
□ Kempul:				+			+		
○ Kenong:	+		+		+		+		+
○ Gong ageng:	+								+

Diagram 5. *Ladrang Wilujeng (Lik)* colotomic structure

The second feature that reveals a degree of orchestral dramaturgy lies in the textural layers—or individual instruments—that enter and withdraw over the course of the piece. Although each instrument and instrumental group performs a stable textural function, they periodically fall silent and then re-enter, creating shifts in texture, timbre, and register. More pronounced changes occur at the boundaries between larger formal sections. Revisiting the examples discussed above (figures 5 and 6), we observe that the degree of change within these fragments is minimal—the full orchestra is employed throughout. However, as the episodes progress, certain textural layers are gradually withdrawn (for instance, at bar 150 in figure 5). Thus, the principle of removing and adding stable textural layers activates the process of orchestral dramaturgy and brings about a certain timbral change. It is also worth noting that the timbral changes produced through this principle do not function as a significant or consciously crafted dramaturgical device, unlike in the symphony orchestra. Instead, they appear as secondary effects arising from the musical structure itself and from the logic of performers' entries. Consequently, both the dramaturgical dimension of orchestral structure and the parameter of timbral stability should be regarded as secondary within the gamelan orchestra.

### 2.3. The overall structure of the gamelan orchestra

To summarize the points discussed above regarding the structure of the gamelan orchestra, we can present the following comprehensive diagram (diagram 6).

The foundation of the orchestral structure is formed by a structural unit *balungan*, characterized as a *macro-monoparametric unit with a tendency toward vertical expansion*. This structural unit, expanding in both vertical and horizontal directions, forms all the fundamental elements of the orchestra.

Within the structure, we observe that certain elements play a greater role (the principle of instrumental group formation, the nature of interaction between these groups, layers of texture, dominant musical parameter), while others become less significant (dominant timbre and timbral stability, orchestral dramaturgy). We see that vertical orchestral elements prevail, while horizontal elements appear to be less important. At first glance, this may seem paradoxical, given that the dominant musical parameter is the melodic line, which is primarily horizontal in character. However, although gamelan performance is fundamentally grounded in linear thinking, the absence of pronounced change over the course of a piece allows the orchestra to be described in greater detail through vertical parameters—parameters that are themselves the product of horizontal thinking and horizontally organized layers.

We can also observe certain patterns in the relationship between vertical and horizontal elements. Unlike the structural logic of the symphonic orchestra, in the gamelan the element of *orchestral dramaturgy* maintains a reciprocal relationship with the *layers of orchestral texture*. In other words, orchestral dramaturgy is shaped primarily by changes within these textural layers. Furthermore, the *dominant musical parameter* is closely tied to the nature of *interaction among the orchestral groups*. This is evident through the influence of the melodic line on the linear-melodic nature of orchestral group interaction. In many cases, an orchestral group also

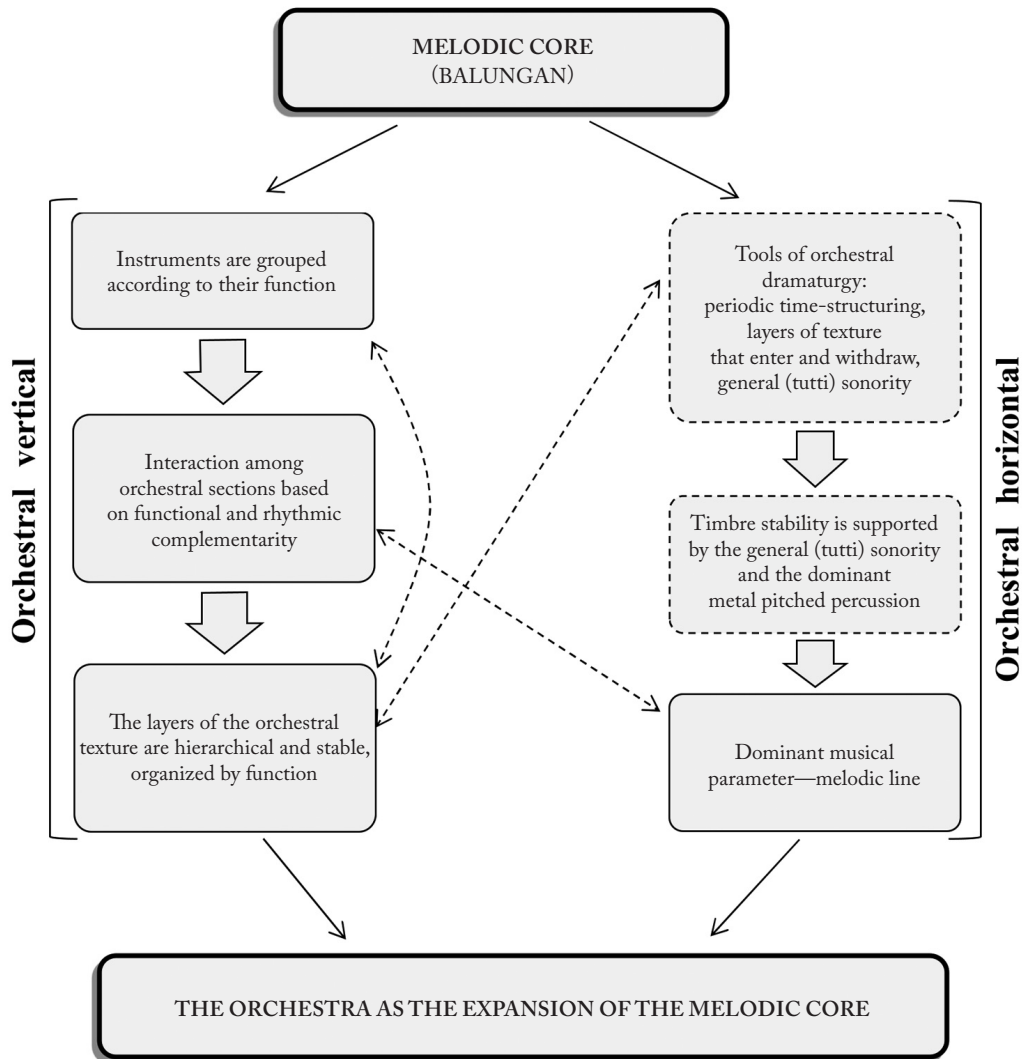


Diagram 6. The totality of gamelan's structural elements

corresponds to a textural layer, so these vertical elements tend to merge into a single unit (indicated in the diagram by an additional dotted arrow).

Overall structural principle of the gamelan orchestra: the orchestra as an expansion of a melodic core.

### 3. Concluding remarks

The structural analysis of the gamelan orchestra has yielded clear results. By applying an appropriate analytical approach and taking specific cultural contexts into account, it becomes evident that such a method can reveal the fundamental principles of the gamelan orchestra and integrate them into a coherent system.

Traditional gamelan theoretical terms and concepts can be linked into a single chain in which each element is connected to the one preceding it. Three conceptual groups have been identified: pitch-related concepts (*lara*, *pathet*, *balungan*); concepts of time division and form (*irama*, *bentuk*, *padhang-ulihan*); and performance-practice concepts (*garap*, *kotekan*). The directions of vertical and horizontal orchestral expansion are embedded within this theoretical system: the pitch group contributes primarily to vertical expansion, while the time-division group underpins horizontal expansion. Vertical *balungan* development is grounded in *irama*, *garap*, and *kotekan*, whereas horizontal development is reflected in *bentuk* and *padhang-ulihan*.

Two essential structural characteristics of the orchestra have emerged: *balungan*, which serves as the melodic core and generative model for the entire composition, and the colotomic structure, which organizes musical time.

The structural analysis method employed in this study has demonstrated its effectiveness. It can be applied not only to the symphonic orchestra but also to the gamelan orchestra, whose structure and principal elements can be described through the system of orchestral structural elements. All components of this system function, to varying degrees, within gamelan music.

One structural unit—the *balungan*—has been highlighted. It possesses macro characteristics and is mono-parametric, with a tendency toward vertical expansion. On this basis, a single overarching structural type can be defined, one that may be subdivided into numerous potential subtypes. The structural unit in the gamelan orchestra reflects a model of the whole, which is then elaborated, divided, and distributed across other orchestral elements. The structure is dominated by elements of the orchestral vertical. The gamelan orchestra is thus characterized by a structural principle that simultaneously functions as a compositional strategy: the orchestra as an expansion of a melodic core.

It is likely that the model of gamelan orchestral elements formulated in this study can serve as a compositional tool for creating new orchestral concepts<sup>16</sup> and for seeking a distinctive orchestral sound—not through superficial means, but by engaging with deeper principles of structure and internal organization.

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### Gamelano orkestro struktūriniai elementai: šiuolaikinis požiūris

#### Santrauka

Neeuropinės kultūros orkestro analizė turi daug potencialių galimybių atskleisti naujus struktūros modelius, komponavimo strategijas, taip pat galimus sąveikos su europiniais orkestro modeliais būdus. Todėl tai yra svarbus žingsnis orkestro, kaip reiškinių, išsamesnio suvokimo link. Šiame straipsnyje gamelanas nagrinėjamas dviem etapais. Pirmiausia, sistemiškai aptariamos pagrindinės gamelano muzikos koncepcijos. Tai daroma tam, kad būtų lengviau suvokti gamelano muzikos komponavimo principus, gamelano orkestro sandarą, taip pat pagrindines sąvokas ir terminus. Vėliau pateikiama detali orkestrinių elementų analizė, remiantis kontekstais, aptartais straipsnio pirmame skyriuje. Svarbu pabrėžti, kad, siekiant suprasti gamelano orkestro veikimo principus ir sugebėti juos pritaikyti kūrybinėje praktikoje, mums reikalingas specialus orkestrinės analizės metodas – bendri kriterijai, kuriais remiantis būtų galima atskleisti įvairių tipų ir kultūrų orkestrų esmines savybes bei principus. Naudodami bendrą analitinį įrankį, galime orkestrus lengviau lyginti tarpusavyje, numatyti jų sąveikos galimybes ir vertinti juos skirtingų orkestrinių kultūrų kontekste. Straipsnio autoriaus sukurta orkestro struktūrinių elementų sistema yra taikoma siekiant išsamios ir įvairiapusės gamelano orkestro analizės.

Teorinės gamelano bazės elementus galime sujungti į vieną grandinę, kurioje kiekvienas jos narys susijęs su ankstesniuoju. Matomos trys grupės: garso aukščio koncepcijos (*lara, pathet* ir *balungan*), laiko dalijimo arba formos koncepcijos (*irama, bentuk* ir *padhan-uliban*) bei atlikimo praktikos koncepcijos (*garap* ir *kotekan*). Nors šios muzikinės koncepcijos nėra tiksliai orientuotos

<sup>16</sup> For more information on the creative application of this model and its potential interactions with symphony orchestra models, see Baranauskas (2023, 110–125).

į orkestrinio reiškinių apibūdinimą, jos aprėpia bene visas gamelano muzikos komponavimo ir funkcionavimo pakopas. Be to, galime išvengti minėtų sąvokų didesnę arba mažesnę koreliaciją su tyrime naudojama orkestro struktūrinių elementų sistema.

Vertėtų atkreipti dėmesį, kad gamelano teorinių koncepcijų visumoje slypi orkestrinės vertikalės ir horizontalės sklaidos kryptys: garso aukščio grupė daugiau skleidžiasi vertikalia kryptimi, o laiko dalijimo grupė pagrindžia horizontalią gamelano sklaidą. Pirmosios dvi minėtos sąvokos (*lara, pathet*) apibūdina garso aukščių sistemą ir ryškesnės įtakos orkestro struktūrai nedaro. O *irama* koncepcija, apibūdinanti tempo santykius tarp atskirų orkestro grupių, nors tiesiogiai siejasi su pastarųjų bei faktūros sluoksnių elementais, labiausiai atskleidžia būtent sąveikos tarp orkestro grupių pobūdį. Tam tikrą savitumą galima išvengti tame, kad *irama* apibūdina sąveiką tik ritminio santykio tarp orkestro grupių aspektu ir horizontalės charakteristikų turi šiek tiek daugiau nei visi trys minėti orkestrinės vertikalės struktūriniai elementai, su kuriais ji siejasi (orkestro grupių susidarymas, santykis tarp jų, faktūriniai sluoksniai). Orkestrinės dramaturgijos elementai atsiskleidžia per sąvokų *bentuk* (stambiosios dalys) ir *padhan-uliban* (smulkiosios dalys) sampratas. O atlikimą apibūdinančios sąvokos *garap* ir *kotekan* atskleidžia dar smulkesnį orkestro grupių organizavimo pobūdį ir instrumentinių partijų tarpusavio santykį. Svarbiausia yra tai, kad visos minėtos sąvokos, išskyrus pirmąsias dvi (*lara, pathet*), funkcionuoja vienu ar kitu parametru išskleidžiamos melodinį gamelano kompozicijos branduolį *balungan*. Būtent *balungan* yra gamelano muzikos sistemų visumos pagrindas ir gamelano kompozicijų ašis. Todėl ši sąvoka atitinka orkestro struktūrinio vieneto kriterijus.

Gamelano orkestro struktūros pagrindą sudaro makrostruktūrinis vienetas *balungan*, kuris charakterizuojamas kaip *mono-parametrinis*, turintis polinkį į vertikalį sklaidą. Šis struktūrinis vienetas, besiskleidžiamas vertikalia ir horizontalia kryptimis, suformuoja visus pagrindinius gamelano orkestro elementus. Pastarojo struktūroje išvengiame, kad tam tikri elementai turi daugiau reikšmės (instrumentinių grupių susidarymo principas, šių grupių tarpusavio sąveikos pobūdis, faktūros sluoksniai, dominuojantis muzikos parametras) nei kiti (dominuojantis tembras ir tembrinis stabilumas, orkestrinė dramaturgija). Matome, kad vyrauja orkestrinės vertikalės elementai. Iš pirmo žvilgsnio tai gali atrodyti paradoksalu, ypač turint galvoje, kad dominuojantis gamelano muzikinis parametras yra melodinė linija, turinti horizontalią charakteristiką. Tačiau nepaisant to, kad gamelano muzikavimo pobūdis pagrįstas lineariu mąstymu, dėl akivaizdesnės skambesio kaitos laike nebuvimo orkestras gali būti detaliau apibūdinamas vertikalės parametrais, kurie savo ruožtu yra horizontalaus mąstymo ir horizontalių sluoksnių rezultatas.

Struktūrinė gamelano orkestro analizė davė akivaizdžių rezultatų, todėl galime teigti, kad, taikant tinkamą prieigą ir atsižvelgiant į specifinius kultūrinius kontekstus, tokio pobūdžio analizė gali atskleisti esminius gamelano orkestro principus ir padėti juos susieti į vientisą sistemą. Išryškėjo dvi svarbios struktūrinės gamelano orkestro savybės: makromelodinis branduolys *balungan*, kaip kompozicijos ir viso orkestro ašis, ir *kolotominė* struktūra, kaip muzikinio laiko formavimo priemonė.

Straipsnyje naudojamas struktūrinės analizės įrankis pagrindė savo efektyvumą. Jis gali būti rezultatyviai naudojamas ne tik simfoninio, bet ir gamelano orkestro analizei. Gamelano orkestro struktūra ir visi pagrindiniai jos elementai gali būti apibūdinami taikant orkestro struktūrinių elementų sistemą, kurios visi elementai daugiau ar mažiau aktyviai funkcionuoja gamelano orkestre. Apskritai gamelano struktūrinis vienetas atspindi visumos modelį, kuris yra skaidomas, dalijamas ir skleidžiamas kitais orkestro elementais. Minėtoje struktūroje dominuoja orkestrinės vertikalės elementai. Gamelano orkestrui būdingas struktūrinis principas – orkestras kaip melodinio branduolio sklaidą.

Tikėtina, kad straipsnyje suformuluotas gamelano orkestrinių elementų modelis gali būti naudingas kaip komponavimo įrankis kuriant naujas orkestro koncepcijas ir ieškant savito orkestro skambesio ne tik paviršinėmis priemonėmis, bet ir integruojant gilesnius struktūros bei vidinės sandaros principus.