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GEOMETRICAL CONSTRUCTIONS AS A BASIS FOR COMPOSITION TYPES IN LANDSCAPE ARCHITECTURE

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Abstract

Different kinds of compositions are used in landscape architecture practice, despite the fact that composition types are not deeply theorized or defined precisely as composition styles. The conception of styles concerned in landscape history and theory is a general issue. The current paper aims to explore the geometrical construction types as a concept which gives to composition specific and aesthetic qualities. The research methodology includes the following three steps: several compositions have been analyzed and evaluated by different experts; a model for typology has been made, and as a result a conception for typology has been created. Exemplary compositions are explored through their drawings, plans or satellite images and are perceived as abstract, plane, graphic images. In this way their aesthetic qualities are explored isolated. The evaluation has been statistically checked. On the basis of comparative analysis of the best compositions, criteria for creation of a type model have been suggested. As a combination between the variables of the particular criteria certain types of compositions have been finally established. Thus the geometrical patterns could be understand better and effectively use in the creation of plan drawings.

Key words: design approach, geometrical pattern, type model, visual quality.

Introduction

The composition is a fundamental concept in the arts. It is defined as aesthetic activities towards a harmonious organization of several components (Tkachev 2006). In every field – art, design, architecture, and landscape architecture – there is a theoretical basis that serves to build the composition of the work. In landscape architecture (LA) are used a variety of approaches and composition methods. Typology is one of them.

Achieving harmonious and aesthetic compositions in LA is based generally on geometric constructions and universal artistic laws and principles. By their use in the past masterpieces of garden and park art have been created. The actuality of the study lies in the question whether contemporary landscape-architectural compositions (LAC), influenced by modern art trends obey these principles.

This study aims to identify the most common types of LAC, based on geometrical constructions and characterized by high aesthetic qualities and expressiveness. To realize the objective have been set out the following tasks:

- after selection of exemplary LAC the relationship between aesthetic qualities and geometric constructions to be analyzed;
- based on geometric constructions a model of typology to be made;
- using the model specific types of LAC to be defined.

The scope of the study is determined by the ability to analyze large amounts of exemplary projects. In this case, they are not an illustration, but rather raw material that serves to build the model. The projects are selected from Landezine (2015). This website is among the best ten websites for landscape architecture in the last three years according to the international company Global Site Plans and Alexa International Rankings. The used projects are built after the beginning of the XXI century, as it is assumed that they most closely reflect the impact of various contemporary trends in art. Geographically are covered almost all continents, although dominate projects located in countries with a developed landscape-architectural practice. For the above reasons and methods of work, the analysis of sample projects is done in graphic data – plans, drawings, satellite images, i.e., have been taken into consideration their plane compositions. The plan drawings are more appropriate of geometric analysis.

To conduct the study has been used the following methodology (Fig. 1). The aesthetic qualities of LAC examples are determined by the method of expert evaluation. Establishing the relationship between these qualities and the degree of complexity of the compositions followed. Geometric constructions serve as a basis for creating a model for typology of LAC. It helps to synthesize specific types of LAC. The study concludes by identifying the most common types of compositions, which experts determined that have the highest aesthetic qualities.

For the implementation of the first task an interdisciplinary approach has been

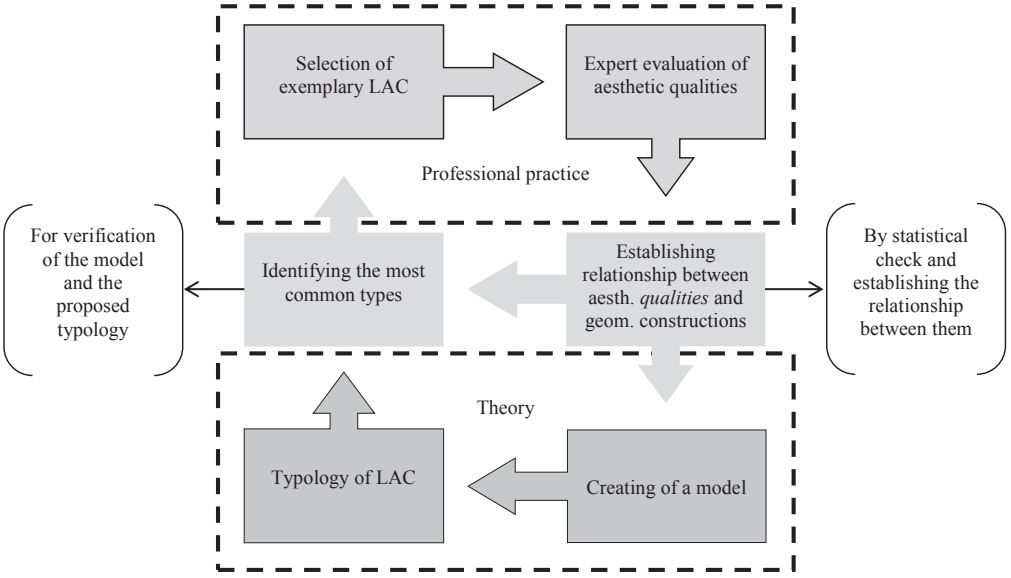

Fig. 1. Methodology and sequential steps.

used. Seventy selected examples of LAC are evaluated by forty experts in the field of landscape architecture, architecture and urban planning, engineering design and fine arts. Half of the experts are in the professional design practice, most of whom with more than ten years of experience. The rest of experts are teachers and researchers from four universities, most of whom with solid design experience too. The projects are analyzed as graphic plain compositions, without considering context, existing features, purpose, size, i.e., in an abstract way. The aim is to be assessed the artistic and aesthetic qualities of the compositions isolated from other functional and technical aspects. This allows the defined problem to be considered from different angle, so that the interdisciplinary approach could be applied.

Argument for this is that the aesthetic qualities of the composition are essential. From psychological point of view 90 % of the information about the surrounding environment of the man is perceived by eyes (Stepanov 2007). According to Rappaport (1970) the importance of the visual characteristics of the environment requires placing the form-creation process on objective scientific basis, in order to avoid subjective interpretations (as cited in Stepanov 2007).

On the other hand since the visual qualities of a work are associated with different effects that it causes in the perceiver, it is incorrect to talk about objective aesthetic evaluation. Even less is possible by quantitative criteria to assess qualities associated with harmony, unity, etc. However, there are two concepts for defining the visual qualities of the landscape – 'objective', based on its physical characteristics and 'subjective', which evaluates the landscape in its perception (Lothian 2000, van Etteger 2008). If these two approaches are adopted in assessing the aesthetic qualities of LAC, the current study is based on the second concept.

After evaluating the sample compositions and determining the relationship between aesthetic qualities and geometric constructions, has been proceed towards solving the second problem of the study – the creation of a model for typology of LAC. The selection of criteria for the model is related to the way in which has been looked at the example compositions – as flat abstract compositions. In this connection, the plane composition, which is relatively two-dimensional and includes clarification of alleys, playgrounds, lawns, flower beds and water areas (Shtiliyanov 2009) is seen as a graphical composition which elements are point, line, spot and colour (Ustin 2007). The criteria are formulated namely on the basis of interactions between these graphic elements and the possibilities for structuring, constructing and form-creation.

Comparing landscape design with other arts: painting, architecture, etc., Fomina (1988) stresses that the creation of LA works is through composing and constructing, and that in the basis of design are the geometric constructs. Precisely constructions based on a logical basis help to define objective criteria for creating typological model.

The third task of the study is related to the definition of specific types of LAC. This is the stage of synthesis, in which the types are obtained as a combination of selected criteria and their variables. There are several studies on the typology and its application in science and practice.

The idea of Type like the idea of Form is philosophical question, which can be viewed from different perspectives (Madrazo 1995). In many philosophical texts and literary materials for psychology of perception, the term 'type' is used to mean, close to the meaning of 'model'

(Güney 2007). On the other hand, comparing the 'type' and 'model', Quatremere de Quincy (1977) found that the type is associated not so much with the image of a thing which can be copied or imitated, but rather with the idea that an element itself may serve as a rule when creating a model (as cited in Güney 2007).

In this sense, according to Rossi (1982) type is something permanent and complex – a logical principle that precedes the form and creates the form (as cited in Güney 2007). Other authors also considered the type as a principle, which results in the creation of a shape (Sandalack and Uribe 2010).

Unlike art and architecture, in the field of landscape architecture theoretical studies for typology of composition are few. Historically, the concept of type in garden design is used to denote gardens with different composition – Baroque, Renaissance, etc. One of the earliest definitions of different types of gardens is from ancient China. There are three main landscapes created in Chinese gardens – 'laughing', 'threatening' and 'idyllic' (romantic) (Dobrev 2011). These types differ in the use of different compositional methods, different kind of landscape components as well as different way of their use. 'Laughing' type includes the use of many flowering species in the open space, while in the 'threatening' type prevail high cliffs, artificial hills, weird trees, etc. 'Idyllic' type normally includes construction of an island in a lake, arched bridge, weeping willow, etc.

Materials and Methods

1. Comparative analysis of exemplary LAC

Some of the main issues at this stage of the study are:

- Whether aesthetic qualities of the composition are due to simple interactions between compositional elements or they are result from complex composition constructs?
- Does simplification of operations linking the compositional elements lead to enhance the aesthetic qualities of the composition as a whole?
- Does relationship between these two judgments inversely proportional and generally whether linear or a complex curve?

The arising issues lead to the formulation of the following thesis. If the composition is considered as a system of interrelated elements, the aesthetic qualities of the work may be tested by analysis of the elements connections in the system. When the links are through forceful and clear structure, the integrity of the system is greater. Since integrity is one of the most significant compositional and artistic principles in art, seemingly more explicit linking elements should lead to increasing the aesthetic qualities of the composition. In this regard have been analyzed:

- the aesthetic qualities of exemplary projects;
- the degree of complexity of compositional constructions;
- the relationship between them.

1.1. Determination of the exemplary LAC aesthetic qualities

Aesthetic qualities of exemplary LAC are evaluated by 40 experts dealing with creation of different type of compositions – landscape architects, architects, designers and artists. Assessment is performed on five-point scale:

1. Very low aesthetic evaluation – 1 point;
2. Low aesthetic evaluation – 2 points;

3. Average aesthetic evaluation – 3 points;

4. High aesthetic evaluation – 4 points;

5. Very high aesthetic evaluation – 5 points.

Average aesthetic evaluation, a sample of which is shown in Table 1, is giveby the formula: $AE = \frac{E_1 + E_2 + E_n}{n}$,

where: *AE* – average aesthetic evaluation; E_n – individual expert assessment; *n* – the number of experts.

1.2. Determination of the compositional constructions degree of complexity

Compositional constructions are actually geometric constructions. Their degree of complexity is associated with three main aspects:

A. Geometrical type of compositional elements;

B. Interaction between the compositional elements themselves;

C. Interaction between compositional elements and the background (visual field).

Each of these aspects affects the possibilities of linking compositional elements and can be evaluated in three degrees of complexity – low, medium and high. Geometric type is determined by the forms used. According to them the following fundamental differences can be determined:

- using elements with identical geometric type – a relatively common forms;
- using elements with geometric forms of the same type – similar forms with slight variations in geometry;
- using different in their geometric form elements – different forms without domination of any of them.

The interaction between compositional elements is determined by their location and orientation. According to them the following fundamental differences can be determined:

- connecting all elements by certain grid, main axes, similar orientation (direction), etc.;
- connecting some elements by one or another type of connections;
- lack of connection between elements.

The interaction between compositional elements and the background is deter mined by their number and size. Accord ing to them the following fundamental differences can be determined:

- using a small number of large compositional elements, which are easily

Table 1. Assessment of aesthetic qualities of exemplary compositions (fragment), points.

No	Exemplary composition	Average assessment	Individual expert assessment										
			1	2	3	4	5	6	7	8	9	…	40
42	Playground at Zorlu Centre	3.43	3	3	1	2	4	4	5	5	5	…	2
43	Garden of 10,000 Bridges	3.73	4	5	5	3	2	3	4	3	5	…	4
44	Hoekenrode Square	3.93	3	2	4	2	4	3	5	4	5	…	5
45	Hoekenrode Square Clos Layat Park	3.33	2	4	1	3	2	4	4	3	4	…	5
46	Central Garden Block B4	3.63	4	2	1	4	3	3	4	2	3	…	5

Table 2. Determination of the degree of complexity of exemplary compositions (fragment), points.

No	Exemplary composition	Overall assessment	Criteria		
			A. Geometrical type of elements	B. Elements interaction	C. Element-background interaction
42	Playground at Zorlu Centre	9	3	3	3
43	Garden of 10,000 Bridges	6	2	3	1
44	Hoekenrode Square	8	2	3	3
45	Hoekenrode Square Clos Layat Park	7	3	3	1
46	Central Garden Block B4	8	2	3	3

distinguished from the background – clear distinction between element and background;

- using many compositional elements in different sizes, whereat the background is lost – the elements are densely arranged together;
- using a small number of large compositional elements, which are difficult to be distinguished from the background – there is no clear idea of element and background.

Through these three aspects of linking compositional elements, each with three levels of complexity (organization), has been determined the general scale for assessing the complexity of compositional constructions. Low complexity is evaluated with 1 point, average – with 2 and high complexity – with 3 points. By summing up the three aspects has been received an overall score of 3 to 9, so that evaluation of 9 points means too complicated decision and evaluation of 3 points – the most simple one, Table 2.

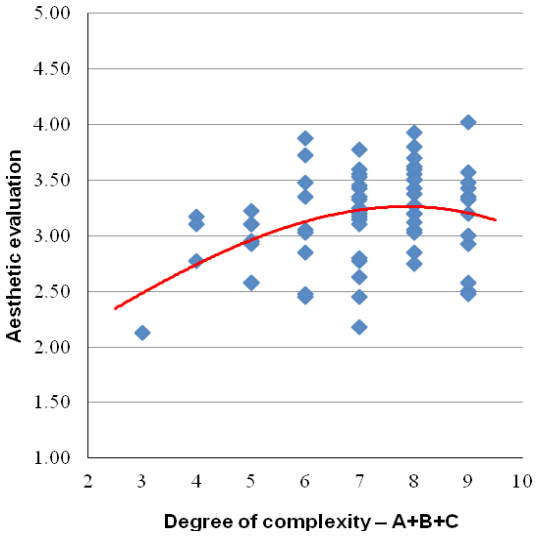

Fig. 2. Relationship between aesthetic qualities and complexity of geometric constructions in the composition.

1.3. Determination of the relationship between the aesthetic qualities and the complexity of geometric constructions in the composition

As comparing the results of the aesthetic evaluation and the complexity evaluation of the exemplary compositions, can be seen that there is a correlation between these two aspects. The correlation coefficient $r = 0.3$, which means that the correlation dependence between studied values is low to moderate. By increasing complexity of geometric constructions, the aesthetic qualities of composition increase as well (Fig. 2).

The figure shows that the compositions which received aesthetic assessments between 2.0–3.5 points have different degree of complexity – they have relatively even distribution. The composition received the lowest aesthetic

evaluation – 2.13 points has the lowest degree of complexity as well – 3.0 points. Those compositions with aesthetic evaluation over 3.5 points have moderate to high complexity. The composition received the highest aesthetic evaluation – 4.03 points has the highest degree of complexity as well – 9.0 points.

2. Model for composition typology

The model consists in the selection of several characteristics of the composition, which can always be found in each LA project. These characteristics are defined as compositional criteria. Each of them varies in certain range, i.e. each characteristic can be represented by a different variety. Thus a type of LAC can be determined by the combination of different varieties of each of the criteria, Table 3.

Table 3. Principal scheme for model typology.

Compositional criterion	Variety 1	Variety 2	…	Variety, *m*
1	1.1	1.2	…	1.*m*
2	2.1	2.2	…	2.*m*
…	…	…	…	…
n	*n*.1	*n*.2	…	*n*.*m*

A certain type LAC can be expressed as follows: $CT\ (n,m) = 1.m+2.m+\ldots+n.m$, where: CT – compositional type; n – the number of criteria; m – the number of criteria varieties.

3. Criteria for LAC typology

Depending on the aspect in which the composition is examined, various criteria can be used in order to receive a particular typology. Since geometric constructions allow the compositions to be compared on an objective basis, this gives rise to criteria selection. In relation to the research aim, have been selected the same three criteria used to determine the degree of complexity of compositional constructions. They define the plane composition as an abstract two-dimensional image and are as follows:

- criterion 'form creation' defined by the geometrical type of compositional elements;
- criterion 'structure' defined by the interaction between compositional elements;
- criterion 'element-background' defined by the interaction between compositional elements and the background.

There are three possible varieties of each of the criteria (again by analogy to the three degrees of complexity), Table 4.

Table 4. Compositional criteria and their kinds.

	Criteria	Criteria variety 1		Criteria variety 2		Criteria variety 3	
A	Form creation	a_1	identical type of forms	a_2	similar type of forms	a_3	different type of forms
B	Structure	b_1	connection of all elements	b_2	connection of some elements	b_3	lack of connection between elements
C	Element-background	c_1	elements with background	c_2	elements without background	c_3	elements and background merging

Results and Discussion

On the basis of exemplary compositions comparative analysis, the proposed typological model, and the adopted criteria and their varieties, certain types of compositions have been finally established.

The possible combinations of the selected three criteria, each with three varieties, allow for the formation of a total of 27 types of compositions. In the surveyed exemplary compositions are explored 21 of the defined types. Composition types are recorded with letters and numbers. The letter shows the certain criterion and the number index recorded after the letter – its variety. For example composition type $a_1b_3c_2$ represents a composition which includes elements with identical forms (a_1), with no connection between them (b_3), occupying the whole space (c_2).

Composition types have some important indicators – aesthetic value, complexity value, frequency of use, rating value. The aesthetic evaluation of compositional types is obtained as an average value from the aesthetic assessments of those compositions, which use the particular type.

The criteria varieties are identical to the degrees of complexity of the geometrical constructions, e.g.: the first variety of 'form creation' criterion – a_1, which comprises the use of identical types of forms has a low complexity; its second variety – a_2, which includes the use of similar forms has average complexity; its third variety – a_3, which comprises the use of different forms has high complexity. Thus the sum of the numeric indices of a certain compositional type determines its complexity index. It varies from 3 to 9, for example compositional type $a_2b_2c_3$ has complexity index 7.

Table 5. Total evaluation of the used composition types.

No	Compositional type	Total evaluation	Aesthetic evaluation × 4	Complexity index × 3	Frequency of use × 2	Rating index × 1
1	$a_3b_3c_3$	67.26	12.62	27.00	24.00	3.65
2	$a_2b_3c_3$	60.69	13.53	24.00	20.00	3.16
3	$a_2b_2c_3$	56.46	13.18	21.00	20.00	2.28
4	$a_3b_2c_3$	53.77	13.30	24.00	12.00	4.47
5	$a_3b_3c_1$	48.91	11.97	21.00	12.00	3.94
6	$a_3b_3c_2$	47.70	13.40	24.00	4.00	6.30
7	$a_2b_3c_1$	38.78	13.55	18.00	4.00	3.23
8	$a_3b_2c_2$	38.08	13.70	21.00	2.00	1.38
9	$a_2b_1c_3$	37.53	12.27	18.00	6.00	1.26
10	$a_2b_2c_2$	37.34	13.90	18.00	2.00	3.44
11	$a_2b_3c_2$	37.09	11.20	21.00	4.00	0.89
12	$a_1b_3c_1$	36.54	10.30	15.00	2.00	9.24
13	$a_3b_2c_1$	35.51	11.60	18.00	4.00	1.91
14	$a_1b_1c_3$	34.67	12.20	15.00	6.00	1.47
15	$a_1b_2c_3$	33.16	12.10	18.00	2.00	1.06
16	$a_2b_2c_1$	32.68	12.35	15.00	4.00	1.33
17	$a_2b_1c_1$	30.66	12.55	12.00	4.00	2.11
18	$a_1b_2c_2$	29.71	11.70	15.00	2.00	1.01
19	$a_2b_1c_2$	27.70	10.30	15.00	2.00	0.40
20	$a_1b_1c_2$	26.15	11.10	12.00	2.00	1.05
21	$a_1b_1c_1$	24.76	8.50	9.00	2.00	5.26

The composition rating value is obtained as the number of viewers is referred to the accumulated days from the date of publication on the website http://www.landezine.com until the time of calculation (on 22.08.2015). The rating indicator of each compositional type is calculated as an average value of the ratings of all compositions, which use the particular type. The resulting value determines its rating index.

The total evaluation of the compositional types is prepared in the following manner. According to its importance, examined indicators receive different number of points: aesthetic evaluation – 4 points; complexity index – 3; frequency of use – 2; rating index – 1. The total evaluation of each compositional type is obtained as sum of the values of all indicators multiplied by the corresponding number of points, Table. 5

In figures 3a, 3b, 3c, 3d are shown exemplary compositions in which are used compositional types, received the highest total evaluation. Composition No 36 has aesthetic evaluation 4.03 and the compositional type a3b3c3 has total evaluation 67.26, the highest complexity index, the highest frequency of use, and some of the highest values of aesthetic evaluation and rating index (Fig. 3a). Composition No 44 has aesthetic evaluation 3.93 and the compositional type a2b3c3 has total evaluation 60.69 (Fig. 3b). Composition No 48 has aesthetic evaluation 3.78 and

Fig. 3a. Exemplary composition No 36 Asnières Residential Park (aesthetic evaluation 4.03), Compositional type a3b3c3 (total evaluation 67.26).

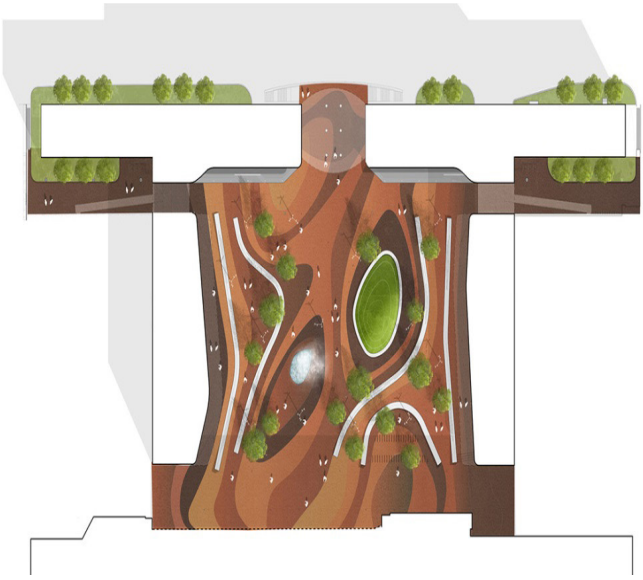

Fig. 3b. Exemplary composition No 44 Hoekenrode Square (aesthetic evaluation 3.93), Compositional type a2b3c3 (total evaluation 60.69).

Fig. 3c. Exemplary composition No 48 Scholars' Green Park (aesthetic evaluation 3.78), Compositional type a2b2c3 (total evaluation 56.46).

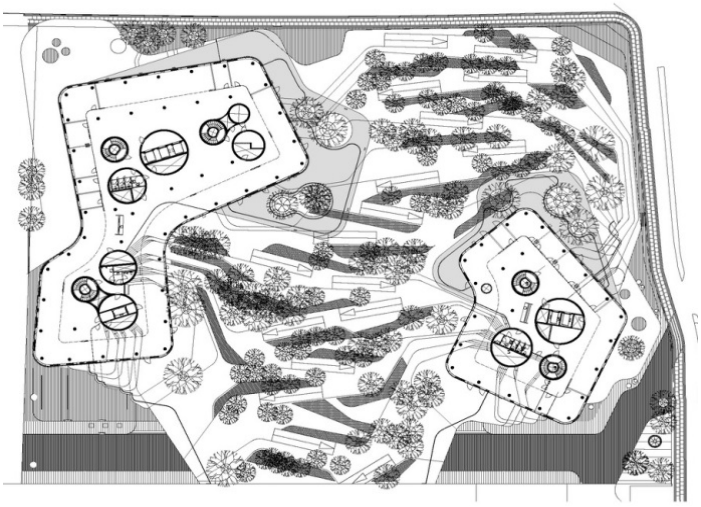

Fig. 3d. Exemplary composition No 53 The City Dune / SEB Bank (aesthetic evaluation 3.70), Compositional type a3b2c3 (total evaluation 53.77).

the compositional type a2b2c3 has total evaluation 56.46 (Fig. 3c). Composition No 53 has aesthetic evaluation 3.70 and the compositional type a3b2c3 has total evaluation 53.77 (Fig. 3d)

Conclusions

The implementation of the research aim and tasks allows conceptualizing the typology of composition in landscape architecture and leads to the formulation of the following conclusions:

1. It is confirmed that the use of a typology as a compositional tool increases the aesthetic properties – the most commonly used types have the highest aesthetic evaluation.

2. Compositional type $a_3b_3c_3$ has most qualities – it is a composition created by different types of forms, without links between them, with merging of elements and background. These combinations as well as other ones that obtain compositional types with high total assessment are a prerequisite for creation of landscape-architectural compositions with profound geometrical constructions that meet modern ideas about shaping the open space and ultimately to achieve high aesthetic qualities.

3. The compositional type received the lowest aesthetic evaluation – 2.58 is $a_1b_3c_1$ – a composition created by the same type of forms, without connections between them, with elements and background.

4. In general the aesthetic composition is a result of deeper geometric constructions. The essential thing is linking a quantitative indicator of the composition such as the degree of complexity with a qualitative characteristic such as its aesthetic assessment. The choice of compositional type with more complex constructions, which is relatively easily, allows the creation of landscape-architectural compositions with high aesthetic qualities.

5. The research shows the relationship between the aesthetic qualities and the geometrical constructions, but to have a practical application such a study it is advisable the compositional types to be presented in appropriate graphic form.

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