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HIERARCHICAL ANALYSIS OF THE STRUCTURE OF THE PERCEPTION OF MUSEUM EXPOSITIONS

Abstract

A hierarchical method of analyzing the structure of the perception of a work of art and assessing the proximity of the perceptive image to the author's intention is suggested. On the example of the perception of a museum exposition, the method has been demonstrated to reveal the fine peculiarities of aesthetic perception and indicate the composition elements violating the integrity and meaning of the scene.

Аннотация

Предложен метод иерархического анализа структуры восприятия произведений искусства и оценки близости этого восприятия замыслу автора. На примере восприятия музейной экспозиции показано, что предложенный метод позволяет выявить тонкие детали эстетического восприятия и указать композиционные элементы, не отвечающие общей идее произведения.

The art of designing museum exposition has not received as much public attention and theoretical analysis as many other arts—even not as much as installation art, which has become so popular in the end of the XX century. The fact that a museum exposition is a work of art close to an installation, or collage, has been often overlooked because of a traditionally utilitarian attitude to museums, which are commonly treated as the places to preserve some relics of the past for the future generations to be able to examine them and thus obtain a more vivid feeling of the former times; it is assumed that the old things can convey the air of the past culture on themselves, as if it were their objective property independent of the cultural environment. However, the perception of a museum exposition is highly dependent on the cultural context, and the laws of that perception are nothing but the same laws of aesthetic perception that equally govern all the arts.

There are two types of museum expositions, permanent and occasional. While both of them obey common laws of composition and perception, the difference in their purpose may cause specific shifts of accents. Thus, permanent expositions are often required to be comprehensive enough and cover as wide range of relevant events as possible, with an accent on the factual side. Expositions dedicated to particular events and dates are less constrained by the demand of comprehensiveness and hence may stress the emotional and conceptual sides of the same collection. However, in both cases, one deals with a modern interpretation of the past rather than with its reproduction, and the difference between the two kinds of expositions can be compared to that between realistic and abstract painting, which are both abstract as any art at all, the only difference being in the selection of forms.

The study of the perception of museum expositions requires special experimental and analytical techniques. This work reports of a pilot application of a generalization of hierarchical cluster analysis [1], based on a new procedure of comparing hierarchical structures suggested by the authors.

It should be stressed that museum visitors' perception as an activity [2,3] is necessarily creative, and that is why one can speak of the adequacy of perception and its agreement with the structure of the

author's intention. From the viewpoint of the general hierarchical approach [4], any creative activity is to pass the stages of syncretism, analyticity and synthesis in every single act, thus reproducing both its historical development and personal growth. Thus, syncretic perception implies non-fragmented integrity of feeling and thought, often vague and unstable. The analytical stage is to discern distinct shapes and their interaction. Perceptive synthesis binds the formal properties of the scene with its integrity, revealing how every single means of expression contributes to the aesthetic whole. Similarly, every one of the above levels unfolds into a hierarchical structure of the same type. In particular, syncretic perception can give way to the analytical stage only after the cyclic interaction of orientation and expression produces enough awareness—these are the phases of syncretic perception. So, creative perception is accompanied with the growth of the hierarchy of the internal image of the scene, the higher levels never replacing the previous phases but rather absorbing and transforming them.

An unguided visitor rarely can come beyond syncretic perception of a museum exposition, and often perception stays on the first, orientation phase of orientation activity, which leaves the person with merely a general impression or random details selected by individual perceptive preferences, without understanding of their role in the whole, the integrity of the exposition being only felt in an unconscious way. The phase of expression is either entirely absent (passive observation) or significantly reduced, and that is why the transition to the analytical level is hampered.

A different picture can be observed if a visitor has a special interest to the theme of the exposition, is directed by an experienced guide, or is involved in an experiment. The induced transition to the analytical and synthetic levels makes the person's perception more correlated with the intention of the expositioner.

We have staged an experiment in the museum of Vladimir Mayakovsky in Moscow, at the special exposition dedicated to the 90^{th} anniversary of the poet in 1983. The exposition consisted of several section highlighting a number of events in Mayakovsky's life that the author of the exposition considered the most important. We could interview the expositioner to clarify the structure of his intention, which had also provided us with a rather complete enumeration of the main elements of every section of the exposition that simplified the procedure of registering the answers of examinees. The visitors of the museum who had agreed to participate in the experiment were instructed to view a section of the exposition indicated by the experimentalist and note all its elements, without any limitations on the kind of elements imposed. The experimentalist was not present during the visitor's observation of the exposition, but readily came when the viewing process appeared to come to an end. Then the examinee was asked to enumerate all the elements of exposition noticed, starting form the most important on the examinee's opinion. After the enumeration was finished, the experimentalist asked to recall all the other elements, which usually added a few more items to the list. In the end of experiment, the examinee was asked to explain the sense of the section and the meaning of its elements in a free form, and then to summarize what had been said in a couple of phrases. The records of the informal reactions of the examinees helped to evaluate the adequacy of their understanding of the instruction and the dominant level of perception, so that the results related to different levels of perception would not be mixed in the same array.

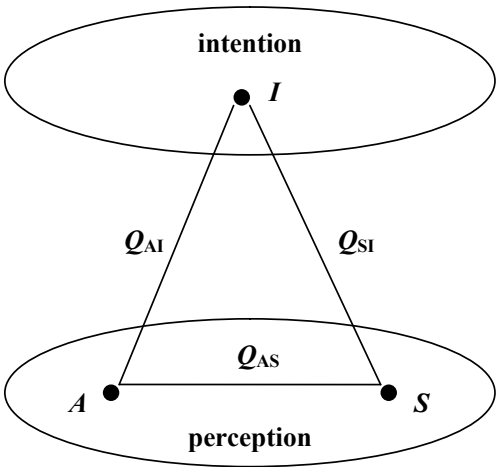
It can be easily seen that the examinee was oriented on expression in the very beginning of experiment, which produced favorable conditions for analytical and synthetic perception. However, higher-level activity was folded on the first (viewing) stage of experiment, and it was further enumeration that unfolded the internal naming of the elements into an external activity. The attempt to convey the sense of the exposition lead the examinee to the analytical level of perception, while the process of summarizing corresponded to the synthetic stage. In this work, we focus on the structure of syncretic perception, that could be extracted from the sequences of the elements of exposition produced by different examinees.

The presence of an element in the answers of an examinee indicates that the element has attracted the person's attention. That is why the ratio A of the number of examinees that have noticed the element to the total number of examinees can be called the *attractivity* of the element. The average ratio S of an element's position in the list of noticed elements to the total number of possible positions could be analogously called the *significativity* of the element in the exposition. For every element i, its attractivity A_i and significativity S_i could be calculated in this way.

Hierarchical approach assumes that any work of art can be perceived in different ways, all these ways of perception being simultaneously present in the same hierarchically organized act of perception. Every mode of perception would produce a hierarchical structure in the perceptive image, with the elements ordered by their relevance to the whole. The integrity of perception implies that different hierarchical structures agree, that is, the relations between perceptive elements are preserved in a way. Without such an invariance, perception cannot be meaningful enough, manifesting internal contradictions.

In our case, every element of the exposition has both external properties (including the element's look and its place among the other elements) that are perceived in an immediate way and determine the element's noticeability and internal qualities mediated by the element's role in the whole, its being semantically loaded. Certainly, the visibility of an element may depend on the peculiarities of the sensory apparatus of the observer and sensory sets, while the judgment about the element's importance may be influenced by the observer's knowledge or personal associations. That is why it is necessary to average in observers to determine the common features of perception that might characterize the exposition in an interpersonal way as an aesthetic phenomenon. Thus, every element of the exposition is characterized by its attractivity and significativity, which put this element in a hierarchical relation to the other elements of the exposition. There may be many such hierarchical structures in aesthetic perception representing different aspects of the same integrity, only two of them being considered in this work.

Generally, the author intentionally places the elements of exposition to control the observer's attention so that the relations between the elements would convey the author's idea as adequately as possible. Here, we do not consider the means of control that can be used, but suggest a procedure to measure the efficiency of the effort. It is assumed that hierarchical structures in visitors' perception must agree with the structure of intention, as well as with each other. The discrepancy between different perceptive structures would indicate the lack of integrity in the exposition, while the discrepancy between the perceptive structures and intention structure would mean the expositioner's failure to implement the idea. Denoting a quantitative measure of the discrepancy between two hierarchical structures as Q, we could represent the relations between the structures involved in our experiment in the following figure.



Since the structures of attractivity and significativity are the two aspects of the same perception, they will be strongly correlated in a merely statistical comparison of the corresponding numeric rows, and one has to account for hierarchical nature of the relations between their elements to be able to extract deeper-lying information.

Tables 1–4 present the results of the experiment for two section of the memorial exposition in Mayakovsky museum in Moscow. One of the sections said about Mayakovsky's confinement in the Butyrki prison in Moscow in 1909, where he was put for his revolutionary activities. The other section referred to cafe *The Pink Lamp*, which was frequented by futurists. The intention structures for these sections are shown in Tables 1 and 3 respectively. In the author's intention, the elements of each section had to be grouped according to three temporal plans, the "now" plan in the center of attention, the "before" plan supporting it and the "after" plan indicating the consequences of the events concerned. Twenty examinees have been interviewed for each section, mainly intelligentsia in the age of 18–30.

After calculating the values of attractivity A and significativity S for every element of each section, we have sorted the elements of each section in descending order, for both attractivity and significativity, obtaining the sequences presented in the first two columns of Tables 2 and 4 respectively. To discriminate the levels of hierarchy, one could use any one of existing clustering techniques [1]; for this pilot experiment, it was enough to admit that the elements of the row belong to different levels if the distance between them (the difference of the corresponding values) exceeds certain threshold, which was taken to be proportional to the row's dispersion: $\Delta = \xi \cdot \sigma$. Different values of ξ would correspond to different generalization levels, and it may be interesting to analyze the dependence of the results on the discrimination threshold. However, in this work, we have put $\xi = 1/5$ to obtain hierarchical structures shown in Tables 2 and 4, where the levels are numbered starting from 0 for the topmost level, with horizontal lines separating the levels.

Table 1. Hierarchical structure of the author's plan of *The Butyrki Prison* section

Plan	No.	Element	Level
"Now"	1	Photo of a solitary cell	0
	2	Peep-hole-like arrangement	
	3	Mayakovsky's photo	
	4	Mayakovsky's petition to the police chiefs	
	5	Commentary text	
	6	Books from the prison library	1
	7	Photo of the Funeral Train Bureau	
	8	Big photo of Mayakovsky's father	
	9	Photo of Mayakovsky's mother	2
	10	Lamp	
	11	Sewing-machine	
	12	Chair	
	13	Chest	
	14	Small photo of Mayakovsky's father	3
	15	Shoulder-straps	
	16	Tree branch	
	17	Forbidden books	4
	18	Newspapers	
"After"	19	"I want to make socialist art" (a quote from Mayakovsky's letter)	5

Table 2. Hierarchical structures in the perception of *The Butyrki Prison* section

Attractivity			Significativity		
A	**Elements**	**Level**	***A***	**Elements**	**Level**
0.95	6, 11	0	0.72	6	0
0.85	4	1	0.71	11	
0.80	15		0.65	4, 8	1
0.75	8, 17		0.59	17	2
0.70	9		0.56	9	
0.60	7	2	0.55	15	
0.55	10, 14, 16		0.46	7	3
0.45	5, 13	3	0.43	14	
0.40	18		0.37	10	4
0.35	12, 19		0.32	16	5
0.30	7		0.30	5	
0.15	2, 3	4	0.29	18	
			0.28	12	
			0.24	13	6
			0.21	7	
			0.19	19	
			0.12	3	7
			0.10	2	

Table 3. Hierarchical structure of the author's intention of *The Pink Lamp* section

Plan	No.	Element	Level
"Now"	1	A painting by Mayakovsky	0
	2	Top-hat	
	3	Walking-stick	
	4	Strap of yellow jacket	
	5	Bottom poster	1
	6	"Take it" (a poem by Mayakovsky)	
	7	Newspapers	
	8	Commentary text	
	9	Graphics	2
	10	A painting by Larionova	
	11	Books	
	12	Plates and dishes	
	13	Glove	
	14	Decanter and photograph	
	15	Table	
	16	Bottle	
	17	Balmont's photo	3
	18	Burlyk's photo	
"After"	19	Partition	4
	20	Mayakovsky's photo	
	21	Upper poster	

Table 4. Hierarchical structures in the perception of *The Pink Lamp* section

Attractivity			Significativity		
A	**Elements**	**Level**	***A***	**Elements**	**Level**
0.95	2	0	0.73	11	0
0.90	11		0.71	1	
0.85	1, 3		0.69	2	
0.80	12, 13		0.62	12, 13	1
0.70	9	1	0.59	3	
0.60	4, 6, 10	2	0.50	9	2
0.55	7, 14		0.46	10	3
0.45	5, 15, 18	3	0.43	6	
0.40	16		0.42	7	
0.35	17		0.40	14	
0.30	8		0.37	15	
0.15	20	4	0.36	4	
0.10	21		0.32	5	4
0.05	19		0.30	18	
			0.26	16, 17	5
			0.22	8	6
			0.10	20	7
			0.08	21	
			0.05	19	

Thus, the numerical rows A_i and S_i have become replaced by the rows α_i and ζ_i of the levels of elements in corresponding hierarchical structures. The analogous row of levels could be obtained for intention structure as well. The simplest measure of the proximity of two numerical rows is correlation coefficient. However, this measure would not be too informative in comparing the level structures of attractivity and significativity, since these structures are strongly correlated by construction. To compare hierarchical structures, one has to account for different importance of different levels in such a comparison. This could be achieved by weighing the differences between the level numbers in two rows to compare. Thus, from the rows α_i and ζ_i one can construct an array of weighed differences

$$\delta_i^{\mathrm{AS}} = w_i \cdot (\alpha_i - \zeta_i),$$

with specially chosen weights w_i. The basic idea is that lower-level elements of hierarchy are less important for the comparison of hierarchical structures, while the larger level differences are more important than the smaller ones. Following the usual perturbation scheme of quantum mechanics [5], the importance of the element of the level λ could be measured by the factor $1/\lambda!$, while the importance of large differences could be stressed by the factor $(\Delta\lambda)!$; in this way, we can set the weights for the difference of the levels of an element's attractivity and significativity:

$$w_i = \tfrac{1}{2}|\alpha_i - \zeta_i|! \left(\frac{1}{\alpha_i!} + \frac{1}{\zeta_i!} \right).$$

The usual statistical measure of the acceptability of the hypothesis of the weighed differences δ_i^{AS} being centered in zero is given by the value

$$Q_{\mathrm{AS}} = 1 - \mathrm{A}(t \mid N),$$

where $\mathrm{A}(t|N)$ is the Student distribution with N degrees of freedom, N is the number of exposition elements, and

$$t = \bar{\delta} \big/ s\sqrt{N-1}, \bar{\delta} = \sum \delta_i \big/ N, s = \sqrt{\sum (\delta_i - \bar{\delta})^2 \big/ N(N-1)}.$$

The quantity Q defined in this way lies between 0 and 1, and it can be used to compare any two hierarchical structures. The quantities characterizing the two exposition sections considered in experiment are summarized in Table 5.

Table 5. Comparison of hierarchical structures

The Butyrki Prison	*The Pink Lamp*
$\overline{A} = 0.558$	$\overline{A} = 0.545$
$\sigma_A = 0.245$	$\sigma_A = 0.263$
$\overline{S} = 0.407$	$\overline{S} = 0.404$
$\sigma_S = 0.201$	$\sigma_S = 0.205$
$\rho_{AS} = 0.969$	$\rho_{AS} = 0.953$
$\rho_{AI} = -0.143$	$\rho_{AI} = 0.630$
$\rho_{SI} = -0.046$	$\rho_{SI} = 0.674$
$Q_{AS} = 0.839$	$Q_{AS} = 0.188$
$Q_{AI} = 0.685$	$Q_{AI} = 0.996$
$Q_{SI} = 0.671$	$Q_{SI} = 0.776$

As expected, there is high correlation between the attractivity and significativity rows for both sections (0.969 and 0.953). However, while the hierarchical measure of proximity Q_{AS} is high for *The Butyrki Prison* section (0.839), there is rather poor agreement between the two perceptive structures for *The Pink Lamp* section (0.188). This confirms our assertion that correlation coefficients are not informative enough to compare hierarchical structures. Using the hierarchical criterion Q, we can conclude about the low integrity of the perception of *The Pink Lamp* section.

On the other side, the Q-criterion reveals a closer resemblance of hierarchical structures in visitors' perception to the structure of the author's intention, while correlation coefficients do not indicate any similarity. Both perceptive structures for *The Pink Lamp* section are rather close to the structure of intention, despite of all the discrepancy between them. This intransitivity of Q-measure of proximity may reflect the situation when both formal and contentual aspects are well expressed in the section, while being perceptively disjoint from each other. On the contrary, for *The Butyrki prison* section, perception shows high integrity, but the image perceived is not entirely what the author intended, which indicates a more important role of the perceptive creativity of the observers. Obviously, the implementation of the formal and contentual sides of author's intention and perceptive meaningfulness are not directly related to each other, and they may be contradictory.

Having the values of weighed differences δ_i, one can indicate, which elements of exposition most violate its perceptive integrity or correspondence to the intention structure. Thus, for *The Butyrki Prison* section, these are elements 1, 2, 3, 5 and 13; for *The Pink Lamp* section, these are the elements 8, 4 and 5. A closer examination of the exposition allows to understand why the indicated elements cannot be adequately perceived and suggest the ways of improving the exposition.

In this work, we have demonstrated how hierarchical approach can be used to analyze the structure of aesthetic perception and its correspondence to the structure of the author's intention. Naturally, the procedures can be refined, and more theoretically grounded comparison algorithms could be suggested in the future. In particular, the weight function used here might be replaced by a different expression with similar properties. However, even in its present form, the method allows to reveal important features of the aesthetic whole and constructively indicate the ways of its improvement. The very same technique could be used to assess the perceptive integrity and adequacy

of the whole exposition, not only separate sections. In a somewhat modified form, the method can be applied to the analysis of other arts, like poetry, painting and music.

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