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TWO-COORDINATED ANALYTICAL MODEL OF THE RELATIONSHIP BETWEEN MULTI-LAYER PLATE DISTANCE AND THE DISTANCE OF OVERVIEW

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Abstract:-

The article solves the task of the two-coordinate analytical determination of the distance between the layers in the multi-layer poster (diorama) and the distance of its observation by the viewer. Analytical dependencies were developed, with the help of the Matlab software system.

Keywords: - *Multilayer poster, spacing between layers, poster observation distance.*

INTRODUCTION

The multi-layer poster (diorama), as an approach and construction, has long been known. In some designs it is made of thin wooden layers. In the case of others - metal sheets, as well as flat glasses arranged in front of each other. Object of research and specific technologies used in diorama production are used by some contemporary authors such as the two Indians P. Hari and N. Dypti ^[1], the Estonian Lisa Kiwiame ^[2] and others. The first author of this article elaborated a dissertation in which, as part of the work, is protected by the Bulgarian Patent Office its own construction of the diorama ^[3], which includes several layers of transparent foils suspended on stands one above the other, the exposure being possible the individual layers are moved in order to highlight one or other element of the overall image. Literature does not offer solutions to the task of determining the relationship - the distance between the layers and the distance from which the viewer observes the diorama.

The task of analytical determination of the dependence, which takes into account the distance between the individual layers in the diorama on the one hand and the distance from which the spectator watches it was solved in one plane ^[4], which did not take into account the visitor's percentile. In the present article, the results of a study are published, which takes into account the connection - the distance between the layers in the diorama and the distance from which the viewer observes it, with the introduction of the second coordinate also taking into account its percentile.

1. Analytical reasoning

Fig. 1 illustrates the diorama with two layers, as well as the viewpoint shown in two perpendicular planes. Several draws can also be drawn from the image.

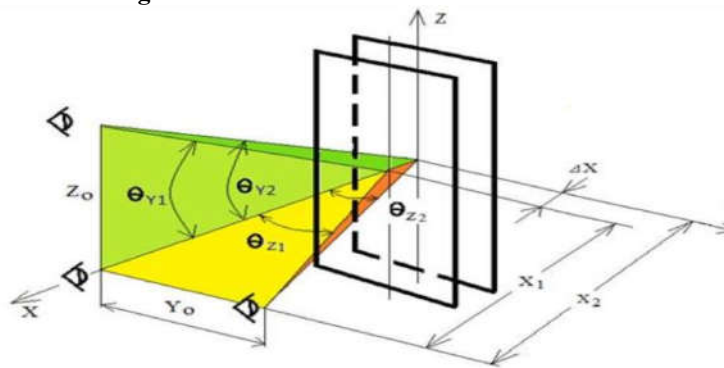


Fig. 1. Spatial interpretation of the multi-layered poster in terms of its perception by people with different percentiles (growths) and occupying a different perspective in the horizontal plane.

$$tg\theta_{Y1} = Y_0/X_2 \quad \text{и} \quad (1)$$

$$tg\theta_{Y2} = Y_0/X_2, \quad (2)$$

$$\frac{Z_0}{X_1 + \Delta X} = tg\theta_{Y2} \quad (3)$$

$$\Delta X = X_1 \left(\frac{tg\theta_{Y1}}{tg\theta_{Y2}} - 1 \right) \quad (4)$$

The proportion is also valid:

$$tg\theta_{Y1}/tg\theta_{Y2} = tg\theta_{Z2}/tg\theta_{Z1} \quad (5)$$

Using the Matlab ^[5] and derived formulas is build Fig. 2. In this graphical dependence the values of angles θ_Y and θ_Z are shown in the two horizontal axes, and in the appendix the value $\Delta\theta^0$, expressing the spatial change in viewer's view.

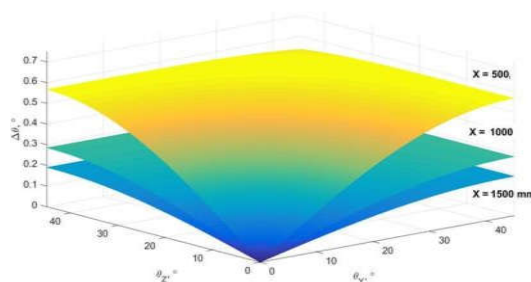


Fig. 2. Spatial Interpretation of Dependence $\Delta\theta^0 \rightarrow (\theta_Y \text{ and } \theta_Z)$ in terms of the perception of the multilayer poster by viewers at different distances X from it.

It can be seen that at the position of the viewer strictly perpendicular to the multilayer poster, on its axis and regardless of the distance X , a minimal spatial effect is achieved. At the same time, with a change in the viewer's position, which is counted using the two angles θ_y and θ_z , the spatial vision increases. In this case, the two angles are varied in the range of $0^\circ \div 45^\circ$. The layout of the multilayer poster allows spatial effects to be achieved in the case of full coincidence of the viewpoint of the observer along the X coordinate axis and zero values for $ZO = 0$ and $YO = 0$. This is because the final dimensions of the multilayer poster by two coordinates Y and Z are real values, and as many points of the area of the multilayer poster are farther away from the focus, the local ΔX value measured along the axis of observation is greater. It will be greatest at the endpoints (in corners) of the image area. In this sense, if the viewer is standing with his eyes on the X axis (his perpendicular corresponds exactly to that viewing position) and observes the diorama at the extreme angular points (Fig. 3), there will be an effect of spatiality in perception. In other words, as the observer's view moves from the periphery to the intersection of the diagonals of the multilayer poster, the spatiality in the perception of the observed picture will diminish.

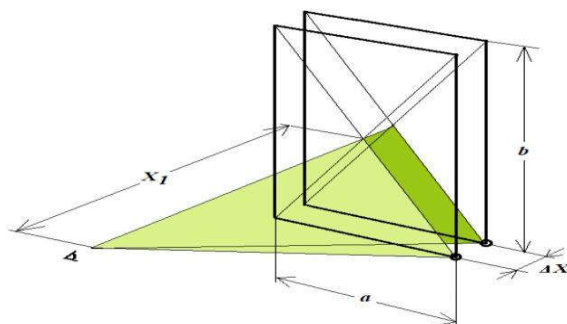


Fig.3. Spatial interpretation of the multilayer poster, provided that the viewer is located exactly along the X axis and observes a peripheral point in the image.

However, the role of the so-called “peripheral vision” that encompasses perception. The inverse proportionality applies to the value of $X1$. In the spirit of the above considerations and the image in Figure 3 it is possible to write a new equality:

$$\Delta X = [X1 + (a+b)/2] (\operatorname{tg} \theta_{y1} \cdot \operatorname{tg} \theta_{y2} - 1). \quad (6)$$

Equality (6) has one imperfection. It does not take into account the fact that human vision is stereoscopic. In fact, the point of view of man is a combination of the massive case in which two healthy eyes, which, within their X_Y plane spacing at a distance of 68 mm on average, perceive the picture of the diorama as two photoreceptors that combine both paintings from each of the two eyes and transform it mentally as one. In the case of the multi-layered poster, there is no confusion in the brain, but on the contrary, the accepted multilayer picture - double in two layers, triple at 3, etc., is interpreted as general and spatial.

3. Conclusion

As a result of the constructions made, the dependencies and the analyzes made, the following summary can be made: the diorama is a promising tool for making posters and pictures with a desired spatial image effect. The results obtained show that it is possible to make accurate calculations related to some essential parameters relating to this specific technology.

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