

DESIGN SOLUTIONS INTERPRETATION USING DIGITAL GRAPHICS

INTERPRETACIJA PROJEKTANTSKIH REŠENJA PRIMENOM DIGITALNE GRAFIKE

UDK: 004.932
Originalni naučni rad

Dr Aleksandar ČUČAKOVIĆ, dipl. inž. arh.¹⁾
Dr Biljana JOVIĆ, dipl. pejzažni arh.²⁾
Dr Jelena TOMIĆEVIĆ – DUBLJEVIĆ, dipl. pejzažni arh.²⁾
Mast. Ing. Jelena STOJANOVIĆ, dipl. pejzažni arh.²⁾

SUMMARY

Contemporary design solutions that move the boundaries of creativity include the use of digital graphics, in order to get innovative graphical interpretation which includes interventions in space using various element, materials and plants, which requires the use of a combination of different software packages. This paper analyzes the combination of the available graphical software for interpretation projects in the context of landscape architecture profession. Model "Garden" was created in the "SketchUp" software for the purpose of visual questionnaire and detailed research work in programs for visualization: "Photoshop", "Lumion" and "3DMax". Combining the two research methods: study graphic interpretation, "learning by doing" method in software for digital graphic and research public opinion questionnaire ("Single stimulus" method) led to the results which give recommendations for the use of a combination of appropriate software packages.

Key words: Digital Graphics, Questionnaire, Visualization, Landscape Architecture.

REZIME

Savremena dizajnerska rešenja koja pomeraju granice kreativnosti podrazumevaju upotrebu digitalne grafike, u svrhu dobijanja inovativnih grafičkih interpretacija. Pejzažna arhitektura je transdisciplinarna struka, koja podrazumeva intervencije u prostoru upotrebom različitih elemenata, materijala i biljaka, što zahteva upotrebu i kombinaciju različitih softverskih paketa. Ovaj rad se bavi istraživanjem kombinacija dostupnih grafičkih softvera za interpretaciju projekata u okviru pejzažnoarhitektonske struke. Model "Vrt" je izrađen u "SketchUp" softveru za potrebe izrade vizuelnog upitnika kao i detaljnijeg istraživanja rada u programima za vizuelizaciju: "Photoshop", "Lumion" i "3DMax". Kombinacijom dve istraživačke metode: istraživanjem grafičke interpretacije, učenjem kroz rad ("Learning by doing") u softverima za digitalnu grafiku i istraživanjem mišljenja javnog mnjenja upitnikom ("Single stimulans" metodom) došlo se do rezultata koji daju preporuke za upotrebu kombinacije adekvatnih softverskih paketa.

Ključne reči: Digitalna grafika, Upitnik, Vizuelizacija, Pejzažna arhitektura.

1. INTRODUCTION

Landscape architecture, as well as related disciplines, drawing is the primary means of communication. In addition to verbal profession requires and visual communication through graphic works. Designing in land-

scape architecture is noticed and viewed in a more realistic form which involves the use of computer software. The problem that arises is the availability of specialized software for visualization of landscape architectural projects that give satisfactory results.

Software as: "Realtime Landscaping Plus", "Viz-Terra Landscape Design Software", "TurboFloorPlan Landscape Deluxe Design Software", "Home & Landscape Design", "Landscape Deck & Patio", "Landscape Vision", "TurboFloorPlan 3D Home & Landscape" are designed for landscape architecture, however visualization in the aforementioned software's is not enough realistic. Context of space, materials, and plants make the final look of the complex phenomenon of which are required by different applications, resulting in high-quality

Adresa autora: ¹⁾ Associated Professor at University of Belgrade, Faculty of Civil Engineering, Bulevar kralja Aleksandra 73/I, 11000 Belgrade

E-mail: cucak@grf.bg.ac.rs

²⁾ Docent at University of Belgrade, Faculty of Forestry, Kneza Visislava 1, 11030 Belgrade

E-mail: biljana.jovic@sfb.bg.ac.rs

²⁾ Associated Professor at University of Belgrade, Faculty of Forestry, Kneza Visislava 1, 11030 Belgrade

E-mail: jelena.tomicevic@sfb.bg.ac.rs

²⁾ E-mail: jelenadstojanovic@gmail.com

ity visual solutions. For this reason, landscape architects combine several software packages and on that way finding a solution for graphic interpretation of landscape architectural projects. Software as: “AutoCad”, “Archi-Cad”, “SketchUp”, “Photoshop”, “CorelDraw”, “Illustrator”, “Lumion”, “3DMax” are tools that accelerates the process of designing and creating realistic graphic interpretation.

The task is to explore the work in software for graphic interpretation adequate for the profession of landscape architecture, and an analysis of the use of combinations of different programs obtained through the preliminary design made for this research.

The aim is to get through a visual questionnaire (survey) within the two groups (students of landscape architecture and population interested in landscape architecture). There is a concrete proposal in terms of recommending certain available and suitable software package, or combinations of them, for the interpretation of design solutions using digital graphics gained in quality.

2. METHODS

Combining the two research methods: study of graphic interpretation, “learning by doing” in software for digital graphics and opinion research public opinion questionnaire (“Single stimulus” method) explores the appropriate software for landscape architecture profession and public perception.

2.1. The study graphic interpretation in software

This work is an exploration step by step [1], which encourages thinking about the possibilities, and finding the right solutions. It is based on a scientific method of “learning by doing” [2], identifying and solving problems during creation, which requires quick thinking about the possibilities in the learning process [3]. The research involves independent work in graphic software, as well as a modest contribution to finding adequate and high-quality graphics modes of interpretation within the profession [4]. Figure 1. shows the path of the research through software’s. The study used a control 3D model “Garden”, modeled in “SketchUp” program, which continues to export as “.dae” file for “Lumion”, “.jpg” for “Photoshop” and “.3ds” for “3DMax” software. After import the appropriate software follows the final render



Figure 1. The study graphic interpretation in steps

and export “.jpg” image. Each program used a different style, which will help the further course of research and understanding of digital graphics attractive for the general public.

2.2. Questionnaire – evaluation of the public

The second part of the research relates to visual questionnaire aimed at finding appropriate graphic interpretation. In the questionnaire, the results of the research are graphic interpretations in appropriate software, where the opinion of two groups of participants in this survey is explored.

In questionnaire evaluation the graphic interpretation of the 100 respondents, who participated randomly, are divided into two groups. The first group consisted of 50 respondents, students of landscape architecture, and the second group are 50 respondents who had interest in landscape architecture and horticulture. The survey was conducted in July in the hall of the Faculty of Forestry with students of landscape architecture and horticulture as well as in the nursery “Goga and Dragan” in Ugrinovci, with nursery clients. Method was used for the subjective assessment of image quality, “Single stimulans” [5]. Under this method, the assessment is made in the image sequence or individually. Observers give estimates for each displayed image or sequence. There are two approaches: without repeating the scene to test or with mul-

Rate visual display marks from 1 (bad) - 5 (excellent)

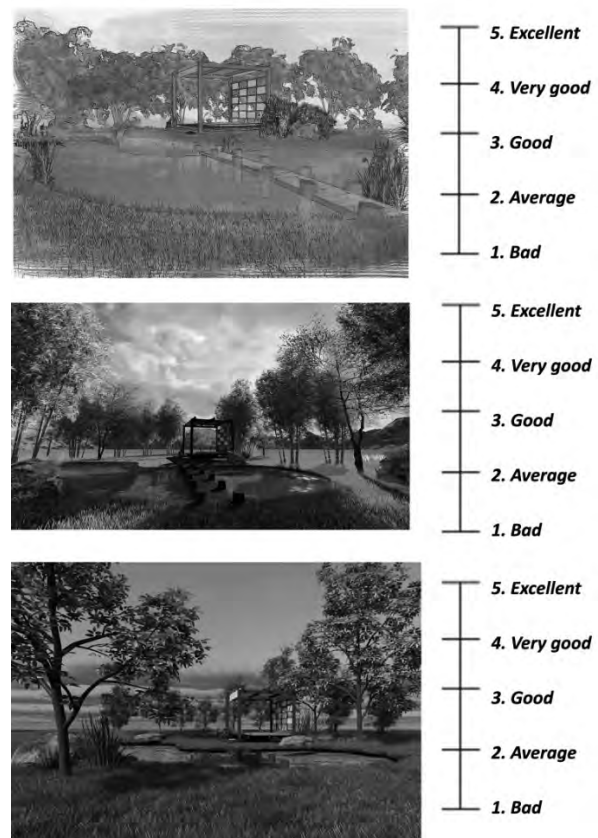


Figure 2. Structure of the questionnaire – images with scale

multiple repetition. The study used the first approach is with no repeating ("SSIS"). "Single Stimulus Impairment Scale" (SSIS): during the assessments, images or sequences of images allocated to one of the categories defined in semantic terms are observed. Categorical scales for assessing and improving the quality of the picture is the most commonly used. Questionnaire (Figure 2) consists of three graphical interpretation handled in different software and styles (from realistic to unrealistic).

Respondents based their criteria given by graphic interpretation of evaluation (Figure 2 – scale): 1 (poor), 2 (average), 3 (good) 4 (very good) and 5 (excellent). Shortly before completing the questionnaire, respondents were explained the goal of the research and the process of completing the questionnaire.

3. GRAPHICS SOFTWARE

3.1. SketchUp software

In this paper, this software is used as a starting point, from which the 2D images or 3D model exported further into the software for the graphical interpretation. Getting started in the software consists of first modeling course with lake, then modeling pergola with additional elements (Figure 3). Since all areas of the same color by default, to integrate materials and textures (water, grass, wood) to be in software for rendering recognize it as the same size, which will simplify further work with the materials.

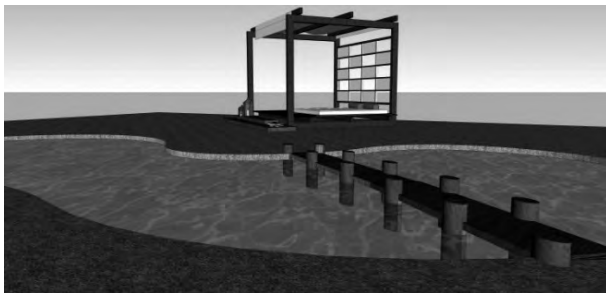


Figure 3. Model "Garden" in SketchUp software – process of modeling

In the "SketchUp" software vegetation is subsequently introduced through other programs ("Lumion", "Photoshop" and 3DMax"). Reason for that is less burden on the software, which makes the operation easier and faster.

The paper uses three software's: "Photoshop", "Lumion" and "3DMax". For the "Photoshop" software is exported to the ".jpg" or ".pdf" files ("File – Export – 2D model – .jpg") because the program does not support 3D extensions. "Lumion" and "3DMax" 3D software do not use the same extension. Lumion use ".dae" file ("File – Export – 3D model – Collada"). After exporting the model as ".dae" file in the selected directory folder is created containing the file with all the materials individually. For "3DMax" software process is similar, instead of ".dae" (Collada), indicated by ".3ds" file ("File – Export – 3D model – .3ds").

3.2. Photoshop software

"Photoshop" program is designed graphical modifications without the possibility of creating 3D models. But nevertheless it is widely used by landscape architects. "Photoshop" have applications to modify images and crafted models. The most common use of this professional software is for processing digital photos. "Photoshop" provides a large number of filters and effects that could be used on the finishing pictures and paintings and in the formation of new illustrations. The effect of the whole picture could be achieved without using 3D programs, so such bases to processed image model or adding new images, which together give fine graphical interpretation.

Working in the software begins by creating a new file, "Ctl + N" shortcut opens a new window with the settings for the new file. It is called as a file, set the dimensions of the working area, recommended a resolution of 200 pixels per inch, because of the image quality. Followed import 2D images: "File – Place" use the desired image. When the image is entered into the software, it is followed by arranging the environment and materials. Using a tool "Magic Wand tool" and "Polygonal Lasso Tool" are selected areas of the image (Figure 4) to be removed. To make a selection, you must mark the edge of this area to set the selection.

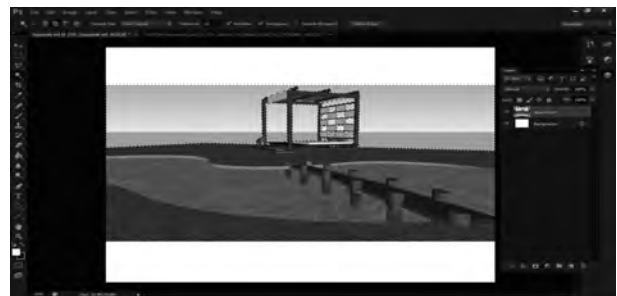


Figure 4. Selecting surfaces using the "Magic Wand Tool"

On the selection could be applied operations "Move", "Copy", "Paste" and in this case the "Delete". When environment is removed import a new image is possible (File – Place).

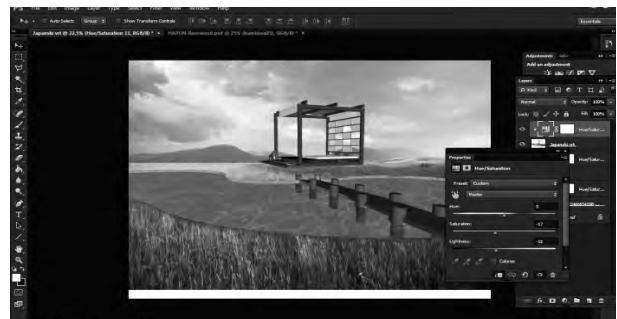


Figure 5. Adjust color using the "Hue Saturation" color corrector.

Each image that is entered as a new, gets its own layer that is positioned above the background which is at the lowest position in the panel. Layers allow you to make changes to the images without changing the original. By

entering new images its original color is entered as well. For adjusting the color model in the panel with color correctors “Hue Saturation” tool is selected. “Hue Saturation” allows you to change the parameters of all or individual colors (Figure 5). Right-click on the “Hue Saturation” layer is selected “Create Clipping Mask” to change the color applied to only one layer. Without “Clipping Mask” colors are changing in all layers. The next steps are added to the picture for other areas and, where appropriate, to their lack of transparency (“Opacity”) to the final image realistic look. When all the textures entered the picture, the vegetation is added (Figure 6). The procedure for the import of vegetation is the same as for entering image (“File – Place – .png” image from folder), and later color correction to “Hue Saturation” option [6]. “Brush tool” or a painting brush is used for imaging soft lines (“Brush Tool”). Pulling brushes are made of soft lines and strokes. Option “Brushes” offers a wide range of parameters (form). In order to blend the textures in the image and spilled over into each other, is used to selecting the Brush tool Brush (Figure 6) that looks like a lawn, choosing the approximate color of the lawn and fill in switching to an image look as a whole.

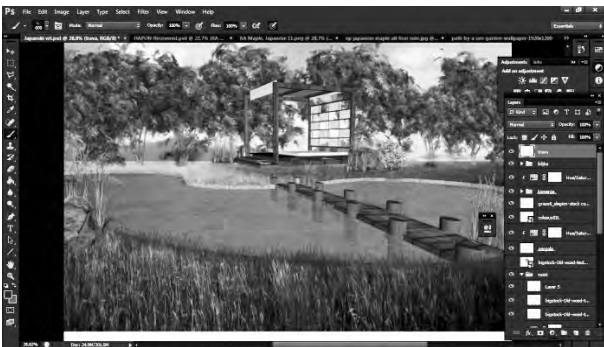


Figure 6. Adding vegetation and filling in the transition from “Brush Tool” brush.

If filter or a certain style is still needed, previously stored image could be re-opened in the software or layers merge into one (“Ctrl + Shift + Alt + E”) and opens the filter gallery (Filter – Filter gallery). “Blur” filters are used to highlight any part of the image. Lines could be emphasized by using this option (Figure 7)

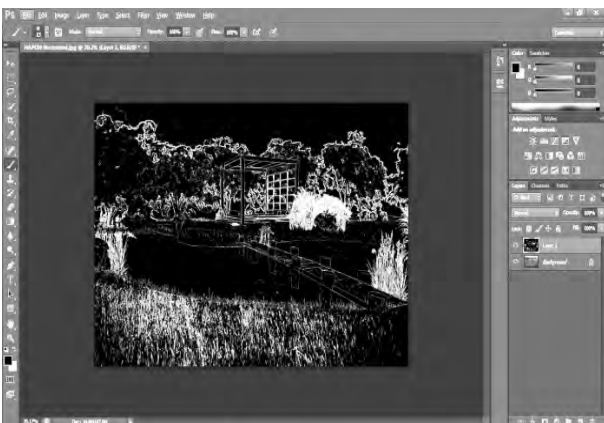


Figure 7 Blur filter

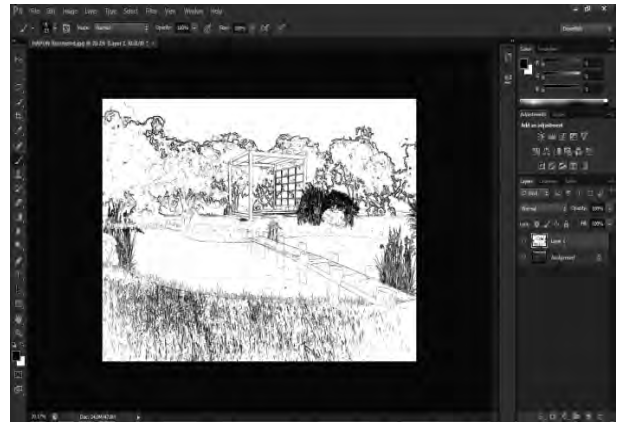


Figure 8. Turning vector masks

However it is necessary that the lines are black with white environment “Ctrl + i” shortcut rotates the vector mask, when the opposite of what is needed (Figure 8). “Dissolve” controls or color of each pixel and converts it into the resulting color. The resulting color is selected, or the basic color which is adjusted according to the providence of pixels in that location. Layer is copied, and the background is added layer mask (Figure 9) which when swept brush, leaves color (opens layer located below).

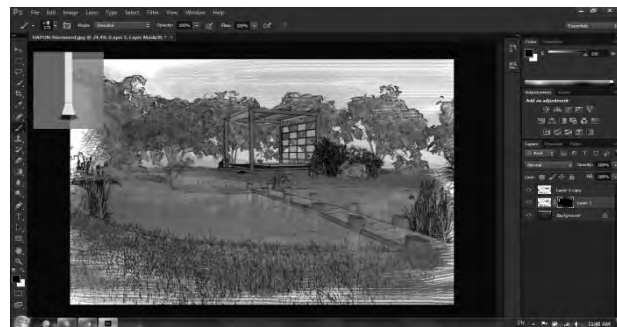


Figure 9. Creating “Layer masks” and “Dissolve” option.

“Hue Saturation” option for the last time before the export of “.jpg” file is correct colors. This procedure, will produce an image that gives the impression that picture is hand-drawn. Another using the filter gallery, layers are combined into one, and selects the filter with a texture, which gives the impression that picture is drawn on paper with the texture (Figure 10).



Figure 10. The result of working in “Photoshop” software package.

3.3. Lumion software

Lumion 3D software is very suitable for render. Easy to understand, as well as easy to read interface, it has a library with materials, components, vegetation and the possibility of changing seasons, daylight, adding artificial lighting, scenes, materials, people, models, vegetation, furniture, ect. Lumion is not just a program for rendering but also a tool for designing.

Before starting work in Lumion it is necessary to determine the environment in which to create a graphic interpretation. Running the software opens a window with available options. The first step after dialing "Background" is importing a 3D model (Figure 11), ".dae" file that has been exported from the "SketchUp" software.

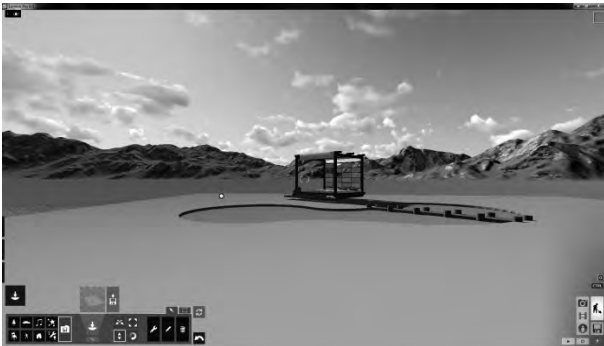


Figure 11 . Import of 3D models into software

If the "SketchUp" software is not assigned to a material surface, "Lumion" will not be recognized and in this case will show as empty space. These types of errors can not be corrected in the "Lumion" software, because it is not intended for the construction of new areas, but only for rendering. The next step, after inserting the model into the scene, is the choice of materials and its application on the model. It is necessary to mark the area where the material is changed, around the selected area a green selection will be created, and clicking on it a window with materials will be opened. Depending on the material, internal or external materials shall be elected. By applying the material to the model, a new window opens with options: gloss, texture, size or color shifting. Upon completion of the material selection, in order to apply the selection, it is necessary to select the correct sign (Figure 12).

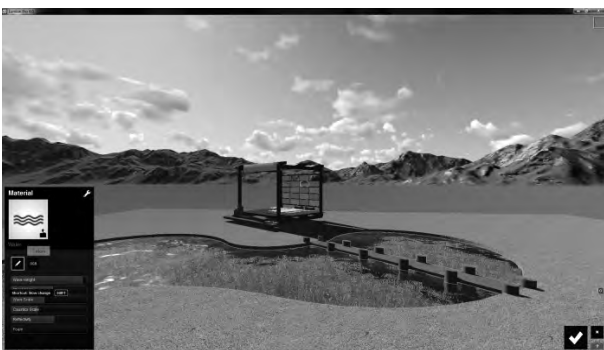


Figure 12. Application materials on model

The same is repeated with other materials now on the model. The software works by recognizing materials that are assigned to the surfaces in the "SketchUp" software. All materials that have the same shade or texture will be included in selection and changed. When assigning materials in the "SketchUp" software, it should be taken into account that result will be shown as different materials in the final render. Also, they are not accorded to the same texture. During the import of vegetation, for each plant appears polygon mesh in the middle of a red line with numbers (Figure 12a). Polygon represents the area that will take the plant. The numbers and lines, the amount also will be shown. For the imported vegetation project requirements, could be reduced, moved or rotated.



Figure 12a. Entering vegetation model

In addition to the vegetation, if necessary, in this step it could be added the furniture, the silhouettes of humans and the effect of the software library. If in the library does not exist the plant or furniture that we needed for the project, on the Internet there are free open library of 3D models of plants and furniture. The procedure is the same as for the import of 3D models. Imported 3D model of plant should be previously saved as ".dae" file in the "SketchUp" software. The next step is to adjust the brightness, density of clouds, preparing for render and "export" ".jpg" file. When all the parameters and filters are set, the image is saved as "Email", "Desktop", "Print" or "Poster". The difference is in the size and image quality. When you choose a format, the software starts to render the image. The image is saved as a ".jpg" file in the directory selected. Used photo effect could change living conditions, seasons or image style.



Figure 13. The result of the "Lumion" software package

3.4. 3DMax software

“Autodesk 3ds Max” is a professional 3D computer graphics program for creating 3D animations, models and images. “Vray” and “Forest pack” are extension for 3DMax, which are widely used in the construction of graphical interpretation. “Vray” is a plug-in for 3D graphics applications (“3ds Max”, “Cinema 4D”, “Maya”, “Modo”, “Nuke”, “Rhinoceros”, “SketchUp”, “Softimage”, “Blender”), which allows users to quickly and easily create realistic images. The most important is to complete side lighting, shading and rendering. It is used in the media, industrial design, architecture, etc. It is widely used instead of the standard renders for “3DMax” software. “Forest Pack” is the most popular extension for “3DMax”.

Before starting work in the software it is necessary to set up a “Vray” render as the default for subsequent add materials applied for Vray render. Under the tab “Vray”, “Image Sampler” (“Anti-aliasing”), the “Image sampler” will always use the “Adaptive DMC” or “adaptive subdivision” algorithm for “antialiasing filter” is the best set “Mitchell-Netraval filter”. By “Vray – Environment” turned “On” at “GI Environment (Skylight) Override and reflection / refraction environment override”. This option is used to enable ambient lighting, by default, it is skylight (lighting daylight) could be used and image will obtain different ambiances. In “Color Mapping” tab there is possibility to set the mode “Color mapping only”. In the “Global illumination” menu includes “Enable”. “Illumination”, which changes the calculation of deductions brightness is divided into primary and secondary deductions. For “Primary engine” (Primary deductions brightness) is chosen “Brute force” (which gives the most accurate results). For “secondary engine” there is possibility to chose “Light Cache”. When the parameters for “Vray” render are set, it is followed by the introduction of materials, environment and vegetation.

The work begins by opening “.3ds” file that is exported from the “SketchUp” software (“File – Open” – selecting “.3ds” file from the folder – “open”). In Figure 14 shows the appearance of a “.3ds” file entered into the software.

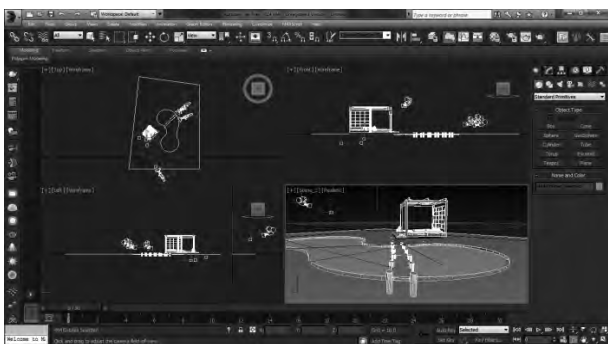


Figure 14 .3ds model in the work environment 3DMax software.

The palette controls the selection “Create”, and instead of “Standard Primitives”, including the “Vray”,

so that the material in the later use of “Vray” renders recognized. Pressing the letter M on keyboard, the window is opened to add material (“Material editor”). At the top is a row of slots, where it could be seen pictures material after the addition. Material is active when it is surrounded by a white window. By clicking on the “Get Material” button opens a “Material / Map Browser” (Figure 15).

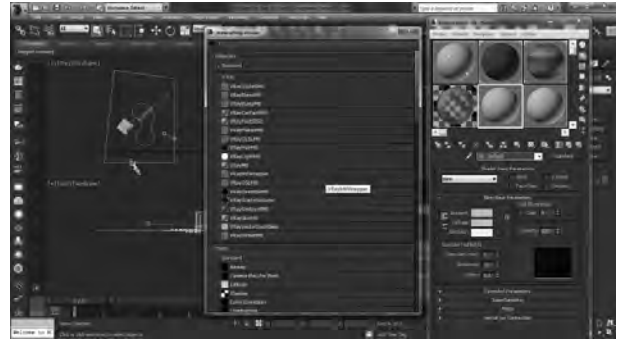


Figure 15 . Material Map Browser

In the upper corner of the “Material/Map Browser” in the options of the command “Open Material library” materials is imported in the software and applied on the model [7]. When the material is imported, the elected surface on material is applied. Cursor is marked and by click on “Put material to scene” object is added to the highlighted portion. It is selected (highlighted) in order to be applied to the surface.

After adding all materials added to the environment in the scene, “HDRI” folder is obtained. It’s a map that has a picture of the environment and the software uses bright. The folder is added as the material except that the “Material/Map browser” elected “VRay HDRI” and added folders. The environment is not active until it is flush with the render and lighting. Render and folders are linked by a menu choice: “Rendering – Environment”. In the new window (“Environment and Effect”) in the “Environment Map” is added to the same “HDRI” folder. The third step is to link the lighting folder [8]. “VRay” Light is a specific light source that can be used to create physically accurate illuminated zones. In the “Modify” menu to create a new lighting, choosing the “VRay – VRay Light”, “type Dome”. “Dome -VRay” light acts as a “skylight” building in “3DMax”. The brightness comes from the sphere through the z-axis light. “Use texture” – selected forms of light source: “Rectangle”, “Dome” and “Mesh”, this deals with the benefits of the light texture of the surface light. “Texture” defines the textures that could be used. He adds also “HDRI” folder. If you add a folder at all three locations, the fourth “viewport” should be applied, see “HDRI” folder (Figure 16).

In “3DMax” software, vegetation could be modeled, adding textures and materials. Vegetation can also be found in open libraries of 3D models on the Internet or simply by installing the “Forest Pack” and

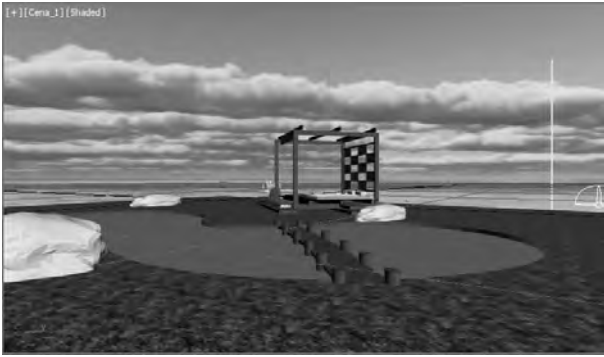


Figure 16. Applied HDRI map

entered into the software. In library, “Forest Pack” has lawns, trees, shrubs, stones, bark mulch and more natural materials suitable for landscape architecture. The advantage of this program is that in combination with “Vray” render natural atmosphere and gives photorealistic renderings.



Figure 17. Import vegetation with “Forest Pack” extension.

“Forest pack” is activated by turning “Itoosoft” add-in “Create Panel”, “Object type – Forest Lite”. In the ‘Forest Creation – Library’ “from the library, the desired vegetation could be selected and incorporated into the model [9]. The last step is the inclusion of “Vray” render and getting the results which is done in the software (Figure 18).



Figure 18. The result of working in 3DMax software package

4. RESULTS

4.1. Questionnaire

By filling out a questionnaire with three graphic interpretation, processed in different software packages (“Lumion”, “Photoshop”, “3DMax”), two groups of respondents (first: students of landscape architecture and other: respondents who have interest in landscape architecture and horticulture) awarded on the basis of its assessment criteria. By the results obtained in the questionnaire (Table 1,2,3.) it could be concluded that the opinion of students of landscape architecture and those who have interest in landscape architecture and horticulture, differs in terms of 3D interpretation. Students of landscape architecture highest ratings were assigned to the graphic interpretation of the processed “Lumion” software package, then “Photoshop” program, while the interpretation of “3DMax” software assigned the lowest rating. Respondents who have interest in landscape architecture and horticulture are also the highest scores assigned to the graphic interpretation of “Lumion” software, then the interpretation of “3DMax” software package, while the lowest ratings assigned to the graphic interpretation of “Photoshop” software. Opinion among groups of respondents on the interpretation of “Lumion” program, which represents a middle ground, between the real and abstract impressions, matches (both groups was evaluated the highest grade – Table 2). Graphical interpretation of “Photoshop” software that is not realistic, students are assessed with 60%, with 20% of respondents (Table 1). Interpretation in “3DMax” program, which is more realistic than the interpretation of “Photoshop” and “Lumion” software, students are assessed with 30%, while the group of respondents from elsewhere assessed as very good with 58% (Table 3). These results lead to the conclusion that students accept the freedom of expression when it comes to abstract interpretation, whereas the second group of respondents aspire to a more realistic interpretation of what the future project solutions.

Table 1. Results of the questionnaire for the graphic visual interpretation of the Photoshop software.

	Bad	Average	Good	Very good	Excellent
1group	0%	6%	14%	60%	20%
2group	0%	14%	56%	20%	10%

Table 2. Results of the questionnaire for the graphic visual interpretation in Lumion software.

	Bad	Average	Good	Very good	Excellent
1group	0%	0%	10%	12%	78%
2group	0%	0%	28%	66%	6%

Table 3. Results of the questionnaire for the graphic visual interpretation in 3DMax software.

	Bad	Average	Good	Very good	Excellent
1group	0%	16%	34%	30%	20%
2group	0%	0%	12%	58%	30%

4.1. Graphic software

“Photoshop” is software designed for graphical modifications without the ability to create 3D models. Graphical presentation created using 2D image model that previously made in 3D software (“SketchUp”) or digital photos that are added to images, shapes and textures by using tools that are integrated into the whole. Lack of modeling compensates its wide range of tools and options. For this reason, it is widely present in the landscape architecture.

The software has no possibility of changing the material on the model and render, but the materials are imported as “.jpg” or “.png” file that is still correct tools for the needs of the design. Libraries with vegetation do not exist in the software, it could be download from the Internet.

The positive thing is that on the Internet there are many species of plants as “.jpg” and “.png” files. Import files and work with tools can significantly slow down during operation, unlike the software (“Lumion”, “3DMax”) in which materials can be changed by pressing the desired material in the libraries of materials. “Photoshop” is the appropriate program for use in the context of the profession if landscape architectural graphical interpretation does not require modeling (Figure 19).



Figure 19. The result of the work in the “Photoshop” software package.

“Lumion” is software for rendering, which functions in an intuitive way, with easy to read interface. The software is programmed for 3D modeling, but also for visualization of the final solution. Used in conjunction with 3D modeling software (“SketchUp”, “3DMax”) from which exported “.dae” file, in which the later “Lumion” software applied materials and creates a graphic interpretation. “Lumion” has a library of materials, landscape architectural elements, vegetation, as well as special effects (fire, snow, rain, wind, water, etc.) which significantly accelerates working in this program. Libraries have a large selection of indigenous plants, but on the Internet there are 3D models that easily could be additionally entered into the software. During operation in the software determines that the final render materials is applied. Rendering speed depends on the amount of material on a model as well as the performance of the computer on which the project is designed. Also the scale of the project is important and the weight of memory size (5 to 30 min). The ending result is a “.jpg” (Figure 20)

graphical interpretation. “Lumion” is a program that could be quickly learned and which, in combination with the “SketchUp” software, provides high-quality results in a short time of operation.



Figure 20. The result of the work in the “Lumion” software package.

“3DMax” is one of the researched graphics programs (Figure 21) for modeling and visualization. The software is complex because it can add new area (modeling), install interior visualization (“Vray”) and vegetation (“Forest Pack”). With these additions “3DMax” has its place in landscape architecture, but a small amount of the available vegetation and the time required to master the work in software, represent a barrier. For photorealistic render it is not necessary to have knowledge of modeling in software. By entering the model from SketchUp software as a “.3ds” file in the “3DMax,” there is only the possibility of adding 3D visualization and modeling of vegetation without prior work in the program, so it speeds up the working process. The time it takes for “Vray” to allow photorealistic render depends on the amount of details on the 3D model and the performance of the computer on which it is designed. “3DMax” with its annexes majority programmed for architecture, although it may have important role in landscape architecture. If the focus is the graphic interpretation of the landscape architectural elements, materials that will provide photorealistic visualization, “3DMax” has the advantages of software over the other programs (Figure 21).



Figure 21. The result of the work in the “3DMax” software package.

5. CONCLUSION

The unstoppable development of digital graphics pushing the boundaries of creativity, which are daily striving to create new designs that are not always easy to present. Landscape architecture is a transdisciplinary area, which require visualization of graphical solutions that involve the use of software packages. Context of the space, materials, and plants make the final look for the emergence of a complex that you need several different programs, resulting in high-quality visual solutions. This research used a combination of two research methods: study of graphic interpretation, learning through work [10] on software for digital graphics and Opinion Research – Public Opinion Questionnaire (“Single stimulants” method). The study used a 3D model “Garden”, modeled for the purposes of this research, for graphic interpretation in three different software. “Garden” is modeled in the “SketchUp” program, which is still exported (“Export”) as “.dae” (“Lumion 6”), “.jpg” (“Photoshop CS6”) and “.3ds” (“3DMax 2016”) files. Software that are used has a different style, which contributes to the understanding of which style of visualization is the most acceptable for the perception of the respondents. The results of this research suggest that “Lumion” is one of the software that could be appropriate. Based on the research conducted in this paper, Lumion can be recommended for the graphical interpretation for the landscape architectural profession. “Lumion” in combination with “Photoshop” software gives good results in graphic interpretation of landscape design projects. Render in the “Lumion” and an additional filter light in the “Photoshop” software. The software proved to be a flexible, fast in rendering and rich of materials. The public survey conducted on students of landscape architecture and horticulture through visual questionnaire, leads to conclusion which indicate the appropriate graphical interpretation. The “Single stimulus” methods for the subjective assessment of picture quality assessed the images shown to the respondents. “Single Stimulus Impairment Scale” was used during the evaluation.

Students of landscape architecture are the highest ratings assigned graphical interpretations addressed in “Lumion” and “Photoshop” software package, while the lowest grade rated “3DMax” software. The study concluded that students are understanding and allow freedom in graphics expression, ie. accept abstract graphic interpretation. Respondents who are interested in landscape architecture and horticulture are positively reacted to the graphical interpretation from “Lumion” and “3DMax” software, and the visualization of “Photoshop” software is the estimated lowest grades. They were assigned the highest ratings questionnaire visualization that looks realistic, but drawing on the grounds it is not sufficiently clear to them. It turned out that the respondents who are not in the profession, have no power to visualize future design solution if it does not look realistic. It lead us to conclude that “Lumion” is quick and quality program for graphic interpretation and visual perception. Participants from both groups reacted positively to the graphic inter-

pretation of 3D models “Garden” treated in the software package “Lumion”. Using “Lumion” program the full reality display is not achieved, but it is acceptable by both, the public and to students of landscape architecture and horticulture.

Acknowledgment

Authors are supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Projects No. TP 36008 and III 43007.

6. REFERENCES

- [1] Yang F., Hao S., Tan S., Tan F., (2016): Graphic modeling for step-by-step construction of the Dayn pagoda in Xi’ An, Ohio State University, Proceedings of 17th International Conference on Geometry and Graphic, Beijing 2016.
- [2] Wang Z., Zhang F., Qui B. (2016): The application and practice of “Learning by doing” for engineering course. Dalian University of Technology, China, Nanjing Forestry University, China. Proceedings of 17th International Conference on Geometry and Graphic, Beijing 2016.
- [3] Wei D. (1990): Democracy and education. People education press, Beijing.
- [4] Čučakovic, A., Teofilovic, N., Jović, B.(2013): Digital modeling of free forms structures at experimental design Preceedings The Industrial Art and Design Issue No 12. The Interdepartmental Collection of Proceedings of SED-13, 10th Crimean International Scientific – Practical Conference, Geometrical and Computer Simulation: Safe Energy, Ecology, Design. Crimea, Simferopol, 7-10 October 2013. Ukraine Association for Applied Geometry. Kyiv. pp. 104-108. ISSN 2221-9293. UDK 514.18
- [5] Maksimović-Moićević. S. (2015): The proposal of new measures for assessing the picture quality when interpolation and its implementation in the computer processing of the image signal, University Novi Sad, Faculty of Technical Sciences, Novi Sad.
- [6] Cantrell,B., Michaels W. (2010): Digital Drawing for Landscape Architecture. Hoboken, New Jersey.
- [7] Derakhshani R., Derakhshani D. (2014): Autodesk 3ds Max 2014 Essentials, Autodesk official press, Canada.
- [8] <https://docs.chaosgroup.com/display/VRAY-3MAX/Area+Lights+%7C+VRayLight>
- [9] <http://docs.itoosoft.com/display/FORESTPACK/General>
- [10] Čučaković A., Jović B. (2011): Constructive Geometry Education by Contemporary Technologies SAJ_2011_3_ Serbian Architectural Journal, original scientific article, approval date 12.06.2011. UDK BROJEVI 514.18:62 ID BROJ 184977420 p.164-183