

15. 3D GRAPHICS AS AN EFFECTIVE TOOL FOR ONLINE ADVERTISING

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Introduction. There is an enormous variety of goods and services offered in the modern online marketplace. Very often, a single product category is produced by hundreds of different companies, leaving consumers overwhelmed by this variety. Consequently, one of the most effective approaches in online advertising is the development of creative solutions capable of distinguishing a specific product on the market and producing memorable advertising content. The use of 3D (three-dimensional) models to create engaging characters as well as product and object visualizations can significantly enhance advertising effectiveness. This has determined the relevance of studying the specific features of using 3D graphics in online advertising.

The advertising industry rapidly adopts new tools that help attract and influence the audience's attention. 3D animation is perceived particularly well by the human eye, and its effectiveness is reported to be five times higher than that of traditional 2D advertising animation. In some cases, 3D animation is the only viable method of visualization. 3D animation provides marketers with greater opportunities to showcase a product's advantages.

To create effective online advertising, it is necessary to identify the specific design and technical requirements for 3D models that meet not only the technical

requirements of online placement but also the expectations of consumers. Therefore, the purpose of this study is to examine the characteristics of various types of 3D models used in online advertising and to determine the key features of online advertising that attract Internet users.

To confirm the effectiveness of using 3D models in online advertising, it is essential to analyze the characteristics of internet users, the properties of different types of online advertising, and the features of models used for character creation as well as object and product visualization, taking into account the requirements of online advertising and consumer preferences.

For this purpose, three hypotheses are proposed and examined:

- the use of 3D graphics in online advertising is more effective than photograph or 2D graphics.
- the speed and cost of creating a 3D model depend on the modeling method;
- the use of 3D graphics increases interest in advertising and attracts consumers.

Relevance and Problem Statement

With the development of information technologies, 3D marketing continues to evolve and expand. It offers several significant advantages. Advertising campaigns based on 3D modeling are often more cost-effective than traditional photo- or video-based solutions. In other words, it is cheaper than organizing a photoshoot. Creating photographic materials for advertising requires taking into account numerous factors: studio rental, photographer, models, stylist, makeup artist, and more – and this is only the basic setup. Moreover, once the photoshoot is completed, the result can no longer be modified; if substantial changes are needed, the entire shoot must be repeated, which results in considerable time and financial costs.

If 3D modeling is used, the only investment required is the production of 3D content, either through specialized agencies or by hiring appropriate professionals. In addition, rapid adjustments can be made, which significantly simplifies the entire production process. In 3D visualization, substantial changes can be introduced within minutes: adjusting the camera angle, lighting, or modifying the objects with ease. 3D modeling also makes it possible to create a photorealistic visualization of an object that does not yet exist, such as a prototype of a new product design.

A single 3D model can demonstrate nearly any idea and all its features from every angle. The object can be rotated 360°, accurately representing dimensions and realistic parameters within various contexts. Another important advantage is differentiation from competitors. The use of modern technologies in advertising signals to customers that a business is continuously evolving and keeping pace with contemporary trends. 3D technologies are an effective way to communicate this through demonstrations, promotional materials, and non-standard advertising approaches.

Photographs used in advertising are not always accurate – and consumers understand this. Photographs may be retouched or taken from a more flattering angle. 3D visualization allows for highly accurate and honest representation of an object. Consumers appreciate this transparency.

Modern modeling techniques make it possible to create large 3D scenes such as interiors, buildings, and streets; apply diverse textures; and select optimal lighting. The environment plays a crucial role in product presentation. 3D modelling can be used not only to depict the product design but also to establish the appropriate mood and atmosphere.

Another advantage is the ease of scaling content to meet advertising needs. Traditional marketing and advertising tools often face significant limitations in scalability. For example, photos taken for brochures may not be suitable for billboards, and a vertical image may not work for a horizontal banner. With 3D models and visualization scenes, dimensions can be adjusted freely. Need a banner for targeted advertising today? Easy. Need a large outdoor banner tomorrow? Also not a problem. The scene can be edited just as easily to match the required advertising theme.

3D visualization also introduces interactivity: customer can not only view the object but also interact with it, such as opening drawers in a virtual furniture model. Interaction can be extended further by allowing consumers to customize the product – changing shelf positions, colors, or handle designs. People are much more willing to purchase something they have contributed to shaping.

Unlike traditional custom furniture production, this does not require visiting a studio or consulting with designers. Users can create and purchase their personalized design in minutes through an application. As consumers increasingly value innovation, products promoted using 3D technologies are more likely to be chosen, especially in competitive markets where differentiation is essential.

These factors underscore the relevance of 3D modeling for digital marketing. The aim of this study is to examine the characteristics of 3D models of various objects for their use in online advertising and to identify the key features of digital advertising that attract Internet users. The object of the research is the specific features of applying 3D graphics in online advertising.

To confirm the effectiveness of using 3D models in digital advertising, it is also necessary to analyze the properties of the target audience – namely, Internet users – as well as the features of different types of online advertising. Additionally, the study examines the properties of models used for character creation, object modeling, and product visualization, taking into account the requirements of online advertising and consumer preferences.

In accordance with the stated aim, the following tasks were addressed:

- analysis of the literature relevant to the research topic;
- study of the main tools and characteristics of online advertising;
- analysis of Internet users in Ukraine and identification of their preferences;
- investigation of the specific aspects of creating various models for use in online advertising;
- comparison of online advertisements developed using different techniques (2D graphics, photography, 3D graphics);
- development of recommendations for designing and applying 3D graphics across different formats of digital advertising.

1. Overview of the subject area and literature review

1.1 Applications of 3D animation and visualization

A review of the literature [1-9] indicates that 3D imagery and animation are used across an exceptionally wide range of industries.

3D software and hardware are applied in various sectors, each employing 3D animation for distinct purposes. Goals and implementation approaches differ significantly.

Science and entertainment are the primary consumers of 3D animation and visualization. Scientific applications include specialized projects aimed at visualizing physical, medical, or forensic processes. In film production and gaming, 3D animation is used to create characters, environments, futuristic or historical worlds, and visual effects. These industries employ thousands of 3D professionals.

3D Animation in Film Production. The film industry is the largest user of 3D animation. Films may be entirely produced in 3D (e.g., *Shrek*, *Toy Story*) or may incorporate 3D visual effects (*Jurassic Park*, *Tron: Legacy*). Film production typically takes from 6 months to 4 years and may involve from 3 to 300 specialists.

Production of fully animated feature films requires 2–4 years and is usually carried out by studios employing hundreds of professionals. Short films up to 40 minutes are commonly produced by small studios or even a single individual and serve as testing grounds for new technologies.

Short films with a duration of up to 40 minutes are typically created by a single individual or a small studio. In large studios, short films are often used to test new technologies. Films that incorporate visual effects differ from fully animated films in that they are shot on a sound stage, after which the recorded footage is handed over to visual effects artists, who add the necessary effects and elements.

Studios that work on visual effects may be either small or large, depending on the type and volume of work they perform.

3D Animation on television. Television also uses full 3D animation, though the process is costly and time-consuming. For instance, the children's show *Mickey Mouse Clubhouse* is fully 3D-animated.

More commonly, 3D is used for effects or show intros. Educational channels such as *Discovery* and *History* incorporate 3D animation for visual explanation of complex concepts.

Television does not have the large budgets or extended production timelines characteristic of the film industry. Television programs are filmed and edited within days or weeks rather than years, yet the 3D animation used in them is still expected to look equally high-quality.

3D in video Games. The profit generated by video game production is substantial, reaching hundreds of thousands and sometimes even millions of dollars. In terms of profitability, video games can compete only with the film industry. 3D animation is used to create the game worlds into which the player enters. The video game industry is similar to filmmaking, except that 3D designers work much faster.

Mobile games are developed quickly, whereas the production of a full-scale video game may take two to three years.

Creating all characters and the game environment is a labor-intensive yet highly engaging process. Typically, the people who work on developing 3D characters and game environments are deeply and irrevocably passionate about their craft, able to immerse themselves in it continuously. This profession is exceptionally well compensated, but the competition within the field is also among the highest.

3D Animation in Advertising. In the advertising industry, short-form animation is commonly used—ranging from 10 seconds to 5 minutes. This duration is sufficient to showcase all key advantages and provide a detailed presentation of a product or service. Advertising spots often contain a significant amount of information, as airtime is extremely costly. Similar to films or television programs, a commercial can be fully animated, or visual effects may be added to live-action footage. Advertising requires very high-quality animation, yet clients typically provide limited time for production, which makes the task even more challenging and engaging.

For online advertising, an additional requirement applies: 3D models must be lightweight, meaning they should contain a minimal number of elements to ensure fast visualization regardless of the user's Internet capabilities.

3D animation in VR. Virtual Reality (VR) is a relatively new area in the world of digital content, and each day it attracts an increasing number of users. Currently, it represents one of the most rapidly expanding segments of the IT industry. Of course, modern devices and VR technologies are still far from perfect: processors and graphics cards can still experience latency, and sensors do not always respond accurately to user movements. For this reason, we still cannot completely abandon controllers (joysticks). However, the VR field is developing rapidly, and our devices are becoming more powerful every year. Even today, any modern smartphone can easily support VR technology via a 3D-box without noticeable delay, and virtual tours as well as 3D cinemas featuring short films have already become a stable part of everyday digital experiences.

Medicine and 3D Animation. The results of a 3D designer's work created for scientific purposes are rarely visible to a mass audience. Medicine, forensics, and architecture are among the specialized fields in which a 3D animator may work. In medicine, 3D animation is widely used – from visualizing medical processes to representing biological reactions. For example, it is difficult to depict how a disease blocks blood flow to the heart and causes a heart attack. 3D animation makes it possible to clearly illustrate what is happening, which is a significant advantage for medical applications.

3D visualization is used extensively in education and medical marketing. It is also applied in research, helping to make predictions and establish diagnoses. The market for medical 3D visualization and animation is growing rapidly, offering substantial opportunities for freelance 3D animators and small studios.

The challenge, however, lies in the fact that many 3D specialists prefer to work in the gaming or film industries rather than collaborate with pharmaceutical companies or produce content for academic research.

3D in Forensics. 3D animation and modeling are used in forensics to support the reconstruction of events. Animations and models are created to help confirm, refute, or refine the understanding of a crime or an accident. Although 3D models and animations are not direct evidence, they enable investigators, judges, and prosecutors to reproduce the event and visually demonstrate the sequence of actions.

At times, forensic experts need to recreate missing objects or fragments relevant to a case, and new technologies, such as 3D modeling and 3D printing, assist in this process. This field is highly specialized and requires additional expertise.

Architecture and 3D Animation. 3D modeling enables interior designers and architects not only to visualize objects and interior spaces, but also to test variations in color, textures, and the placement of architectural elements or decorative items. This is a relatively narrow field, yet those who work in it can collaborate with interior designers, architectural studios or departments, as well as marketing units within construction companies [3].

1.2 Main advantages of three-dimensional graphics

The main advantages of three-dimensional graphics are as follows.

Uniqueness. By extending beyond the flat plane, the graphic appears unusual and distinctive. What was once a flat stroke becoming volumetric. Three-dimensional illusions, the interplay of light and color, and abstract forms all contribute to this effect (Figure 1.1).

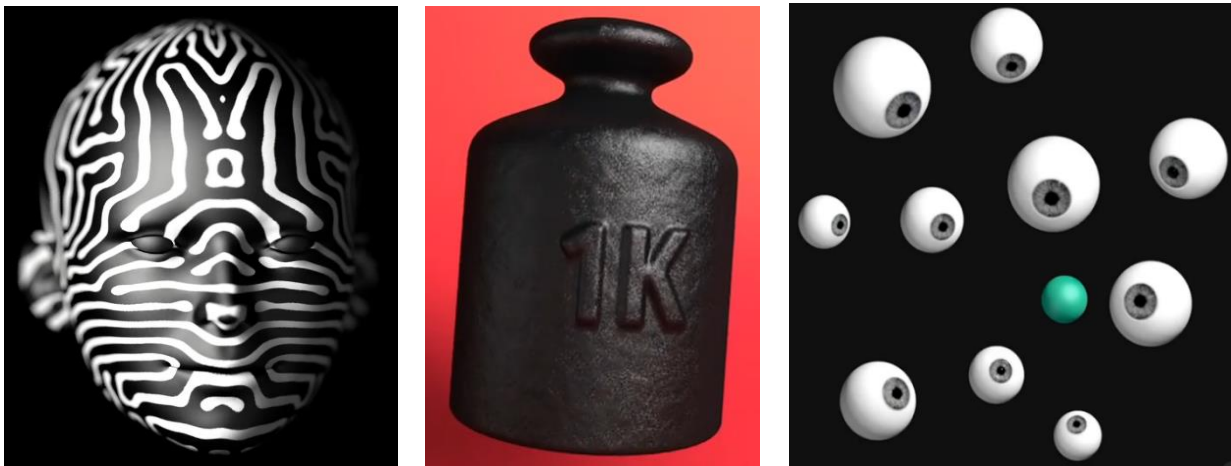


Figure 1.1. Examples of object 3D modeling

Source: Pinterest (2019)

Generativity. 3D objects can be generated in editors simply by pressing a few buttons: creating a sphere, cloning it, adding randomness, applying a blending effect, assigning a material, and sending it to render. Rendering is the most time-consuming part, yet it occurs automatically (Figure 1.2).

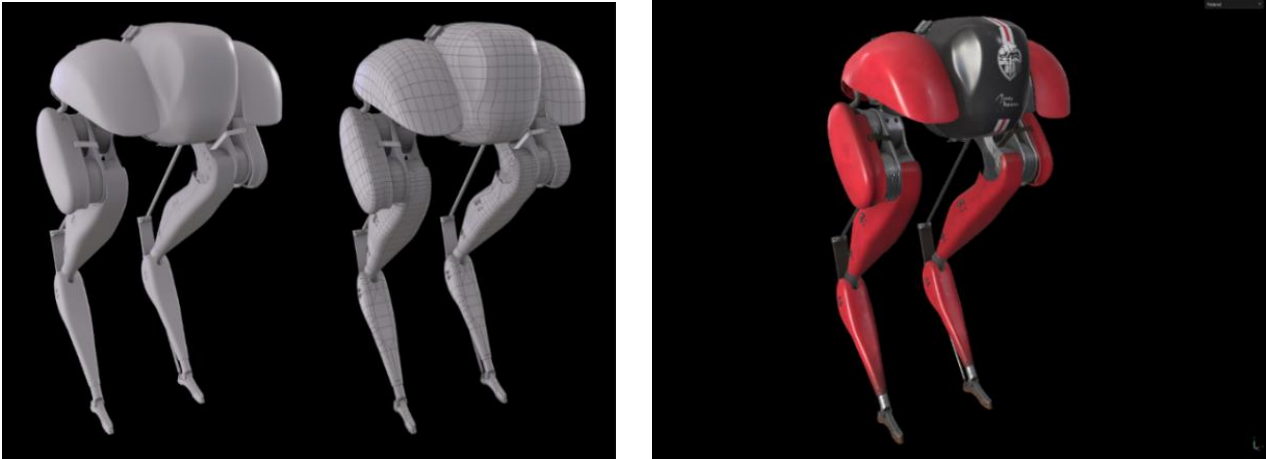


Figure 1.2. Model after rendering
Source: Created by authors (2025) [9]

Animation. Three-dimensional graphics are easy to animate, and this advantage should be utilized—moving objects attract attention more effectively. Animation can be performed in a semi-automated mode; for example, for a complex transformation, it is enough just to define a trajectory of movement or deformation. Configuring an object’s sinusoidal transformation takes only a few minutes.

Sound can also be added to an animated 3D image, engaging an additional sensory channel of the viewer. This enhances the emotional impact and captures attention more strongly [6-8, 10].

Another advantage of 3D graphics is their *wide range of applications*. For example, they can be used to create models of real objects (Figure 1.3), 3D printing model (Figure 1.4), and real or fictional characters (Figure 1.5).



Figure 1.3. Model of printing equipment
Source: Created by authors (2025)

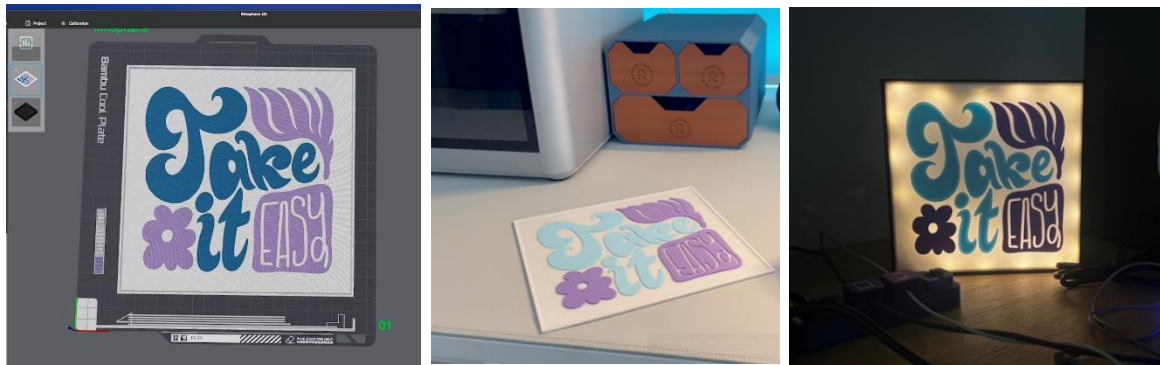


Figure 1.4. Light panel (3D printing)
Source: Created by authors (2025) [5]

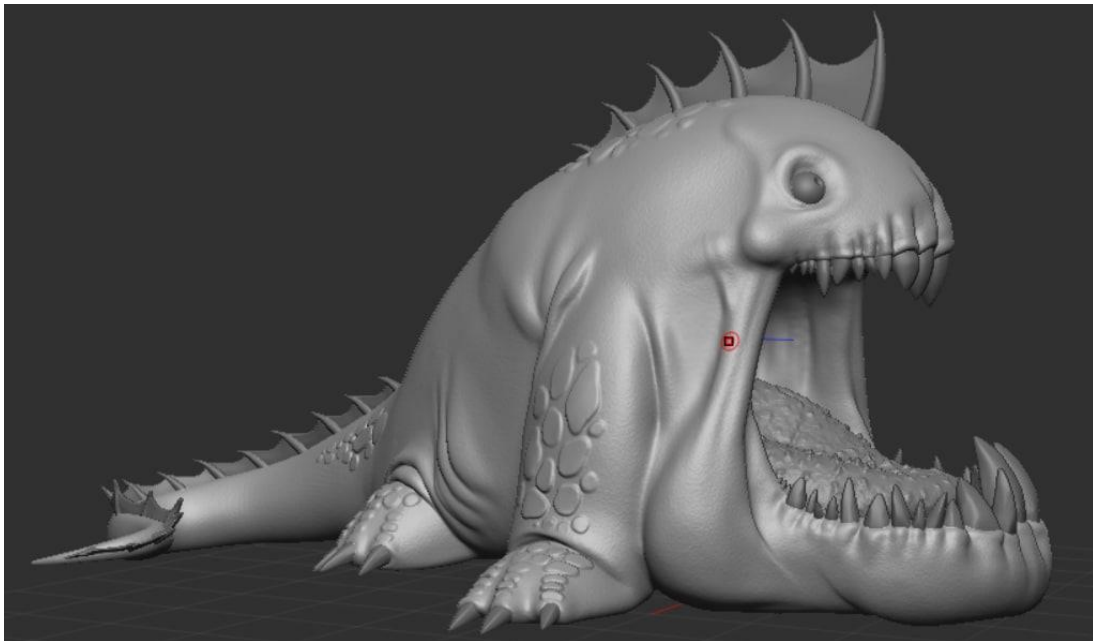


Figure 1.5. Models of fantasy and advertising characters
Source: Created by authors (2025)

In some cases, these images appear realistic, while in others intentionally “trash-like,” yet this is done consciously, with taste and purpose. Their primary task is to attract consumer attention. Trash aesthetics also function as a tool of visual

identification. Another advantage is that such graphics do not require meticulous polishing or making everything “perfect.”

Three-dimensional graphics can also be used for social media—for example, to illustrate posts with 3D metaphors. And to attract even more attention, these visuals can be animated.

There is also the option of using ready-made models. If something more complex than simple abstractions is needed, time can be saved by purchasing a pre-made model from a 3D stock marketplace. Prices vary widely, but simple assets can be found for \$10–50 (Figure 1.6).

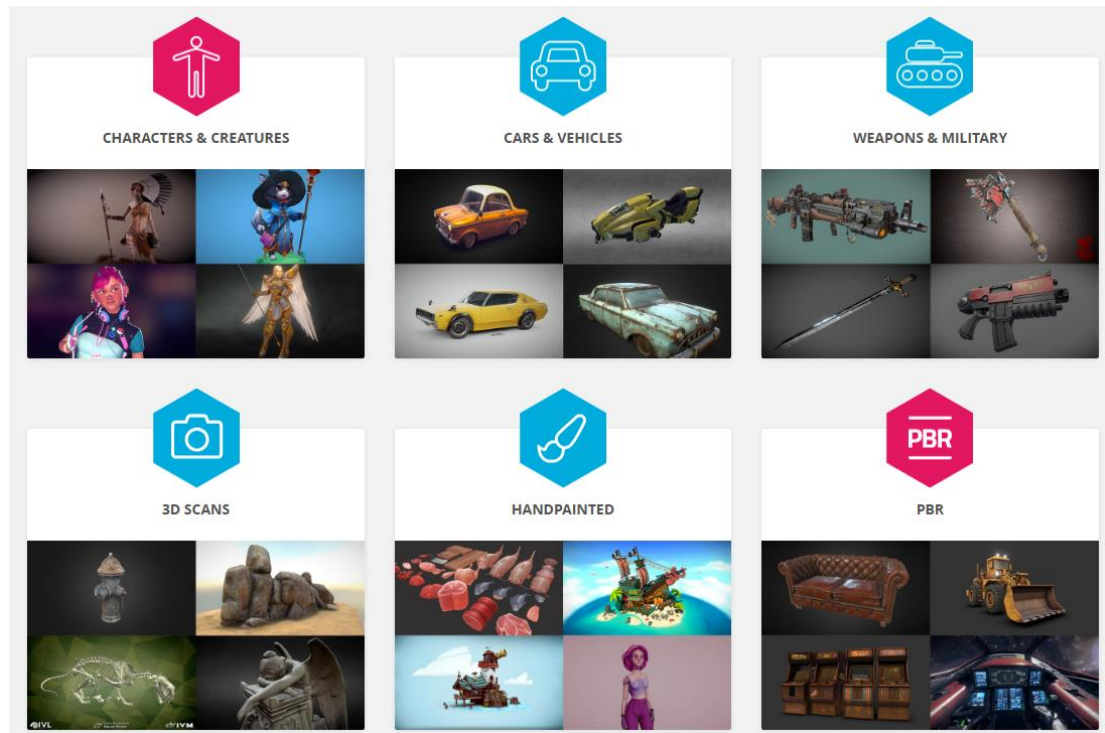


Figure 1.6. 3D stock of ready-to-use models

Source: Stock 3D models (2025). <https://sketchfab.com/features/free-3d-models>

An analysis of the literature and resources on this topic [6, 12, 13] makes it possible to compare advertisements created using 2D and 3D graphics and to conclude that three-dimensional graphics outperform in several aspects – development time (particularly for simple abstract models), variability (once a 3D model is created, any textures, lighting setups, or effects can be applied without modifying the model itself, and developed effects can be transferred to any other model), ease of animation, and more. By using lightweight three-dimensional models and animation, it is possible to create highly memorable brand identity elements.

The first example from global practice is the colorful Telia stones [14]. Only the coloring and viewing angles change, yet they appear very bright and diverse (Figure 1.7). Another example is the identity created for the KM3 event – an illustration of a simple yet highly versatile visual identifier [14]. Any medium can be branded with the multicolored “sausage” form, and modeling and rendering the required shape requires minimal effort (Figure 1.8).

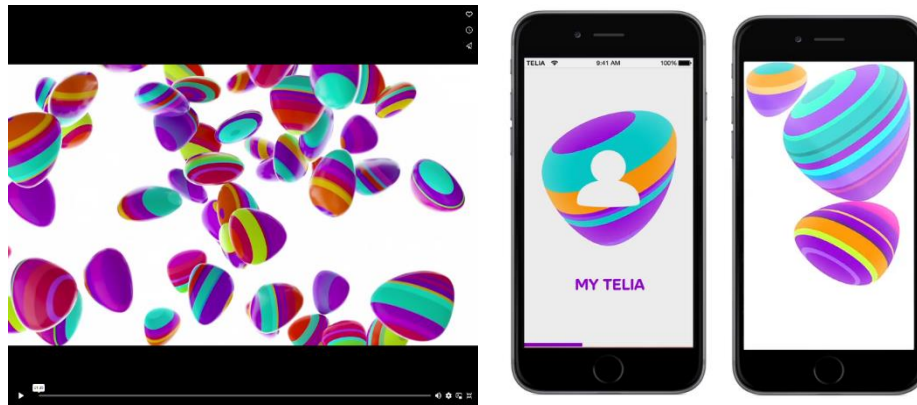


Figure 1.7. Telia colorful stones
Source: Telia. <https://www.telia.ee/en>

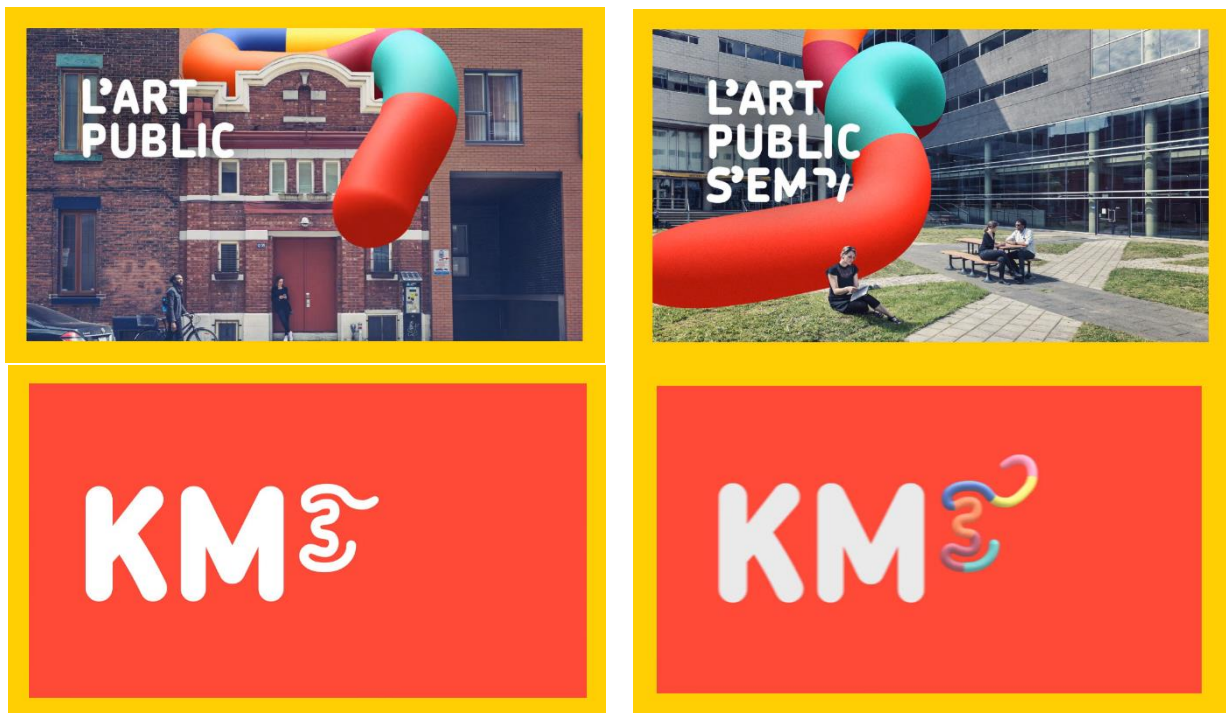


Figure 1.8. KM3 event identity
Source: Telia. <https://www.telia.ee/en>

3D graphics are currently a trend, but they should be used thoughtfully and only when suitable. For example:

- a large number of brand identity applications that require compositional variability;
- the need to continuously evolve the identity and generate new ideas;
- the necessity to stand out with something more dynamic than static images, for example when a brand is heavily represented in digital environments or relies on digital media;
- a high volume of textual materials that must be illustrated quickly, effectively, and with visual diversity;
- a large number of similar objects requiring modification of individual attributes (such as color, texture, etc.).

2 Analysis of key Internet user groups

Today, nearly every person can be an active Internet user. Even primary school students actively use the Internet for online games, and this trend continues to grow. According to research [15], the most active Internet users belong to the 22–44 age group. These individuals frequently access the Internet both from home computers and smartphones. In Ukraine, 66% of people over the age of 16 regularly use the Internet for personal purposes. The most active users are those aged 25–34, who make up 27% of the total user base. The 35–44 age group accounts for 23%. Although younger users traditionally spend more time online, Internet usage today is distributed more evenly across age categories. There is also a steady increase in mobile Internet usage, as smartphones provide a convenient way to connect outside the home, and modern technologies ensure fast and reliable Internet access.

The Internet is used not only for work but also for education and entertainment. Computers and smartphones have become an integral part of everyday life. Since 2020, the Internet has evolved into a platform where one can perform nearly any activity: communication, work, learning, travel, shopping, and much more. The research company Gradus Research conducted a segmentation analysis of Internet users based on their behavioral patterns [15]. The segmentation was performed using several parameters that make it possible to study different types of online behavior, including:

- place of Internet use;
- device types;
- various online environments (email, chats, calls, social networks);
- content consumption (job listings, education, health, humor, etc.);
- types of online activity (gaming, shopping, booking, etc.).

The results of the study helped identify the target audience more accurately and enabled more effective customization of advertising materials. According to the research [15], the following segments of Ukrainian Internet users were identified (Figure 3.1).

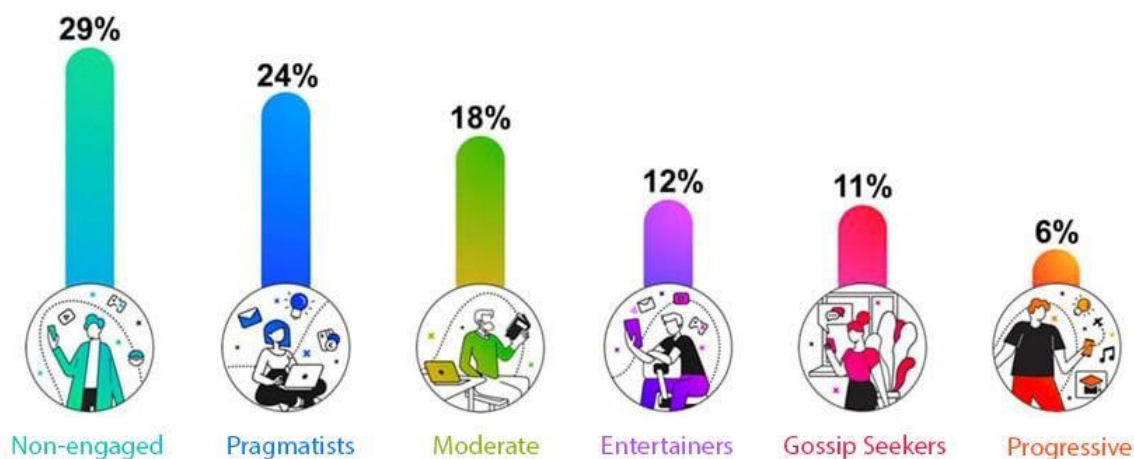


Figure 3.1. Segments of Internet Users

Source: Gradus reports. <https://gradus.app/uk/open-reports/>

The “Progressive” segment accounts for 6% of all users and consists primarily of men (67%). The largest share of this group is represented by young people under the age of 24 (18%). This segment is characterized by active Internet use in various locations such as educational institutions, public transport, cars, and workplaces. However, they use the Internet at home to a lesser extent (81%), which indicates high mobility and a reliance on modern devices that enable connectivity from virtually anywhere. According to the study, users in this segment are “obsessed” with the Internet. They actively create content for social media, freely sharing personal thoughts and emotions. Additionally, they frequently make online purchases and often use digital financial tools. However, this segment uses search engines less frequently than others.

The “Entertainers” segment represents 12% of users, with a predominance of individuals aged 25 to 44 (72%). The primary devices used for internet access in this group are smartphones (98%) and desktop computers (44%). The main purposes for going online among these users are socialization, watching videos, listening to music, and gaming. Users in this segment actively use YouTube, search for information through search engines, and communicate extensively via messaging applications.

According to the study, the “Pragmatists” segment (24%) consists predominantly of women (72%) of middle age, most of whom have higher education (84%). This group includes the highest proportion of residents of Kyiv (26%) and other large cities. They typically access the internet via laptops (69%) and often do so at their workplaces (71%). Users in this segment are not inclined to share personal information, although they actively engage with social networks. For them, the Internet is primarily a tool for learning, earning, and meeting professional needs.

The “Gossip Seekers” segment (11%) mostly consists of women (68%) of older age (35–54 years – 56%), and 44% of them do not have higher education. These users are highly active online at home (98%). They frequently use social networks but mainly repost and comment on others’ content rather than creating their own. The Internet is perceived as complex and inconvenient by this group, and they use it situationally, often following the behavior of others.

The “Moderate” segment (29%) consists predominantly of women (62%) aged 25–44 (74%), residents of major metropolitan cities (44%), and individuals with higher education (73%). They are not active users of social networks and primarily use the internet for communication through messaging applications, although their overall level of online activity remains low.

The “Non-engaged” segment (18%) is mostly composed of women (63%) aged 25–54 (89%) and residents of small and medium-sized cities (64%). Among them, 32% use desktop computers and 91% use smartphones, with the majority accessing the internet at home (94%). For this group, the Internet serves only as an additional source of information and communication, but they do not show significant interest in it and use it only situationally.

The study was conducted by Gradus Research using a self-administered questionnaire method within a mobile application. The Gradus online panel reflects the demographic structure of cities with populations exceeding 50,000 residents, covering

individuals aged 18 to 60 [15]. The described user categories demonstrate high levels of activity both in internet browsers and on social networks. Among them, young users – the “Progressive” segment – show interest in new, original, and dynamic trends; middle-aged men – the “Entertainers” segment – seek diverse and engaging information; and the older audience – the “Pragmatists” and “Gossip Seekers” – use the internet for a variety of purposes, actively searching for information and sharing content. These characteristics of the target segments should be taken into account when developing online advertising.

3 Analysis of the Specific Features of Using 3D Graphics in Online Advertising

3.1 Clarification of the number and participants of the expert group

For the implementation of the expert evaluation procedure, the following input materials were prepared: advertising mock-ups created using various methods, as well as informational and reference materials. In addition, questionnaire forms for the expert group were developed, in which scores will be recorded for subsequent analysis. At this stage, the number and participants of the expert group are also determined.

In order to conduct the study, experts working in the field of advertising were selected. They have experience in advertising development and understand the specifics of applying modern design and marketing trends to online advertising. These experts include designers, marketers, and bloggers who actively use advertising on social media. The expert group consists of 7 experts of different age categories who meet the listed criteria. They evaluate 3 advertising media, where the number of evaluation criteria is 10.

3.2 Planning of the Experiment

In the experimental section, it is necessary to test the three formulated hypotheses.

Hypothesis 1 – “The use of 3D graphics for online advertising is more effective than photographs or 2D graphics”.

Hypothesis 2 – “The speed and cost of creating a 3D model depend on the chosen modeling method”.

Hypothesis 3 – “The use of 3D graphics increases interest in advertising and attracts consumers”.

To confirm the first hypothesis, it is necessary to specify the core characteristics of online advertising that will be used as evaluation metrics and then conduct the corresponding expert assessment within the selected group of experts. The main evaluation criteria are chosen based on a review of the literature on this topic and the authors’ professional experience.

The second hypothesis is confirmed through an analysis of different modeling methods during the development of a 3D model for product visualization. For objective

evaluation, the authors' working models are used.

To confirm the third hypothesis, a sociological survey must be conducted among internet users who may be interested in online advertising. For this purpose, the target audience was analyzed, and the most active users who meet the research objectives were selected. A Google Form was developed for conducting the online survey.

The main characteristics of online advertising that will be examined during the experiment have been identified:

- 1) variability (ease of modification);
- 2) ease of idea implementation;
- 3) speed of advertisement creation;
- 4) originality of implementation;
- 5) use of colors;
- 6) attention engagement;
- 7) animation (ease of implementation);
- 8) file size (small);
- 9) cost (low);
- 10) image detail;
- 11) possibility of using sound;
- 12) professional experience of the designer.

3.3 Conducting the Expert Survey

To investigate the possibilities of using 3D graphics in online advertising and to verify the first hypothesis, an evaluation form was developed to evaluate the criteria of advertising media implemented using different methods:

- using photography and subsequent editing (see Fig. 3.1);
- using 2D graphics tools (see Fig. 3.2);
- using 3D graphics tools (see Fig. 3.3).



Figure 3.1. Advertising mock-up created using photography and subsequent editing

Source: Created by authors (2025)



Figure 3.2. Advertising mock-up created using 2D graphics tools

Source: Created by authors (2025)

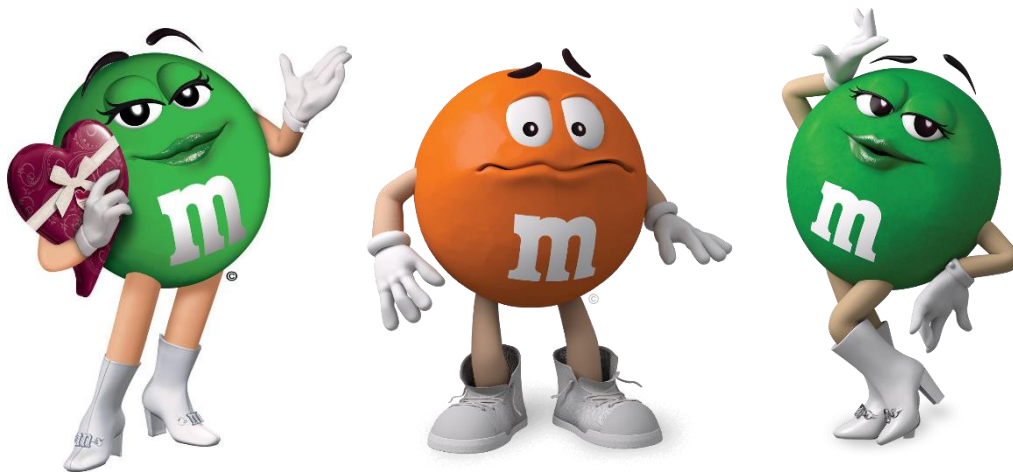


Figure 3.3. Characters and advertising mock-up created using 3D graphics tools

Source: Created by authors (2025)

The expert survey was conducted remotely, and the evaluation was carried out using a 10-point scale. Some characteristics were desirable, meaning that higher values indicated better results - for example, “variability (ease of modification),” “attention engagement,” and “speed of advertisement creation.” Other characteristics were undesirable, meaning that lower values were preferable - for example, “file size” and “cost.” Therefore, explanations were provided to the experts regarding the evaluation of all characteristics to ensure accurate recording of survey results.

Additionally, the sufficient experience and competence of the experts were taken into account, particularly for evaluating more subjective characteristics such as “professional experience of the designer” or “originality of implementation.” A designer working with 3D models must have a thorough command of specialized software to create optimal and visually appealing 3D graphics.

The results of the expert survey for each advertising medium are shown in Tables 3.1 - 3.3.

Table 3.1. Expert evaluations of the photomontage advertisement

N o	Evaluation characteristics	Experts						
		1	2	3	4	5	6	7
1	Variability (ease of modification)	5	4	3	6	5	3	2
2	Ease of idea implementation	5	6	4	5	5	6	5
3	Speed of advertisement creation	8	6	7	8	7	6	6
4	Originality of implementation	9	8	7	10	9	8	7
5	Use of colors	9	10	8	9	9	8	7
6	Attention engagement	9	10	8	9	8	7	8
7	Animation (ease of implementation)	6	5	5	7	4	4	5
8	File size (small)	7	6	6	7	6	6	5
9	Cost (low)	4	6	4	5	6	7	6
10	Image detail	9	10	9	8	7	9	9
11	Possibility of using sound	8	8	7	6	7	8	9
12	Professional experience of the designer	8	9	9	7	7	8	8
	Total	87	88	77	87	80	80	77

Table 3.2. Expert evaluations of the advertisement created using 2D graphics

N o	Evaluation characteristics	Experts						
		1	2	3	4	5	6	7
1	Variability (ease of modification)	6	5	5	5	6	4	5
2	Ease of idea implementation	8	9	8	8	8	8	7
3	Speed of advertisement creation	8	9	7	7	7	8	6
4	Originality of implementation	8	9	7	9	8	8	8
5	Use of colors	9	10	10	9	10	10	9
6	Attention engagement	8	10	9	7	8	8	9
7	Animation (ease of implementation)	6	6	5	5	6	5	4
8	File size (small)	6	6	5	6	6	5	7
9	Cost (low)	5	5	6	5	6	7	6
10	Image detail	8	9	9	8	9	9	9
11	Possibility of using sound	4	5	5	4	4	4	5
12	Professional experience of the designer	6	7	7	6	6	6	7
	Total	82	90	83	79	84	82	82

Table 3.3. Expert evaluations of the advertisement created using 3D graphics

No	Evaluation characteristics	Experts						
		1	2	3	4	5	6	7
1	Variability (ease of modification)	10	10	9	10	10	9	10
2	Ease of idea implementation	10	10	10	9	8	9	10
3	Speed of advertisement creation	9	10	9	9	8	9	10
4	Originality of implementation	9	10	9	9	10	9	9
5	Use of colors	9	10	10	9	10	10	9
6	Attention engagement	9	10	10	9	9	9	10
7	Animation (ease of implementation)	10	10	10	10	10	10	10
8	File size (small)	8	7	10	9	8	9	9
9	Cost (low)	6	7	7	8	9	9	9
10	Image detail	9	10	9	8	8	9	9
11	Possibility of using sound	9	10	10	8	9	9	9
12	Professional experience of the designer	5	5	4	4	6	6	6
	Total	103	109	107	102	105	107	110

Based on the results of the survey, it can be concluded that 3D advertising is more effective according to most indicators. Therefore, for further data processing, we use the last Table 3.3.

3.4 Processing and Analysis of the Expert Survey Results

The main stages of processing expert evaluations include:

- determining the experts' competence;
- calculating the generalized (aggregate) evaluation;
- assessing the consistency of experts' opinions;
- preparing conclusions based on the results of the expert evaluation.

Since the experts' evaluations were given in points, the table must first be normalized. Next, the consistency of expert opinions is assessed. For this purpose, it is necessary to calculate:

the average value of the criterion evaluation according to the formula:

$$\bar{x} = \frac{\sum x}{n}, \quad (3.1)$$

where x – is the criterion score;

n – is the number of experts.

The standard deviation can be calculated according to the formula:

$$\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}, \quad (3.2)$$

where x_i – is the i -th criterion score;

\bar{x} – is the arithmetic mean score;

The variance can be calculated according to the formula:

$$D = \sigma^2. \quad (3.3)$$

The range of variation can be calculated according to the formula:

$$R = x_{\max} - x_{\min}, \quad (3.4)$$

where x_{\max} – is the maximum score of the criterion;

x_{\min} – is the minimum score of the criterion.

The results of the performed calculations are shown in Table 3.4.

Table 3.4. Calculation results

Evaluation characteristics (criteria)	Mean score	Standard deviation	Range of variation	Variance
Variability (ease of modification)	0,092	0,00017269	2	0,00000003
Ease of idea implementation	0,089	0,00025405	2	0,00000006
Speed of advertisement creation	0,086	0,00014649	1	0,00000002
Originality of implementation	0,088	0,00012533	2	0,00000002
Use of colors	0,090	0,00014532	2	0,00000002
Attention engagement	0,089	6,9141E-05	1	0,00000000
Animation (ease of implementation)	0,095	3,8538E-05	1	0,00000000
File size (small)	0,081	0,00018699	1	0,00000003
Cost (low)	0,072	0,000206	1	0,00000004
Image detail	0,084	0,00013783	1	0,00000002
Possibility of using sound	0,086	0,00016377	1	0,00000003
Professional experience of the designer	0,049	0,00040452	2	0,00000016

To verify the consistency of the experts' evaluations, the coefficient of variation is calculated according to the formula:

$$V = \frac{\sum \sigma}{\sum \bar{x}}, \quad (3.5)$$

$$v = 0,002 / 1,00 = 0,002.$$

According to the obtained value of the coefficient of variation $V \leq 0,2$, it can be concluded that the experts' opinions are consistent for each criterion.

When more than two alternatives are used, the coefficient of concordance is applied to assess the average degree of agreement among all experts:

$$W = \frac{S}{\frac{1}{12} \cdot m^2 (n^3 - n) - m \cdot \sum T_i}, \quad (3.6)$$

where $m = 7$ – number of experts;

$n = 12$ – number of alternatives;

S – is the standard deviation of all rank evaluations for each alternative relative to the mean value, determined by the formula:

$$S = (d_i - \bar{d})^2, \quad (3.7)$$

where d_i – is the sum of ranks of the i -th indicator assigned by all experts:

$$d_i = \sum r_{ij}, \quad (3.8)$$

where r_{ij} – is the sum of ranks of the i -th indicator assigned by the j -th expert;

\bar{d} – the average value of the alternatives:

$$\bar{d} = \frac{n(n+1)}{2}. \quad (3.9)$$

The value of the concordance coefficient lies within the range $[0;1]$:

0 – is no agreement among the experts;

1 – is complete agreement among the experts.

We determine the concordance coefficient:

$$W = \frac{3943}{\frac{1}{12} \cdot 7^2(12^3 - 12) - 7 \cdot 197.5} = 0.7, \\ S = 3943, \quad n = 12, \quad m = 7, \\ T_i = \frac{1}{12} \cdot \sum (t_l^3 - t_l). \quad (3.10)$$

where T_i – is the number of ties (types of repeated elements) in the evaluations of the i -th expert;

t_l – is the number of elements in the l -th tie for the i -th expert (the number of repeated elements).

$$T_1 = [(33 - 3) + (63 - 6)] / 12 = 19.5; \\ T_2 = [(93 - 9)] / 12 = 60; \\ T_3 = [(53 - 5) + (53 - 5)] / 12 = 20; \\ T_4 = [(23 - 2) + (63 - 6) + (33 - 3)] / 12 = 20; \\ T_5 = [(43 - 4) + (53 - 5) + (23 - 2)] / 12 = 15.5; \\ T_6 = [(83 - 8) + (23 - 2)] / 12 = 42.5; \\ T_7 = [(53 - 5) + (53 - 5)] / 12 = 20; \\ \sum T_i = 19.5 + 60 + 20 + 20 + 15.5 + 42.5 + 20 = 197.5.$$

The obtained concordance coefficient $W = 0.7$ indicates a high degree of agreement among the experts in the conducted study.

Let us assess the significance of the concordance coefficient. For this purpose, we calculate Pearson's concordance test statistic using the formula:

$$\chi^2 = \frac{S}{\frac{1}{12} \cdot mn(n+1) + \frac{1}{n-1} \cdot \sum T_i}, \quad (3.11)$$

$$\chi^2 = \frac{3943}{\frac{1}{12} \cdot 7 \cdot 12(12+1) + \frac{1}{12-1} \cdot 197.5} = 53.98.$$

The calculated value of χ^2 can be compared with the tabulated value for the number of degrees of freedom $K = n - 1 = 12 - 1 = 11$ and a given significance level $\alpha = 0.05$.

Since the calculated χ^2 value $53.98 \geq$ the tabulated value (19.67514), then the value $W = 0.7$ – is not due to random variation. Therefore, the obtained results are meaningful and can be used in further research. Table 3.5 presents the ranked criteria according to the total score, from highest to lowest.

Table 3.5. Ranking of indicators by total score

No	Evaluation characteristics	Total score
1	Animation (ease of implementation)	70
2	Variability (ease of modification)	68
3	Use of colors	67
4	Ease of idea implementation	66
5	Attention engagement	66
6	Originality of implementation	65
7	Speed of advertisement creation	64
8	Possibility of using sound	64
9	Image detail	62
10	File size (small)	60
11	Cost (low)	53
12	Professional experience of the designer	36

During the analysis of the obtained expert evaluations, it was found that the experts agreed on the higher effectiveness of 3D graphics compared to 2D graphics or photographs for use in online advertising. It can be concluded that the study was successfully conducted and the results of the expert assessment can be used for further work. A detailed comparison of the evaluations of all samples will be carried out to confirm the research hypothesis.

The first advertising sample with a photo collage (see Fig. 3.1) received the lowest total score – 576. Almost all experts noted low potential in terms of variation of the advertising composition and ease of idea implementation. This is due to the fact that even a skilled photographer cannot capture all the necessary scenes to create any composition according to the client's wishes. Sometimes, implementing a designer's idea requires rather complex props or photographic techniques. This also affects the possibility of animation, which can only be achieved through video or post-processing using specialized software. The process is quite complex, time-consuming, and

contributes to the high cost of this type of advertising. At the same time, due to the possibility of using video during the photoshoot, this type of advertisement scores highly in the “*Possibility of using sound*” criterion.

Following the survey results is an advertising sample created using 2D graphics (see Fig. 3.2), i.e., designed by a designer in graphic editing software. It received a total score of 582.

As with the first sample, it has low potential for variability and animation. This is because a static image is created, and the development of 2D animation requires additional specialized software and professional experience of the designer. The same applies to sound overlay. In terms of cost, this is a cheaper option since only a designer is involved in creating the advertisement. At the same time, this type of advertising allows for easy implementation of any original idea, provided the designer is professional.

Both the first and second samples allow for images with any level of detail. This characteristic does not affect the final cost or the speed of advertisement creation.

According to the expert survey, the highest total score value 731 was achieved by Sample 3 (see Fig. 3.3). This is an advertisement created using 3D graphics.

We can see that the ease of animation implementation and variability received the maximum values. Animation can be carried out in a semi-automatic mode. It is created through the generation of various objects, application of colors, transformation of objects along different trajectories, cloning, mirroring, and other effects, which can be configured within minutes. At the same time, any color, texture, lighting, etc., can be applied to the created 3D model, which ensures high variability.

In oversaturated advertising market segments, 3D modeling allows for easy realization of any design idea, making it an excellent way to stand out and be memorable to clients.

It is also worth noting that full use of colors is possible for any type of advertisement. This criterion is high for all three samples, which can be explained by the advanced level of technical and software tools currently used in advertising production.

The main disadvantage of this type of advertisement is the relatively high cost when complex models are used. However, for online advertising, small file sizes are required, so simple models with lower detail can be used in this segment. This not only reduces the production time but also significantly decreases the cost of the advertisement.

3.5 Study of object modeling

Let's examine how modeling time, model quality, and cost change depending on the chosen modeling method.

The creation of any 3D model is carried out in several stages.

Geometry of the model. At this stage, the form and overall structure of the object are created. Technical characteristics of the object are not yet taken into account.

Texturing. This process gives the model realistic appearance. The selected

materials and applied surface maps play a crucial role. Modern software used in 3D modeling enables the creation of highly natural and convincing textures.

Lighting and camera placement. Proper adjustment of brightness, contrast, and shadow depth makes the model appear realistic. These parameters correspond to the chosen viewing point. The object may be viewed from human eye level or from a bird's-eye perspective.

Rendering. At this stage, the three-dimensional model is generated using computer software. Graphic effects and detailed model settings are added during this process.

Post-processing. The completed model is refined to make it aesthetically pleasing and visually attractive.

The more detailed a model needs to be, the longer its development and rendering will take. For online advertising, a more flexible, "lightweight," and cost-efficient tool is required; complex modeling and hyper-realistic rendering are not suitable in this context. Therefore, it is more practical to use simple abstract graphic elements that can be easily modified and combined, allowing experimentation with color and effects. In other words, simpler models can be employed to reduce both the cost and the development time of 3D graphics.

To confirm Hypothesis 2 – "the speed and cost of a 3D model depend on the chosen modeling method" – this study examines object (hard-surface) modeling, which is frequently used in certain game applications as well as in advertising development.

For the analysis of object modeling, a stone cliff model was created using the procedural modeling method, and this approach was compared with other modeling techniques. Procedural modeling can significantly simplify the modeling process and reduce the time required, which is one of the key factors in 3D modeling workflows for online advertising.

3.5.1 Creation of a 3D model using procedural modeling

Procedural modeling is the creation of 3D models not by manually shaping every detail – regardless of its size – but by modifying various parameters that alter the model itself. This method is not suitable for highly complex models such as humans or animals, but it is indispensable for creating landscape elements such as plants, rocks, cliffs, and other complex surfaces. It saves a significant amount of time and effort, which is one of the most important factors in 3D production.

For the development of this model, the Autodesk 3ds Max software package was used, as it is particularly well-suited for procedural modeling. The application contains a large number of so-called "modifiers" – special operations that include predefined sets of functions and parameters which can be applied to an object [9].

An example of a cliff created using procedural modeling is shown in Figure 3.4. To create additional variations of cliffs, it is sufficient to duplicate the existing model and its textures, apply them to a new model, and modify their parameters.



Figure 3.4. Cliff models created using procedural modeling
Source: Created by authors (2025)

3.5.2 Modeling 3D objects using sculpting

It is also possible to create the same type of model using a different method – the sculpting method (Figure 3.5).



Figure 3.5. Cliff models created using the sculpting method
Source: Created by authors (2025)

3D sculpting is a modeling technology that has recently gained momentum and has rapidly become widely popular around the world. It enables the creation of models with a very high level of detail – something that is still largely unattainable through traditional 3D modeling methods [16]. For this reason, 3D sculpting has become one of the most effective technologies for producing highly realistic scenes and models. Today, digital 3D sculptures are actively used in artistic and fantasy films, in the arts, and in industrial design. They are also employed in the creation of various prototypes, photorealistic illustrations, and physical sculptures produced through 3D printing. The essential tools for digital sculpting are a computer and specialized software, such as Autodesk Mudbox, 3ds Max, ZBrush, Sculptiris, Blender, and others. Another helpful

tool in working with digital sculpting programs is a graphics tablet. A defining feature of 3D sculpting is the way the artist manipulates the 3D model in a manner that imitates working with clay [9, 16].

As noted earlier, the sculpting method involves a significant amount of manual work, which is impractical for creating many typical objects such as rocks, trees, flowers, and similar elements. Although this method makes it possible to reproduce a result, it is not efficient because it requires considerable time and effort. When modeling such objects, it is impossible to quickly modify their form in order to create several similar variations. For example, when modeling multiple rocks using the procedural method, it is sufficient to duplicate the existing model along with its textures, apply them to a new model, and then simply adjust the parameters. In contrast, when using the sculpting method, the model must be created almost from scratch each time. The result may also vary: when sculpting a rock manually, the artist may not always clearly envision the final form, which can lead to an inaccurate or inconsistent model, whereas procedural modeling relies on computational algorithms that randomly distribute shapes and surface features. To compare the modeling results, the time required to create the rock model was measured, an expert evaluation of the result was performed using a 10-point scale, and the model's cost was determined (Table 3.6).

Table 3.6. Results of comparing 3D modeling methods during practical implementation of the rock model

Modeling Method	Time, hours	Result Quality (10-point scale)	Model Cost, \$
Procedural Modeling	0,5 h	10	4
Sculpting	3,1 h	8	24,8

As a result of comparing the two methods discussed in the study, it can be concluded that for this type of model, the procedural modeling method is more advantageous. This research also confirms the hypothesis that the choice of modeling approach affects both the development speed of 3D graphics and its overall co

3.6 Conducting a Sociological Survey

To confirm the third hypothesis – “*The use of 3D graphics increases interest in advertising and attracts consumers* – it is necessary to conduct a sociological survey among internet users who may be interested in online advertising. At the preliminary stage, the target audience was analyzed, and categories of the most active users were selected – those whose characteristics meet the research objectives and whose opinions are both important and reliable.

The survey was conducted on the popular social network Facebook, targeting an older segment of respondents, as well as on Telegram, where the majority of younger internet users are currently active. A total of 88 respondents were surveyed across the selected segments. The survey produced very interesting and even unexpected results, which, at the same time, confirm the proposed hypothesis. Moreover, they allow us to draw several additional conclusions regarding the development of online advertising.

For instance, when asked about the amount of time they spend online, a

significant proportion of respondents (52.1%) indicated more than 8 hours. Additionally, this audience most frequently uses the internet to search for necessary information, communicate, and acquire knowledge (see Fig. 3.6).

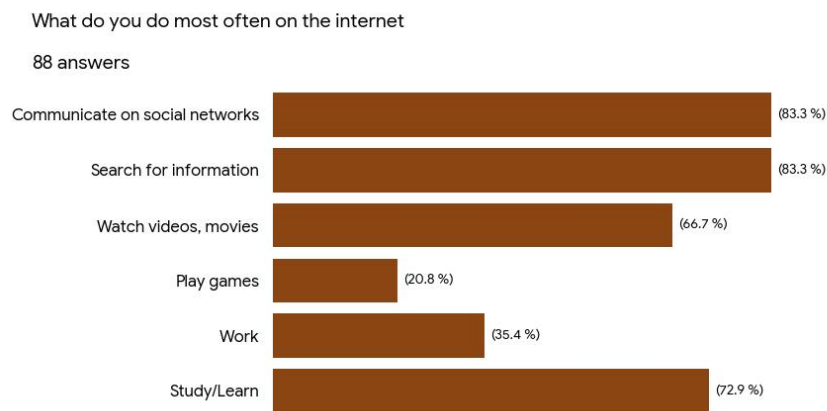


Figure 3.6. What do people do online
Source: Authors' survey results (2025)

Thus, there is a clear trend showing that the majority of users spend nearly all of their personal time in the online environment. This applies to respondents of different age groups. Consequently, they have increased expectations regarding the information they encounter online. This also applies to advertising. Respondents not only pay attention to advertising (Fig. 3.7), but they also placed rather high demands on it. Advertising must feature an engaging design (67%), an original idea (73%), clear product information (56%), and high-quality imagery (48%). The results regarding advertising requirements are presented in Figures 3.8 and 3.9.

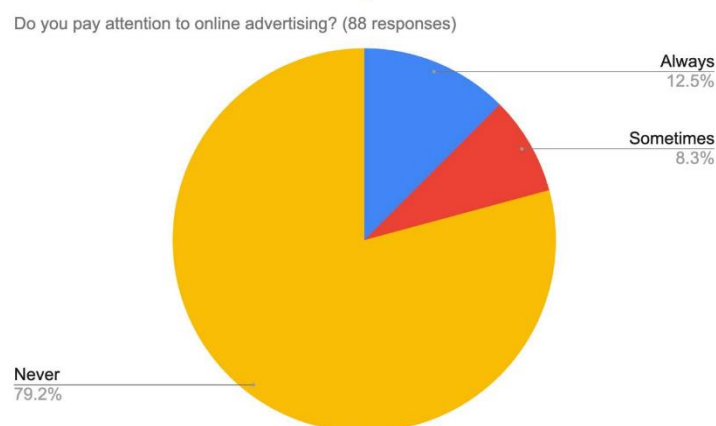


Figure 3.7. Attention to advertising
Source: Authors' survey results (2025)

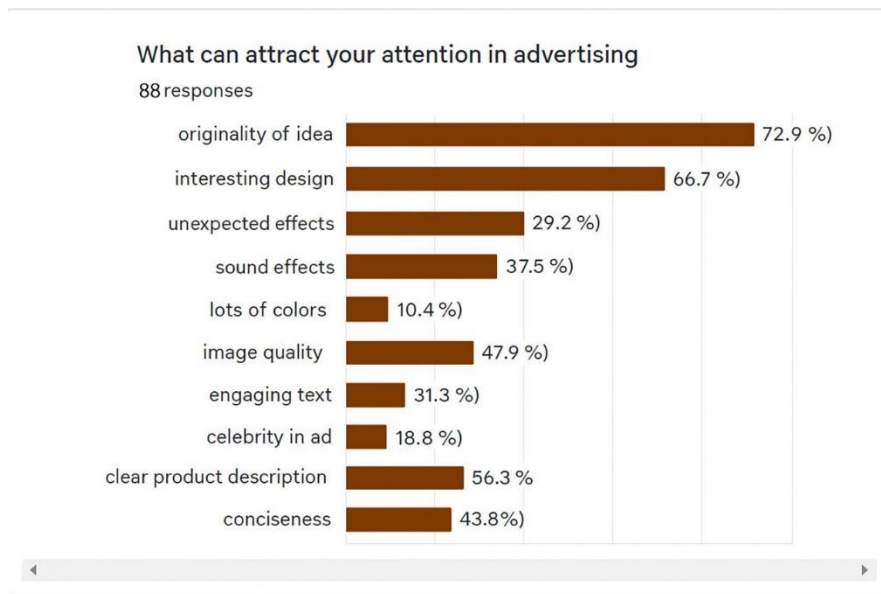


Figure 3.8. What is interesting about advertising
Source: Authors' survey results (2025)

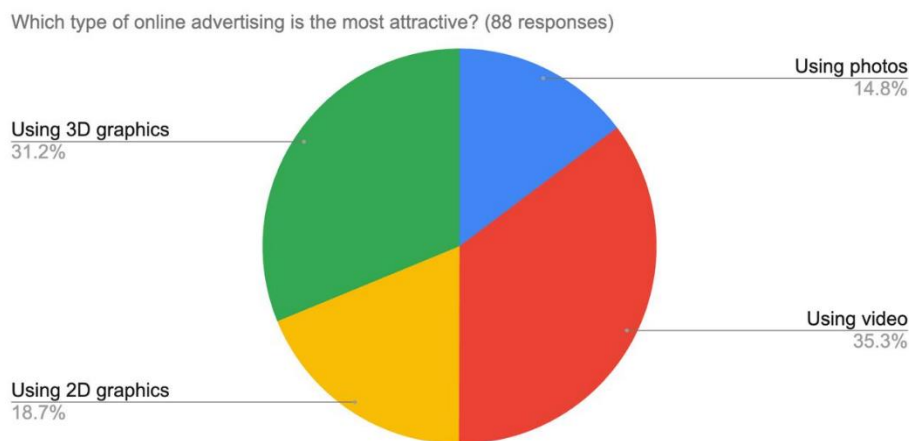


Figure 3.9. Features of using graphics in online advertising
Source: Authors' survey results (2025)

All these findings confirm that, in order to attract the attention of the target audience today, online advertising must be modern, original, dynamic, high-quality, and utilize all available capabilities of information technologies and the design industry, including 3D modeling, video, and animation.

Conclusions

Graphics are one of the key means of communication, whose primary functions include identification, distinguishing a product within the information space, and ensuring ease of perception. Relying solely on two-dimensional tools does not always allow for achieving an optimal balance between visual appeal and ergonomic clarity: projects often either stand out through originality but require significant resources and are less practical, or, conversely, remain accessible and convenient but overly conventional.

For a long time, the prevailing opinion within the professional community was that three-dimensional modeling is excessively resource-intensive, costly, and insufficiently flexible in both development and subsequent maintenance, and that its use is justified only in high-budget advertising productions or in the creation of cinematic visual effects.

Despite the fact that 3D graphics are indeed more expensive compared to 2D solutions, when aesthetic expressiveness, functional convenience, and economic feasibility are successfully combined, three-dimensional approaches can become an effective tool for identity development and promotion.

The choice of a graphical solution depends on the tasks at hand. For large-scale but short-term advertising campaigns, it may be reasonable to invest in complex production that provides a level of visual impact comparable to works presented at design festivals or created for globally recognized brands. At the same time, it is important to consider that the more complex the production process, the less flexible the final product becomes.

If a long-term, adaptable, and more economically efficient tool is required, overly detailed modeling or hyper-realistic rendering becomes impractical. In such cases, it is more rational to use simple abstract 3D elements that can be easily modified, combined, and enriched with new semantic accents depending on the medium.

For advertising purposes, it is essential that the design of an advertisement attracts consumers. Therefore, it is crucial to use development tools that make advertising engaging, appealing, and original. All of this can be achieved through the use of 3D graphics.

To this end, three hypotheses were formulated and confirmed:

- 1) the use of 3D graphics in online advertising is more effective than photography or 2D graphics;
- 2) the speed and cost of a 3D model depend on the chosen modeling method;
- 3) the use of 3D graphics increases interest in advertising and attracts consumers.

3D modeling tools can be recommended for teaser and mobile advertising to create unusual effects and add originality to the advertisement. Such advertising is highly effective for products driven by emotional demand and for low-cost goods. Advertisers have the ability to personalize ads, thereby making campaigns more effective. In this context, technologies for developing optimized 3D models – which can be easily adapted for mobile devices – prove particularly useful.

3D models also simplify the workflow, as issues can be corrected at the product development stage. Three-dimensional visualization is steadily spreading across various fields, improving processes and enhancing production efficiency.

REFERENCES

1. Zhong, Lei and Guo, Chuan and Xie, Yiming and Wang, Jiawei & Li, Changjian. (2025). Sketch2Anim: Towards Transferring Sketch Storyboards into 3D

Animation. *Association for Computing Machinery*, 44(4), 1-15. DOI: 10.1145/3731167.

2. Lukcyhasnita, A., Khairina, I., & Siregar, R.K. (2025). Development of 3D Animation in AR-based Children`s Storybooks. *International Journal of Research in Vocational Studies (IJRVOCAS)*, 4(4), 07-14. DOI: 10.53893/ijrvocas.v4i4.315.

3. blogger.com. (2019). *Використання 3D-графіки в різних галузях людської діяльності*. <https://shaiu21.blogspot.com/>.

4. Мартиненко, Є. (2022). *Зародження геймдеву в Україні і перспективи його розвитку*. <https://gamedev.dou.ua/blogs/the-origin-of-gamedev-in-ukraine/>.

5. Chebotarova, I., & Astakhova, A. (2025). Using FDM 3D printing technology to create a lamp with custom design. *Jóvenes en la ciencia*, (35). <https://www.jovenesenlaciencia.ugto.mx/index.php/jovenesenlaciencia/article/view/4727>.

6. Адашевська, І.Ю., Краєвська, О.О., & Шеліхова, І.Б. (2023). Особливості технології анімації у сучасній рекламі. *Поліграфічні, мультимедійні та web-технології. Сучасний стан: монографія*. (с. 129-141). Харків: ТОВ «Друкарня Мадрид». DOI: 10.30837/978-617-8254-16-2.

7. Вовк, О.В., Григор'єв, О.В., & Біла, Д.С. (2025). Особливості створення 3D-анімації для трейлерів відеоігор у середовищі Blender. *Поліграфічні, мультимедійні та web-технології*. Т. 2. (с. 12-13).

8. Чеботарьова, І.Б., & Мартиненко, Ю.С. (2025). Актуальність створення сінематика для комп'ютерних ігор. *Поліграфічні, мультимедійні та web-технології*. Т. 2. (с. 69-72).

9. Чеботарьова, І.Б., & Трохін, К.О. (2024). Проектування тривимірних моделей для комп'ютерної гри AAA-проекту. *Поліграфічні, мультимедійні та web-технології*. Т. 2. (с. 226-230).

10. Вовк, О.В., & Чуб, Л.О. (2025). Вплив анімаційних відео на цільову аудиторію. *Поліграфічні, мультимедійні та web-технології*. Т. 1. (с. 245-247).

11. Wickramasinghe, M.H.M., & Wickramasinghe, M.M.T. (2021). Impact of using 2D Animation As a Pedagogical Tool. *Psychology and Education Journal*, 58(1), 3435-3439. DOI: 10.17762/rae.v58i1.1283.

12. Дейнеко, Ж.В., Зелений, О.П., & Криворучко, М.О. (2025). Технічні та творчі аспекти комп'ютерної анімації. *Поліграфічні, мультимедійні та web-технології. Сучасні тренди: колективна монографія*. Т. 2. (с. 71-94). Харків: ТОВ «Друкарня Мадрид». DOI: 10.30837/PMW.2025.T2.071.

13. Chen, Cheng, Xu, Bin, Yang, Jong-Hoon, & Liu, Mi. (2022). Sentiment Analysis of Animated Film Reviews Using Intelligent Machine Learning. *Computational Intelligence and Neuroscience*, 2022(2), 1-8. DOI: 10.1155/2022/8517205.

14. Telia. (n. d.). <https://www.telia.ee/en>.

15. Gradus. (n. d.). *Звіти загального доступу*. <https://gradus.app/uk/open-reports/>.

16. Шерер, М. (2015). *ZBrush 4 Скульптинг для ігор*. Packt Publishing.