передбачає певні законодавчі механізми (переведення студентів на дистанційне навчання як окрему форму здобуття освіти, наявність підстав для переведення, створення класів, груп з дистанційною формою навчання тощо).

Для ефективної роботи при організації дистанційного навчання виникла потреба у співпраці з різними викладачами, наприклад, створити разом сайт для навчання, якщо у вас збігаються програми, підручники, записати відео, розробити інтерактивну вправу і т.д. Це дає можливість оптимально використати свій час для створення повноцінного заняття. Співпраця між викладачами дає можливість реалізації творчого потенціалу та креативності. якщо буде налагоджена співпраця, взаємодопомога, то ми оптимально підтримаємо свій ресурс (емоційний стан). Це дає можливість уникнення емоційного вигорання викладача.

У зв'язку із ситуацією, яка склалася, багато навчальних платформ відкрило доступ для безкоштовного використання своїх ресурсів, що дало можливість полегшити роботу при пошуку необхідної інформації для створення та проведення онлайн занять. Хоча онлайн-інструменти мають багато вад й не можуть замінити особистісного контакту в освіті, вони відкривають ширший спектр взаємодії між викладачами та студентами.

Тож після завершення карантину багато викладачів вже не повернеться лише до традиційних методів проведення занять, а будуть використовувати також ті засоби дистанційного навчання, які зарекомендували себе найкраще під час карантину.

ДЖЕРЕЛА ТА ЛІТЕРАТУРА

1. Величко В.Ю., Камишин В.В., Стрижак О.Є. Інформаційні технології формування сучасних систем знань як основа інноваційного розвитку освіти // Матеріали міждисциплінарної науково-практичної конференції «Інноваційні технології навчання обдарованої молоді» 08–09 грудня 2010 року в м. Київ. ІОД. 2010. 168 с.

2. Кулага І.В., Ільницький Д.О., Стрельник С.О., Матвійчук А.В., Василькова Н.В., Турчанінова В.М., Єршова В.С., Тищенко М.П., Краснопольська Н.Л. Світовий досвід організації та розвитку університетської системи дистанційного навчання / Інститут вищої освіти КНЕУ імені Вадима Гетьмана, Київ, 2013.

3. URL: https://nus.org.ua/articles/praktyky-ta-pidhody-do-dystantsijnogo-navchannya-rekomendatsiyi-dlya-vchyteliv

4. URL: https://osvitoria.media/experience/italijski-uroky-karantynu-dystantsijne-navchan nya-dlya-vsih

5. URL: https://vezha.ua/tse-velykyj-vyklyk-dlya-batkiv-yak-karantyn-zminyv-navchannya-shkolyariv

6. URL: https://vseosvita.ua/news

УДК 004.9

Vitalii Hlembotckiy, Kseniia Kugai
(Kyiv)

COMPUTER GRAPHICS

The article deals with the history of computer graphics creation, its types, advantages and disadvantages in usage. The areas of computer graphics application and process of its development are analyzed.

Key words: *computer, raster graphics, vector graphics, display, image.*

Стаття присвячена історії створення комп'ютерної графіки, її типам, а також перевагам і недолікам у використанні. Проаналізовано сфери використання комп'ютерної графіки та процес її створення.

Ключові слова: *комп'ютер, растрова графіка, векторна графіка, дисплей, зображення.*

Raster and vector graphics

Computer graphics (also machine graphics) is an area of activity in which computers are used as a tool for the synthesis (creation) of images and for visual information processing obtained from the real world. Computer graphics is also called the result of such activities. The first computers did not have separate tools for working with graphics, but were already used to obtain and process images. By programming the memory of the first electronic machines, built on the basis of a matrix of lamps, it was possible to obtain samples. In 1961, a programmer S. Russell led a project to create the first computer game with graphics. The game was called "Space Wars". It was created on the machine PDP-1.

In 1963, American scientist Ivan Sutherland created the Sketchpad software and hardware system, which allowed drawing dots, lines and circles on a tube with a digital pen, supported basic actions with primitives: move, copy, etc. In fact, this was the first vector editor implemented on a computer. Also, the program can be called the first graphical interface.

In the mid-1960's there were developments in industrial applications of computer graphics. Thus, under the leadership of T. Moffett and N. Taylor, the company Itek has developed a digital electronic drawing machine. In 1964, General Motors introduced the DAC-1 computer-aided design system, developed in collaboration with IBM [2, p. 150].

The field of computer graphics application is not limited to artistic effects. Computer-generated schemes, graphs, diagrams, designed to visualize a variety of information are used in all branches of science, technology, medicine, in commercial and administrative activities. Designers, developing new models of cars and airplanes, use three-dimensional graphic objects to present the final look of the product. Architects create a three-dimensional image of a monitor screen, and this allows them to see how it will fit into the landscape.

Computer graphics is the creation and processing of images (drawings, etc.) using a computer. There are two ways to create subject images – raster and vector and, accordingly, two types of computer graphics – raster and vector.

Raster graphics

In raster graphics, the image consists of coloured dots (pixels), which together form the image. The raster image resembles a sheet of paper in a cell, on which each cell is painted in some colour. In life, there are often images collected from individual elements: stained glass consists of several pieces of glass, embroidery – from individual stitches, photography – from silver granules [1, p. 400].

Each raster map has a number of points horizontally and vertically. These two numbers characterize an image size. The size of an image in pixels is written as the number of pixels horizontally X, the number of pixels (number of rows of pixels) vertically. For example, for Windows, the full screen size in pixels is 640x480, 1024x768, 1240x1024. Obviously, the greater the number of pixels contained horizontally and vertically for the same geometric image size, the higher the image reproduction quality.

In addition to size, the image is also characterized by the colour of each pixel. Thus, to create or save a bitmap image, you must specify its size and the colour of each pixel (Fig. 1).

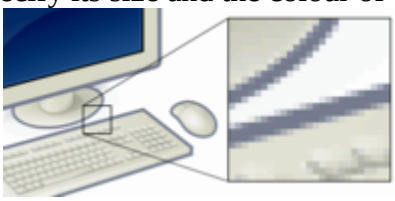

Fig. 1. A raster image example

Raster graphics allow you to get high image quality because it effectively represents real images. The real world is made up of billions and billions of tiny objects. The closer the object under consideration, the better it is seen as it is composed of smaller particles. The human eye is precisely adapted to the perception of objects as large sets of discrete elements that form objects. The disadvantage of bitmap graphics is the large size of the files that store the bitmap image. Thus, to save a copy of the graphical display screen of Windows with a size of 1024x768, provided that

the pixel colour is encoded by three bytes, you need 1024x768x3=2.3 MB of memory. A large amount of graphic bitmap files requires powerful computers to process them. In raster graphics, there are also difficulties with scaling and editing image elements [4, p. 510].

Vector graphics

In vector graphics, the image is constructed using a mathematical description of objects, such as a line, circle, rectangle. Such simple objects are called primitives. With their help more complex objects are created. To create primitive objects in vector graphics use simple commands such as: draw a line from point A to point B or draw a circle of radius A with center at point B. Such commands are perceived by output devices for drawing objects. The advantage of vector graphics is that the files that store the vector image are 10-1000 times smaller in size than similar graphic bitmap files.

Vector graphics take full advantage of the resolution of the specific device on which the image is displayed. Vector commands simply tell the output device that you need to draw an object of a given size, using as many dots as possible. In other words, the more dots a device can use to create an object, the better it will look.

Vector graphics also make it easy to edit a single object in a drawing without affecting other parts.

The disadvantage of vector graphics is the "unnaturalness" of an image. Nature avoids straight lines, and not every picture can be made of circles and straight lines without losing quality. Because of this, vector graphics are mainly used to build drawings, stylized drawings and icons (Fig.2).

Fig. 2. A vector image example

Forming the color of the image

It is known that by mixing three different colours in different proportions: red, green and blue, you can get any colour. Thus, a mixture of these colours in equal proportions forms a white colour, a mixture of red and green – yellow, etc. (Fig. 3).

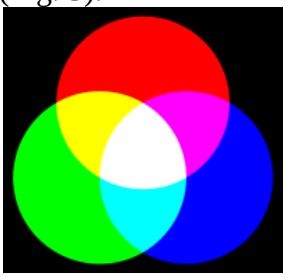

Fig. 3. RGB colour transmission system

This is due to the ability of the human eye to mix colours and see only one colour – an average. This system of colour formation is called the RGV system. Thus, to specify any colour, you must specify the proportions (intensity) of the three colours: red, green and blue. The total number of colours depends on the number of gradations of intensities of each of the main colours. Thus, if each of the primary colours has four gradations of intensity, then the total number of possible colours will be 4x4x4=64. In modern computers, one byte is allocated to encode the intensity of each of the primary colours, which gives 256 gradations of intensity, and the number of possible colours reaches 256x256x256=16.7 million [3, p. 762].

Any image on a monitor, due to its plane, becomes raster, because the monitor is a matrix, which consists of columns and rows. Three-dimensional graphics exist only in our imagination, because what we see on the monitor is a projection of a three-dimensional figure, and we are

already creating space ourselves. Thus, the visualization of graphics is only raster and vector, and the method of visualization is only a raster (a set of pixels). And the number of these points depends on the method of setting an image.

REFERENCES

1. Bedet A., Burdkhardt D. Hlosarii kompiuternykh terminiv [Computer terms glossary] // 10-e vydavnytstvo [10th edition]. M.: Vyd-vo: Viliams, 2002. 432 s.

2. Izergin N.D., Kudryashov A.Yu. Rozrobka elektronnykh uchbovykh vydan. Stvorennia i vykorystannia informatsiinykh zasobiv navchannia [Electronic educational issues development. Teaching media creation and usage] // navchan. posibnyk [study guide]. M.: Kolomna, 2006. 160 s.

3. Stepanenko O. S. Robota na personalnomu kompiuteri (PK) v ofisi [Computing (PC)] // uchbovyi kurs [study course]. M.: Vydavnytstvo Viliams, 3-e vydavnytstvo, 2006. 768 s.

4. Uhrynovych N.D. Informatyka i informatsiini tekhnolohii [Information science and information technologies] // Pidruchnyk [textbook]. M: Vydavnytstvo BINOM. Lab. znan, 2005. 512 s.

Vanessa Krasnovyd, Kseniia Kugai
(Kyiv)

TECHNOLOGIES DEVELOPMENT. VIRTUAL REALITY

The article deals with virtual reality field, methods of its work and usage. The areas of virtual reality application and its development are studied.

Key words: *virtual reality, technology, video.*

Стаття присвячена сфері віртуальної реальності, методам її роботи та використання. Розглядається, в яких сферах використовується віртуальна реальність і як вона створюється.

Ключові слова: *віртуальна реальність, технології, відео.*

We know the world through our senses and perception systems. In school we all learned that we have five senses: taste, touch, smell, sight and hearing. The truth is that humans have many more senses than these, such as a sense of balance for example. These other sensory inputs, plus some special processing of sensory information by our brains ensures that we have a rich flow of information from the environment to our minds.

Everything that we know about our reality comes by way of our senses. In other words, our entire experience of reality is simply a combination of sensory information and our brains sense-making mechanisms for that information. It stands to reason then, that if you can present your senses with made-up information, your perception of reality would also change in response. You would be presented with a version of reality that isn't really there, but from your perspective it would be perceived as real. Something we would refer to as a virtual reality [3].

So, in summary, virtual reality entails presenting our senses with a computer-generated virtual environment that we can explore in some fashion.

Virtual reality is a fascinating way to travel using nothing more than the power of technology. With a headset and motion tracking, VR lets you look around a virtual space as if you're actually there. It's also been a promising technology for decades that's never truly caught on. That's constantly changing with the current wave of VR products, especially as the biggest names in the industry are starting to really hone and tweak their headsets.

How VR technology works

The most common means of immersion in virtual reality are specialized helmets / glasses. 3D video is displayed on the display in front of the user's eyes. A gyroscope and an accelerometer