




Application of Computer-Aided Technology in Diversified Visual Communication Design Under Virtual Reality Environment

Ruoyao Wang 

School of Art and Design, Henan Finance University, Zhengzhou 450046, China,
wangruoyao85218@163.com

Corresponding author: Ruoyao Wang, wangruoyao85218@163.com

Abstract. Visual communication design in the digital era needs to meet the diversified needs of people, and the presentation style of works is diverse and colorful. This paper discusses the connotation, elements, diversified design trend, design concept and thinking innovation of computer-aided design, and points out the characteristics and expression forms of computer-aided visual communication design created with the help of new media. In addition to using new technologies, diversified video communication design also needs new ways of thinking. The educational direction of diversified visual communication design needs the innovation of ideas and thinking, and the innovation of expression assisted by technology. The renewal of visual communication design thinking mode will be of great significance to the cultivation of creative design talents. This paper analyzes the development and characteristics of computer-aided diversified visual communication, deeply studies the technical basis of supporting computer-aided diversified visual communication, and introduces virtual reality technology into the process of computer-aided diversified visual communication, in order to improve the quality of university diversified visual communication. And provide the corresponding reference for the university computer aided diversified visual communication.

Keywords: Virtual reality technology; Multimedia; Computer aided virtual reality computer aided technology diversified visual design; Visual communication design; Diversified

DOI: <https://doi.org/> <https://doi.org/10.14733/cadaps.2022.S5.21-31>

1 INTRODUCTION

Virtual reality, computer aided technology and multimedia technology make the traditional visual communication design break through the static plane effect, and personalized and colorful

information is quickly transmitted to the audience. Thus, diversified visual concepts and new visual communication design connotation are generated. Computer as a tool to record, clip and store in digital form to assist visual communication design process, design results are displayed on various visual terminals; Digital technology promotes the innovation and development of visual communication design, and has become a design field integrating multiple elements, multiple disciplines, and collaborative innovation with new media. In the digital age, the influence of media on audiences is more and more profound. The content expressed by traditional graphic design is far from covering some new information. The transmission mode of static information can no longer meet the needs of modern life, and visual communication design has been impacted by diversification. The popularity of PC and tablet computer, the continuous improvement of various auxiliary design software, and the increasing maturity of information collection and output equipment have promoted the emergence of various new design ideas, and put forward diversified new design directions, so that the visual communication design has gradually appeared a rich and diversified development trend.

Based on the field of visual communication design, focusing on the concept of design innovation, analyzing the design thinking mode composed of "comprehensive observation -- rational analysis -- intuitive induction -- corresponding association -- imagination and creation" and the continuous "systematic evaluation" in each stage. Found that "the problem of cognitive (comprehensive observation by rational analysis to intuitive inductive)" and "image translation (Imagination to create one by one)" is the two key links in the process of design and the main content, complementary design method in the application of visual communication design is mainly manifested in this: "complementary perspectives" build visual communication design cognitive mode, Through forward and reverse perspectives, seeking common ground and seeking difference, self and non-self perspectives, order and disorder perspectives, traditional and future perspectives, innovative thinking is guided to be more comprehensive and in-depth. In order to "complementary method" to construct visual image translation and generation patterns, look from the straightforward and metaphor design theme of interpretation, look from the representational and abstract the visual image of the building, look from the precise and fuzzy expression of visual image, from the static and dynamic visual form rendering, from one-way and interaction to convey visual information, in the way of many contradictions find design solution.

2 RELATED STUDIES

In the specific design process, Peng and Liu [1] proposed technical personnel coordinate and control through virtual and real technologies, and the object elements existing in reality can be truly presented through THREE-DIMENSIONAL technology, so as to carry out friendly human-computer interaction. The development of modern media technology field obviously leaves the virtual technology, computer image graphic design technology and visual communication design technology, and in order to achieve a perfect design effect, must promote the integration of the three small with design technology. In the specific design process, Chen and Zheng [2] designed computer graphic image design and visual communication design make full use of the artistic conception beauty and real simulation environment of virtual reality technology, so that the objects and elements designed are lifelike, vivid and even vivid. Visual communication design uses visual media as the carrier to express and convey information to the audience through visual symbols. The traditional visual communication design combines the basic elements on the plane, such as graphics, colors, words and signs, into a set that can achieve the purpose of conveying information. It has the function of accurate visual communication, meets the needs of the audience and meets the visual psychology. With the progress of science and technology and the development and application of new products, the fields involved in visual communication design are gradually expanding, and it is integrated with other fields [3], constantly developing into a brand-new design field that is interrelated with, collaborates with and collaborates with other visual media. In addition to two-dimensional graphic designs such as photography, fonts and logos,

the generalized visual communication design also includes three-dimensional designs such as packaging and display in three-dimensional space. In addition, Zhang and Zhao [4] introduced time designs such as animation, stage design and TV studio in four-dimensional space. Designers are responsible for the design and sending of information, and the receivers are the conveying objects and audiences of information. Zhou [5] designed the information transmission of visual communication realizes the information expression of the designers to the receivers through watching. Therefore, all forms of design must be related to the visual.

The visual language of understanding is narrated and expressed, which can trigger the audience's perception and association of the information and content expressed by the visual image in the shortest time. Hohmann and Paluch [6] introduced style of visual symbols needs to be based on the needs of design. Accurate expression of ideas is the cornerstone of visual language. A good visual language can usually break through traditional visual perception and express unique and creative connotations. Communication means that the information sender sends information to the information receiver through symbols, which includes four aspects: the sender, the content conveyed, the receiver, the effect and influence conveyed [7]. The core of visual communication design is the accurate transmission of information. Therefore, White believes that the job of a designer is not to fill all the space, but to express the information clearly, easily understood and attractive. Any function in visual communication can be realized through new media art, through the mutual combination of sound, image and video [8], and through various terminals, perfect information transmission and expression forms can be displayed.

Cable network, wireless network technology development to create conditions for people to instant communication information, network services grow, the digital age, designers through the computer aided writing expression ability is greatly increased, people's demand increase gradually, the diversified development trend, audio, all kinds of words and images, games, entertainment and business information, etc. [9]. The design of personalized needs can better meet people's various needs, which will further promote the diversification of video communication design, and visual communication design will more clearly reflect the diversification of needs and the diversification of design to meet the needs [10].

2.1 Analysis of Computer Graphics Image Design and Visual Communication Design Based on Virtual Reality

Based on the design concept of all-view function, the one-view beam should be regarded as a specific panoramic function at any point in space in the design interface as well as any point covering the Wave range and any time. Therefore, this technology processing method is based on virtual reality images and horizontal 360 spatial graphics organization environment, it is a new image information mode. The process of establishing the data model is relatively simple, but the graphics and image processing technology in China's design field is not perfect at present. In the process of data graphics modeling, users need to carry out intensive sampling of the original image according to the requirements of graphics and image processing, and then input the key contour points into the relevant design frame. Thus, the computer image post synthesis processing and visual communication design processing. The computer-aided multi-element design framework of its virtual reality is shown in Figure 1.

In addition, in the process of the above technology processing, based on the virtual reality design technology to design and process the image graphics to carry out layered design and puzzle design. The overlapped areas in the original graphics are seamlessly joined together according to a specific algorithm to meet the design requirements of the new view. The main processing advantage of this technique is that virtual reality technology can be used to splice cylindrical panorama through computer technology and seamless stitching technology. Its main design principle is to make full use of the correlation of image design, to find the overlapping property between small and objects, so as to synthesize the dissimilar points. However, this processing technology also has some design shortcomings, such as the overlapping area features between small objects and objects are

small and significant, and it needs to carry out human pre-automatic alignment in the stitching process, resulting in large errors.

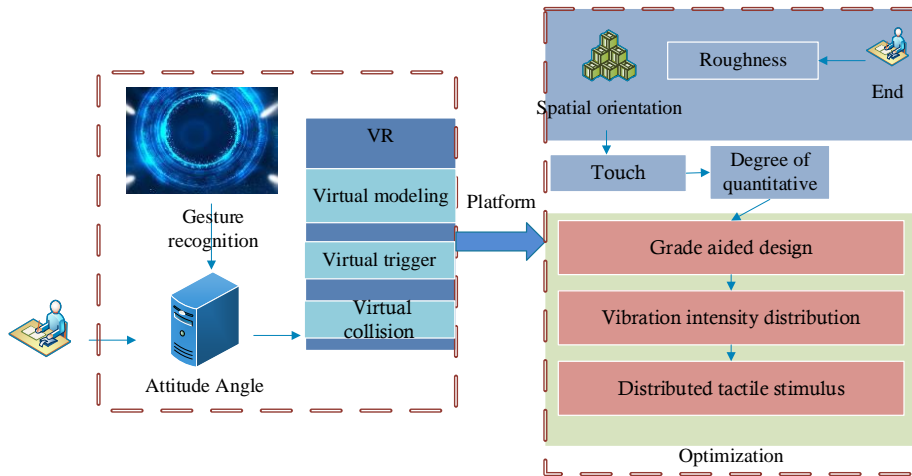


Figure 1: Frame diagram of computer-aided multi-element design of virtual reality.

2.2 Complementary Design Method of Multiple Visual Communication

Generally speaking, design thinking mode includes three aspects: design cognitive structure mode, design thinking method mode and design value structure mode. Design cognitive structure mode mainly solves the cognition of design problems; Design thinking mode belongs to the tool system of designers and is the operation mode of thinking activities adopted by designers in the process of generating design ideas. Design value structure mode belongs to the evaluation system of design value, which reflects the purpose of design and the essence of design, as shown in Figure 2.

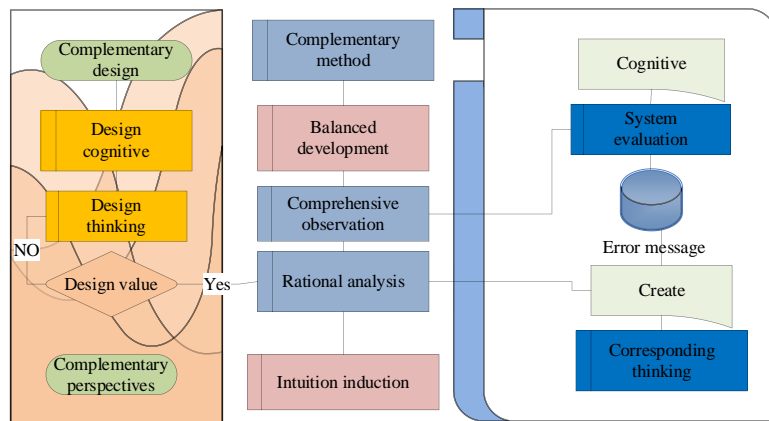


Figure 2: The structural system of the complementary design method.

The "complementary method" is used to complete the translation and generation mode of visual image, that is, through the straightforward and metaphorical interpretation of the design theme, the construction of visual image from the concrete and abstract, the expression of visual image from the precise and fuzzy, the presentation of visual form from the static and dynamic, and the

communication of visual information from the one-way and interactive. The detailed running process is shown in Figure 3.

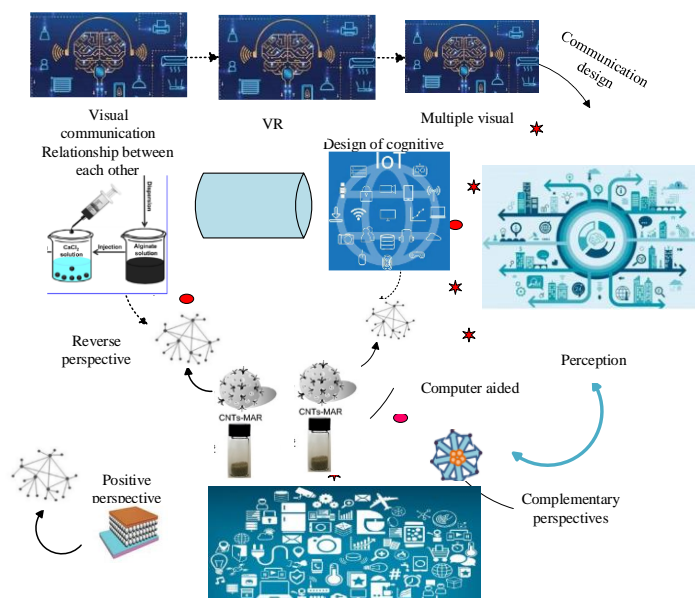


Figure 3: The operation of mutually related design thinking patterns in visual communication design.

First of all, from the "problem" introduction, in the creative stage of comprehensive observation, especially in the "complementary" perspective (forward and reverse perspective, seeking common perspective and seeking different perspective, ordered perspective and disordered perspective, traditional perspective and future perspective) observation and analysis. This is in the complementary design cognitive structure mode, through comprehensive "observation", the accumulation of a large number of information materials, looking for and finding problems; "Rational analysis", to observe the results of the essence of the understanding, depth of observation, to raise design problems; "Intuitive induction", clear ideas to solve the problem, put forward design concepts.

Then, the translation of design concept and the generation of visual image are realized through "corresponding association - imagination and creation". In this process, the "complementary method" can make the visual information expression show the characteristics of diversification, synthesis and system, and seek the crossover, synergy and integration in the complementary. The specific methods are as follows: the continuous interpretation of the design theme from the plain and metaphor; construction of visual image from concreteness and abstraction; the expression of visual image from precision and blur; The presentation of visual form from static and dynamic; The communication of visual information from the perspective of single and interaction. See Figure 4.

In-depth analysis of this kind of thinking mode of structure, the author found in the way of thinking of complementary physiology, sociology, philosophy, etc., on the basis of visual communication design thinking method also have complementary laws, namely in the process of design thinking, from the perspective of the direction of thinking and path: divergent thinking level (thinking) and convergent thinking (vertical thinking) complementary to use; From the way of information collection and soil addition of cognitive materials, the dialectical system of image

thinking (perceptual thinking) and abstract thinking (rational thinking) can work together to achieve the completion of the whole creation.

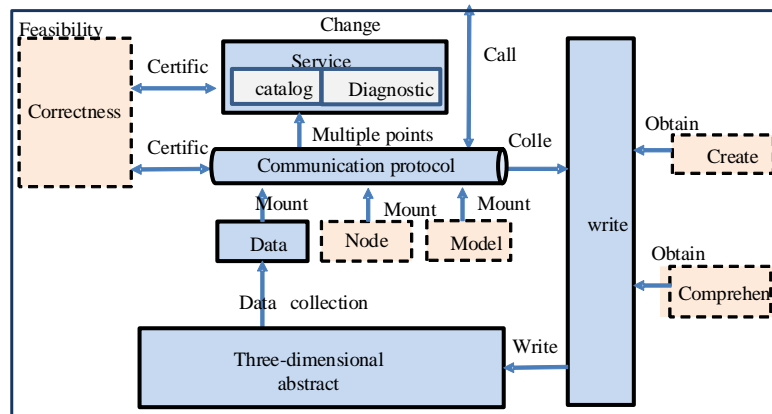


Figure 4: Analysis of design thinking method.

3 ANALYSIS OF RESULTS

3.1 Results of Pre-test Data

The feedback analysis mode of virtual reality technology is classified and expounded, and the unique advantages of virtual reality technology in the diversified visual design and creation of computer aided technology in virtual reality are also analyzed in detail. However, the application of its basic evaluation be ignored. 12 respondents randomly divided into two groups, one group for the virtual reality model experience, a set of pictures show group, within the prescribed time, complete the three schemes of experience and observation, after test will eye movement data import of SPSS software, an in-depth analysis, finally let the respondents according to experience the situation very well fill in the questionnaire, and combining the eye movement analysis of the final conclusion. See Table 1.

Group	Viewing Time (S)	Total fixation points	Computer aided Technology for Virtual Reality Diversified visual design Node area Fixation percentage (%)	Mean fixation time (ms)	Computer aided Technology in Virtual Reality Diversified visual design Percentage of fixation time in node area (%)
Virtual reality experience group	495.2(17 3.68)	1162.50 (478.00)	31.43(6.53)	345.73(2 9.58)	34.45(8.58)
Picture display group	669.6(16 8.50)	1660.44 (433.82)	41.65(5.64)	348.53(5 4.54)	43.35(4.23)

Table 1: Statistics of various indicators during scheme experience (standard deviation in brackets).

As can be seen from Table 1, there was no significant difference in total fixation points between the two groups. However, the percentage of fixation points in the computer-aided diversified visual design node area of VIRTUAL reality was significantly different. The percentage of fixation points in the virtual reality experience group in the computer-aided diversified visual design area of virtual reality was less than that of the picture display group. There was no significant difference in the average fixation time between the two groups. However, the percentage difference between the fixation time and the total fixation time in the node area of the computer-aided diversified visual design of virtual reality reached the marginal significant level.

Figure 5 shows that visitors can easily understand multiple visual design schemes using virtual reality models with computer aided technology. The blue bar shows the number of people who understand, while the red bar shows the number of people who don't understand virtual reality's computer-aided diversified visual design. It is very advantageous to use the virtual reality model to communicate the diversified visual design concept of the computer-aided technology of virtual reality, because it can give an intuitive "explanation" to the diversified visual design design of the computer-aided technology of virtual reality. The above results show that the virtual reality model is more suitable and effective for the designer to convey the diversified visual design concept of the computer aided technology of virtual reality to the interviewees. The idea of diversified visual design of each VIRTUAL reality computer-aided technology can be understood by the audience or investors. After the interviewees operate the VIRTUAL reality model and investigate the diversified visual design choice of each VIRTUAL reality computer-aided technology, they provide real feedback.

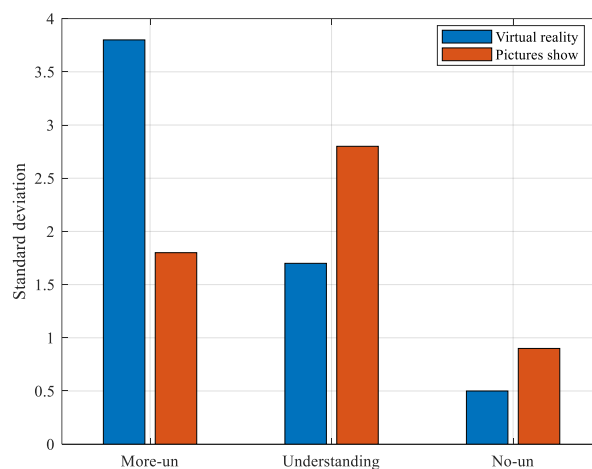


Figure 5: Statistical chart of respondents' understanding of design scheme.

The function and function of virtual reality computer-aided technology diversified visual design, the environment and the number of users, etc. Faced with a number of optional things, it is not quick to make the best choice. The logic of optimization is benefit maximization choice from many objects. The optimization logic under the view of virtual reality is based on the thinking of experience design. Through the subjective experience with a clear goal and objective quantitative evaluation, a relatively suitable scheme is selected under the comprehensive effect of technical analysis and design view. The optimal logic of morphogenesis is a kind of technical application logic, permeated with the process idea of bottom-up generation. In the process of dynamically changing morphogenesis, the adjustable parameters will correlate to generate different morphogenesis with similar morphological functions and traits. However, due to the virtual reality

technology of computer aided diversified visual design is a complex system, because of the different point of view, referred to in its concept and range is different also, therefore, the current parametric technology applied in the virtual reality of computer aided technology more diversified visual design in virtual reality and computer aided technology diversification monomer and the visual design sketch, The parametric introduction of multi-visual design of computer aided technology for the whole virtual reality needs to be further deepened and practiced. Nevertheless, its technical concept and logic can be used for reference in the creation of diversified visual design of computer aided technology in virtual reality. The preferred logic core lies in the creation idea was shown in Figure 6.

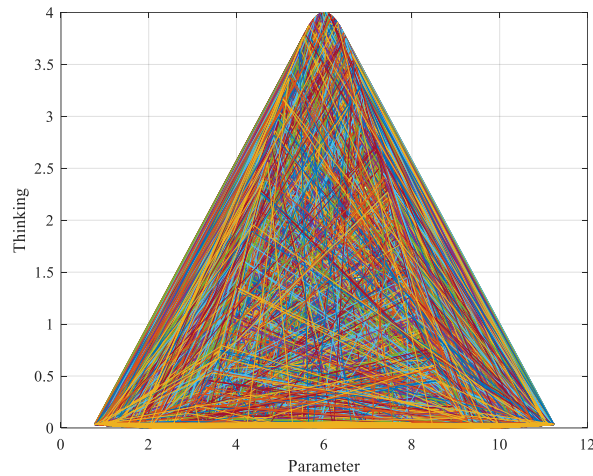
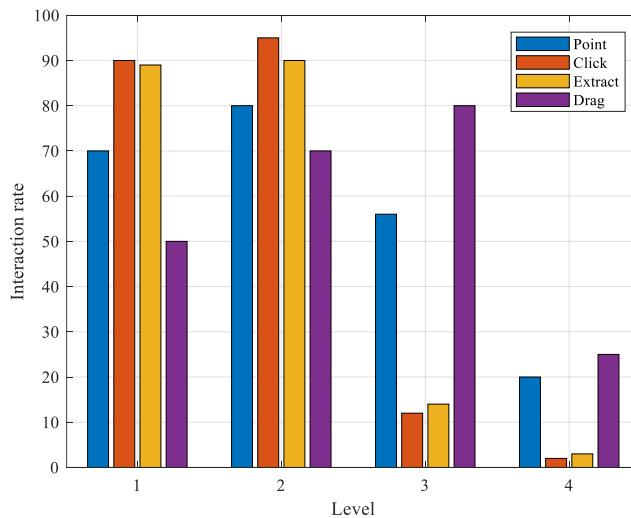
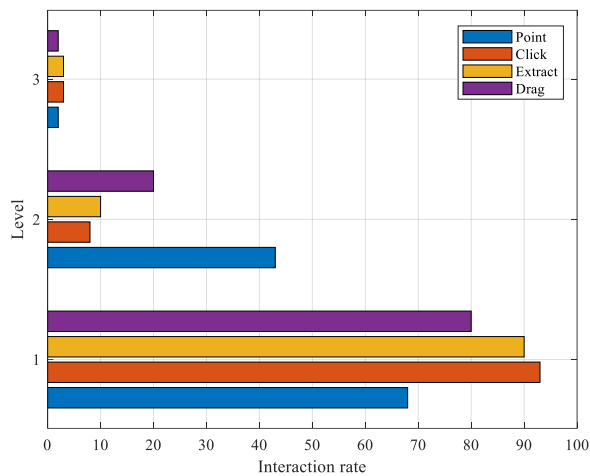


Figure 6: Visualization of generated data.

The experimenters tested users with different perceptions of virtual reality interactions, and Figure 7 shows the results.



(a) The usability test results of interactive gestures.



(b) The comfort test results of interactive gestures.

Figure 7: Interactive experience user test.

The usability test results of interactive gestures in 3DUI are shown in Figure 7(a), where the abscissa is the evaluation scale and the ordinate is the user identification ratio. The comfort test results of interactive gestures in 3DUI are shown in Figure 7(b), where the abscissa is the evaluation scale, and the ordinate represents the percentage of users' votes to evaluate the corresponding comfort level. Can be seen from the figure 7, click and hold gesture is designed in this paper the scenario more in line with the user's intuition, do not need additional guidance and tips you can easily grasp, due to the daily habits in line with the real world, there is a better comfort, procrastination and point to the prompt teaching cases, recognition are rising, although meet the interactivity, but poor compared to click and knead take comfort, In general, the user interface designed in the experiment can meet the needs of human-computer interaction in immersive virtual reality, and can improve the user's immersion experience.

Different ways of design thinking will lead to different design results. When using complementary dialectical thinking to consider design problems, thoughts and problem-solving ideas are not so single. For example, from the perspective of complementarity, if products are tangible assets that enterprises can touch, then brands are intangible assets that enterprises can see. Tangible products are the material basis for the generation of intangible assets (brand). Brand image, emotional cognition and brand loyalty can help to express the value of products and generate premium appreciation. Tangible assets and intangible assets exist in the community, interdependence, interaction. They serve the manufacturer's business interests to the maximum, but also provide consumers with the needed value, services, needs, recognition, and so on. In the transformation process of soil design development, at present we still focus on the product development itself in the product development chain, but not enough attention to the creation, operation, accumulation and management of intangible assets. This produces our products, the lack of value-added space, lack of "intangible" impetus. When entering the international market competition, it is difficult to meet the requirements of developed markets for brand differentiation, and the phenomenon that the brand value formed in China cannot be copied to foreign countries appears. See Figure 8.

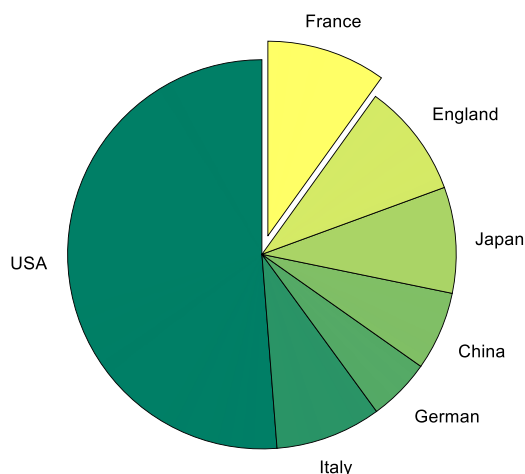


Figure 8: Number analysis of the world's top 500 Brands.

This kind of traditional type of visual communication design virtual reality computer aided technology diversified visual design and visual communication design virtual reality under the new context environment under the computer aided technology diversified visual design together to form a new development system. Reflect a correct development model and system, pay attention to the construction of the overall curriculum system. In this aspect, the cultivation of the integrity of the curriculum system can be regarded as an important starting point. In the process of the systematic construction of this important type and way, the development plan of the efficient construction system can be reflected. Especially in the context of new media education development, the main central content is multimedia as the main direction of development.

4 CONCLUSIONS

The virtual reality technology and computer aided virtual reality technology of computer aided diversified combination of visual design, can the virtual reality technology of computer aided innovation diversity in the form of visual design, make the virtual reality technology of computer aided diversified visual design scenario is more vivid, students more engaged, to learn is that much more investment, Thus, it can improve the effect of diversified visual design of computer aided technology in virtual reality. Based on computer aided virtual reality technology of computer aided diversified visual design, the analysis of the virtual reality technology, virtual reality technology was discussed and computer-aided virtual reality of computer aided technology diversification of visual design combined with the virtual reality of computer aided technology diversification significance of visual design, plays an important role in the development of modern education. The continuous development of diversified visual design based on virtual reality technology will form an education network covering the whole world and promote the reform and development of global education. The development of China's education needs to conform to this trend of education development. Step by step to promote diversified computer-aided virtual reality technology of computer aided the popularity of visual design, speed up the virtual reality technology in computer assisted virtual reality of the application of computer aided technology diversification of visual design. Under the background of the development of visual communication design, artistic language presents the development trend of diversification, designers should pay

attention to the expression forms of related artistic languages and analyze and investigate them in a scientific and reasonable way. Designers should form a good sense of design concept, reasonable innovation and reform of visual communication expression.

Ruoyao Wang, <https://orcid.org/0000-0002-1560-9738>

REFERENCES

- [1] Peng, X.; Liu, X.: Application of Graphic Aided Design in Garden Environment Design under Computer Internet Technology, *Journal of Physics: Conference Series*, 1915(3), 2021, 32032-32038. <https://doi.org/10.1088/1742-6596/1915/3/032032>
- [2] Chen, H.; Zheng, X.: Application of Traditional Culture based on Computer Technology in Modern Visual Communication Design, *Journal of Physics: Conference Series*, 1744(3), 2021, 32094-32099. <https://doi.org/10.1088/1742-6596/1744/3/032094>
- [3] Sun, G.; Wang, X.: Application of Computer Virtual Reality Technology in Practical Teaching of Construction Engineering Survey, *Journal of Physics Conference Series*, 1915(3), 2021, 32072-32086. <https://doi.org/10.1088/1742-6596/1915/3/032072>
- [4] Zhang, R.; Zhao, X.: The Application of Folk Art with Virtual Reality Technology in Visual Communication, *Intelligent Automation and Soft Computing*, 26(4), 2020, 783-793. <https://doi.org/10.14366/usg.17046>
- [5] Zhou, S.: Innovative Research on New Media Interactive Art and Visual Communication Design Based on Computer Virtual Reality, *Journal of Physics Conference Series*, 1648, 2020, 32043-32054. <https://doi.org/10.1016/j.ijporl.2015.10.038>
- [6] Hohmann, V.; Paluch, R.: The Virtual Reality Lab: Realization and Application of Virtual Sound Environments, *Ear and Hearing*, 41(Supplement 1), 2020, 31S-38S. <https://doi.org/10.1097/AUD.0000000000000945>
- [7] Erolin, C.; Reid, L.: Using virtual reality to complement and enhance anatomy education, *Journal of Visual Communication in Medicine*, 6(4), 2019, 51-59. <https://doi.org/10.1080/17453054.2019.1597626>
- [8] Vasilieva, V.-N.: Application of Computer Technologies in Building Design by Example of Original Objects of Increased Complexity, *IOP Conference Series: Materials Science and Engineering*, 262, 2017, 12106-12023. <https://doi.org/10.1088/1757-899X/262/1/012106>
- [9] Zhang, C.: Research on interface visual communication design based on virtual reality technology in paper manufacturing, *Paper Asia*, 2(1), 2019, 146-150. <https://doi.org/10.1088/1742-6596/1915/4/042047>
- [10] Yuhang, C.: Research on application of computer aided design in environmental engineering, *Agro Food Industry Hi Tech*, 28(1), 2017, 2769-2773. <https://doi.org/10.32604/iasc.2020.010113>