UI design of visual communication of coastal city landscape based on embedded network system and remote sensing data

Qian Xie 1

Received: 10 March 2021 / Accepted: 23 April 2021 / Published online: 1 June 2021
© Saudi Society for Geosciences 2021

Abstract
Now the development speed of cities is getting faster and faster, and many cities have reached the stage of urban landscape design. At this stage, the requirements for the urban landscape are mainly in the transmission of information, which can be summarized as the identification of information, the requirements for ideology and readability, which clearly tells urban planners that they need to receive information from the perspective of vision. To design the urban landscape. After investigation, it is found that under the current technological development trend, the application of geographic information based on smart mobile terminals has become a development trend and has become one of the research hotspots in the field of geographic information science. With more and more methods of acquiring geographic information, such as smart phones, drones, and remote sensing satellites, a large amount of spatial data is continuously presented at an extremely fast speed. In recent years, the rapid development of the computer hardware manufacturing industry has made great contributions to the performance of embedded devices in improving computing speed and expanding memory. In this high-speed development environment, the fittest will survive, and the inadequate will be eliminated. Under the background of the information age, any new field will face the problem of short life cycle. Although UI also has it, the development of UI still has a long way to go. Therefore, the UI design industry still has great development prospects.

Keywords Embedded network · Remote sensing data · Coastal city landscape · Visual communication

Introduction
In today’s information age, the requirements for urban landscape construction are greatly improved. After realizing this high requirement, related designers found that the best state of urban landscape information design is whether it can convey the urban regional cultural information and construct the core aspects of urban spiritual culture.

The connotation of urban landscape information design
To put it simply, the purpose of urban information design is to allow tourists to memorize large amounts of complex and relatively advanced information through easy-to-identify means. Urban landscape information design needs to analyze the urban landscape, and then, collect all kinds of information to obtain an urban landscape image with artistic connotation (Shaban and Hamzé 2017). In the actual process of urban landscape information design, we must pay attention to highlighting regional cultural thoughts and meet the cognitive needs of the public through the transmission of cultural information. Based on the design and transmission of landscape information, promote the construction of a harmonious city, and ensure that people live in harmony. The goal was achieved. It can also be said that urban landscape information design plays an important role in expressing urban cultural information and inheriting regional background (Ding et al. 2010). It can also show the characteristics of urban culture in...
the process of urban construction and development in the new era and has an important influence on the identification of urban image in the information age and the promotion of urban construction and development. It can effectively avoid the problem of “a thousand cities on the same side” in the process of urbanization in our country and accelerate the process of urbanization.

The role of visual communication in urban landscape information design

Visual communication design is based on the situation of obtaining information visually, using a series of methods of reconstruction, symbolization, and reproduction to achieve information extraction, and then, realize the organic integration of visual elements, ensuring that the information and information are transmitted at the material and spiritual levels through effective design (Vu and Goldscheider 2006). Thought and highlight the cultural connotation of information. In the context of the era of picture reading, in terms of urban landscape information design, if you want to promote the improvement of urban image recognition, you also want to highlight urban regional cultural characteristics in landscape information design, which can be analyzed from the perspective of visual communication.

Emphasize the recognizability of urban landscape information

Under the influence of visual communication, we can consider introducing a visual symbol system, which can make visual communication more useful, allowing viewers to more effectively extract urban landscape information, which can quickly attract viewers’ attention, which improves urban landscape information Identifiable.

Enhance the expressibility of urban landscape information

Ideology is an important content of visual communication. Under the effect of visual communication, through the rational use of visual symbols with certain ideological connotations and cultural characteristics, the communication between people and the environment can be achieved through image expression techniques such as reconstruction, reproduction, and metaphor (Entezari et al. 2016). The transformation of urban landscape information can ensure the formation of a clear image of urban landscape information at the level of human consciousness, trigger the emotional changes of the audience, promote the role of cultural identity, and highlight the effect of urban landscape information transmission.

Enhancing the readability of urban landscape information

By applying visual communication to the design of urban landscape information, visual symbols with obvious overall characteristics can be reasonably applied to ensure that the visualized urban landscape information is expressed in a dynamic and diverse landscape environment (Shaban et al. 2006). This gives the urban landscape information a strong logic, which makes it easier for people to understand the city, and transforms the urban landscape information into information that can be read by the audience, so as to truly realize the understanding of the urban landscape information. Communicate accurately and improve the overall effect of urban image construction.

The rise and development status of UI design

Initially, UI was limited only by man-machine technology, and it will develop together with the development of information technology today. With the progress of related technologies, UI technology gradually matures and becomes a new research direction. From the development of the first personal computer GUI-Alto at the Palo Alto Research Center in Silicon Valley in 1970 to the computer produced by Apple in 1980 and the emergence of Microsoft Windows in 1990, GUI (graphical user interface) (Ducci et al. 2008) tended to be standard. The user interface standards are beginning to be accepted by the public. Since then, with the popularity of the Internet and digital products, the range of user interface applications has become more and more extensive, and its role in products has also grown. The huge commercial benefits it brings have begun to be valued by businessmen and product developers. User needs and usability design have also become the common concern of designers, and UI design has also appeared in this environment. In 2000, UI design entered China. The company that first recognized UI was Jinshan. At the beginning of its establishment, there were only two people. Later, it continued to develop and cultivate a large number of outstanding industry leaders, and then, major IT companies began to pay attention to UI. The beginning of the UI concept has been recognized by the public. When Apple entered China in 2009, the popularity of the iPhone series made the status of UI rise rapidly. Nowadays, the UI interface design of WPS produced by Kingsoft and Kingsoft Internet Security is very characteristic in the entire industry.

Researching the current market development, UI design has three development difficulties. The first is that industry standards and opinions are not uniform and the foundation is weak. Basically from 2013 to 2016, UI design occupies a large area of the design industry; regardless of the previous PCs, mobile devices, virtualized games; and emerging electronic products, UI design has begun to be applied (Guan 2012).
to UI designers, and art students studying design also position their future development direction in UI design. Although there were reports in the first half of 2016 that continued to slander UI design, it is believed that other design talents poured into the UI too much, making the initially unstable UI more confusing. Many industry experts also believe that UI has been declining, but studies have shown that UI design is still in its infancy, there is still a big gap, and it is far from reaching saturation (Shaban et al. 2005). These are the results of inconsistent views on the future of UI. Second, the industry demand is still huge, and the talent gap is still large. iPhone 7 was launched in 2016, and the “Double Eleven” of the e-commerce platform is also proceeding as planned. Its economic and social impact is still huge. This shows that, at least in the mobile Internet and e-commerce, UI design still has great development prospects. From the perspective of professional supply and demand, scarce talents and rigid demand talents have always been the treasure house of market choices. Just like the current real estate industry, this brings out the current situation and prospects. Third, there is still a lot of work to be done in the construction of related supporting talents and professional education. Currently, as a professional course, UI is rarely added to the design school (Wamelink et al. 2018). A few colleges that offer courses are exploring how to contact and arrange courses. Most people who switch to UI design are self-study or go to training institutions in the market. Both methods are not easy. Self-study is more difficult, and the cycle is long; training will cost a lot of tuition, and training usually “emphasizes technology rather than art” like an assembly line, and is created by a single model, so it lacks independent design ideas and design aesthetics.

The relationship between UI design and visual communication design

Visual communication design refers to the process of summarizing and analyzing the collected information according to specific design purposes, then designing through visual elements such as text, graphics and colors, and finally conveying the design results to users. In visual form, the core is to allow users to gain awareness and experience. Traditional visual communication design is usually recognized by the concept of graphic design. From the concept of content, visual communication design is equivalent to an upgraded version of graphic design. Just like graphic design, various things with visual symbols will also be expressed on the plane (Swaine 2000). However, with the development of technology, graphic design is no longer a single-plane output, but more three-dimensional and multi-dimensional expression. Therefore, the term graphic design is gradually being replaced by visual communication design. This is the inevitable trend of the development of things. Today, visual communication design conforms to the development of the times. With the popularization of digital media and the advancement of software technology, design has become three-dimensional. UI design uses this advantage to achieve a balance between the needs of design works, creators, and users (Wang et al. 2016). It shows the design process in front of users and allows users to participate in it, so it is more personalized and humane. In addition to “inner feeling”, visual performance is still the most important.

It can be seen from the name “User Interface Design” of UI design that the foothold of UI design is still interface design. Interface design is an important aspect of visual communication design. The difference is that users should be emphasized before user interface design. Although the final visual communication design results in designing user-satisfied visual output works according to user needs, user interface design seems to allow users to use tools based on their use (Guo et al. 2014). Use it as you like. They hardly know that a friendly interface will bring comfortable visual enjoyment to people, attract audiences, and create selling points for businesses. This is especially true today when “appearance” is dominant. UI design should not be just a simple artistic icon design. It needs to cooperate with various interactive information of users, analyze and locate user needs, and finally display it to users in a visual form. User needs and feedback determine the quality of UI design (Xue et al. 2005). Various connections indicate that visual communication design and UI design are mutually perfect. This article discusses the application prospects of UI design in the direction of visual communication and discusses the two as a whole. What we want to express is how to communicate visually.

Materials and methods

Data source and processing

The main research objects of this article are urban landscape and thermal environment. Therefore, remote sensing data is selected to extract urban landscape and retrieve land surface temperature. Landsat data is provided by USGS. Its open approach makes it easier to obtain and include other bands such as multispectral and thermal infrared bands. It has rich spectral information (Hakanson 1980). The highest resolution can be achieved by fusion with data in the panchromatic band. It is 15-m long and is widely used in landscape pattern, temperature inversion, environmental ecology, and land use/cover change monitoring research. Many scholars at home and abroad use Landsat data to extract urban landscapes. The Landsat data obtained from the geospatial data cloud has undergone rough geometric correction and radiation correction, but the vapor particles of the first grade product that are affected by atmospheric water have not been eliminated, so atmospheric correction is required.
Radiation calibration and atmospheric correction

In the Landsat infrared band, the main influence of the atmosphere comes from the scattering of air molecules and aerosol particles, which blur the image. The study found that in the visible light band, the main influence is Rayleigh scattering, while in the near-infrared and mid-infrared bands, the main influence comes from the absorption of water vapor by the atmosphere. First, the radiometric calibration is to convert the pixel brightness value of the remote sensing image into the surface reflectivity of the object. Because the FLAASH atmospheric correction model is used, this parameter selects ApplyFLAASHSettings (Yan et al. 2014). This tool can automatically set the correction data type, including storage order, data type, and emissivity data unit adjustment coefficient. Use the FLAASHAtmosphericCorrection tool to perform atmospheric correction on the radiometrically calibrated file. When setting the parameters, please select “Urban” as the aerosol model, and select “2-band” (K-T) as the “aerosol inversion” method. It can be seen from the figure (Fig. 1) that after atmospheric correction, the influence of the water phase particles on the Phase III Landsat image is completely eliminated, and the reflectivity of ground objects tends to be normal.

Image cropping

Usually, the range of the satellite images we download through the remote sensing data download platform is larger than the research field we need (Guo et al. 2013). When we only need to analyze a part of the image, we must crop the entire image in order to delete the area outside the study area. At a later stage, when the moving window algorithm in FRAGSTATS 4.2 is used to calculate the landscape index, edge effects will occur. In order to obtain a complete landscape index map for future spatial correlation analysis, this article uses the buffer tool in ArcGIS to obtain vector data of the study area. Generate a 1 km buffer to expand the initial study area, use vector boundary regions and buffers, and then, use the SubsetDatafromROIs tool in ENVI5.3 to mask the three-phase image after geometric correction and radiometric correction. After the preliminary calculation is completed, the administrative boundary of the study area without a buffer zone will be used to adjust the calculation results for further analysis.

Urban landscape pattern information extraction and spatial visualization research methods

The impervious surface mainly includes concrete-coated ground and bare rock. Bare land mainly includes cultivated land without vegetation and some second-hand or unused bare land. According to expert experience, the normalized index can be used to determine the thresholds of different land types, so that finally the land types in the image can be distinguished by different screening levels (Han et al. 2015). The normalized vegetation index (NDVI) time series data is suitable for detecting long-term land use cover changes and extracting valuable information about land surface characteristics. NDVI is calculated based on the normalized conversion of reflectance between the near-infrared band and the red band. It is an index reflecting the absorption and reflection characteristics of red and near-infrared vegetation in the electromagnetic spectrum. It is calculated as follows:

\[
\text{NDVI} = \frac{(NIR - RED)}{(NIR + RED)}
\]

Among them, NIR is the reflectivity in the near-infrared band, and RED is the reflectivity in the visible red band. NDWI uses reflected near-infrared radiation and visible green light to enhance these characteristics. The existence of characteristics eliminates the existence of soil and terrestrial vegetation characteristics. However, because images are often mixed with urban building land information and shadows, the range and area of water bodies extracted by the NDWI index have been expanded, and there is no better way to separate the two. To this end, a new set of calculation methods is proposed; the calculation formula is as follows:

\[
\text{MNDWI} = \frac{(Green - MIR)}{(Green + MIR)}
\]

By calculating the three bands of red (Red), near infrared (NIR), and mid-infrared (MIR), the building index is obtained. Some scholars have made improvements on the basis of NDBI, such as improved NDBI algorithm and new index. The soil adjustment index (SAVI) can reduce the impact of bare land. Therefore, Xu (2008) uses the soil adjustment vegetation index (SAVI) and the modified normalized difference water index (MNDWI) value to eliminate other land use and cover grades, and proposed index based building index (IBI) method to improve the understanding of urban architecture. It is calculated as follows:

\[
\text{IBI} = \frac{[NDBI - (SAVI + MNDWI)]}{2} + \frac{[NDBI + (SAVI + MNDWI)]}{2}
\]

Among them, NDBI is the building index, SAVI is the soil index, and MNDWI is the modified water difference index. Since most of the ground in the city is not exposed, the issue of impermeability must be considered. Some data use thermal infrared, near-infrared, mid-infrared bands and water index (WI) to construct a normalized impervious surface index (NDISI) to effectively suppress noise (Huysmans et al. 2006). In order to improve the impermeability of the extraction accuracy and reduce the bare ground information, many scholars have made improvements to NDISI. For example, Mu Yachao et al. (2017) created a new enhanced normalized differential impervious surface index (ENDISI) by analyzing the
spectral characteristics of various ground objects and selecting blue, red, near-infrared and two mid-infrared bands. The index selects blue and mid-infrared 2 (2MIR) bands as impermeable surface enhancement factors; doubles the value of the blue band; and selects red, near-infrared, and mid-infrared 1 (1MIR) bands as suppression and impermeability. In addition to the factors of other land types except the surface, the difference between the two is calculated to finally achieve the effect of enhancing the impervious surface information and restraining other land types. It is calculated as follows:

$$ENDISI = \left[ \frac{(2BLUE + MIR_2)}{2} - \left( RED + NIR + MIR_1 \right) / 3 \right] + \left[ \frac{(2BLUE + MIR_2)}{2} + \left( RED + NIR + MIR_1 \right) / 3 \right]$$

(4)

Among them, BLUE is the reflectance of the visible blue band, RED is the reflectance of the visible infrared, NIR is the reflectance of the near infrared, 1MIR is the reflectance of the mid-infrared band 1, and 2MIR is the reflectance of the mid-infrared band. Through literature research and repeated calculations and tests, the normalized differential vegetation index

---

Fig. 1  Vegetation spectrum curve after preprocessing Landsat data
(NDVI), the enhanced normalized differential impervious surface index (ENDISI), and the improved normalized differential water index (MNDWI) were finally selected (Ye and Ning 2009) (Fig. 2). The BandMath function accesses spatial data by mapping variables to bands or files. If the spatial data is too large to be completely read into the memory, please use data splicing for automatic access. BandMath tool can perform ratio and difference based on different band information of remote sensing image. The frequency band calculation method has many advantages. Not only is it fast and accurate, its algorithm is also very simple.

This article selects training samples based on the combination of frequency bands and high-resolution images in Google Earth. The selection of training samples must be able to accurately reflect the characteristics of the ground features, and different band combinations can highlight different ground features (Ling et al. 2014). Generally, if samples are taken from n bands, each type of experimental sample contains at least 10n or more sample points. In order to improve the accuracy of sample extraction, multiple bands are used for combination, and 50 samples are selected for each feature, a total of 5 types and a total of 250 samples. And refer to the Google image of the study area for screening and comparison, and then, delete the samples to increase the number of samples, and get a more satisfactory result. Through specific analysis, it is found that the sample values are all greater than 1.8, which tells us that the sample is very good and has high separability. Use the “StatisticsforAllROIs” tool to count the spectral response curves of the samples and get the decision tree classification model, as shown in the figure (Fig. 3).

**Vector acceleration display strategy of embedded network system**

According to the analysis in the introduction of this chapter, it takes a long time to draw when rendering large spots on embedded devices, the vector display is not smooth, and it is easy to cause the application to jam (Fig. 4). In order to solve the above problems, the author proposes an improvement plan in this article. The specific implementation process of the improvement plan is as follows:

1. Query the database by using the visible area and markers of the screen, and obtain a result set of larger image points that include or intersect with the visible area of the screen with the smallest outer rectangle MBR.
(2) Query the database by using the visible area and markers of the screen to obtain the result set of discarded patterns (small patterns) (Liu et al. 2015) that fall into or intersect the visible area.

(3) Take out the spots in order from the result set of larger spots, and then perform the following work: If the MBR of the spots falls within the visible area, use GDI to draw the spots directly. If the MBR of the spot intersects the visible area, first use a rectangular window to crop the pattern in the visible area, and then draw.

(4) Take out the spots in order from the result set of small spots, and perform the following operations: if the area of the spots is not less than the minimum visible area threshold, draw them.

Use the “EditDecisionProperties” tool to enter the initial classification thresholds for different nodes. After repeated trials, the result of each layer is superimposed on the initial image with the node data through “Overlay-Class”, and finally, the required node threshold is obtained. In the decision tree model, B7 is the mid-infrared band of Landsat data. Collect data for 1990, 2002, and 2019, and then run the decision tree, and finally get the classification results, as shown in the figure below (Fig. 5).

Use the tool to randomly generate 1000 sampling points in the research area, use the attribute table to export the coordinates of each point, and organize them in excel. Use the value extraction point tool in ArcGIS to calculate the feature name of each point in 2017, and export it to an excel table. Through the Google Earth high-resolution variability image in the study area, each point can be judged manually (Marchiori-Faria et al. 2006). Among all sampling points, 885 points are correctly classified, and the correct rate is about 88.5%. Calculate the selected ROI sample data through the confusion matrix, and obtain the overall accuracy of the classification and the Kappa coefficient. The overall accuracy and Kappa coefficient in 1988 were 89.06% and 0.85, respectively; in 2000, they were 82.26% and 0.79, respectively; in 2017, they were 93.01% and 0.90, respectively.
**Results**

Determine the optimal scale and spatial distribution of the landscape pattern index and the results of temporal and spatial changes

This article uses FRAGSTATS4.2 to calculate the index, which requires the collection of land classification and use data. However, this method has some shortcomings, so if you want to obtain accurate results, you need to expand the scope of land use classification data so that the final result is the actual value of all units in the study area landscape. Therefore, this article uses the buffer tool in ArcGIS to create a 1-km buffer area for the study area to obtain a complete landscape pattern index spatial distribution map (Figs. 6, 7, 8, 9, and 10). In the “AnalysisParameters” window, select the 8 unit rules describing the adjacent rules of the patch, and then, select the “MovingWindow” (Zhang et al. 2012) horizontal indicator. There are round windows and square windows. In order to facilitate subsequent analysis and calculation and match the grid pixels, a square window is used for sliding calculation. In order to obtain the best result scale, this paper chose a type to perform a simple result analysis and found that the smaller the window, the better the result. Taking into account the later data processing issues, a window radius of 90 m was finally selected, and the calculated grid size was 210 m. At the landscape level, 90-m, 240-m, 480-m, and 960-m window turning radius were selected in sequence. At the same time, considering the ratio of the best results, the landscape index was selected, and a simple analysis was performed (Mora 2010). The data obtained was a 480-m window. In order to get a better calculation result, a window radius of 480 m was selected, and the calculation result is 990 m. Then, select the corresponding index in the landscape level index item, select the corresponding index in the class level index item, and calculate the landscape index in batches. The actual results are as follows:

**Analysis of image vision improvement results suitable for embedded network systems**

To explore whether our scheme is effective, we design a control experiment here to compare the vector rendering scheme mentioned above with the improved vector rendering scheme in this chapter (Osipov 2014) (Tables 1 and 2). Here, choose China Haida business intelligence machine as the test platform; the test software is based on the field survey verification software developed by VisualStudio2005. Transfer the test data to the mobile phone, and use the smart phone to do experiments. Experiment 1: The test object is a single large pattern. For each super large map point, zoom at a fixed ratio (the zoom factor here is 2) 100
Fig. 6 Spatial distribution map of the percentage of different landscape types in 2017. (a) shows the distribution of water resources, (b) shows the distribution of bare land, (c) shows the distribution of impervious surface, (d) shows the distribution of woodland, (e) shows the distribution of cultivated land, (f) shows the landscape percentage local clipping.
times, calculate and record the average time required to render each map point at different scales and the overall average rendering time point. The specific data obtained are as follows:

When using this program to test a pair of 8 points, there is no test data in the range of 0.8 to 6.4. This is because the rendering time of the mode is too long at these scales, causing the program to freeze.

**Discussion**

**Research direction of UI design**

The research direction of UI design is very extensive. Generally speaking, it mainly serves two directions: mobile Internet and e-commerce. The mobile Internet includes mobile UI, smart (wearable) devices, and some mobile game UIs. As the main business-driven product of e-commerce, it has important performance in Web UI, PC, etc. One of their common carriers is the Web, and the other is APP.

On the web, all graphic design is essential. With the popularity of the Internet, web pages, as an important medium for visual performance, have always been an important position for all designers. The most important visual output of UI design also comes from web pages (Ouyang et al. 2014). The construction and development of Web UI began with major portal giants. The commercial nature of UI has caused a large number of commercial websites to focus on UI web design.

The popularity of mobile phones and other emerging media transmission terminals has enabled UI design to develop not only on the PC side, but also on mobile smart devices. In addition, the popularity of APP makes network communication and user experience transfer from fixed computers to mobile communication and entertainment tools. It can be said that UI gave birth to APP, and it can also be said that the development of APP has promoted the popularization of UI. Individual needs will only grow with the development of society. APP may be just one of the means. BPP, CPP, and other similar tools may appear in the future, but at least APP will be used as UI design for a long time in the future.
Visual communication performance in UI design

UI design is essentially different from visual communication. The design tenet of traditional visual communication designers is that their works are full of creativity and personality, which can make people shine and accurately capture the needs of users. Therefore, most succeeded. The designer will establish his own design style. For example, people can easily identify the design works of Yuan Yanzai, Jin Daqiang, and others; UI designers are more inclined to serve; and most of their works are invisible and hierarchical and expressed in a clear and compliant form. Generally speaking, the form depends on the content. The UI designer represents the coordination (Ravbar and Goldscheider 2007). They usually work in teams and have strong commonalities. For example, the design interface of the world’s most famous social platform Facebook is smoother and clearer, but its UI designer cannot even be named. Nevertheless, the interface performance of UI design is now slowly developing towards the characteristics of visual communication. Due to the limited size of mobile phone interfaces and the fast pace of life today, it is difficult to attract users’ attention with complete format compliance and content. From logo design to specific interface design, each interface design will be very exquisite, and its expression is still divided into four categories: layout, color, text, and element symbols.

Layout is the most special item in UI design. Compared with PC, the screen of mobile phone is too small. In fact, it is really not easy to handle the operation logic, interaction, and visual beauty on such an interface. Converting pseudo-instantiated icons to flat, the popularization of card pages and the application of hidden sliders are all for better UI design visual effects. Color is an essential part of any interface performance. It is fully in line with the public’s color psychology, and flexible use of color psychology is the only way to make interface icons attractive to users (Zhang et al. 2019). Text is the most direct and accurate way of expression in design. Many interface APP icon designs usually only need

![Spatial distribution map of the degree of connection (COHESION) of different landscape types at the type level in 2017.](image)
to add text elements (no matter which language is used) to attract users’ attention, such as Paper Tiger and Baidu. Element symbols can be regarded as a snack in the web interface. They do not have powerful functions but only serve as...
the main design foil. Sometimes some interesting ideas get unexpected results when experimenting. For example, some designs that load buffer component symbols while the user is waiting can alleviate user anxiety.
Visual perception and urban landscape form composition

“Visual images are by no means a mechanical copy of perceptual materials, but a creative mastery of reality. The images it masters are beautiful images full of imagination, creativity and sensitivity.” The beauty of landscape form is actually related to visual perception. The guidance is inseparable. Human beings live in a three-dimensional world composed of many forms. From the sun, moon, and stars in the natural world to mountains and rivers, from living environment to daily necessities, all belong to three-dimensional material forms. In conscious and purposeful form creation, it also creates ideology and social form (Redvan and Nasim 2017). The advancement and development of human forms of creation have continuously enhanced human beings’ ability to change the environment and adapt to new spaces. The human response to the form of three-dimensional materials is mainly done through visual means. Vision is a reflection of objective things and can be divided into two levels: “visual perception” and “visual perception”. The former is the fragmentation of objective things, the reflection of dispersion and phenomenon; the latter reflects the form of objective things. Our research on form includes two aspects: one is the recognizability of the physical form, and the other is the psychological feeling of the physical form. Therefore, our team’s understanding of things has an objective aspect.

“The creation method of form usually adopts the method of combination.” Composition is one of the modeling concepts in modern graphic art. It has formed a new form by studying how to create images, combinations of shapes, and image arrangement methods. What the concept of form needs to explore is the response of visual perception to various art forms in the urban landscape, as well as the need to understand the artistic interpretation of the urban landscape in other ways. The emergence and development of “super graphic art” have brought new research directions to the field of landscape design. This is an intuitive operation that includes both mechanical tasks and thinking operations. Therefore, it is a product of the combination of intuitive thinking and reasoning thinking and the combination of reason and perception. The super

| Table 1 | Basic information of oversized pattern |
|---|---|
| Spot number | Total number of coordinate points | Circumference (m) | Area (m²) |
| 1 | 8142 | 124357.20393 | 24182346.32526 |
| 2 | 9122 | 89659.29173 | 4082570.40374 |
| 3 | 9751 | 103562.53687 | 3605275.49803 |
| 4 | 10587 | 126379.73593 | 8871210.34862 |
| 5 | 11787 | 175538.94280 | 23881424.91544 |
| 6 | 14343 | 279319.54212 | 17432940.31149 |
| 7 | 15708 | 147507.92825 | 15763002.45121 |
| 8 | 21495 | 249810.99442 | 24521210.86151 |

| Table 2 | The average time consumption of the map spot rendering under each display scale |
|---|---|
| Spot number | Drawing scheme | The average time it takes to render the spots under each display scale (unit: second) |
| | | 0.0125 | 0.025 | 0.05 | 0.1 | 0.2 | 0.4 | 0.8 | 1.6 | 3.2 | 6.4 |
| 1 | Scheme 1 | 0.144 | 0.204 | 0.435 | 1.830 | 4.241 | 6.473 | 8.001 | 8.681 | 9.045 | 9.100 |
| | Scheme 2 | 0.152 | 0.194 | 0.821 | 0.792 | 0.459 | 0.624 | 0.533 | 0.474 | 0.458 | 0.496 |
| 2 | Scheme 1 | 0.079 | 0.176 | 0.713 | 2.614 | 5.609 | 7.903 | 9.033 | 9.634 | 10.126 | 10.212 |
| | Scheme 2 | 0.090 | 0.170 | 0.717 | 2.603 | 1.792 | 0.450 | 0.538 | 0.603 | 0.548 | 0.545 |
| 3 | Scheme 1 | 0.091 | 0.207 | 0.822 | 3.546 | 7.407 | 10.319 | 11.759 | 12.717 | 13.089 | 13.263 |
| | Scheme 2 | 0.126 | 0.269 | 0.823 | 3.605 | 1.170 | 0.469 | 0.544 | 0.570 | 0.586 | 0.655 |
| 4 | Scheme 1 | 0.168 | 0.328 | 1.448 | 4.808 | 9.621 | 13.625 | 15.968 | 17.159 | 17.683 | 17.824 |
| | Scheme 2 | 0.096 | 0.245 | 1.416 | 0.995 | 0.623 | 0.666 | 0.594 | 0.588 | 0.603 | 0.630 |
| 5 | Scheme 1 | 0.253 | 0.824 | 3.157 | 8.747 | 15.553 | 19.928 | 22.317 | 23.539 | 23.985 | 24.241 |
| | Scheme 2 | 0.195 | 0.756 | 3.111 | 3.622 | 0.824 | 0.780 | 0.617 | 0.647 | 0.627 | 0.669 |
| 6 | Scheme 1 | 0.242 | 0.465 | 1.325 | 4.544 | 8.704 | 12.222 | 14.135 | 15.069 | 15.412 | 15.536 |
| | Scheme 2 | 0.226 | 0.387 | 1.300 | 1.944 | 0.623 | 0.702 | 0.891 | 0.877 | 0.716 | 0.728 |
| 7 | Scheme 1 | 0.366 | 0.985 | 3.766 | 10.959 | 21.473 | 28.374 | 31.785 | 33.761 | 34.625 | 34.973 |
| | Scheme 2 | 0.353 | 0.925 | 3.623 | 5.127 | 0.864 | 0.878 | 0.901 | 0.795 | 0.797 | 0.795 |
| 8 | Scheme 1 | 0.542 | 1.822 | 6.554 | 19.030 | 40.619 | 61.637 | 61.637 | 61.637 | 61.637 | 61.637 |
| | Scheme 2 | 0.497 | 1.766 | 5.808 | 2.413 | 1.426 | 0.961 | 1.038 | 1.035 | 1.015 | 1.194 |
graphic art in urban landscape art is based on the “super graphic art” point of view, based on the general graphic theory, and discusses its characteristics and formation rules. In order to facilitate analysis, separate the art form and function, technology, economy, and other factors in the landscape; as a pure modeling and artistic phenomenon, abstract and decompose into basic form elements (point, line, surface) (Shaban 2016), body space. And explore its visual characteristics, study the combination characteristics and laws of its internal visual elements (shape, quantity, color, texture) and relational elements (position, direction, gravity), study the influence of visual psychological elements, and explore the combination of architectural forms and possibility.

**Key points of urban landscape information design based on visual communication**

To study the design of urban landscape information from the perspective of visual transmission, it is necessary to combine the application of visual symbols to highlight the effect of information transmission, thereby greatly enhancing the recognizability of urban images. In the specific design work, combined with the realistic requirements of urban landscape information design, the following work content should be highlighted.

**Respect the objectivity of design**

In the process of using visual communication for landscape design, it should be based on objective reality. Design and planning on the basis of a comprehensive and objective analysis should consider the design value of urban landscape information. In the specific construction, experts make an overall analysis of the urban landscape information according to the specific situation and make some planning and design from the perspective of visual symbols. Fully interpret the performance of visual symbol construction, ensure that the connotation of information can be fully integrated in the design process, effectively highlight the effectiveness of urban landscape design and planning, and improve the effect of information presentation.

**Focus on design functions**

The biggest requirement that needs to be considered in urban landscape information design is the ability to convey information (Shaban and Darwich 2011). Therefore, all visual expressions should first consider the ability to communicate information and highlight the purpose of visual communication design. In the design work, the designer should take the landscape information as the main body, analyze the design in combination with the art form, and then carry out the design and planning activities reasonably in combination with the functional requirements to ensure the rationality of the design content. Obtain the recognition and affirmation of the audience, and comprehensively improve the scientificity and effectiveness of urban landscape information design.

**Focus on the humanization of design**

In the design of urban landscape information, based on the application of visual communication, in order to promote the improvement of the effect of landscape information transmission, it is necessary to recognize the importance of rational processing and storage of thinking activities and pay attention to design awareness. Consider the factor of humanization, putting forward ideas, and designing landscape information through visual communication to highlight the attractiveness of landscape information.

**Application of visual communication in urban landscape information design**

After having a preliminary understanding of the related knowledge of visual communication, we need to understand more related forms if we want to use this technology to achieve better urban landscape design effects.

**Application in environmental recognition system**

In the design of urban landscape information, the design of the environmental recognition system mainly focuses on the design of indicative information transmission. It is hoped that through the effective transmission of the instruction information in visual communication, the audience can quickly select what they need. In parks and squares, visual communication is mainly used on signage (Shaban et al. 2014). These signs are designed according to the needs of visual communication and can highlight the visual aspects of urban landscape information design.

**Application in space guidance system**

In the process of applying visual communication to the design of space guidance system, it is necessary to highlight the transmission of directional information to ensure that the goal can be achieved through reasonable design and planning. The need to obtain information in clarifying spatial location and course of action has been met. In order to improve the accuracy and clarity of information transmission, and use serialized and structured symbols, it can realize the accurate transmission of multi-level and complex logical relationship information.
Application in urban image recognition system

As an important work content of urban landscape design, urban image recognition system should pay attention to how to better convey information, because it is related to the direct feeling of the people’s cultural pursuit. In terms of design, emphasis is placed on the pertinence and culture of information transmission. On the basis of reasonable application, it can improve the audience’s ability to recognize the city and can also reflect the cultural connotation and cultural spirit of the city.

Conclusion

The research on the design of urban landscape information for visual communication should focus on the design effect of landscape information communication so that the construction of the urban cultural core becomes a reality. Achieve brand-new development results, and lay a solid foundation for the development of characteristic cities. The design techniques of “graphic art” usually include realistic display, outstanding contrast, reasonable features, exaggerated vision, focal association, and composition. Since “super graphic art” is placed in the environment, designers should consider basic elements in addition to basic elements. Using the design principles of visual aesthetics and information transmission, the time and space relationship between design work and the environment must also be considered to achieve the growth of visual transmission. In the end, it must be communicated to the user through the interface, and the competition point of UI design must be gradually refocused on the interface based on the user’s feelings. Therefore, the UI design will still move toward the future visual communication. With the advancement of multimedia technology, application fields with unlimited potential will become broader.

Declarations

Conflict of interest The authors declare no competing interests.

References

Ding Q, Yu LF, Tian YJ et al (2010) Environmental risk of specific POPs at a pesticide production site. Res Environ Sci 23(12):1528–1534 (In Chinese). https://doi.org/10.13198/j.res.2010.12.86.dingq.014
Ducci D, De Masi G, Priscoli GD (2008) Contamination risk of the Albuni karst system (southern Italy). Eng Geol 99(3):109–120 doi-org.proxydxgb.bua.mp/10.1016/j.enggeo.2007.11.008
Entezari M, Yamani M, Aghdam MJ (2016) Evaluation of intrinsic vulnerability, hazard and risk mapping for karst aquifers, Khorine aquifer, Kermanshah province: a case study. Environ Earth Sci 75(5):435 doi-org.proxydxgb.bua.mp/10.1007/s12665-016-5258-5
Guo JY, Yang L, Liu X et al (2013) Decadal variation in surface characteristics over Xinjiang, western China, from TAP altimetry backscatter coefficients: evidence of climate change. Terr Atmos Ocean Sci 24(4):565–579 doi-org.proxydxgb.bua.mp/10.3319/tao.2012.11.01.01(tibss)
Guo JP, Zhai PM, Wu L et al (2014) Diurnal variation and the influential factors of precipitation from surface and satellite measurements in Tibet. Int J Climatol 34(9):2940–2956. doi-org.proxydxgb.bua.mp/10.1002/joc.3886
Hakansson L (1980) An ecological risk index for aquatic pollution control: a sedimentological approach. Water Res 14(8):975–1001 doi-org.proxydxgb.bua.mp/10.1016/0043-1354(80)90143-8
Han ZY, Xu M, Liu G et al (2015) Pollutant identification and quality assessment of groundwater near municipal solid waste landfills in China. China Environ Sci 35(9):2843–2852 (In Chinese). doi-org.proxydxgb.bua.mp/10.3969/j.issn.1000-6923.2015.09.042
Huysmans M, Madarász T, Dassargues A (2006) Risk assessment of groundwater pollution using sensitivity analysis and a worst-case scenario analysis. Environ Geol 50(2):180–193 doi-org.proxydxgb.bua.mp/10.1007/s00254-006-0197-1
Ling H, Guo B, Xu H, Fu J (2014) Configuration of water resources for a typical river basin in an arid region of China based on the ecological water requirements (EWRs) of desert riparian vegetation. Glob Planet Chang 122:292–304 doi-org.proxydxgb.bua.mp/10.1016/j.gloplacha.2014.09.008
Liu HJ, Fan MY, Zhang BX et al (2015) Vulnerability assessment of karst water in Feicheng Basin based on COP method. S N Water Transfers Water Sci Technol 13(03):538–542 (In Chinese). doi-org.proxydxgb.bua.mp/10.13476/j.cnki.enwstq.2015.03.031
Marchiori-Faria DG, Ferreira CJ et al (2006) Hazard mapping as part of civil defense preventive and contingency actions: a case study from Diadema, Brazil. In: Engineering Geology for Tomorrow’s Cities IAEG 2006, 6–10 Sept. 2006, CD-rom, paper no. 4–154
Mora S (2010) Disasters should not be protagonists of disaster risk. In: Geologically active, Williams et al. (Eds.), Proceedings of the 11th IAEG Congress, Auckland, New Zealand, 5–10 Sept. 2010, Taylor & Francis group, London, pp89–110
Osipov VI (2014) Large-scale thematic geological mapping of Moscow area. In: Lollino G et al (eds) Engineering Geology for Society and Territory, vol 5, Springer International Publishing Switzerland, pp11–16
Ouyang Y, Zhang JE, Cui L (2014) Estimating impacts of land use on groundwater quality using trilinear analysis. Environ Monit Assess 186(9):5353–5362 doi-org.proxydxgb.bua.mp/10.1007/s10661-014-3784-8
Ravbar N, Goldsheider N (2007) Proposed methodology of vulnerability and contamination risk mapping for the protection of karst aquifers in Slovenia. Acta Carsol 36(3) doi-org.proxydxgb.bua.mp/10.3986/ac.v36i3.174
Redvan G, Nasim SH (2017) Study on groundwater quality using geographic information system (GIS), case study: Ardabil, Iran. Civil Engi J 11(3):797–793 doi-org.proxydxgb.bua.mp/10.21859/cej-030914
Shaban A (2016) New economic policies: instruments for water management in Lebanon. Hydrol Curr Res 7:222 doi-org.proxydxgb.bua.mp/10.4172/2157-7587.1000222
Shaban A, Darwich T (2011) The role of sinkholes in groundwater recharge in mountain crests of Lebanon. Environ Hydrol J 19(9):1–11
Shaban A, Hamzé M (2017) Shared water resources of Lebanon. NOVA, Water Resource Planning, Development and Management series, 2017-3rd Quarter, p 152
Shaban A, Khawlie M, Abdallah C, Faour G (2005) Geologic controls of submarine groundwater discharge: application of remote sensing to North Lebanon. Environ Geol 47(4):512–522
Shaban A, Khawlie M, Abdallah C (2006) Use of remote sensing and GIS to determine recharge potential zones: the case of occidental Lebanon. Hydrogeol J 14:433–443
Shaban A, Darwich T, El Hage M (2014) Studying snowpack and the related terrain characteristics on Lebanon Mountain. Int J Water Sci 2:1–10
Swaine DJ (2000) Why trace elements are important. Fuel Process Technol 65(66):21–33 doi-org.proxydgb.buap.mx/10.1016/s0378-3820(99)00073-9
Vu TMN, Goldscheider N (2006) A simplified methodology for mapping groundwater vulnerability and contamination risk, and its first application in a tropical karst area, Vietnam. Hydrogeol J 14(8):1666–1675 doi-org.proxydgb.buap.mx/10.1007/s10040-006-0069-5
Wamelink GWW, van Dobben HF, Goedhart PW et al (2018) The role of abiotic soil parameters as a factor in the success of invasive plant species. Emerg Sci J 2(6):308–365 doi-org.proxydgb.buap.mx/10.28991/esj-2018-01155
Wang CY, Liang C, Jing N et al (2016) Comparative analysis on evaluation method for karst groundwater quality. J Eng Heilongjiang Univ 7(1):1–6 doi-org.proxydgb.buap.mx/10.13524/j.2095-008x.2016.01.001
Xue Q, Liang B, Liu JJ (2005) Numerical simulation of petroleum components transport in unsaturated zone and its application. J Syst Simul 17(11):2589–2592 (In Chinese). doi-org.proxydgb.buap.mx/10.1360/biodiv.050058
Yachao M, Xu M, Liu G et al (2017) Analysis of the Impervious Surface Changes in Lanzhou City from 1994 to 2015[J]. Geo Spat Inf 02: 57–61
Yan H, Zhan J, Liu B, Huang W, Li Z (2014) Spatially explicit assessment of ecosystem resilience: an approach to adapt to climate changes. Adv Meteorol 2014:1–9 doi-org.proxydgb.buap.mx/10.1155/2014/798428
Ye YH, Ning LB (2009) Prediction of the migration of oil pollutants in vadose zone-A case study of commercial oil reserve base in Xigu, Lanzhou. Environ Sci Technol 32(11):186–200 (In Chinese). doi-org.proxydgb.buap.mx/10.3969/j.issn.1003-6504.2009.11.044
Zhang DD, Xie YF, Liu XJ (2012) Dynamics of redox environment during natural attenuation of 1, 2-dichloroethane in a laboratory aquifer column. Res Environ Sci 25(12):1398–1403 doi-org.proxydgb.buap.mx/10.1007/s11783-011-0280-z
Zhang L, Lu WX, Hou GL et al (2019) Coupled analysis on land use, landscape pattern and nonpoint source pollution loads in Shitoukoumen Reservoir watershed, China. Sustain Cities Soc:51 doi-org.proxydgb.buap.mx/10.1016/j.scs.2019.101788