Soil and water loss of mountain plants based on sensor and research on visual experience art

Tiangang Wei

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Abstract
Soil and water loss monitoring is one of the important tasks in the construction of soil and water conservation ecology, which plays an important role in the national macro decision-making, and also has an important influence in the research of visual experience art. The existing soil and water loss monitoring facilities are out of date, the monitoring cycle is long, time-consuming, and laborious, and become less reliable, unable to achieve real-time online monitoring. Human factors have relatively great influence on the science of observation data. In this paper, based on the periodic structure and homogenization theory, for some drought resistant shrubs, grasses, and trees, we refer to the simulation technology of steel and concrete, and show the cross-section pictures of the root simulation model, and select the soil composite as the model of composite composition relationship. Through the “single package” model and numerical simulation, the root system in soil can obtain synergistic effect. In order to further confirm the accuracy of numerical results, the “single package” model is based on the periodic arrangement of root complex. Sophora root, cypress root, pine root, and loess collected from the test site were used in the experiment, and the parameters were input as “single package” model, and compared with the simulation data, which confirmed its high accuracy. Through the research on the sensor, this paper introduces the research results into the soil erosion of mountain plants and the art of visual experience, which promotes the deeper interaction of the new mass media.

Keywords Online monitoring · Mountain plants · Soil erosion · Visual experience art

Introduction
Visual experience art should take the audience as the starting point, adopt novel methods, and design and publicize according to the public’s vision and aesthetic orientation. Multiple interactive media is a new way of visual experience. It can be divided into three categories: interactive media, plane interactive media, and radio wave interactive media. Its main feature is that it develops from traditional one-way communication to various communication modes of two-way communication. In other words, the audience can take action through the voice of communication tools, and directly affect the content of communication. China’s mountainous areas account for about 67% of the country’s total area, and the degree of soil erosion in many watersheds is different because of the impact of landslides and other geological disasters. Due to the recent turbulence of special climate, soil behavior, and human activities, the Loess Plateau is a typical area of soil erosion in China. Plants can effectively maintain the shallow soil and prevent landslides. According to the concept of ecosystem restoration, plants also adopt the method of slope protection to meet the needs of people for economic and environmental protection, which has been paid more and more attention at home and abroad. The destruction of the original vegetation on the slope leads to the decline of the ecosystem, which affects the safety of production and the quality of life of the people around (McCarty and Kaza 2015). After the destruction of native vegetation, the ability of slope to stabilize soil and maintain water decreased, and the local ecosystem was destroyed, which ultimately affected the safety of human production and quality of life (McConnell et al. 2010). The bare area without vegetation is washed away by rain, and all slope
runoff causing surface erosion takes away a lot of soil and nutrients, which reduces the stability of slope accumulation and reduces the environmental carrying capacity. Slope erosion, shallow landslide, and rock slope stability are also important factors causing natural disasters, and a large number of sediments generated by slope debris pose great danger to the ecosystem and downstream environment, and even lead to land desertification (Ozkurt et al. 2013). The roots of mountain plants are closely combined with soil particles to form natural composite materials with certain spatial heterogeneity (Robinson et al. 2007). This can effectively reduce the erosion of runoff on the slope, prevent the loss of soil resources, and improve the local hydrological resources. Although many studies have analyzed the mechanical properties of plant roots and their ability to maintain soil and improve sediment safety, the mechanism between roots and soil should also be studied (Rawat and Kumar 2015). It is difficult to estimate the impact of multiroot reinforcement on soil, because most of the existing theories are still in the single root stage, and lack of accurate and practical simulation modeling technology, the theoretical value is quite different from the experimental value (Ross et al. 2006). Water conservation monitoring point is the terminal of water conservation online monitoring network, which is responsible for collecting important data, such as water loss and its influencing factors, analysis, and management (Rahman et al. 2019). Collecting water loss data in real time at the monitoring point not only reflects the characteristics of water and soil industry, but also reflects the technical content of water and soil monitoring (Singh et al. 2013). Therefore, the development research of real-time soil erosion monitoring is not only the most urgent task for research, but also focuses on the monitoring of research.

Pattern making

In order to study the relationship between root consolidation and water content, we measured the shear strength of two specimens of normal soil and “fine root normal soil” composite under the same water content. To verify the homogenization and periodic structure theory used in this paper, a total of 16 fine roots (4 × 4) were placed in the sample. Because the sample size selected for triaxial compression test is 61.6 mm in diameter and 120 mm in length, the selected fine roots must meet the requirements of straight root diameter and appropriate length. In addition, several groups of specimens were prepared, including three types of Qiaomu root diameter, 1 mm, 2 mm, and 3 mm, to study the influence of root diameter and root type (Tibshirani et al. 2007). In order to study the maintenance effect of roots close to natural state (natural water content) on soil, three fine roots of Pinus tabulaeformis, Platycladus orientalis, and Robinia pseudoacacia were used to make samples, and compression experiments were carried out according to the following methods.

Design of real-time monitoring sensor for soil erosion

The real-time water-saving monitor is an important equipment for monitoring soil and water loss. The device collects surface water during rainfall, measures the time and weight of sand water collected from equivalent water, calculates the flow rate and density of water flow, and stores them to achieve the purpose of real-time water-saving monitoring, and provides reliable data for analyzing sediment content and water flow change. The main part of real-time monitoring of water loss is tipping bucket, reversing once to show that a certain amount of water with sand has been collected. In addition, the trend level switch can be reversed by self-weight, thus limiting the height of the tipping bucket level (Ying et al. 2007). The quantitative water level switch, load cell, and electromagnet are used to collect water coordinates around the calculation monitoring system, that is, it monitors the tipping bucket. At the same time, it records the water collected during the turnover, and enters the computer monitoring system to calculate the flow and density. External communication is carried out by radio.

Compared with the existing water and soil loss monitoring methods, the water-saving real-time monitor has the advantages of simple structure, high degree of automation, and low monitoring cost. The working principle of the real-time monitor is to measure the body weight, the switch controls the measured object, and the electromagnet controls the guide vane turnover (Young et al. 2020). The controller timer records the time interval between two flips. The measurement process is controlled by program, and the stored data is calculated. The real-time online monitoring is realized by data exchange with the outside through the transmission interface.

Materials and methods

Plant root sampling

The soil samples were collected in the forest land of the investigated objects, and the untreated soil was collected repeatedly by the ring knife method, packaged, and refrigerated in the refrigerator. The soil moisture was measured by a 5-h drying method and the macro density of composite soil was calculated according to the volume ratio of root (Tabatabaei et al. 2013). Triaxial consolidated undrained compression tests were carried out to verify the calculation results of the “unit cell” method, which was based on the root diameter and root arrangement of the tissue tree used to make specimens with different water content. According to the national standard gb-50123-1999, the test was carried out with the membrane root system of partially remolded soil and borehole (Wheeler et al. 2008).
The data transmission is shown in Fig. 1. The large capacity SD memory chip is used as the storage, in order to observe the soil and water loss at a fixed point for a long time.

**Plant water and soil loss control design**

The root system of plants with fixed soil and slope protection has the characteristics of vertical growth and periodic arrangement. The depth of herb root can reach 40 cm, and that of tree root can reach 1 m, which is much larger than the diameter of the root system. Therefore, root and soil can be regarded as a periodic distribution, which is a long fiber root soil composite. By neglecting a small number of roots and assuming that a large number of unidirectional periodic roots are distributed on the slope, plant roots and soil can be simplified as periodic long fiber reinforced composites. To sum up, this paper proposes a root soil consolidation mechanism based on homogenization theory, which starts with a simple root system without considering the complex root soil morphology. The root soil complex can be composed of a single root and the soil around the root, and each part of the configuration is expressed as a “unit cell.” Taking the root soil composite with periodic “cell” structure $y$ as an example, it is assumed that the composite exists somewhere in the spatial coordinate system $X$. The total boundary is $s$, which is subjected to the action of force, plant, and surface force respectively $t$. According to the principle of virtual displacement, the control method is as follows:

$$\int D_{ijkl} \frac{\partial u_j}{\partial x_i} \frac{\partial u_i}{\partial x_l} d\Omega = \int f_i \nu_i d\Omega + \int t_i \nu_i dS$$

The asymptotic representation of two scales is used:

$$u = u^0(x,y) + \varepsilon u^1(x,y) + \varepsilon^2 u^2(x,y) + \ldots$$

According to the periodicity of $Y$, it can be concluded that:

$$\frac{1}{\varepsilon^2} \int \left[ \frac{1}{|Y|} D_{ijkl} \frac{\partial u_k}{\partial x_l} \frac{\partial u_i}{\partial x_j} \right] d\Omega = 0$$

$$\frac{1}{\varepsilon^1} \int \left[ \frac{1}{|Y|} D_{ijkl} \left( \frac{\partial u_k}{\partial x_l} \frac{\partial u_i}{\partial x_j} \right) \right] d\Omega = 0$$

$$\frac{1}{\varepsilon^0} \int \left[ \frac{1}{|Y|} D_{ijkl} \left( \frac{\partial u_k}{\partial x_l} \right) \right] d\Omega = \left[ \frac{1}{|Y|} D_{ijkl} dY \right]$$

The macro scale displacement of root soil complex is described, the results are as follows:

$$\int D_{ijkl} \frac{\partial u_j}{\partial x_i} \frac{\partial u_i}{\partial x_l} dy = \int D_{ijpq} \frac{\partial u_k}{\partial x_l} dY$$

Introduce:

$$u^1_i = -\chi^{jl}(x,y) \frac{\partial u^0_k}{\partial x^j}$$

According to the equivalent term of the project, the equivalent stiffness matrix is:

$$D_{ijkl}^H = \frac{1}{|Y|} \int D_{ijkl} \frac{\partial x^l_i}{\partial y^j} dY$$

The equivalent density of root soil composite can be expressed as:

$$\rho^H = \langle \rho \rangle = \frac{1}{|Y|} \int \rho dY$$

**Experimental methods**

The consolidated undrained method (UU) will be used to determine the shear strength of soil under various moisture
contents. Under each working condition, the test piece was set to repeat 4 times at 100 kPa, 200 kPa, 300 kPa, and 400 kPa, respectively, and compressed to 15% under pressure. According to the obtained principal stress difference and axial strain curve, Mohr's stress circle curve is drawn, and the internal friction angle and cohesion are calculated. According to this method, the tangential elastic modulus of the root soil composite can be obtained, and the macro stiffness test value can be obtained. Whether the results of the asymptotic homogenization theory proposed in this paper correspond to the triaxial compression test, and whether the relationship between the root soil composite is correct.

Results

Analysis on the effect of plants to prevent soil erosion

Soil and complex samples with saturation of 0.2, 0.4, 0.6, and 0.8 were prepared, and four groups of repeated items were set for each saturation: soil volume was 0.5; soil volume was 0.5. The diameter of each root is about 1 mm, and the aggregation value of the specimen subjected to 15% stress shear at 100200300400 kPa is obtained by subsequent treatment. See Fig. 2 for details.

With the increase of soil saturation, the cohesive strength of soil and Pinus tabulaeformis root complex first increased and then decreased, and the lowest value was 0.8. At the same saturation, the cohesion of the composite is about 20 kPa higher than that of the plain soil, and it has been shown that the addition of fine roots in this water content range actually enhances the cohesion of the soil. In the case of soil saturation of 0.4 and 0.6, the improvement effect on cohesion is more obvious, while in the case of soil saturation of 0.2 and 0.8, the enhancement effect is weakened. As shown in Fig. 2, under the same saturation, the internal friction angle of Pinus tabulaeformis composite (red dotted line) is larger than that of ordinary soil (black dotted line). The former increases with the increase of saturation, while the latter first increases and then decreases with the increase of saturation. In a word, it has been proved that the cohesive force and internal friction angle of plain soil can be improved by inserting uniformly distributed slender roots. This is consistent with the conclusion that "plant roots can improve the cohesion and internal friction angle of soil" in the relevant literature, but some studies have shown that adding roots has an irregular effect on the friction angle of soil.

Strength and toughness are the ratio of residual strength to the maximum value of stress difference after complete failure, also known as sensitivity. As shown in Fig. 3, when the soil saturation is 0.2, 0.4, and 0.6, the general trend of the complex is higher than that of the plain land, which is stable, and shows the root system of the saturation. By combining the principal stress difference with the axial deformation curve of the sample, the "toughness" of the composite soil increases when the fracture surface appears, and the root system plays a fixed role before the whole soil is completely destroyed.

For example, different placement methods of root systems will affect the creation of wave front. Compared with horizontal layout, the vertical layout of root system effectively increases the effective shear relative area, which may reduce the shear strength of the main unit and improve the cohesion effect. A related study has shown that the surface of the bond between the convex surface of the soil and the composite is closer to the soil than the surface of the soil particles, thus increasing the cohesion of the soil, thus achieving the effect of increasing the shear resistance. If the slope is eroded by runoff and rain, the root system can keep the surrounding soil until the soil...
particles completely leave the root system. This indicates that the slope can be repaired before it is completely destroyed. The stress difference in Fig. 4 shows the following basic laws: (1) with the shear, the stress difference quickly decreases after reaching its peak value and finally keeps a steady trend until the end of the shear. The velocity usually increases with the increase of additional confining pressure, decreases with the increase of saturation of the sample, and the yield stress limit keeps the same trend. (2) With the increase of the pressure of the set bar, the peak stress difference increases, and the shear modulus of the soil decreases. (3) Compared with the common soil samples, the peak stress difference and shear residual value of the composite increase, indicating that the shear strength was improved. (4) With the increase of water content, the yield stress limit of the soil and the soil composite increases, respectively, indicating that the strength of the composite decreases with the increase of brittleness.

In order to test whether the calculated results of the unit cell are consistent with the shear modulus, take Fig. 5 as an example.
example to measure the slope of the stress difference curve of each saturation, calculate the elastic shear force, and calculate the elastic modulus of the complex.

**Analysis of solution results of vegetation root slope model**

The actual slope is characterized by small root modulus, which is suitable for soil units with large tree roots. Therefore, it is suggested to arrange several rows of tree roots on shallow slope. For 3D modeling, a certain width of slope is selected, including three non-root flat soil slope models of the same size, link root element separation slope model, and a slope model including homogeneous root. The finite element model is shown in Fig. 6. It is the same as the boundary constraint and grass slope model, which simulates the large slope extending infinitely to the left and right.

The modeling of solid-state root device method is the part of establishing link cell. The shallow slope contains 20 rows by 20 columns, with a total of 400 complex cells. Each “cell” has a side length of 0.5 m, a depth of 2 m, and a single root diameter of 0.04 M. The modeling of tree root system is basically the same as the homogenization method of the homogeneous root system mentioned above, so it is not described.

The same composition relationship was used to calculate the root soil complex of Pinus tabulaeformis. The length of unit cell side was 0.5 m, the diameter of root was 0.04m, the elastic modulus of soil was 16MPa, the elastic modulus of root was 195mpa, and the ratio of soil volume to root volume was 0.50%. Table 1 shows the calculated composition of the root soil complex. In the table below, it can be seen that there are some deviations in EZ calculation between the proposed method and the simplified method, but the differences in other elastic parameters are acceptable.

Comparing the contour of XY plane shear stress distribution under three working conditions shown in Fig. 7, the models under the three working conditions all have stress concentration at the toe of the slope, and the area is easy to be damaged and occurs under gravity.

Compared with the two slopes without roots, the stress distribution on the flat slope without roots is uniform. The results of single modeling and homogenization modeling are almost the same. Comparing the area containing the root of Fig. 8(a)–(c), we can get the value of shallow stress of oblique toe of Fig. 8(b) and (c), thus proving the tensile strength of aburamatsu root. Through the action of force, the stress spatial distribution of shallow slope is changed, and the stability of shallow slope is improved. The results of the first mock exam are in good agreement with the results of the root soil separation model. The unified model presented in this paper shows that the model is applicable not only to the roots of trees but also to the requirements of mechanical analysis.

Figure 8(a)–(c) shows the slope without root slope, homogeneous root slope, and equivalent plastic deformation root slope of Pinus tabulaeformis. The sliding surface of flat slope is shallow, including the sliding surface of pine root slope is deepening. The plastic zone represents the fully connected state from the angle of the slope to the top of the slope (b)
(c) the existence of Pinus tabulaeformis root system indicates that the original slope is concentrated on the interior and the stress is distributed on the deep slope, which indicates that Pinus tabulaeformis increases the stability of the slope. The distribution law of equivalent plastic deformation of the model slope connection model is basically the same, which further proves the applicability of the homogenization method described in this paper.

Compared with the three models, the homogenization method proposed in this paper does not need 8290 units for modeling, but needs 146650 units of separated solid model, and reduces the number of units by 94.5%. However, both of them achieved relatively similar results, while homogenization modeling took only about 4 min, while solid modeling took more than 4 h. Especially when facing a large slope, it is difficult for many elements to converge when using the simplified coefficient method to calculate the solid model, which makes the modeling process complicated. The advantages of the method used in this paper become more obvious with the expansion of the scale of modeling, which is not affected by the amount of roots and the type of materials.

### Table 1: Constitutive parameters of root soil complex

|                     | Elastic parameters | Simplified method | Method of this paper | Deviation from the simplified method |
|---------------------|--------------------|-------------------|----------------------|-------------------------------------|
| Ex(MPa)             | 1.520              | 1.327             | 12.11                |
| Ey(MPa)             | 1.520              | 1.327             | 12.11                |
| Ez(MPa)             | 1586               | 2.098             | 32.25                |
| Vxy                 | 0.31               | 0.31              | 0                    |
| Vxz                 | 0.298              | 0.2994            | 0.16                 |
| Vyz                 | 0.298              | 0.2994            | 0.16                 |
| Gxs(MPa)            | 5.892              | 5.892             | 0                    |
| Gys(1MPa)           | 5.892              | 5.892             | 0                    |
| Gxy(MPa)            | 5.768              | 5.810             | 0.74                 |

### Analysis of soil consolidation effect of different vegetation communities

In this experiment, the soil fixed plants were evaluated by three indexes: hydrological function, mechanical function, and plant life ability. The hydrological impact index is the effective moisture retention capacity of vegetation coverage and dead leaves. Vegetation coverage can reflect the ability of plant canopy to prevent precipitation, and waste remediation can reflect the ability of plant waste layer to prevent surface runoff. The mechanical influence index is as follows: it describes the effects of root properties on the shear strength, root density, root surface area density, and plant soil fixation capacity of root soil complex, which have been described in the previous section. Table 2 shows the index values for each community type.

The original data must be standardized before principal component analysis, so that the standardized data can be used for subsequent principal component analysis. Table 3 shows the standardized data required for this survey.

By substituting each standardized data in Table 2 into the equation, six community types from which the comprehensive

![Fig. 7 Contour map of shear stress in XY plane of slope](image-url)
principal component values can be obtained can be used as principal components and sorted according to their comprehensive principal component values. The results are shown in Table 4 below. Hippophae rhamnoides shiroguwai community ranked first, and except for the second major component, other major components showed that Hippophae rhamnoides was one of the main components. In terms of vegetation coverage, shiroguwai community is not as good as other communities, so the ability of canopy to block precipitation is weak, and other indicators are more effective. The total active component of bacterial community was rated as the lowest.

In this section, 10 indexes, such as shear strength, root weight density, root length density, and root surface area density, are selected. After analyzing the soil, vegetation index, and main components of solidification index, four main components were extracted. The first component reflects the mechanical action of plant fixed soil, the second one reflects the ability of plant canopy, which prevents rainfall, and the third main component reflects the ability of plants to absorb water and nutrients. Therefore, the fourth main component reflects the ability of a layer of plant withered leaves to prevent surface runoff.

Table 2  Screening index of soil fixing vegetation

| Community type | Shear strength (kPa) | RWDg/m³ | RLDm/m³ | RBADm²/m³ | SLRM/g | SRSAx10 | Vegetation coverage (%) | Shrub coverage (%) | Herbage coverage rate (%) | Litter water holding capacity (g/g) |
|---------------|---------------------|---------|---------|------------|--------|---------|-------------------------|-----------------|--------------------------|-------------------------------|
| I             | 232.26              | 314.90  | 2373.35 | 2.60       | 7.98   | 8.30    | 84.00                   | 0.00            | 84.00                    | 1.33                          |
| II            | 238.62              | 553.88  | 5773.05 | 4.86       | 10.21  | 8.31    | 100.00                  | 14.00           | 100.00                   | 1.53                          |
| III           | 247.26              | 789.30  | 9313.73 | 8.13       | 1257   | 10.88   | 95.00                   | 62.00           | 94.00                    | 1.64                          |
| IV            | 243.24              | 907.26  | 12794.10| 8.71       | 14.01  | 8.96    | 100.00                  | 71.00           | 94.00                    | 1.10                          |
| V             | 241.41              | 1084.94 | 10862.97| 8.01       | 8.74   | 6.46    | 100.00                  | 62.00           | 94.00                    | 1.28                          |
| VI            | 252.72              | 2757.06 | 17886.22| 16.95      | 6.22   | 6.25    | 95.00                   | 52.00           | 94.00                    | 1.62                          |

Discussion

Development status of interactive media

Interactive media exists in conventional media, such as letters from readers, news columns of newspapers or magazines, calls from radio receivers, and letters from listeners. Through all these interactions, it shows the communicator’s attention to the viewer’s reaction. However, due to technical reasons, these interactive technologies are lagging behind and limited in size. With the development of communication technology and the popularization of application, the timeliness and scale of communication are gradually mature, and the interaction between communicators and receivers is often real-time. In recent years, traditional media has opened up programs and activities, and established audiences as editors, directors, journalists, etc., thus forming a model of demand generation. For example, the content layout of a variety show is fixed, but it still maintains a high popularity, because this format is open and completely dominated by the audience. First of all, anyone can participate in and stand on the stage (Abdelwaheb et al. 2015). That is to say, they have established a media platform, and the protagonist of the show is likely to...
be anyone in front of the TV. This is very attractive to any customer.

**Art design content and characteristics of interactive media**

Interactive media is developing towards the integration of the Internet era, and various types of media are working together to fully cover the attention of target groups. For example, talent shows, online media, and print media can be seamlessly connected (Bahrami Asl et al. 2018). When it is played on TV, the network can be broadcast live at the same time, the interactive area between the network and the client can be opened, and the viewers can participate in the discussion and vote at any time. After a variety of interactive media has become the "standard composition" of all media activities, how to win the fierce competition has high requirements for the structure, image design, and interactive logic of interactive media, among which art design is one of the important decisive factors. The art design of interactive media includes interactive logic and link design, interactive interface design, and interactive effect design. In the era of national media, consumers’ interactive needs are reflected in one question corresponding to one answer, and obtaining high-quality experience in audio-visual and psychological aspects. Therefore, the interaction of interactive media should perfectly reflect the artistry (Briggs et al. 2000). The beauty here is reflected in the originality of logic, the charm of plot, and the sense of pleasure.

In the past two years, many outstanding examples of interactive media have appeared in the television media. These are excellent in plot, interaction, and visual effect. For example, "China on the tip of the tongue" is essentially a documentary, which integrates both content and plot, so it integrates aesthetics and society. On the basis of traditional introduction and story, it introduces the ideological, economic development, geographical, and humanitarian changes of today’s society. We find the most suitable combination of audience and program, usually using real characters as the protagonists (Chen et al. 2010). The app can find standard logos for all audiences responding to social roles and geographic locations. The program went beyond the feast of food, it changed life and values (Chen et al. 2013). The ultimate effect of dissemination of the program is not only to thoroughly promote diet and beauty, but may also lead to the discussion of various real emotional views with the audience. In terms of visual effect, "China on the tip of the tongue" has reached a new height in Chinese documentaries. Both shooting skills and scene selection have a sense of aesthetic penetration, which is very good even in people’s familiar life. In the strong atmosphere of Chinese ink painting, the audience began to re-examine the surrounding details and the neglected scenes, and found the beauty and positive things of life (Huang et al. 2013).

From the above case analysis, we can see that the prominent feature of interactive media art design is based on the audience’s position or attitude and the content or form of communication. First of all, the design of content and plot should be simple and real. Through the popular interactive

| Table 3 | Standardized data of each index |
|---------|--------------------------------|
| ZX1     | ZX2 | ZX3 | ZX4 | ZX5 | ZX6 | ZX7 | ZX8 | ZX9 | ZX10 |
| I       | -1.45 | -0.86 | -1.37 | -1.14 | -0.67 | 0.28 | -1.91 | -1.51 | -1.85 | -0.41 |
| II      | -0.55 | -0.58 | -0.74 | -0.68 | 0.07 | 0.00 | 0.65 | -0.96 | 1.18 | 0.52 |
| III     | 0.65 | -0.31 | -0.11 | -0.01 | 0.91 | 1.50 | -0.02 | 0.61 | 0.16 | 1.03 |
| IV      | 0.08 | -0.17 | 0.54 | 0.11 | 1.38 | 0.40 | 0.63 | 0.96 | 0.16 | -1.46 |
| V       | -0.16 | 0.01 | 0.18 | -0.03 | -0.41 | -1.04 | 0.65 | 0.61 | 0.16 | -0.63 |
| VI      | 1.43 | 1.93 | 1.47 | 1.78 | -1.27 | -1.15 | -0.02 | 0.26 | 0.16 | 0.94 |

| Table 4 | Main component value and ranking |
|---------|----------------------------------|
| Community type | First principal component | Ranking | Second principal component | Ranking | The third principal component | Ranking | The fourth principal component | Ranking | Comprehensive principal component analysis | Ranking |
| I       | -1.05 | 5 | -1.71 | 6 | -0.22 | 3 | -0.13 | 4 | -1.01 | 6 | |
| II      | -1.21 | 6 | 1.25 | 1 | -0.31 | 4 | 0.74 | 2 | -0.23 | 5 | |
| III     | 0.34 | 3 | -0.11 | 4 | 1.54 | 1 | 0.97 | 1 | 0.45 | 2 | |
| IV      | 0.47 | 2 | 0.31 | 3 | 0.82 | 2 | -1.45 | 6 | 0.26 | 3 | |
| V       | 0.01 | 4 | 0.52 | 2 | -0.76 | 5 | -0.87 | 5 | -0.16 | 4 | |
| VI      | 1.44 | 1 | -0.26 | 5 | -1.07 | 6 | 0.73 | 3 | 0.60 | 1 | |
media, we capture the most profound and meaningful content of the contemporary audience. For example, in a variety show, economic and social development has an impact on children’s future, not only on their growth, but also on the relationship between parents and children (Isobe et al. 2005). Through the design of content and plot, it may have a significant impact on the lives of the closest people, but it is full of fun and commerce. This kind of art design far exceeds the traditional pure commercial design. Secondly, whether it is clothing, props, or audio-visual effects, it reflects the trend of fashion or brand, that is to say, the various elements used in the media are not just pure performance and expression. However, because “China on the tip of the tongue” has opened up a brand channel, what we have now is not a copy style, but an artistic style with unique regional personality and characteristics, and a popular business operation. Media and visual experience first fascinate the audience, and then have the following plots. Therefore, interactive media needs to impress the audience in terms of visual effects (Jassim et al. 2018). For example, the biggest visual effect of “if you are the one” is the beauty on the stage, while “China on the tip of the tongue” is the attraction of all kinds of food features. In the network and print media, the role of visual effect is more prominent. For example, simulated interactive programs are more attractive than flat interactive interfaces (Kim et al. 2019).

**Visual effect design of interactive media art design**

A variety of interactive media integrate multiple media formats and channels, including audio-visual, image, text, other formats, television, radio, network, and other channels. These forms and channels are independent and have no specific target groups (Krami et al. 2013). All consumers can access the same content on these media. Too many visual effects will bring aesthetic fatigue to the audience. Because of many similar visual effects, consumers feel parasitic. Interactive media requires consumer engagement and the demand for visual experience is growing.

The main reason why visual experience affects many interactive media art design is that consumers have sufficient rights to choose and evaluate the content of their communication. Since interactive media itself is a form of consumer media, such as communication with participants, does the consumer need to pay attention to the content of the communication, originality of content and plot, and particularly striking visual effects (Luvsan et al. 2012). Content and form can be imitated, but visual experience is specific to specific elements and cannot be copied to some extent. For example, dating shows are broadcast on various TV channels, but “if you are the one” still enjoys a high rating; one of the reasons is that the stage design is excellent, the guest image is excellent, and the visual experience of the viewer is more prominent (Lanzafame et al. 2015). When consumers have many choices, unique visual experience can hold the consumers’ eyes tightly. In addition to choices, it can also be spread through interaction with consumers and shared with friends or people with the same interests. Therefore, the visual experience of art design is neither benefit nor short-term, but it should be universal and symbolic, because it has been popular in some groups.

From the perspective of visual experience, the art design of various interactive media has prominent fixed elements, pursues the unity of style and form, and has universal and lasting popularity in the selection of design elements. First, because of the background of media integration, the media industry has lost the boundaries between physical industry and scale. As a result, some interactive media are emerging, and stage layout design and special effects must match the target symbols of communication (Lightowlers et al. 2008). Once established, they need to be maintained for a long time to impress consumers. Secondly, no matter which channel or location it is displayed, it must maintain a uniform style, and the phenomenon of image mismatch from different sources will not cause confusion of consumers. For example, traditional logos and symbols of CCTV are traditional font typesetting, but the development of network media has a significant visual impact, so CCTV redesigns all logos and fonts. However, no matter which channel it is on or where it appears, all logos and layouts are of a uniform style and can be recognized at one glance (Larson et al. 2007). Finally, you need to choose a persistent and popular element. In the era of media integration, it is undeniable that the changing is an undeniable fact that audiences become faster and faster by appreciating new things and hating old ones. Therefore, choosing a permanent and popular element can change the visual experience of media and gain a certain scale of audience in different time periods (Li et al. 2017).

**Conclusion**

Visual art design needs to communicate with the help of visual aids to benefit basic elements such as color and graphics. Therefore, the importance of vision cannot be ignored by human feelings. This paper analyzes the reflection and development strategy of interactive media from the perspective of soil erosion of mountain plants. Visual communication in art design mode realizes the communication between people through the specific function of visual mode, and conveys information according to the function of human eye. Specifically speaking, the means of information transmission in visual communication are graphics, images, texts, colors, and their typesetting. Visual communication designers express their own intentions and audience’s intentions and establish interpersonal relationships through visual media and visual language. The specific attitude of information exchange: visual communication is a way that people take action.
on people mainly through visual channels, which realizes the transmission of information between people. Visual communication is a two-way information communication method, which is lack of design and implementation. In this study, for the purpose of visual experience of mountain plants, we analyzed the soil characteristics, root characteristics, and shear characteristics of six types of people growing naturally in the root side uplift, and compared them with the shear characteristics of flat land. The factors affecting the increase of shear strength index value were analyzed by gray correlation method, and the soil fixed plants were screened by principal component analysis, which provided an effective density planting method for controlling soil erosion. At the same time, using the reduction factor method to calculate the finite element method, the stress distribution and calculation results of the homogeneous root model and the rigid root surface model are very similar. At first, the root model is a single line model, but it will become more complex if a multiline model is used.

**Declarations**

**Conflict of interest** The authors declare that they have no competing interests.

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