



# Analysis of the Influencing Factors of User Experience in Online Art Forms During the COVID-19—Based on the DEMATEL Method

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**Abstract.** This research aimed to investigate the relevant factors that influence users' choice of online art forms during the Covid-19 pandemic. The research used interview, questionnaire survey and literature research combined with factor analysis to summarize 10 major influencing factors on users' choice of online art forms. The depth interviews were deployed with Decision-Making Trial and Evaluation Laboratory (DEMATEL) questionnaires to evaluate the influencing directions and the degrees of the interactions among the 10 influencing factors.

The finding showed that three key factors that affect users' choice of online art form are performance-price ratio, required equipments and technical means, and these three factors can greatly affect other influencing factors. According to the influential relation diagram, three key influencing factors were used as entry points to fully explore the role and advantages of online art. A user satisfaction optimization model of online art service was proposed, aiming at providing a feasible way to enhance the user experience of online art, and to propose suggestions on optimizing online art forms. It is hoped that in the post-pandemic era, this research can help the online art continue to flourish and complement offline art forms to enrich the art field, and improve the art cognition level of the public.

**Keywords:** Online art forms · Consumer decision · DEMATEL method · User research

## 1 Introduction

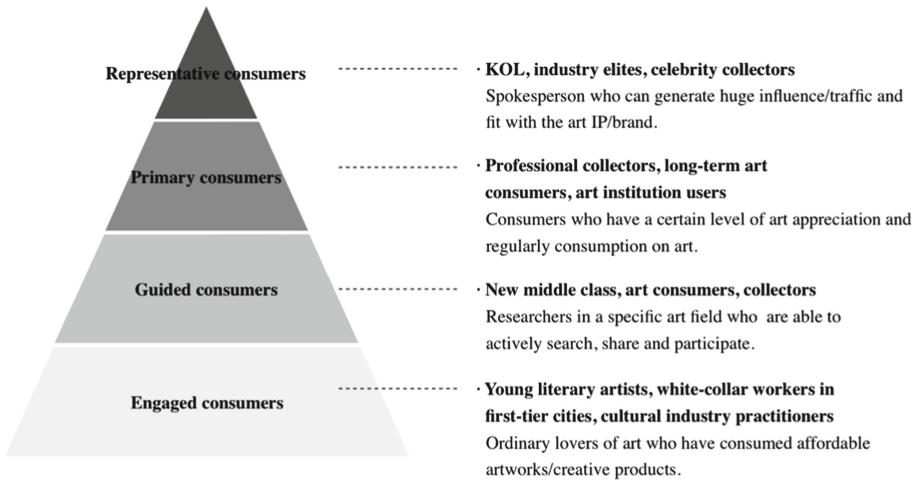
### 1.1 Background

In early 2020, the novel coronavirus (severe acute respiratory syndrome; SARS-CoV-2) pandemic had spread rapidly throughout the planet. China, Korea, Japan, Italy, the United States, the United Kingdom, and many other countries paid a heavy price in this sudden outbreak. In the process of raising the strength of the country and using various high-tech means to prevent and fight the pandemic, our country has paid a great price, but also achieved remarkable results.

Due to the need to prevent and control of the Covid-19 pandemic, museums and art galleries closed one after another, and many scheduled exhibitions and lectures were temporarily cancelled, bringing modern art activities to a standstill. To meet the public’s demand for exhibitions and visits, many museums, art institutions and performance venues launched ‘Cloud Exhibitions’ and ‘Cloud Performance’. Along with the postponed opening of the national education system and the cancellation of various offline courses, the ‘Cloud Classroom’ has emerged with the development of online teaching and live webcasting. These ‘Cloud Arts’ are diverse and rich in content. ‘Art is still there, just a different way to watch and participate.

From the perspective of art history, online art is a new visual derivative of traditional ‘offline art’, a new visual phenomenon in the context of the Internet, a cross-border and multi-dimensional interaction marked by visual images, and a grammatical revolution of visual art innovation [4]. Online art forms include digital museums, online exhibitions, online galleries, online art healing, online art auctions, online art classes, online concerts, art live streaming and so on, which have many advantages like break of time and space restrictions, strong audience interaction, two-way information transmission, low curation costs and high participants freedom. Online art can be optimized through a variety of advanced technologies, such as virtual reality technology, computer network technology, 3D hologram technology, visual and auditory special effects technology, interactive entertainment technology, etc., to optimize offline art forms into online art. New technology can present a variety of content reasonably and bring a multi-faceted sense of ‘immersion’.

As people’s pursuit of spiritual life increases, online art audience is gradually expanding and can be divided into the following four categories according to their preference for art and art consumption (Fig. 1).



**Fig. 1.** Classification of online art audience

## 1.2 Literature Review

The literature research is carried out through databases and search engines, primarily initiated through ScienceDirect, Web of Science, CNKI and Google Scholar but includes findings from papers reference sections as well. The research started from collecting studies from database, based on 4 keywords (“online art”, “art forms”, “online museum”, “user experience”), for the publication year range 2019 to 2020. The authors kept the relevant literatures according to the abstracts, and extracted from the articles about the introduction of online art and the factors influencing its user experience.

**Online Art Forms.** The sudden COVID-19 pandemic forced many national/regional governments to forcibly close all non-essential structures and activities. Art events of all kinds that could not be opened to the public had to resort to online means of disseminating culture and knowledge, which led to an acceleration of the digital transformation process. Online art, in simple terms, is the transformation of traditional offline art forms into online through digital means and the process may involve the use of new technologies and forms. Taking the digitization of museums as an example, the first approach is cultural education, in which the museum delivers cultural materials to the user. This is a one-way relationship involving the storyline of the artwork, expert presentations, etc. The second approach involves asynchronous interaction, in which a message or material is delivered to the user but does not require a response from the user. In this case, the relationship flows in two ways between the museum and the visitor, and it requires an (asynchronous) response from the user, despite being instigated by the museum. Finally, the third method is synchronous interaction, in which the museum and the visitor interact in real time. The relationship here is two-way, but it is simultaneous. It includes real-time interactions between the museum and the students/children, as well as educational activities organized with the museum, etc.

According to statistics from the National Cultural Heritage Administration of China, during the Spring Festival, museums nationwide conducted more than 2,000 online exhibitions, and more than 1,300 cultural and art expo venues opened online exhibitions [1]. On March 5, 2020, the Art App launched the “Spring 2020-Collect + Art Week” online event, in which a total of 33 galleries, 27 art galleries and 24 auction houses participated, collaborating with many partners and brands to discuss the art industry’s “Collaboration and Power” model [2]. At the same time, there are also online participatory art practices for COVID-19 in the form of drawings, posters, newspaper clippings and music releases on platforms such as Kuaishou, tiktok and WeChat, showing sincerity and support for the frontline staff of COVID-19 [3], and in so doing they produce alternative media that is more informative, conscientious, and consoling than the state media [4].

Foreign studies have shown that social media platforms have become the preferred means for museums to spread their culture during the COVID-19 lockdown in Italy. Museum-related online activities have also increased significantly due to the availability of digital tools. The data showed that online activities on all social media platforms has doubled since Italy went into embargo in March 2020. On average, museums make 25 prior posts per month on Facebook, but that increased to 40 by March. On Twitter, the first 32 posts per month increased to 60, while on Instagram they more than doubled, from 15 to 33 per month per museum [5]. Not only have museums increased their online

activity, but they have also changed the content sent through these channels. From mere tools of communication, social media have evolved into tools for spreading knowledge. For example, some museums have used Facebook to share information about an artwork and to reveal certain or other unknown aspects about that artwork. Other museums have arranged for expert interviews or guided tours with the museum director. Others have opted for a more ‘playful’ approach, running virtual treasure hunts among the museum’s collections or organizing quiz events. The Ministry for Cultural Heritage has also stimulated creativity in social initiatives, joining in with virtual culture-related flashmobs and inviting museums to take part, and these museums have, in turn, galvanised cultural participation.

The COVID-19 pandemic has also led to a decline in face-to-face art therapy and has contributed to a widespread shift to remote delivery by some art therapists. More generally, digital technology is increasingly being used to deliver health care services remotely. Studies of online art therapy in both the Arab region and the UK have shown that the COVID-19 pandemic has assisted in the development of online art therapy services, with many therapists able to respond immediately to the new demand for remote service provision to ensure continuity of treatment for their clients. More than three-quarters of respondents felt more comfortable using technology than before, suggesting that new ways of working, while challenging, can allow for greater familiarity with digital technology, and more than 90% of respondents said they would continue to practice distance therapy to some degree, providing greater coverage of art therapy in the region [6, 7].

Another new model we found was an increased opportunity for children to participate in cultural and arts-related experiences through an open-door policy of virtual museums, art galleries, and live performances for children. Parenting blogs and websites recommend free online museum tours around the world, including the Louvre in Paris, France; the Uffizi Gallery in Florence, Italy; the British Museum in London, England; and the U.S. National Gallery of Art in Washington, D.C. Online museum tours are available to everyone connected via the Internet no matter where they are, and they offer children in the United States the opportunity to interact with art. In Korea, the National Museum of Korea, as well as the Seoul Museum of Art, the SAVINA Museum and the Daz Museum of Art have also opened online exhibitions with curators in response to school closures. Another source of relief may be cinemas, with the Korean government providing over 200 million won to the Busan Film Center for an online art education program for children and teenagers [8].

**Influencing Factors of Online Art Forms.** Because of the differences in the extent of the pandemic and the period of severity of the pandemic at home and abroad, and the variability in ethnicity and geography, etc., and considering the selection of subsequent subjects, this study was analyzed and summarized with a focus on the literature and the current situation in China.

Regarding the influencing factors of online art, in the analysis of the characteristics of online art exhibitions under the influence of the COVID-19 pandemic, four elements of exhibition content diversification, richness, uniqueness, and popularization of publicity are mentioned [1]. An article on online art sales mentions that the online content itself and the fluidity of the experience are more important in planning the campaign, and that

interactivity, freedom of time and space, transparency of information, and presentation also have an impact [2]. In a study on the application of digital technology in museum exhibitions, the authors argue that factors such as exhibit display effect, information transferability, interactivity, interestingness, personalization, experience realism, mobilization of multiple senses such as visual, auditory and tactile, and real-time share ability have a greater impact [9]. In the study of the Internet on the operation of art museums, the authors believe that low energy consumption, intelligent and share ability are the advantages of online art, and that in the process, attention needs to be paid to factors such as the user experience, the degree of content optimization and knowledge dissemination [10]. However, most studies have been conducted from a certain perspective or on a particular online art form, and do not involve the user's decision making process, which does not provide a complete and clear overview of the whole problem and its internal structure. Therefore, this study hopes to conduct a comprehensive analysis of the issue of users' choice of different online art forms during the pandemic with the help of the Decision-Making Trial and Evaluation Laboratory method.

### **1.3 Research Purpose**

In order to fully understand the relevant factors influencing users' choice of online art forms, explore the advantages of online art during the pandemic, and then discuss the content and future enhancement directions that need to be paid attention to when holding online art. It is hoped that in the post-pandemic era, online art will continue to flourish and complement offline art forms to enrich the art field. Based on the online art process and combining literature research and user research, this study summarized the relevant factors that influence users' choice of online art forms and used the Decision-Making Trial and Evaluation Laboratory method to analyze the relationship between factors that influence users' choice of different online art forms and their degree of importance.

## **2 Analysis of Factors Influencing Users' Choice of Different Online Art Forms**

### **2.1 Summary of Factors Influencing Users' Choice of Different Online Art Forms**

Based on the literature search, the following 28 preliminary influencing factors (PIF) for users to choose different online art forms were summarized from four aspects: online art factors, user factors, service factors, and promotion factors as shown in Table 1.

**Table 1.** Preliminary summary of the preliminary influencing factors for users to choose different online art forms

| Number | Dimension    | Influencing factors      | Description of factors  |
|--------|--------------|--------------------------|---|
| 1      | Online art   | Online art types         | Types of online art, such as exhibitions, auctions, concerts, etc.                                  |
| 2      | Online art   | Online art contents      | Content of online art, such as artifacts, music, courses, etc.                                      |
| 3      | Online art   | Online art background    | The cultural, historical, environmental and other contexts in which online art content is generated |
| 4      | Online art   | Interactivity            | The interactivity and engagement of the audience in online art                                      |
| 5      | Online art   | Uniqueness               | The uniqueness of online art content  |
| 6      | Online art   | Immersion                | The audience's level of engagement in sensory and cognitive experiences                             |
| 7      | Online art   | Interestingness          | The fun of the online art content, the fun of the audience experience process                       |
| 8      | Online art   | Preciousness             | The preciousness of online art content  |
| 9      | Online art   | Environmentalism         | Environmental protection of online art content and display process                                  |
| 10     | Online art   | Quality-price ratio      | The matching degree of price and the quality of online art  |
| 11     | Online art   | Multi-sensory experience | Mobilize the audience's vision, hearing, touch, smell and other senses                              |
| 12     | User factors | Gender                   | Differences of audience's gender  |
| 13     | User factors | Age                      | Differences of audience's age   |
| 14     | User factors | Monthly income           | Differences of audience's monthly income  |
| 15     | User factors | Career                   | Differences of audience's career  |

*(continued)*

**Table 1.** (continued)

| Number | Dimension         | Influencing factors                  | Description of factors   |
|--------|-------------------|--------------------------------------|--|
| 16     | User factors      | Education level                      | Differences of audience's education level  |
| 17     | User factors      | Artistic preference                  | Differences in audience's preferences for art type, content, presentation, etc.                                  |
| 18     | User factors      | Artistic awareness                   | Differences of audience's art cognitive level, aesthetic level, etc.   |
| 19     | User factors      | Experience of online art             | Experience of audience's participation in the online art   |
| 20     | Service factors   | Technical means                      | Technology for demonstration and form of presentation, such as VR, AR, panorama, live streaming, etc.            |
| 21     | Service factors   | Presentation effect                  | The final presentation of the online art form  |
| 22     | Service factors   | Organizers                           | Types of organizations holding online art, popularity, etc.  |
| 23     | Service factors   | Duration                             | Duration of online art   |
| 24     | Service factors   | Required equipments                  | Equipments required for audience's participation in online art, such as cell phones, computers, VR glasses, etc. |
| 25     | Service factors   | Network Status/Experience smoothness | Requirements for network conditions in online art forms  |
| 26     | Promotion factors | Multimedia promotion                 | Diversity of promotional channels, such as physical and video advertising, etc.                                  |
| 27     | Promotion factors | Promotion efforts                    | Diversity of publicity platforms, length of publicity, availability of celebrity promotion, etc.                 |
| 28     | Promotion factors | Audience groups                      | Differences in the audience for publicity  |

## 2.2 Screening of Factors Influencing Users' Choice of Different Online Art Forms

Since an excessive number of preliminary influencing factors will result in homogeneity of factors and bring about the problem of lack of accuracy of the subsequent survey data, this study used factor analysis to extract important factors from the above 28 factors that

influence users' choice of different online art forms as the main influencing factors (MIF) of the research construct.

The degree of influence of each of the above 28 factors on online art forms was collected through one-on-one interviews and used to study the importance of the influencing factors and the extraction of principal components. Seventeen users, aged 20–50 years old, distributed in different professions and different occupations, were selected to ensure the objectivity of the interviews. The interview process began with a detailed description of the 28 factors, followed by asking the interviewees to select the 10–15 factors they felt had the greatest impact on the online art forms. Any doubts during the process were answered immediately. Based on the interview results, the final summary of the 10 main influencing factors (MIF) for users to choose different online art forms is shown in Table 2. Based on the external and internal factors of online art forms, the 10 main influencing factors are the three dimensions of online art, user factors and service factors.

**Table 2.** Main influencing factors for users to choose different online art forms

| Number | Dimension       | Influencing factors      | Description of factors   |
|--------|-----------------|--------------------------|--|
| 1      | Online art      | Online art contents      | Content of online art, such as artifacts, music, courses, etc.   |
| 2      | Online art      | Uniqueness               | The uniqueness of online art content   |
| 3      | Online art      | Immersion                | The audience's level of engagement in sensory and cognitive experiences  |
| 4      | Online art      | Quality-price ratio      | The matching degree of price and the quality of online art   |
| 5      | Online art      | Multi-sensory experience | Mobilize the audience's vision, hearing, touch, smell and other senses   |
| 6      | User factors    | Artistic preference      | Differences in audience's preferences for art type, content, presentation, etc.                                  |
| 7      | User factors    | Artistic awareness       | Differences of audience's art cognitive level, aesthetic level, etc.   |
| 8      | Service factors | Technical means          | Technology for demonstration and form of presentation, such as VR, AR, panorama, live streaming, etc.            |
| 9      | Service factors | Presentation effect      | The final presentation of the online art form  |
| 10     | Service factors | Required equipments      | Equipments required for audience's participation in online art, such as cell phones, computers, VR glasses, etc. |



### 2.3 DEMATEL Procedure

Decision-Making Trial and Evaluation Laboratory (DEMATEL) method is often used to analyze the complex relationship between management problems. It is a methodology put forward by Battelle Geneva Research Center in 1971 to solve the complex and difficult problems between science, technology and human beings in the real world and clarify the essence of the problems [11]. It is a method of system analysis using graph theory and matrix tools [12]. The DEMATEL procedure in this study is carried out in the following steps: (1) identifying the main influencing factors that impact the users' choice of online art forms; (2) collecting opinions of target users to estimate the influence of factors on each other using the DEMATEL questionnaire with one of five level values; (3) generating the direct relation matrix Z; (4) Calculating the  $\lambda$  value, the normalized direct relation matrix and the direct/indirect relation matrix T; (5) From the direct/indirect relation matrix, obtaining the corresponding Prominence value (D + R), and Relation value (D - R) of each influencing factor; (6) obtaining the influence relation map (IRM) with (D + R) value and (D - R) value of each influencing factor to help observe the interrelationship structure.

**Questionnaire and Data Statistics.** The 10 main influencing factors of users' choice of different online art forms were formed into a 10\*10 matrix of rows and columns in DEMATEL questionnaire. The DEMATEL questionnaire is used to estimate the direction of interaction and the degree of relative priority of each factor listed in first column to each factor listed in first row. The relationships between the factors in the rows and columns are defined as five levels, i.e., value '0' means "no impact", value '1' means "low impact", value '2' means "distinct impact", value '3' means "big impact", and value '4' means "extreme impact".

The questionnaire survey was screened by the control of questionnaire filling time and the restrictions of age and whether wired on art experience, and 31 pieces of effective data were calculated based on the following equation to obtain the direct relation matrix Z.

$$Z = \frac{1}{n} \sum_{m=1}^n [z_{ij}^m], \quad ij = 1, 2, 3, \dots, k. \quad (1)$$

The questionnaire data were organized and normalized to obtain the normalized direct relation matrix as shown in Table 3.

**Table 3.** Normalized direct relation matrix

|    | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1  | 0.000 | 0.095 | 0.092 | 0.111 | 0.086 | 0.076 | 0.080 | 0.080 | 0.102 | 0.099 |
| 2  | 0.090 | 0.000 | 0.095 | 0.111 | 0.107 | 0.074 | 0.090 | 0.097 | 0.092 | 0.109 |
| 3  | 0.078 | 0.092 | 0.000 | 0.099 | 0.090 | 0.088 | 0.113 | 0.088 | 0.074 | 0.088 |
| 4  | 0.086 | 0.105 | 0.111 | 0.000 | 0.128 | 0.109 | 0.105 | 0.113 | 0.120 | 0.122 |
| 5  | 0.092 | 0.103 | 0.097 | 0.105 | 0.000 | 0.090 | 0.105 | 0.086 | 0.074 | 0.086 |
| 6  | 0.065 | 0.086 | 0.078 | 0.090 | 0.084 | 0.000 | 0.069 | 0.090 | 0.071 | 0.107 |
| 7  | 0.080 | 0.084 | 0.080 | 0.090 | 0.078 | 0.076 | 0.000 | 0.103 | 0.069 | 0.103 |
| 8  | 0.109 | 0.118 | 0.099 | 0.113 | 0.101 | 0.109 | 0.107 | 0.000 | 0.101 | 0.095 |
| 9  | 0.090 | 0.103 | 0.086 | 0.090 | 0.086 | 0.080 | 0.101 | 0.097 | 0.000 | 0.088 |
| 10 | 0.099 | 0.109 | 0.092 | 0.116 | 0.109 | 0.113 | 0.111 | 0.109 | 0.097 | 0.000 |

Users only estimated the direct influence of factors on each other. Hence, the direct/indirect relation matrix T is obtained from matrix X by applying the transition theory and summing up all direct and indirect effects. The direct/indirect relation matrix T (Table 4) was derived, by using Eqs. (2)–(4). Matrix X is the normalized direct relation matrix, and I is the identity matrix.

$$X = [x_{ij}]_{k \times k} = sZ \tag{2}$$

$$s = \min \left( \frac{1}{\max_{1 \leq j \leq k} \sum_{i=1}^k z_{ij}}, \frac{1}{\max_{1 \leq j \leq k} \sum_{j=1}^k z_{ij}} \right) \tag{3}$$

$$T = \lim_{m \rightarrow \infty} (X + X^2 + \dots + X^m) = X(1 - X)^{-1} \tag{4}$$

The upper quartile Q3 of all the elements in the total relations matrix T (keep 3 decimal places), i.e., 0.652, is taken as the threshold to measure the strength of interactions between factors. If all values in the row and the column that correspond to a factor in the matrix T are below the threshold value, this factor and the corresponding row and column will be removed. So the ‘1 online art content’ factor was deleted.

Then, the upper third of Q3 (0.707) is taken as the boundary value of strong influence relation and general influence relation. Values higher than 0.707 are considered as strong influences, and values between 0.701 and 0.652 are considered as general influences. As shown in Table 6, the general influences are marked with bold type, and the strong influences are marked with underlines.

Value D and R are achieved by summing up the rows and columns of total relation matrix T, using Eqs. (5)–(6).

$$D_i = \sum_{j=1}^n t_{ij}, (i = 1, 2, 3, \dots, n) \tag{5}$$

**Table 4.** The direct/indirect relation matrix T

|    | 1     | 2            | 3            | 4            | 5            | 6            | 7            | 8            | 9            | 10           |
|----|-------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1  | 0.474 | 0.618        | 0.581        | 0.649        | 0.599        | 0.560        | 0.600        | 0.590        | 0.573        | 0.623        |
| 2  | 0.582 | 0.559        | 0.609        | <b>0.677</b> | 0.644        | 0.583        | 0.636        | 0.630        | 0.590        | <b>0.659</b> |
| 3  | 0.539 | 0.607        | 0.489        | 0.629        | 0.594        | 0.562        | 0.619        | 0.589        | 0.541        | 0.606        |
| 4  | 0.645 | <u>0.729</u> | <b>0.692</b> | <b>0.654</b> | <u>0.734</u> | <b>0.682</b> | <u>0.722</u> | <u>0.717</u> | <b>0.679</b> | <u>0.744</u> |
| 5  | 0.566 | 0.632        | 0.592        | <b>0.652</b> | 0.527        | 0.579        | 0.628        | 0.602        | 0.556        | 0.621        |
| 6  | 0.495 | 0.565        | 0.526        | 0.584        | 0.553        | 0.447        | 0.545        | 0.554        | 0.505        | 0.584        |
| 7  | 0.519 | 0.576        | 0.539        | 0.597        | 0.559        | 0.529        | 0.492        | 0.576        | 0.515        | 0.593        |
| 8  | 0.638 | <u>0.711</u> | <b>0.655</b> | <u>0.726</u> | 0.683        | <b>0.655</b> | <b>0.695</b> | 0.587        | 0.638        | <b>0.694</b> |
| 9  | 0.556 | 0.623        | 0.574        | 0.630        | 0.597        | 0.561        | 0.615        | 0.602        | 0.478        | 0.613        |
| 10 | 0.633 | <u>0.707</u> | <b>0.653</b> | <u>0.731</u> | <b>0.693</b> | <b>0.662</b> | <b>0.701</b> | <b>0.689</b> | 0.637        | 0.611        |

represents all values in the row and the column that correspond to a factor in the matrix T are below the threshold value

Bold type represents general influences

Underline represents strong influences

$$R_i = \sum_{j=1}^n t_{ij}, (i = 1, 2, 3, \dots, n) \tag{6}$$

Value D is called the degree of influential impact, and value C is called the degree of influenced impact.  $D_i$  is the sum of the  $i$ th row of matrix T and represents all the direct and indirect effects which are dispatched from Factor  $i$  to other factors. And  $R_j$  is the sum of the  $j$ th column of matrix T and represents all the direct and indirect effects that Factor  $j$  receives from the other factors [13].

The prominence value (importance) played by the factor in a system is represented by  $(D + R)$  value, where  $(D - R)$  value stands for the net effect (i.e. the degree of importance) of the factor contributed to the system. The factors are categorized into two groups of cause (driver) and effect (receiver) factors.

When the  $D + R$  value is higher, it indicates that the factor is more important in the overall evaluation factors. Table 5 shows that the four factors with higher than average centrality are, in descending order: quality-price ratio, required equipments, technical means, and uniqueness, and the above factors are the core factors that influence users' choice of different online art forms.

If the  $(D - R)$  value of a factor is positive, this factor is grouped under the category of driver factors which has an influence on other factors; if the value of  $(D - R)$  is negative, this factor is grouped under the category of receiver factors which receives influence from other factors. technical means, quality-price ratio, required equipments, and presentation effect are driver factors, while others are receiver factors.

The value  $(D + R)$ ,  $(D - R)$  of factors were listed in Table 5.

**Table 5.** Prominence  $(D + R)$  and Net effect  $(D - R)$  values.

|                            | Prominence $(D + R)$ |                            | Net effect $(D - R)$ |
|----------------------------|----------------------|----------------------------|----------------------|
| 4 Quality-price ratio      | <b>13.529</b>        | 8 Technical means          | 0.547                |
| 10 Required equipments     | <b>13.065</b>        | 4 Quality-price ratio      | 0.470                |
| 8 Technical means          | <b>12.818</b>        | 10 Required equipments     | 0.370                |
| 2 Uniqueness               | <b>12.498</b>        | 9 Presentation effect      | 0.136                |
| 5 Multi-sensory experience | 12.139               | 3 Immersion                | -0.136               |
| 7 Artistic awareness       | 11.750               | 2 Uniqueness               | -0.158               |
| 3 Immersion                | 11.686               | 5 Multi-sensory experience | -0.230               |
| 9 Presentation effect      | 11.563               | 6 Artistic preference      | -0.462               |
| 6 Artistic preference      | 11.179               | 7 Artistic awareness       | -0.759               |
| Average value of $D + R$   | 12.174               |                            |                      |

Bold type represents exceeding the average value

**The Influential Relation Diagram.** The influential relation diagram can be plotted in the  $(D_i + R_{i,i} - R_j)$  layout, using  $(D_i + R_i)$  as the horizontal axis and  $(D_i - R_i)$  as the vertical axis. Ten main influencing factors are marked in the coordinate axis, and the influential relation diagram is made. According to the position of each factor in the diagram, the ones which have a great effect on other factors or have a complicated relationship with other criteria can be found.

The factors under different dimensions are distinguished by different colors in the figure, orange indicates the online art own attribute dimension, blue indicates the user dimension, and green indicates the service dimension.

The relationship with the influence strength lower than 0.652 will not be marked. The relationship with the influence strength between 0.652 and 0.707 will be regarded as general influence and marked with dotted line; the relationship with the influence strength greater than or equal to 0.707 will be regarded as strong influence and marked with solid line. The direction of the arrow indicates the direction in which one factor affects the other factor. The specific location of each factor is shown in Fig. 2.

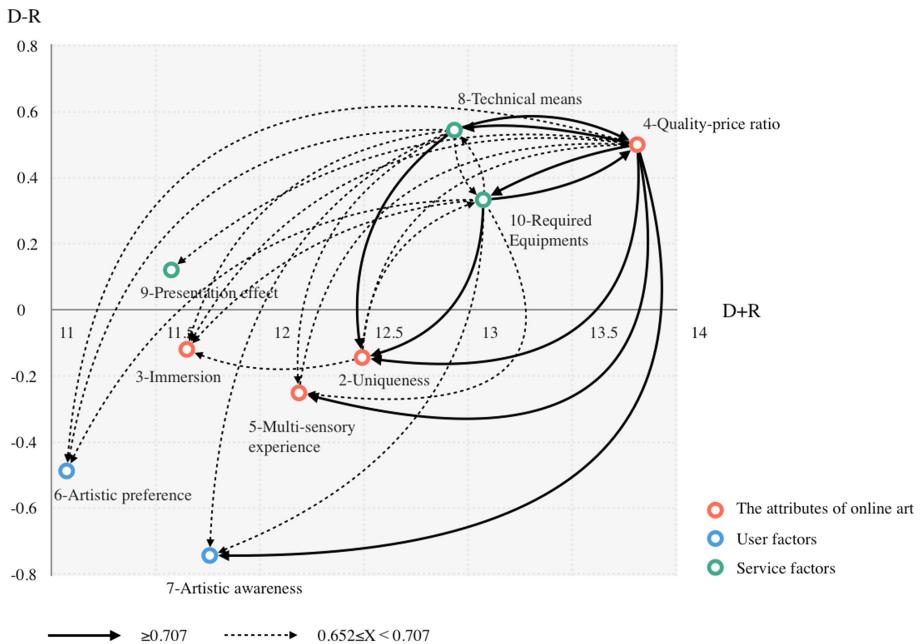


Fig. 2. The influential relation diagram of 10 influencing factors for users to choose different online art forms.

### 2.4 Discussion

**Key Factors for Users to Choose Different Online Art Forms.** Table 6 lists the top three and bottom three of prominence (D + R) and net effect (D – R). The top three of D + R are quality-price ratio, required equipments, and technical means, which are the three factors that have the greatest impact on users’ choice of different online art forms and other factors, with the quality-price ratio factor having the largest D + R value and being the most important factor influencing online art decisions and requiring significant consideration. The three factor of immersion, presentation effect, and artistic preference have the smallest D + R and less overall impact.

The top three D-R rankings are technical means, quality-price ratio, and required equipments, which are more likely to influence other factors and are driver factors. The bottom three D-R rankings are Multi-sensory experience, artistic preference, and artistic awareness, which are more likely to be influenced by other factors and are receiver factors. The factor of uniqueness is not listed in the table, but it has a higher prominence and lower net effect, and the influence of other factors on uniqueness can be considered to influence users’ decision.

**Analysis and Discussion.** The influential relation diagram shows that the service factors have a stronger influence on the attributes of online art itself, while the technical means and the required equipments will have a stronger influence on the three factors of immersion, uniqueness and multi-sensory experience. The user factors, on the other hand, are vulnerable to other factors. Among them, the factor of quality-price ratio has

**Table 6.** Key influencing factors for users to choose different online art forms

| The top three factors in (D + R)   | The last three factors in (D + R)   |
|------------------------------------|-------------------------------------|
| 4 quality-price ratio              | 3 immersion                         |
| 10 required equipments             | 9 presentation effect               |
| 8 technical means                  | 6 artistic preference               |
| The top three factors in D – R > 0 | The last three factors in D – R < 0 |
| 8 technical means                  | 5 Multi-sensory experience          |
| 4 quality-price ratio              | 6 artistic preference               |
| 10 required equipments             | 7 artistic awareness                |

a strong interaction with many other factors and is the easiest aspect to improve. The required equipments and the technical means are also two factors with high prominence and net effect that have a strong impact on the decision process and are two issues that could be improved.

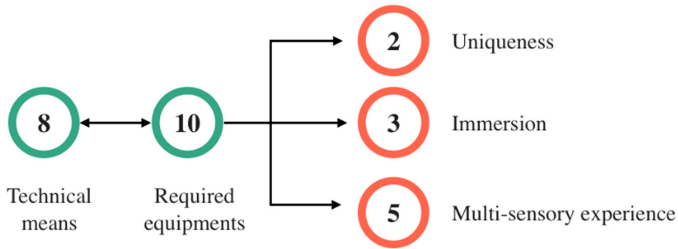
The following analysis and recommendations were made based on the influential relation diagram:

*Enriching Online Art Presentation Forms and Enhancing Online Art Experience.* From the influence relationship diagram, it is clear that the two factors of technical means and required equipments are at the core and have a strong influence on other factors, especially the decision-making process, which will directly affect the final presentation of online art and thus the user's sense of experience.

It is suggested that emerging digital technologies such as virtual reality, augmented reality, and panoramic scanning can be introduced when presenting art online content. These technologies can digitize and store offline art, break the restrictions of venues, spaces, and personnel, realize high freedom art dissemination, and effectively display art contents within a certain spatial range through the network and mobile terminal devices, which can maximize the expression effect. In this kind of presentation, users can get closer to the artwork, observe and understand the details in all aspects, and have a better sense of immersion and interactivity.

In the process of art display, the application of digital technology establishes a connection between the audience and the artwork, transforming the traditional "one-way" information transfer into a 'two-way' information transfer. The audience can interact in the process of enjoying online art, and establish the best virtual environment in multiple senses such as sight, sound and touch, and finally provide users with a real display environment, making the audience immersive, to a certain extent, to get the best real experience (Fig. 3).

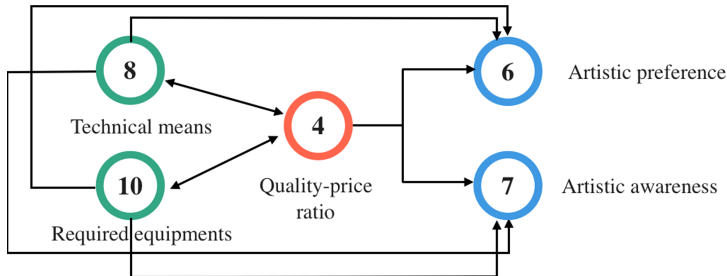
*Improving the Quality-Price Ratio of Online Art and Expanding the Scale of Engaged Consumers.* In the influence relationship diagram, the factor of quality-price ratio has a strong influence relationship with many other factors, so it is considered to start from quality-price ratio to influence users' choice of different online art forms.



**Fig. 3.** Interrelationship diagram of factors 2, 3, 5, 8 and 10

First of all, quality-price ratio and technical means, the required equipments both have a strong influence relationship with each other, so it is possible to use lower cost technical means and presentation equipments to lower the price for users to participate in online art and attract more engaged consumers and guided consumers to experience online art.

Secondly, the three factors of quality-price ratio, technical means, and the required equipments all influence the user's artistic preference and artistic awareness. So appropriately lowering prices of online art, such as launching free art activities, increasing online art student discounts, and releasing online art discount tickets for seconds, can attract more art enthusiasts to experience multiple art forms, expand the scale of engaged consumers, and raise the overall art cognition level of society (Fig. 4).



**Fig. 4.** Interrelationship diagram of factors 4, 6, 7, 8 and 10

### 3 Conclusion

This study identified the main factors influencing users' choice of online art forms during the COVID-19 pandemic, used DEMATEL method to analyze the interrelationships of 10 main influencing factors. It was clarified that the main three key factors influencing users' choice of online art forms were quality-price ratio, required equipments, and technical means. Based on the influence relationship diagram, these three key influencing factors were used as entry points to propose suggestions on optimizing online art forms. This was of great significance for developing the online art market in China in the post-pandemic

era, optimizing the sense of user experience, and raising the level of art awareness in society.

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