WILEY | Hindawi

*Research Article*

# Study on the Path of Continuous Participation of Digital Art in Public Space in 6G IoT Communication

**Xu Jiang** ⓘ**, Feng Wang, and Ziwen Jiang**

*School of Design Jiangnan University, Wuxi 214122, China*

Correspondence should be addressed to Xu Jiang; 7200306012@stu.jiangnan.edu.cn

With the intervention of digital art in recent years, the quality and vitality of urban public space have been greatly enhanced. However, with the wide application of digital art and the gradual maturity of communication technology, especially in the upcoming 6G era, the application scenario of digital art will be an extension of the "line" to "surface" and then to "body." Digital art design is no longer a single surface or a single dimension, but a comprehensive design in terms of the breadth and depth of information; the network and the user are seen as a unified body, and the user's needs will be deeply explored and realized. With the most cutting-edge means of communication, artificial intelligence, and big data, these technologies and art merge to create a new way to appreciate art. To this end, digital art will also be in this artificial intelligence and human intelligence in a harmonious symbiosis of the environment in the depth of the user's needs and the formation of a new dimension of interaction. Based on the "five-in-one" theory, the study introduces media literacy, technology acceptance model, and user experience theory as influencing factors and explores the influence of emotional experience, interaction experience, sensory experience, perceived usefulness, perceived ease of use, and media literacy on users' willingness to continuously participate through qualitative comparative analysis. The results of the study show that there are three paths that influence users' willingness to continuously engage, namely, affective experience∗interactive experience∗sensory experience∗perceived usefulness∗perceived ease of use; affective experience∗interactive experience∗perceived usefulness∗perceived ease of use∗ perceived entertainment∗medium literacy, and ∼ affective experience∗interactive experience∗sensory experience∗~perceived ease of use∗perceived usefulness∗medium literacy. The paths suggest that users' willingness to sustain participation is influenced by a variety of factors, among which interactive experience and perceived usefulness are essential factors affecting the users' willingness to participate. User participation is an important manifestation of the vitality of urban public space, and the analysis of the factors influencing users' willingness to sustain participation provides theoretical guidance for the design and application of digital art in the upcoming Internet of everything space.

## 1. Background

6G, the sixth generation mobile communications standard, is also known as the sixth generation of mobile communications technology. 6G networks are capable of using higher frequencies than 5G networks, beginning to move toward terahertz communications and offering higher capacity and lower latency, and one of the goals of 6G networks is to support 1 microsecond or even sub-microsecond latency communications. 6G may have a 100-fold increase in transmission capacity over 5G and is expected to support speeds of 1 Tbps. This level of capacity and latency will be unprec-edented, and it will enhance the performance of 5G applications and extend the range of capabilities. 5G begins deployment in 2019 and is expected to be the dominant mobile technology by 2030. 6G networks will be aimed at creating a world of fully connected communications that integrates terrestrial, satellite, and ocean communications [1] in deserts, uninhabited areas, oceans, and other areas where today's mobile communications systems cannot achieve continuous coverage. 6G will be applied to space communication, intelligent interaction, tactile Internet, emotional and tactile communication, multisensory mixed reality, intermachine collaboration, and fully automated

traffic [2]. China officially launched the research and development of 6G technology under the organization of the Ministry of Science and Technology, Development and Reform Commission, and other ministries. According to Liu Guangyi, the chief expert of China Mobile Research Institute, 5G brings the Internet of everything, and 6G will help the whole society to move towards a digital twin world of the real and the virtual [3]. 5G comprehensive construction has prompted libraries to move from information interaction to information ubiquity, and 6G advance layout makes it possible to move from information ubiquity to perception ubiquity and intelligence ubiquity. In this complex information environment, the future of urban public space should become an important issue of concern and planning for the industry. While the wave of technologies such as big data, Internet of things, and artificial intelligence is sweeping the world, digital twin technology has been listed in Gartner's top 10 strategic technology trends for four consecutive years since 2016 and is believed to have a disruptive impact on society, individuals, and existing technologies in the 6G era. Currently, this technology is widely used not only in aerospace and smart manufacturing but also in smart cities, such as the Xiongan New Area planning outline in April 2018, which proposes to build a "digital twin city" [4]. When the future 6G era comes, "human-machine-object-environment" spatial communication, holographic intelligent interaction, haptic and emotional communication, intelligent machine coordination, multisensory mixed reality, and body domain network in physical and virtual space become reality; in what form will the deep integration of digital technology and art reshape the intelligent application of public space? What is the pattern? This series of questions is worth thinking about and laying out in advance.

Since the reform and opening up, the market-oriented economy has brought about rapid urbanization, and the original urban development relied on industry, and industrial development drove urban development. In recent decades of urban development, the development of real estate is also accelerating the process of urbanization, which also brings many problems. Real estate developers developed a large number of new districts by acquiring land and building and selling houses, a model characterized by high visibility and accelerated urbanization, but it is not sustainable. This has led to a situation where the number of existing housing units far exceeds the number of people in several times, and this has resulted in many empty cities, ghost cities, and large amounts of vacant land. This is why China is currently implementing urban renewal initiatives to transform the way it builds cities. The core of urban renewal is content, not exactly a change of urban appearance or space, but essentially promoting the continuous improvement of urban vitality. Microrenewal and microrenovation projects, especially proposed in many communities, are about transforming a large number of original, single-function public space into public space with complex functions, thus meeting the needs of the audience.

Zaxi and Feng took twelve major cities in Hubei Province as an example and used the combination of fuzzy comprehensive evaluation and information entropy to construct a relatively scientific and perfect urban vitality evaluation index system from three levels: comprehensive urban vitality, urban vitality system, and urban vitality system elements [5]. Xiang et al. used cell phone big data as an example to conduct a comprehensive evaluation of park vitality in Nanjing City parks [6]. Shenglan et al. combined entropy theory with fuzzy element theory and established a fuzzy element model based on entropy power for urban vitality evaluation, which provided a comprehensive method for urban vitality evaluation considering multiple factors [7]. With the development of information technology, especially with the popularity of 5G era, artificial intelligence, and Internet of things, the renovation and improvement of urban public space not only start from green landscape, functional improvement, and spatial renovation but also gradually introduce intelligent and novel media to close the relationship between space and people, bringing more imagination and feasibility to urban public space.

Through the measurement and evaluation of urban vitality, the quality and distribution characteristics of urban space are examined, and a new perspective is provided for optimizing the layout and form of towns. The evaluation system has both individual index evaluation such as cultural vitality and economic vitality [8, 9] and comprehensive evaluation by combining fuzzy comprehensive evaluation with information entropy and constructing an entropy-weight-based fuzzy object metric urban vitality evaluation model [10, 11]. Traditional metric analysis is usually based on questionnaires and expert scoring, and the data acquisition and accuracy are restricted [12]. With the booming development of big data, significant progress has been made in measuring street and neighborhood vitality, vitality areas, virtual spatial vitality, and spatial patterns using geographic big data such as points of interest, cell phone base stations, Wi-Fi connection data, and location check-in data [13–17]. The introduction of spatial analysis and model construction methods in recent years has provided relatively adequate technical means to study the influencing factors of spatial differentiation of urban vitality, and studies have mostly been conducted by constructing multiple linear regression, spatial autoregression and spatial lagged regression, and geographically weighted regression models [18] from internal urban elements, which in turn provide valuable references for effectively enhancing urban vitality.

Current urban public space renewal and enhancement not only start from green landscape, functional improvement, and spatial reshaping but also gradually introduce intelligent and novel media to bring closer the relationship between space and people and bring more imagination to the urban public space. However, research on the vitality of urban public space driven by new media is still in its preliminary stage. Although there are numerous practical projects on the application of new media in the renewal of urban public space, many problems in the implementation process cannot be solved by previous theories; in particular, many one-size-fits-all expressions have been produced. The new media can enhance the vitality of public space in the short term, but it cannot be maintained in the long term. The focus of the current research is how to drive the vitality

of public space in a localized way to form the characteristics of the field. Kenneth Burke, the famous American rhetorical titan, believes that all human-motivated behaviors are dramatic. The five categories of scene, person, action, medium, and purpose can be used to describe all human-motivated behaviors and events or to give meaning to behaviors, referred to as the "five-in-one" theory [19]. Therefore, the "five-in-one" theory can be used as the basis for exploring strategies to continuously improve the vitality of urban public space. As public space is an important field of daily interaction between people, the audience's willingness to continuously participate and gather is an important source of urban civic space vitality. Based on the theoretical foundation of "five-in-one," the study introduces theories of media literacy, technology acceptance model, and user experience to investigate the influence of media literacy, perceived ease of use, perceived usefulness, sensory experience, interactive experience, and emotional experience on users' willingness to sustain participation. Through qualitative comparative analysis, the core factors and the paths of sustained engagement intention are derived, with the aim of providing strategies for the benign development of urban public space vitality in the upcoming 6G era.

## 2. Review of the Literature

*2.1. 6G.* Inspired by Maslow's hierarchy of needs theory, as shown in Figure 1, which divides human needs into five levels, China Mobile evolved it to the level of communication needs [20] and proposed a hierarchical model of communication needs, divided into five levels: essential communication, universal communication, information consumption, sensory extension, and emancipation of self, as shown in Figure 2. In this model, communication needs and communication system constitute a spiral cycle: the emergence of needs stimulates the development of communication technology and communication system, while the improvement of the communication system pushes communication needs to a higher level and finally realizes human liberation and the ultimate pursuit of human intelligence. According to the new communication Maslow demand model, after the low-level demand is satisfied, the high-level demand will naturally appear. The 4G era is the era of explosive growth of data services, and with the popularization of smartphones and the development of consumer Internet, the convenience of human daily life, from clothing, food, housing, and transportation to medical care, education, and entertainment has been greatly enhanced. 5G will open up a new era of interconnection of everything, which will realize the comprehensive interconnection of people and things, penetrate all walks of life, and make the whole society more vibrant than ever [21]. In the future, with the rapid penetration of 5G applications, new breakthroughs in science and technology, and the deep integration of new technologies and communication technologies, new demands of a higher level will be derived. If the 5G era can realize the ubiquitous availability of information, 6G should fully support the digitization of the entire world on the basis of 5G and combine with the development
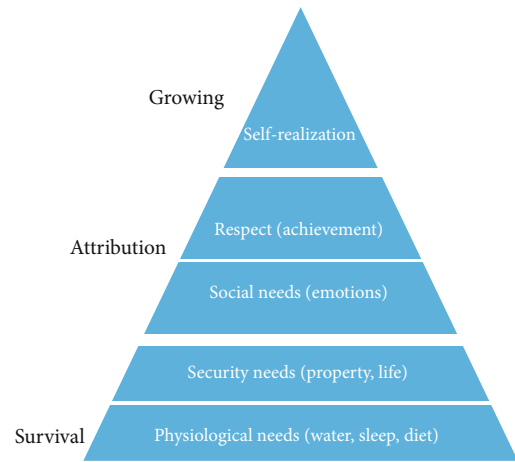


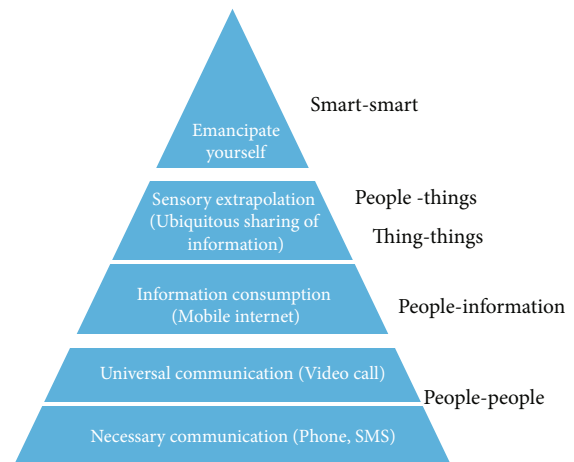FIGURE 1: Maslow's hierarchy of needs model.



FIGURE 2: Communication requirement model.

of artificial intelligence and other technologies to realize the ubiquitous availability of wisdom and comprehensive empowerment of everything.

In the era of 2030 and beyond, with the ubiquity of information and senses [22], the whole world will generate a digital twin virtual world based on the physical world, where information and intelligence can be transmitted between people and people, people and things, and things and things in the physical world through the digital world. The twin virtual world, on the other hand, is a digital simulation of the physical world, which accurately reflects and predicts the real state of each intelligent body in the physical world and even the whole world and predicts the future development trend in advance, proposes and verifies the necessary means and measures to intervene in advance in the operation of the physical world, and avoids the occurrence of individual or group disaster risks and accidents in the physical world. This will help human beings further liberate themselves, improve the quality of life and living, enhance the efficiency of production and governance of society as a whole, and realize the beautiful vision of "reinventing the world." Therefore, the digital twin will be useful not only in the industrial field but also in communications,

smart city operations, home life, and monitoring and management of human functions and organs.

At the same time, with the breakthrough of artificial intelligence and big data technology, the digital twin world will provide broader scenarios for AI applications. One of the roles of the future 6G network is to create an "intelligent and ubiquitous" world based on ubiquitous big data, which will empower AI applications in various fields. Therefore, 6G will realize the smart connection of everything through ubiquitous intelligence. Intelligent collaboration between machines, intelligent monitoring and collaboration between devices in the body area network, deep thought interaction between people and virtual assistants, and even intellectual exchange between people will enhance the skills and efficiency of human learning.

In 2030 and beyond, in the context of digital twin world and intelligent ubiquity, the application scenarios of mobile communication will show brand-new characteristics. The ubiquitous wireless connection and the application of big data and artificial intelligence technology will give rise to new application scenarios in three aspects: smart life, smart production, and smart society, including twin body domain network, superenergy transportation, fluent Internet, and smart interaction. At the same time, mobile communication services and applications will develop in the following directions: first, diversification of business needs, with a greater dynamic range of service rates and time delays; second, three-dimensional coverage, including integrated network coverage of air, space, and sea; third, diversification of interaction forms and content, including data, media, biology, and intelligence; fourth, business openness and customization and users being able to customize network capabilities on demand; and fifth, communication, computing, and artificial intelligence. Fifth is the convergence of communication, computing, artificial intelligence, and security to provide trusted and secure services.

The existing communication networks deliver mainly voice, text, pictures, and video. With the digital and intelligent development of human society, the delivery of richer forms of content has become a possibility, so the 6G network will expand the content delivered from traditional voice, text, pictures, and video to a wider range of human perception, including touch, taste, smell, and even emotion, forming an empathic Internet. The Internet of sensing is a kind of experience transmission network that links multidimensional senses to achieve sensory interoperability. In the Internet, people can fully mobilize their senses of sight, hearing, touch, smell, and taste through an interconnection infrastructure and realize the remote transmission of these important senses. Based on the Internet, people will no longer be limited to interacting with real or virtual humans and objects but will be able to interact with the entire real or virtual environment, giving users a full-dimensional immersive experience. For example, distance education will no longer be limited to visual and auditory senses but can also provide users with rich tactile extensions, and skills such as music playing, art, and sports learning will be available through the Internet of the sense of real environment learning experience. In daily life, the Internet of the sense will further

upgrade the experience of immersive shopping, entertainment, and games, so that users can get a remote, nonconsuming trial experience before buying food and bouquets. In the future, with its low latency, high reliability, and high security features, the pass-through Internet will be widely used in industries such as autonomous driving, industrial automation, smart grid, entertainment life, and education to create a pass-through better life.

The subject of future social communication is no longer just people, but intelligent bodies, including people, virtual digital people, and human-like robots. The future communication between intelligent bodies will include not only the transmission of data and information but also intelligent interaction. Intelligent interaction is the intelligent interaction generated between intelligent bodies. Most of the existing smart body interactions are passive and depend on the input of demand, such as voice and visual interaction between human and smart home. With the comprehensive penetration and deep integration of AI in various fields, the intelligent body for 2030+ will be endowed with more intelligent context perception, autonomous cognitive ability, emotional judgment, and feedback intelligence and can generate active intelligent interaction behavior, which can be useful in learning ability sharing, life skill replication, children's mental growth, and elderly group companionship.

2.2. New Media and Media Literacy. The term "new media" was first mentioned in a plan published by Goldmark for the development of electronic video merchandise, and the understanding and perception of this term are very different from the current context, which also indicates that "new media" is a changing concept [23], but the connotation of new media is relatively stable within a certain period of time. The current new media are mainly media based on computer information processing technology, which is interactive and composite digital media. The new media has a close relationship with people; it can change the meaning of geographic space and accelerate the speed of communication and greatly enhance the communicative nature between people [24], for which the influence of media needs to be explored from the human perspective.

Media literacy encompasses two dimensions: the user's ability to understand and discern various media messages and the ability to use media messages for personal life or social development [25]. The development and evolution of media literacy are also influenced by the factors of the times. The mechanical period was characterized by textual literacy in the form of paper [26], and visuals were the main way of perception. In contrast to the mechanical period and the use and development of abstract energy elements in the electric period, people began to shift to audiovisual literacy [27]. Despite the gradual diversification of access to information channels in the electric power period, the user's autonomy was limited due to the complexity of media technology and the limitations of media allocation time. Media literacy developed to the current digital period gradually transformed into a composite literacy stage where the virtual and the real merge [28], and the digital era made everything possible.

With the rapid development of information technology, urban public structures, production relations, and social relations begin to deconstruct and reorganize under the influence of information technology. Users' value orientation, behavior patterns, and spiritual needs are also presented in different ways. While the new media generated by new technologies bring new experience to users, audiences also have to face the wear and tear on their thinking patience caused by the exponential growth of information. The enhancement of the vitality of urban public space must take into consideration the problems of users in the mediated living environment, i.e., the problem of their media literacy.

*2.3. Technology Acceptance Model.* Technology acceptance models are used to analyze the impact on users in the acceptance and use behavior of the system. The user's acceptance of a product depends on the user's behavioral intention [29]. The behavioral intention is controlled by perceived usefulness, which reflects how easy it is for the user to use the system and the extent to which the user can improve performance, and perceived ease of use, which also positively affects perceived usefulness [30]. In the study between perceived usefulness and satisfaction, Bhattacherjee pointed out that there is a positive association between perceived usefulness and users' satisfaction in using the system. In addition, material or spiritual benefits that the system brings to the user should be considered to improve user experience satisfaction.

As a product of the information age, new media are intelligent and interesting in their own right. Participants need multiple behavioral approaches to interacting with them, and participants' participation experience is influenced by these approaches [31]. In addition, because the entertainment nature of new media also positively affects their willingness to participate [32], a pleasant user experience subsequently increases user satisfaction, and ease of use is the basis for entertainment, so the impact on the willingness to sustain participation can be explored in terms of the perceived ease of use and perceived usefulness of new media.

*2.4. User Experience.* User experience refers to a physical and psychological feeling established during the interaction between users and products and services or systems and was first proposed by Donald Norman, an American cognitive psychologist. In his book, *Emotional Design*, he divided the user's emotional experience into three levels from bottom up: instinctive, behavioral, and reflective levels [33]. Domestic and foreign scholars have made a lot of progress in the research of user experience; for example, Vyas and Veer constructed the APEC model of user experience and proposed that user experience is composed of aesthetic, practical, emotional, and cognitive elements [34]; Garrett proposed that user experience should be built from five aspects: performance layer, framework layer, strategy layer, scope layer, and structure layer [35]. Wei proposed that user experience has dynamic, interactive, emotional, personalized, and induced characteristics [36]. This is due to the dif-

ferences in age, education, and cognition of participants, which differ in processing imagination and association of external events. At the same time, objective things in the objective environment act as mediators between the person and the experience, constantly providing ways and conditions for the generation and development of the experience. The interactive experience and results obtained by participants also vary, so that experience contains both sensory perceptions of participants and the guidance of objective things [37].

User experience can be divided into sensory experience, interactive experience, and emotional experience. Sensory experience is the intuitive image formed by users in the process of participation, which originates from the sensory stimulation of participants and is the intuitive impression formed by users; interactive experience is the experience generated for users through actions and behaviors in the process of interaction. Emotional experience is the psychological recognition achieved by the user in the process of participation, which is the recognition and expression of the user's inner emotion through participation. The interaction process brings the user deeper reflection of the interactive device [38].

In summary, the research framework of this paper is shown in Figure 3.

# 3. Variable Measurement and Data Collection

*3.1. Variable Measurement.* In this paper, all variable measures in the questionnaire are referred to existing mature scales and modified and improved with gamification application scenarios. Specifically, we refer to Wakefield et al.'s [39] study for perceived fun and Alraimi et al.'s [40] study for perceived usefulness. Perceived ease of use was referenced from the study of Moon and Kim [41]; media literacy was referenced from the study of Chao [42]; sensory experience was referenced from the study of Lavie and Tractinsky [43] and Patricio et al. [44]; interactive experience was referenced from the study of Coker [45]; emotional experience was referenced from the study of Garrett [35], with three question items for each variable.

*3.2. Questionnaire Design.* The research study was conducted in the form of a questionnaire, and in order to further enhance the scientific research of the questionnaire, firstly, we consulted experts and scholars in communication, design, and psychology to revise the questions to ensure that the question items met the design expectations. Secondly, a small-scale survey was conducted to correct the problem items to ensure the validity of the questionnaire. The questionnaire was divided into two parts: the first part was to understand the anthropological characteristics of the survey users, such as gender, age, and number of peers, and the second part was the set of questions based on the seven variables set in the study; each measurement item was mainly based on previous studies and modified based on the characteristics of the new medium, and the measurement items were scored using a 7-point Likert scale, with 1 being very unimportant and 7 being very important.
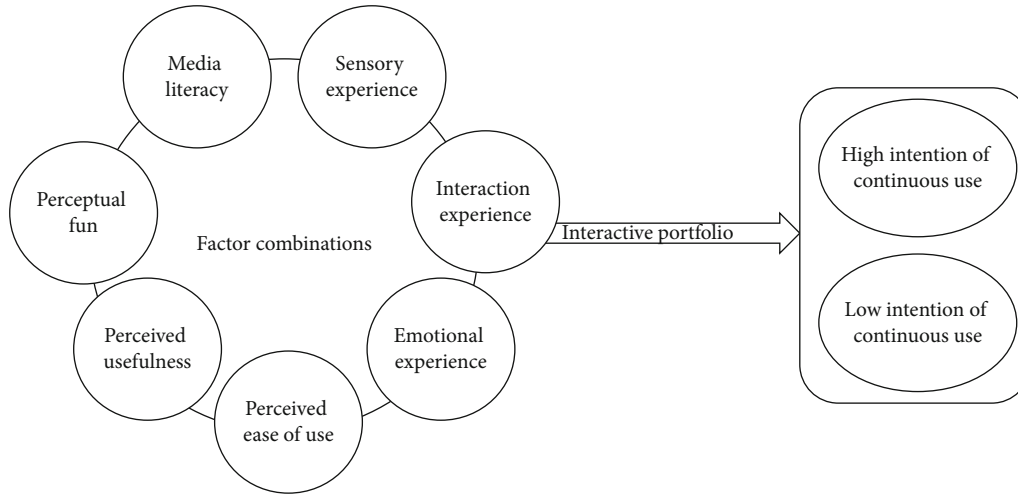
FIGURE 3: Theoretical framework model of users' willingness to continuously participate.

TABLE 1: Results of confidence validity analysis.

| Variables | Cronbach's alpha | Minimum factor loading coefficient | AVE | CR |
|---|---|---|---|---|
| Emotional experience | 0.774 | 0.817 | 0.69 | 0.87 |
| Interaction experience | 0.722 | 0.779 | 0.643 | 0.844 |
| Sensory experience | 0.763 | 0.805 | 0.679 | 0.864 |
| Perceptual usefulness | 0.757 | 0.813 | 0.674 | 0.861 |
| Perceptual ease of use | 0.749 | 0.794 | 0.667 | 0.857 |
| Media literacy | 0.762 | 0.795 | 0.737 | 0.893 |
| Willingness to continue using | 0.739 | 0.79 | 0.658 | 0.852 |

*3.3. Sample Distribution and Collection.* The questionnaire survey was conducted by a combination of online and offline methods, and the respondents included users who had used the new media and those who had knowledge of the new media. A total of 349 questionnaires were returned in this study, of which 301 were valid questionnaires, with an effective rate of 86.2%. Table 1 shows the basic characteristics of the valid questionnaires.

Among them, 34.9% were female and 65.1% were male; 23.9% were under the age of 3-17, 31.9% were 18~-35, 27.6% were 25-60, and 16.6% were over 60; among the number of peers, 29.2% traveled individually, 46.8% traveled with 2-4 people, and 23.9% traveled with more than 5 people. The data results show that the number of male participants is redundant to female, and middle-aged and young people are more enthusiastic about the new media, usually the number of 2-4 people traveling.

## 4. Reliability and Validity with Descriptive Statistical Analysis

*4.1. Reliability and Validity Analysis.* The results of the analysis are shown in Table 1. The overall Cronbach's alpha coefficient of the questionnaire was 0.959, and Cronbach's alpha coefficient of each variable was greater than 0.7, indicating that the data of this questionnaire had good reliability. In addition, KMO value obtained after factor analysis was 0.957, which was greater than 0.7, indicating that the corre-

lation between the question items was good and had good validity.

*4.2. Descriptive Statistical Analysis.* The variables were analyzed for discriminant validity, and the variable means, standard deviations, and correlation coefficients are shown in Table 2. From Table 2, we can see that the variables have good discriminant validity among each other.

## 5. Data Analysis

### 5.1. Qualitative Comparative Analysis

*5.1.1. Introduction of QCA.* Qualitative comparative analysis is applied to comparative case studies with small- and medium-sized samples. The method draws on set theory to establish the necessary and sufficient relationships between explanatory conditions and outcome variables. In terms of sufficient relationships, qualitative comparative analysis helps to identify multiple concurrent causes for the occurrence of outcomes, i.e., combinations of different explanatory conditions that together lead to the occurrence of a particular outcome, while the same outcome may occur for different combinatorial reasons. QCA uses a Boolean algebraic algorithm to formalize the logical process by which one analyzes a problem. In logical comparisons, the Boolean algebra approach views any individual case as a combination of multiple causal and consequential conditions. If the

Table 2: Model fit indicators.

| Variables | Average | Standard deviation | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Emotional experience | 5.43 | 1.37 | 0.831 | | | | | | |
| 2. Interaction experience | 5.42 | 1.38 | 0.725 | 0.802 | | | | | |
| 3. Sensory experience | 5.39 | 1.35 | 0.736 | 0.756 | 0.824 | | | | |
| 4. Perceptual usefulness | 5.39 | 1.34 | 0.827 | 0.727 | 0.723 | 0.821 | | | |
| 5. Perceptual ease of use | 5.41 | 1.33 | 0.751 | 0.745 | 0.726 | 0.734 | 0.817 | | |
| 6. Media literacy | 5.40 | 1.35 | 0.750 | 0.735 | 0.726 | 0.746 | 0.752 | 0.858 | |
| 7. Willingness to continue using | 5.44 | 1.32 | 0.759 | 0.745 | 0.733 | 0.735 | 0.765 | 0.741 | 0.811 |

number of cases is large, this in-depth analysis of the cause and effect conditions will exceed the multiplicative load of human brain power and needs to be replaced by a quantitative analysis based on variables. QCA was developed to simplify the relationship between cause and effect conditions by using Boolean algebraic algorithms without resorting to traditional quantitative analysis in the case of a large number of cases.

The analytical logic of QCA is divided into four steps. First, the QCA method is based on bifurcating the variables, i.e., the explanatory variables and the outcome variables, each with a value of 0 or 1. When a condition occurs or exists, the variable is represented by an uppercase letter with a value of 1. Conversely, when a condition does not occur or does not exist, the variable is represented by a lowercase letter or -, with a value of 0 (where a lowercase letter means that it does not occur and – means that it does not exist). + represents "or," * represents "and," and → and = both represent "cause." For example, $A * B = Y$ means that $A$ and $B$ occur simultaneously to cause $Y$ to occur.

Second, the logic of QCA is different from that of quantitative analysis, mainly in the understanding of causality. Quantitative research assumes that the causal relationships of social phenomena are linear, while qualitative comparative analysis assumes that the causal relationships of social phenomena are nonlinear, the effects of causal conditions on outcomes are interdependent, and the occurrence of the same social phenomenon may be caused by different combinations of causes. Since QCA assumes that causal relationships are diversity, complexity, and substitutability, it is more concerned with multiple combinations of causes of social phenomena; i.e., the effect of one condition on the outcome depends on other conditions at the same time. For example, the simultaneous occurrence of cause conditions $A$ and $B$ leads to outcome $Y$. The simultaneous occurrence of $C$ and $D$ can also lead to outcome $Y$ ($A * B + C * D = Y$); i.e., the same outcome can be produced by a combination of several different causes. Another example is that in social scenario $B$, the occurrence of cause condition $A$ may lead to the production of $Y$, i.e., $A * B = Y$; in social scenario $D$, the absence of cause condition $A$ may also lead to $Y$, i.e., $a * D = Y$. That is, the occurrence or nonoccurrence of the same cause condition in combination with different social scenarios can produce the same outcome, i.e., $A * B + a * D = Y$.

Once again, the unit of analysis in QCA is the combination of conditions rather than cases, and the researcher uses all combinations of conditions as the basis of analysis, sim-

plifying the combination of conditions according to the Boolean algebra algorithm. The most basic logic of the Boolean algebra is to find the common point of different combinations: for example, $A = Y$ can be obtained from $A * B + A * b = Y$; i.e., if two different cause combinations $A * B$ and $A * b$ lead to the result $Y$ at the same time and there is one and only one cause condition among these two combinations that takes different values (such as $B$ and $b$ in this case), then cause condition $B$ is redundant.

Finally, QCA is an inferential logic based on necessary and sufficient conditions, rather than a logic of statistical inference, so that qualitative comparative analysis holds "asymmetric causality"; i.e., the researcher cannot directly infer that $a = Y$ from $A = Y$. Instead, the researcher can analyze both the reasons why a social phenomenon occurs ($Y$) and why it does not occur ($y$). When analyzing $Y$, the data corresponding to $y$ are not included in the analysis process and vice versa.

In order to overcome the shortcoming that traditional explicit set qualitative comparative analysis requires all variables to be dichotomous, Larkin proposed a fuzzy set-based qualitative comparative analysis. The fuzzy set qualitative comparative analysis takes the fuzzy set score to indicate the degree of occurrence of the outcome and explanatory conditions, and its score can in principle be any value between 0 and 1, thus better avoiding the information loss during data transformation and more accurately reflecting the actual situation of the case. This method has been applied to social research.

In the analysis, the researcher should first clarify the principle of fuzzy set assignment and the meaning of the values taken and then judge the relationship between the results and the explanatory conditions according to the consistency and coverage indicators [46]. Consistency indicators can be used to determine whether a particular condition (combination) is regarded as a sufficient or necessary condition for the result [47]. If the explanatory condition (combination) $X$ is a sufficient condition for the result $Y$, the fuzzy set score of $X$ should be less than or equal to the fuzzy set score of $Y$, and the corresponding consistency is measured by the following indicators:

$$\text{Consistency}(X_i \leq Y_i) = \frac{\sum [\min (X_i, Y_i)]}{\sum X_i}. \tag{1}$$

When this indicator is greater than 0.8, it means that more than 80% of the cases meet the consistency condition,

and $X$ can be considered a sufficient condition for $Y$. When the consistency is satisfied, the researcher can further calculate the coverage index:

$$\text{Coverage}(X_i \le Y_i) = \frac{\sum [\min (X_i, Y_i)]}{\sum Y}. \tag{2}$$

This indicator describes the explanatory power of the explanatory condition (combination) $X$ on the outcome $Y$. The larger the coverage indicator, the greater the explanatory power of $X$ on $Y$ empirically. Similarly, we can calculate Consistency $(Y_i \le X_i)$ to assess whether $X$ can be considered a necessary condition for $Y$. If this indicator is greater than 0.9, we can consider $X$ to be a necessary condition for Y.

In exploratory analysis, researchers can use the above indicators to assess the necessity and sufficiency of univariate. However, when analyzing the multiple concurrent causes of the outcome, the researcher first needs to construct a truth table with the help of consistency indicators to present different combinations of explanatory conditions and outcome variables, and then, the truth table can be simplified using a Boolean minimization algorithm to obtain the causal paths that lead to the occurrence of the outcome.

In qualitative comparative analysis, if more explanatory conditions are chosen, the number of variable combinations will increase geometrically, thus making the results too complex to understand. The existing methodological literature suggests first theoretically elucidating the mechanisms by which different variables interact to influence the outcome, and then, bow $I$ into the corresponding variables in the analysis [48]. Given that most of the existing literature on resistance outcomes only indicates the factors that influence the outcome and few elucidate how different factors jointly influence the resistance outcome, this paper will first examine the explanatory factors of each theory separately and then assess the interaction of different factors together.

*5.2. Variable Calibration.* The most important step in the qualitative comparative analysis of fuzzy sets is the calibration of variables, and three qualitative thresholds of full affiliation, midpoint, and full disassociation need to be preset in the calibration process. The thresholds should be set based on existing theories or existing knowledge and experience as much as possible, so that the affiliation of the calibrated variables is consistent with the psychological public expectations to some extent. However, sometimes variables are often calibrated with a lack of relevant knowledge, when mechanical anchor points can also be used as the three thresholds, such as mean and quantile. In this paper, the maximum value of the variable is set as the fully affiliated value, the minimum value is the fully unaffiliated value, and the intersection point is the median of the two values. However, the scale used in this paper is a Likert 7 scale with a maximum quantified level of 7. Based on the data characteristics, the distribution of the values in the variable with a score of 7 is less, which is not suitable as the fully affiliated value, so the 6-bit fully affiliated value is set, and accordingly, 1 is set as the fully unaffiliated value. The calibration criteria of each variable are shown in Table 3.

TABLE 3: Variable calibration standards.

| Variable category | Variables | Calibration standards |
|---|---|---|
| Condition variables | Emotional experience | (6, 4, 2) |
| | Interaction experience | |
| | Sensory experience | |
| | Perceptual usefulness | |
| | Perceptual ease of use | |
| | Media literacy | |
| Result variables | Willingness to continue using | |

*5.3. Necessary Condition Analysis.* Necessary condition analysis is required for each condition variable before the group analysis, with the aim of testing whether a single condition will be necessary to lead to a high willingness to use consistently. The test is based on the consistency value, and in general, when the consistency is greater than 0.9, it indicates that the condition is a necessary condition that leads to the result. The results of the test are shown in Table 4, where the prefix "~" in the variable name means that the variable does not appear or is not affiliated with the variable. According to the consistency and coverage, the consistency of all single-condition variables is below 0.9, so there is no necessary condition; i.e., no single condition can lead to the result of high or low intention to use consistently.

*5.4. Configuration Analysis.* The study used fsQCA 3.0 software to perform the adequate analysis of results resulting from multiple groupings consisting of multiple conditions, and most of the existing studies concluded that the minimum acceptable value for the consistency threshold is 0.8, and consistency below 0.8 should be removed. Therefore, the study set the lower consistency threshold value to 0.8 and the frequency to 1. After performing the operation, the software outputs a complex solution (fully applying the original variable settings and not using logical residuals), a parsimonious solution (more parsimonious and incorporating all logical residuals), and an intermediate solution (incorporating logical residuals that match the actual knowledge and are meaningful). In general, the intermediate solution is the optimal solution, and the study uses the intermediate solution for analysis, while distinguishing between core conditions (conditions that appear both in the intermediate solution and in the parsimonious solution) and edge conditions (conditions that appear only in the intermediate solution) in combination with the parsimonious solution, and the results of the analysis are shown in Table 5.

After the histogram analysis, a total of three histogram paths leading to high intention of continuous use and one histogram path leading to low intention of continuous use were generated, and the consistency was greater than 0.8, indicating that each histogram was a sufficient condition leading to the corresponding result, but among the histogram paths leading to high intention of continuous use, the original coverage of path 3 was much lower than the other two paths, indicating that path 3 contained fewer cases

TABLE 4: Conditional variable necessity analysis.

| Condition variables | Willingness to continue using | | ~Willingness to continue using | |
|---|---|---|---|---|
| | Consistency | Coverage | Consistency | Coverage |
| Emotional experience | 0.942 | 0.969 | 0.491 | 0.089 |
| Interaction experience | 0.951 | 0.966 | 0.522 | 0.093 |
| Sensory experience | 0.959 | 0.968 | 0.531 | 0.094 |
| Perceptual usefulness | 0.944 | 0.970 | 0.499 | 0.090 |
| Perceptual ease of use | 0.942 | 0.970 | 0.501 | 0.091 |
| Media literacy | 0.945 | 0.965 | 0.530 | 0.095 |
| ~Emotional experience | 0.113 | 0.536 | 0.825 | 0.715 |
| ~Interaction experience | 0.107 | 0.538 | 0.809 | 0.743 |
| ~Sensory experience | 0.102 | 0.531 | 0.817 | 0.776 |
| ~Perceptual usefulness | 0.113 | 0.541 | 0.831 | 0.722 |
| ~perceptual ease of use | 0.117 | 0.550 | 0.835 | 0.714 |
| ~Media literacy | 0.114 | 0.558 | 0.806 | 0.718 |

TABLE 5: Configuration analysis results.

| Condition variables | High willingness to continue to use | | Low willingness to continue to use | |
|---|---|---|---|---|
| | $H_1$ | $H_2$ | $H_3$ | $NH_1$ |
| Emotional experience | ● | ● | ⊗ | ⊗ |
| Interaction experience | ● | - | ● | ⊗ |
| Sensory experience | ● | ● | ● | ⊗ |
| Perceptual usefulness | ● | ● | ⊗ | ⊗ |
| Perceptual ease of use | ● | ● | ● | ⊗ |
| Media literacy | - | ● | ● | ⊗ |
| Original coverage | 0.848 | 0.852 | 0.071 | 0.653 |
| Unique coverage | 0.009 | 0.014 | 0.006 | 0.653 |
| Consistency | 0.993 | 0.990 | 0.997 | 0.953 |
| Overall coverage | | 0.867 | | 0.653 |
| Overall consistency | | 0.989 | | 0.953 |

Note: ● means that core condition appears, • means that edge condition appears, ⊗ means that edge condition does not appear, and – means that condition is irrelevant.

and was less convincing compared with other paths. The persuasive power is weaker, and the explanation of each histogram path is as follows.

Grouping 1: emotional experience∗interactive experience∗sensory experience∗perceived usefulness∗perceived ease of use.

Group 2: emotional experience∗interactive experience∗perceived usefulness∗perceived ease of use∗perceived entertainment∗media literacy.

Group 3: ~emotional experience∗interactive experience∗sensory experience∗~perceived ease of use∗perceived usefulness∗media literacy.

Group 4: ~emotional experience∗~interactive experience∗~sensory experience∗~perceived usefulness∗~perceived ease of use∗~medium literacy.

As can be seen from Table 5, the interaction of the vitality-influencing factors generated three paths of high intention to continue using and one path of low intention to continue using, and the consistency of the four paths was 0.993, 0.99, 0.997, and 0.953, respectively, which showed high consistency, indicating that the three paths constituted a sufficient condition for high intention to continue using and the one path constituted a sufficient condition for low intention to continue using. The coverage rates of the model solutions are 0.867 and 0.653, respectively, which means that the 3 paths largely explain the reasons for users' willingness to continuously engage.

H1: affective experience∗interactive experience∗sensory experience∗perceived usefulness∗perceived ease of use indicates that regardless of users' media literacy, as long as users are given a better user experience and the perceived ease of use and perceived usefulness of the new media are enhanced, users will be promoted to continuously participate in the urban public space under the new media, thus enhancing the vitality of the urban public space. Maximized characteristics of the new media are digital and interactive, and this path verifies the necessity of interactive experience of users in the process of participation. To enhance the vitality of urban public space, urban designers should first consider the interactive experience of the new media and secondly focus on the sensory perception and emotional resonance of the new media. New media that are solely visual or thought-provoking have less impact on users, while interesting and novel new media tend to attract users to stop and participate. In addition, with new media as interactive systems, perceived ease of use and perceived usefulness also influence users' willingness to continue to participate. In the design process, designers need to fully consider the practicality of the new media, not just as an interactive and interesting device, but to make it have a composite function, and also need to understand user behavior, human-computer interaction, and other knowledge so that users can easily operate.

H2: emotional experience∗interactive experience∗perceived usefulness∗perceived ease of use∗perceived entertainment∗media literacy indicates that regardless of

the level of sensory experience, users' continuous engagement with the new media can still be promoted by considering emotional experience, interactive experience, perceived ease of use, perceived usefulness, and media literacy. In this path, perceived usefulness is the core condition, while interaction experience, emotional experience, perceived ease of use, and media literacy appear as marginal conditions. This path focuses more on the functional expression of the new media and can be applied in more mature public space. Due to the limitations of space, demand, and policy, mature public spaces need to grasp the main contradiction when updating the scene, fully consider the usefulness of the new media, and meet the needs of the surrounding users; even if less attention is paid to the sensory presentation, it will not have too much impact.

H3: ~emotional experience∗interaction experience∗sensory experience∗~perceived ease of use∗perceived usefulness∗medium literacy indicates that the lack of emotional experience and perceived usefulness can be used to improve users' willingness to continuously participate from the perspective of interaction experience, sensory experience, perceived ease of use, and media literacy. This path reflects the importance of the core conditions in the above two paths, but with slight differences. This path is a strategy that addresses the current situation of uniform application of new media in urban public space. The current new media are more fully involved from the perspective of urban quality, ignoring the emotional needs of users and the ease of operation. Due to the digital property of new media, it is still possible to use information technology to improve some of the current problematic new media in terms of interactive experience, sensory experience, and perceived usefulness. In addition, the government and society should also pay full attention to the media literacy ability of users in order to alleviate the digital divide problem.

NH1: ~emotional experience∗~interactive experience∗~sensory experience∗~perceived usefulness∗~perceived ease of use∗~media literacy indicates that the lack of emotional experience, interactive experience, sensory experience, perceived ease of use, perceived usefulness, and media literacy will result in low willingness of users to participate. This path reflects the importance of the above factors.

Analyzing the above high sustained use hospital paths, we find that the original coverage of path H2 is as high as 85.2%, and the index coverage is higher than that of H1 and H3, indicating that path H2 is the path through which most urban designers and users think they can achieve high sustained engagement willingness, and interactive experience and perceived usefulness are the key factors of users' sustained engagement willingness. However, the emergence of three paths also indicates that the influence paths of high sustained engagement willingness are diverse and require specific analysis of specific problems and implementation of strategies combined with actual usage scenarios.

## 6. Conclusion

In the context of urban renewal, urban public space is constantly being focused on and improved, and the intervention of new media in particular has brought quality improvement to urban public space. The interactive properties of new media bring positive user participation and the gathering of a large number of people to enhance the vitality of urban public space. Based on the "five-in-one" theory, the study examines the effects of sensory experience, interactive experience, emotional experience, perceived ease of use, perceived usefulness, and media literacy on users' willingness to sustain participation. The qualitative comparative analysis of the three paths of high sustained engagement intention shows that users' sustained engagement intention is influenced by various factors, while the interactive experience and perceived usefulness of new media are key factors affecting users' sustained engagement intention, both as core and marginal conditions.

The study can provide design guidance strategies for new media in urban public space, but the influence of other factors needs to be further debated due to the number of cases and the level of detail. Meanwhile, the study analyzes the multiple interactions among influencing factors through qualitative comparisons, which can be supported by other empirical research methods in the future.

## Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Consent

Informed consent was obtained from all subjects involved in the study.

## Conflicts of Interest

The authors declare no conflict of interest.

## Acknowledgments

## References

[1] H. Yao, L. Wang, X. Wang, Z. Lu, and Y. Liu, "The space-terrestrial integrated network: an overview," *IEEE Communications Magazine*, vol. 56, no. 9, pp. 178–185, 2018.

[2] K. David and H. Berndt, "6G vision and requirements: is there any need for beyond 5G?," *IEEE Vehicular Technology Magazine*, vol. 13, no. 3, pp. 72–80, 2018.

[3] Q. Xiaozhu and Z. Xingwang, "The application of digital twin technology in the digital construction of material cultural heritage," *Information and Documentation Work*, vol. 2, pp. 103–111, 2018.

[4] Y. Zhou and C. Liu, "The logic and innovation of building a digital twin city in Xiongan New Area," *Urban Development Research*, vol. 25, no. 10, pp. 60–67, 2018.

[5] L. Zaxi and Z. Feng, "Research on the evaluation method of urban public space vitality based on cell phone data - taking

Nanjing City park as an example," *Geography Research*, vol. 38, no. 7, pp. 1594–1608, 2019.

[6] Z. Xiang, Z. Pengyi, and W. Jun, "Research on mobile shopping users' information browsing characteristics and influence on purchase - an analysis based on mobile e-commerce APP clickstream logs," *Data Analysis and Knowledge Discovery*, vol. 2, no. 4, pp. 1–9, 2018.

[7] W. Shenglan, L. Ding, Y. Xiaomei, C. Qiang, and J. Xiaorong, "Research on the fuzzy comprehensive evaluation of city vitality–a case study of major cities in Hubei," *Journal of Huazhong Normal University (Natural Science Edition)*, vol. 47, no. 3, pp. 440–445, 2013.

[8] L. Liu, X. Yilun, J. Shanhu, and W. Qingming, "Evaluation of urban vitality based on fuzzy object element model," *Geography and Geographic Information Science*, vol. 26, no. 1, pp. 73–77, 2010.

[9] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "Extrinsic and intrinsic motivation to use computers in the workplace[1]," *Journal of Applied Social Psychology*, vol. 22, no. 14, pp. 1111–1132, 1992.

[10] A. Bhattacherjee, "Understanding information systems continuance: an expectation-confirmation model," *MIS Quarterly*, vol. 25, no. 3, pp. 351–370, 2001.

[11] R. L. Oliver, "A cognitive model of the antecedents and consequences of satisfaction decisions," *Journal of Marketing Research*, vol. 17, no. 4, pp. 460–469, 1980.

[12] L. Xin, L. Qi, and Y. Meng, "Research on the continuous use intention of group buying APP–an analysis and empirical evidence of the integration path based on ECM," *Journal of Dalian University of Technology (Social Science Edition)*, vol. 40, no. 4, pp. 56–65, 2019.

[13] C. P. Lin, H. T. Yuan, and C. K. Chiu, "Modeling customer loyalty from an integrative perspective of self-determination theory and expectation-confirmation theory," *Journal of Business & Psychology*, vol. 24, no. 3, pp. 315–326, 2009.

[14] K. L. Hsiao and C. C. Chen, "What drives in-app purchase intention for mobile games? An examination of perceived values and loyalty," *Electronic Commerce Research & Applications*, vol. 16, no. 3-4, pp. 18–29, 2016.

[15] L. Zhenyu and C. Chaohui, "Research on the integration model of factors influencing the continuous use of mobile banking - based on the perspective of ECM and TAM," *Modern Management Science*, vol. 9, pp. 63–65, 2014.

[16] A. P. Oghuma, C. F. Libaque-Saenz, S. F. Wong, and Y. Chang, "An expectation-conformation model of continuance intention to use mobile instant messaging," *Telematics & Informatics*, vol. 33, no. 1, pp. 34–47, 2016.

[17] C. S. Lin, S. Wu, and R. H. Tsai, "Integrating perceived playfulness into expectation-confirmation model for web portal context," *Information & Management*, vol. 26, no. 2, pp. 106–113, 2014.

[18] F. D. Davis, "Perceived usefulness, perceived ease of use and user acceptance of information technology," *MIS Quarterly*, vol. 13, no. 3, pp. 319–340, 1989.

[19] K. Burke, *A Grammar of Motives*, Univ of California Press, New York, 1969.

[20] L. Zhengmao, *Communication 4.0*, CITIC Press, Beijing, 2017.

[21] M. Elsayed and M. Erol-Kantarci, "AI-enabled future wireless networks: challenges, opportunities, and open issues," *IEEE Vehicular Technology, Magazine*, vol. 14, no. 3, pp. 70–77, 2019.

[22] Z. Xiang, F. Gabriel, E. Urbano, G. T. Nguyen, M. Reisslein, and F. H. P. Fitzek, "Reducing latency in virtual machines: enabling tactile Internet for human-machine co-working," *IEEE Journal on Selected Areas in Communications*, vol. 37, no. 5, pp. 1098–1116, 2019.

[23] S. Rettberg, "Introduction: New Media Studies," *American Review*, pp. 35–42, 2003.

[24] D. Croteau and W. Hoynes, "Media society: industries," *Images and Audiences. Pine Forge Press*, vol. 322, 2003.

[25] C. A. Zhang and G. L. Shen, "Media literacy: an urgent EFA issue: a review of media literacy research in mainland China," *Journal*, vol. 5, pp. 11–13, 2004.

[26] D. T. Chen, J. Wu, and Y. M. Wang, "Unpacking new media literacy," *Systemics, Cybernetics and Informatics*, vol. 9, no. 2, pp. 84–88, 2011.

[27] S. M. Gao, "From utilitarian tool to ecological interaction: on the change of cognition in the relationship between technology, media and human," *Journal of Henan University of Technology (Social Science Edition)*, vol. 14, no. 5, pp. 42–48, 2018.

[28] D. Haraway and C. Jing, *Hominids, cyborgs, and women-the reinvention of nature*, Henan University Press, China, 2017.

[29] L. Zhongqi and J. Jianhua, "Analysis of influencing factors of WeChat user satisfaction based on DEMATEL method," *Modern Intelligence*, vol. 38, no. 12, pp. 114–119, 2018.

[30] C. L. Luo and S. D. Zhu, "An empirical study on the factors influencing the willingness to use balance transfer based on TAM/TPB and perceived risk," *Modern Intelligence*, vol. 35, no. 2, pp. 143–149, 2015.

[31] L. Iaqi, K. Wan, and L. Chun, "Research on the factors influencing the continuous use intention of bicycle sharing users based on TAM-ECM model," *Soft Science*, vol. 33, no. 7, pp. 116–121, 2019.

[32] Z. Pei, F. Suyun, and Z. Yuechun, "An empirical study on the factors influencing the continuous use of shopping app users," *Journal of Nanjing Normal University (Natural Science Edition)*, vol. 43, no. 2, pp. 140–148, 2020.

[33] D. A. Norman, *Fu Qiufang, Cheng Jinsan. Emotional Design*, Electronic Industry Press, Beijing, 2005.

[34] D. Vyas and G. C. V. D. Veer, "APEC: a framework for designing experience [EB/OL]," 2016, http://www.academia.edu/282319.

[35] J. J. Garrett, *The Elements of User Experience User-Centered Web Design*, Machinery Industry Press, Beijing, 2008.

[36] Z. Wei, "From user acceptance to user experience in library information services," *Library Work and Research*, vol. 9, pp. 114–116, 2014.

[37] Z. Ming, H. Renke, Z. Danhua, and W. Wei, "Interactive device experience design based on flux transformation theory," *Packaging Engineering*, vol. 42, no. 4, pp. 109–114, 2021.

[38] G. Lei, "A study on users' willingness to continue using digital library websites in higher education - an integrated model based on user experience, TAM and ECM," *Library Work and Research*, vol. 2, pp. 48–59, 2020.

[39] R. L. Wakefield, K. L. Wakefield, J. Baker, and L. C. Wang, "How website socialness leads to website use," *European Journal of Information Systems*, vol. 20, no. 1, pp. 118–132, 2011.

[40] K. M. Alraimi, H. Zo, and A. P. Ciganek, "Understanding the MOOCs continuance: the role of openness and reputation," *Computers & Education*, vol. 80, pp. 28–38, 2015.

[41] J. W. Moon and Y. G. Kim, "Extending the TAM for a world-wide-web context," *Information & Management*, vol. 38, no. 4, pp. 217–230, 2001.

[42] M. Chao, "Media use and media literacy among urban and rural youth in the digital media era: an empirical survey of youth in S province," *Journal of Sichuan Institute of Technology (Social Science Edition)*, vol. 33, no. 5, pp. 79–100, 2018.

[43] T. Lavie and N. Tractinsky, "Assessing dimensions of perceived visual aesthetics of web sites," *International Journal of Human-Computer Studies*, vol. 60, no. 3, pp. 269–298, 2004.

[44] E. R. Patricio, J. R. Francisco, and A. G. Jorge, "Student information system satisfaction in higher education: the role of visual aesthetics," *Kybernetes*, vol. 8, 2018.

[45] B. Coker, "Antecedents to website satisfaction, loyalty, and word-of-mouth," *Journal of Information Systems and Technology Management*, vol. 10, no. 2, pp. 209–218, 2013.

[46] C. Ragin, *Redesigning Social Inquiry*, University of Chicago Press, Chicago, 2008.

[47] E. Amenta, N. Caren, and S. J. Olasky, "Age for leisure? Political mediation and the impact of the pension movement on U.S. old-age policy," *American Sociological Review*, vol. 70, no. 3, pp. 516–538, 2005.

[48] E. Amenta and J. D. Poulsen, "Where to begin - a survey of 5 approaches to selecting independent variables for qualitative," *Comparative-Analysis*, vol. 23, pp. 22–53, 1994.