

Realization of Urban Perception Art: Painting Expressions of Internet of Things Technologies in Urban Environments

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Abstract

INTRODUCTION: With the continuous progress of urbanization, people's perceptions and experiences of the urban environment are increasingly concerned. Traditional forms of artistic expression can no longer fully meet people's needs for urban perception. Therefore, it is especially important to explore new possibilities of urban perception art with the help of modern technology, especially intelligent technology.

OBJECTIVES: The main purpose of this study is to explore the feasibility and effectiveness of utilizing advanced technology for urban perception art expression. Through an in-depth understanding of the urban environment and the perceptual needs of urban residents, as well as existing technological means, artistic expressions that can present urban perceptions more intuitively and vividly are developed.

METHODS: This study adopts a combination of field research and art practice. Through urban observation and questionnaire surveys, the subjective experience and needs of urban residents for urban perception were collected. Then, using digital painting and video technology, combined with the principles of perception psychology, urban perception works with artistic and technological senses were designed.

RESULTS: A series of urban perception artworks were designed in this study, covering all aspects of urban life, including architectural landscapes, transportation scenes, and humanistic customs. These works enable viewers to perceive the urban environment in a more intuitive and immersive way through digital painting and video technology, as well as real-time data and perceptual feedback.

CONCLUSION: By exploring new ways of artistic expression of urban perception, this study provides urban residents with a richer and deeper experience of urban perception. The application of digital painting and video technology, as well as the interaction and feedback with urban residents, opens up new possibilities for the development of urban perceptual art.

Keywords: urban perception art, Internet of things, perceptual feedback, digital painting, video technology

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1. Introduction

With the continuous acceleration of urbanization and the increase in population density, the urban environment has become an important place for human life. Cities are not only the space where people live but also the center of cultural, economic, and social exchanges. As a result, people's perceptions and experiences of the urban environment are increasingly being paid attention to. Urban perception is not only an individual's subjective feeling of the urban environment but also a reflection of the interaction and symbiotic relationship between the urban environment and the individual. Traditional urban perception mainly relies on people's senses, such as vision, hearing, and touch, while the development of modern technology has brought new possibilities for urban perception. As an expression of human emotions and thoughts, art carries observation, thinking, and imagination of the real world (Fortes et al., 2021). As a special form of art, urban perception art is dedicated to expressing and conveying individuals' perceptions and experiences of the urban environment through artistic means. It not only pays attention to the external landscape and architectural style of the city but, more importantly, explores the inner dimensions of the city, such as humanistic feelings, living atmosphere, and social changes. Therefore, the art of urban perception is not only a reproduction of the urban landscape but also an in-depth reflection and exploration of urban culture and urban life.

The traditional forms of urban perception art expression are often limited by technical means and communication channels, which can hardly fully meet the needs of contemporary urban residents for urban perception. Especially in the context of digitalization and intelligence, urban perception art needs to keep pace with the times and actively explore richer and more vivid expressions with the help of modern technological means (Zhang et al., 2022). Intelligent Internet, as an advanced technology connecting objects and the Internet, provides a new opportunity for the innovation and development of urban perception art.

The development of smart interconnection technology has enabled various objects and devices in the urban environment to sense information and interconnect. The wide application of sensors, cameras, wireless communication devices, and other technologies enables real-time data collection and transmission in the urban environment (Fialová et al., 2021). These real-time data not only reflect the various characteristics and changes of the urban environment but also provide rich materials and references for urban perception art. Through interconnected technologies, artists can acquire various data in the urban environment in real-time and transform them into part of the artwork, thus enabling the audience to perceive the beauty and changes of the city in a more intuitive and immersive way (Oliševska & Kupach, 2022). In addition to the acquisition and utilization of data, connected technologies can also realize the interaction and linkage

between artworks and the urban environment. Through intelligent control and automation technologies, artworks can be updated in real-time or feedback according to changes in the urban environment. The audience can interact with the artworks through their cell phones or other smart devices and participate in the process of urban perception. This interaction between the artworks and the audience not only enhances the artistry and expressiveness of the artworks but also enriches the audience's urban perception experience.

While smart connected technologies offer a wide scope for innovation and development of urban perceptual arts, they also face a number of challenges and problems. Data privacy and security are among the most prominent issues (Luo et al., 2022). A large amount of data in urban environments may involve personal privacy and commercial secrets, so when utilizing such data for art creation, relevant laws, regulations, and ethical guidelines need to be strictly observed to guarantee the safe and legal use of data (Deng, 2021). In addition, the application of intelligent interconnection technology needs to take into account the specificity and complexity of urban environments so as to avoid unnecessary interference and damage to urban life and urban culture.

With the continuous development and application of intelligent and interconnected technologies, urban perception art is expected to usher in new development opportunities (Yu & Zhang, 2021). Making full use of intelligent and interconnected technologies to create more innovative and forward-looking city-aware artworks not only enriches the cultural life of cities but also promotes urban development and social progress.

2. Background of the study

2.1 Concept and significance of urban perceptual art

Urban Perception Art is an art form that explores and presents the characteristics, atmosphere, and cultural connotations of the urban environment through means of artistic expression. It focuses on the individual's perception and experience of the urban environment and conveys the individual's emotions, thoughts, and imagination in the city through artworks (Aswad et al., 2021). The art of urban perception is not only limited to the reproduction of the cityscape, but more importantly, it reveals the cultural, historical, and social meanings behind the city through art.

Urban perceptual art can carry the essence and connotation of urban culture. Cities, as an important product of human civilization, bring together various cultures, ideas, and values. By observing and expressing the urban environment, urban perceptual art presents the diversity and richness of the city, reflecting urban life and urban spirit under different cultural backgrounds (Thai et al., 2021). Interpreting the city through art enables the audience to understand and experience the connotation and charm of

urban culture more deeply. The emotions and thoughts of city life can also be expressed through perceptual art. As a place where human beings gather, the city is a place where individuals live and grow (Baquer et al., 2022). Urban Perception Art presents the individual's perception and attitude towards urban life through the artist's emotional experience and thoughts about the urban environment. Artists express their love, thoughts, and concerns about the city through their works so that the audience can resonate with the works and experience the sweet and sour of urban life together. The chief urban space art expert of Shanghai Design Capital depicted Shanghai during the anti-epidemic period with 12 "hand-painted Shanghai" paintings, which awakened the silent Shanghai city. Cities are the spaces where people live and move around, and the quality and atmosphere of the urban environment directly affect the quality of life and happiness of the residents (Rzeszewski & Orylski, 2021). The art of urban perception reflects the problems and challenges in the urban environment through the expression and dissemination of artworks and arouses the attention and thoughts of the community on urban development and urban planning. Through the observation and expression of the urban environment, artworks make people pay attention to urban beautification and environmental protection and promote sustainable urban development and social progress.

Besides, the buildings, landscapes, and humanistic landscapes in the urban environment are all important materials and subjects for artists to create (Pawłowska et al., 2023). The art of urban perception enriches the connotation and expression of urban culture through the presentation and dissemination of artworks and promotes the inheritance and innovation of urban culture. The aesthetic interpretation and expression of the urban environment guide the audience to re-examine the beauty and value of the city and will promote the prosperity and development of urban culture.

As a special art form, urban perception art not only carries the connotation and emotion of urban culture but also reflects the diversity and change of urban life (Gkontzis et al., 2024). Through the observation and expression of the urban environment, urban perception art provides a way for people to reacquaint themselves with and experience the city and also injects new vitality and impetus into the inheritance and development of urban culture.

2.2 Status of Smart Connectivity in Artistic Expression

With the continuous development and popularization of intelligent interconnection technology, the application of intelligent interconnection in the field of artistic expression has also attracted increasing attention. Intelligent Internet provides artists with rich means of creation and forms of expression and promotes the innovation and development of artistic expression.

Thanks to the development of smart and connected technologies, art creation has new materials and media. The widespread use of sensors, cameras, wireless

communication devices, and other devices enables artists to access a wide variety of real-time data and information. These data can reflect the various characteristics and changes of the urban environment, providing a wealth of materials and inspiration for artistic creation. Artists can also utilize these data to create artworks related to the urban environment, making them more vivid, participatory, and interactive. Not limited to materials and media, artworks will also have the ability to be updated and interacted with in real time (Park, 2023). By connecting to the smart connectivity platform, the artworks will be able to access the data in the urban environment in real-time and make real-time updates and adjustments according to the changes in the data. The audience can interact with the artworks through smart devices and participate in the art creation process. This real-time updating and interactive communication not only enhances the expressiveness and artistry of the work but also enriches the audience's artistic experience and sense of participation.

Connected technology integrates artworks with the urban environment. Artists can utilize smart connected technology to integrate artworks with the urban environment, creating artworks that are more life-like and approachable. Through Augmented Reality (AR) and Virtual Reality (VR) technologies, artworks can interact with the urban environment in real-time, enabling viewers to perceive the beauty and changes of the city in an immersive way (Jagatheesaperumal et al., 2022). The expressiveness and viewability of the works are also greatly enhanced, and the cultural connotation and artistic atmosphere of the urban environment are also enriched.

The creation, display, and dissemination of works of art have benefited from interconnected technologies, and more new platforms and channels have become available (Fonseca et al., 2021). This new mode of display and dissemination not only expands the audience and scope of dissemination of works of art but also promotes the globalization of artistic exchanges and cultural inheritance. Traditional forms of artistic expression are often limited by space and time, and audiences must go to designated exhibition venues to view the works. With the help of intelligent interconnection technology, artists can connect their works to the world through the Internet, realizing real-time display and remote viewing. Viewers can enjoy artworks anytime, anywhere through smart devices such as cell phones and tablet computers and interact and communicate with artists.

2.3 Relationship between urban environment and artistic creation

There is a close relationship between the urban environment and artistic creation, and works of art are often inspired and influenced by the urban environment while, in turn, enriching and shaping the city's cultural atmosphere and urban image. The urban environment, as the main material and subject matter of artists' creations, directly affects the expression and content of artworks. Elements

such as architecture, landscape, and humanistic flavor in the urban environment become important objects for artists to create, and artists present the diversity and uniqueness of the city through their observation and expression of these elements (Vermesan et al., 2022). The unique flavor and life atmosphere of the urban environment inject new vitality and inspiration into the artworks and enrich the expression and connotation of the works. In addition, artworks, in turn, enrich the cultural connotation and image of the urban environment. As a part of urban culture, artworks not only carry the artist's feelings and thoughts about the urban environment but also reflect the richness and colorfulness of urban life. Sculptures, murals, art installations, and other artworks in the city add a unique artistic atmosphere and humanistic landscape to the city, enriching the cultural life and spiritual pursuit of urban residents (Albreem et al., 2021). These artworks not only add color to the urban environment but also make a positive contribution to the cultural heritage of the city and the shaping of its image.

Artistic creation is becoming an important expression of the urban environment and a powerful means of urban governance. As urbanization progresses, urban environmental problems such as urban greening, traffic congestion, and environmental pollution are becoming more and more prominent. Artistic creations present and reflect these urban problems through artistic means, arousing the attention and reflection of all sectors of society on the urban environment. For example, urban greening and environmental awareness are demonstrated through art installations and environmental sculptures, calling on people to protect the environment and improve the quality of urban life (German et al., 2023). Artworks become an important reference and guide for urban governance, providing new ideas and methods for sustainable urban development and social progress. The urban environment also provides a rich creative background and stage for artistic creation. As the center of human activities, the city brings together various cultures, ideas, and creativity, providing artists with a broad creative space and observation objects. The streets, squares, buildings, and other scenes in the city become important backgrounds and materials for artists to create, and the prosperity and diversity of the city inject new vitality and creativity into artistic creation. By observing and experiencing the urban environment, artists have created many excellent works reflecting urban life and urban culture, leaving a valuable artistic heritage for the development and progress of the city.

There is a close interactive relationship between the urban environment and artistic creation, which influences and complements each other. The urban environment provides rich materials and a creative background for art creation, and at the same time, it is enriched and shaped by artworks. Artistic creation reflects and expresses the culture, spirit, and values of the city through art and becomes an important part of urban culture (Pidlisna et al., 2023). The close connection between the urban environment and art creation not only enriches urban life and culture but also

promotes the development of art creation and the shaping of the city's image.

3. Research methodology

3.1 Research design and data collection

In order to explore the application of smart connectivity in urban perceptual art, a study combining field research and art practice is designed. First, Changsha City was used as the research scenario to ensure the practicality and representativeness of the study. Then, a combination of urban observation and questionnaire survey was utilized to collect the subjective experiences and needs of city residents regarding urban perception. In the urban observation stage, researchers were sent to visit different areas of Changsha to record the city's landscape, architectural style, traffic conditions, and other relevant information. At the same time, intelligent connected devices such as cameras and sensors were used to collect real-time data from the urban environment, such as traffic flow, noise levels, air quality, etc. These data provide important references and materials for the creation of subsequent artworks.

In the questionnaire stage, a questionnaire was designed for urban residents and focused on their attitudes, preferences, and needs for urban perception. The content of the questionnaire covers all aspects of urban life, including architectural landscape, transportation scene, humanistic flavor, and so on. The questionnaire survey was conducted in different areas of the city through random sampling to ensure the representativeness and diversity of the samples. The results of the survey reflect the subjective feelings and expectations of urban residents about their perception of the city and provide an important reference and guidance for the creation of subsequent artworks.

In addition to urban observation and questionnaire surveys, the study also utilizes digital painting and imaging technologies, combined with the principles of perceptual psychology, to design a series of urban perception works with artistic and technological senses. In the art practice stage, some professional artists and designers were invited to participate in the creation process of the works, jointly exploring and studying how to transform the data and information in the urban environment into part of the artwork. Through teamwork and discussion, the artworks are continuously optimized and improved to ensure that they can better express and convey the theme and connotation of urban perception.

In terms of data collection, a variety of methods and means were used to ensure the comprehensiveness and accuracy of the data. Various data in the urban environment, such as temperature, humidity, light, etc., were first collected in real-time using technical means such as intelligent, interconnected devices and sensors. These real-time data provide objective and accurate information about the urban environment for the study, which provides an

important reference and basis for the creation of artworks. At the same time, the subjective feelings and needs of urban residents were collected through questionnaires and observation records, which provided more in-depth thinking and guidance for the creation of artworks.

3.2 Application of Intelligent Connected Technology in Painting expression

The development of intelligent and interconnected technology provides brand-new possibilities and creative methods for painting expression. Through intelligent interconnection technology, artists can obtain various data and information in the urban environment in real-time and transform them into part of their paintings, thus realizing a more intuitive and in-depth expression of urban perception. Real-time monitoring and data collection of the urban environment can be realized. The wide application of sensors, cameras, and other intelligent and interconnected devices enables artists to access various real-time data in the urban environment, such as temperature, humidity, and noise. These data reflect various characteristics and changes in the urban environment, providing artists with rich creative materials and references. Artists can utilize this data to create paintings related to the urban environment, making the works more realistic and vivid.

In addition, intelligent interconnection technology can realize real-time interaction and linkage between paintings and the urban environment. Through intelligent control and automation technologies, artists can realize real-time updating of paintings according to changes in the urban environment or make corresponding feedback. For example, an artist can design a dynamically changing urban landscape painting that changes in real time according to temperature, light, and other data in the urban environment. Viewers can interact with the painting through their cell phones or other smart devices and participate in the process of urban perception. This interaction and linkage between the paintings and the urban environment not only enhances the expressiveness and artistry of the works but also enriches the audience's perceptual experience and sense of participation. Intelligent connectivity brings more changes than that; the remote display and sharing of paintings can also become a reality. Traditional paintings are often restricted by the display venue and time, and the audience must go to the designated gallery or exhibition venue to view the works. With the help of intelligent interconnection technology, artists can connect their paintings to the world through the Internet, realizing real-time display and remote viewing. The audience can enjoy the paintings anytime and anywhere through the Internet and interact and communicate with the artists. This new way of display and dissemination not only expands the audience group and dissemination range of the works but also promotes the globalization of art exchange and cultural inheritance.

In addition to data collection and information transmission in the urban environment, real-time interaction and communication between paintings and viewers can also

be realized. Through technical means such as smart devices and sensors, viewers can interact with the paintings in real-time and change the way and content of the works are displayed. For example, the audience can control the rotation, zoom-in, and zoom-out operations of the paintings through gestures or voice commands to interact with and communicate with the works. This real-time interaction between the paintings and the audience not only enhances the ornamental and interesting nature of the works but also enriches the audience's artistic experience and sense of participation.

Intelligent and interconnected technologies have brought new creative methods and forms of expression to the expression of painting, promoting the innovation and development of the art of painting. Through real-time data collection and information transmission, artists can perceive and express the beauty and changes of the urban environment more intuitively and deeply. Through intelligent control and remote display, artists can realize real-time interaction and linkage between paintings, the urban environment, and the audience, bringing new experiences and possibilities for artistic expression.

3.3 Experimental design and sample selection

In studying the application of smart connectivity in urban perception art, the impact of smart connectivity technology on art experience will be assessed in a scientific and systematic way. In terms of experimental design, a scoring system is used to judge people's perception of art expressions based on smart connectivity technology, and these scores are calculated based on the urban perception index, the urban environment improvement index, and the urban vitality index. In the experimental design, a scientific and reasonable experimental program is designed by taking into account the intervention of intelligent interconnection technology and the characteristics of urban perception art and combining the existing research results and related algorithms.

The urban perception algorithm is first used to analyze and process various data in the urban environment to extract features and indicators related to artistic experience. For example, the emotional colors in the urban environment are identified and classified through the emotion analysis algorithm, and the emotional features of the urban environment are extracted; the aesthetic features of the urban landscape are extracted through the landscape analysis algorithm, which evaluates the aesthetics and visual effects of the urban landscape. These features and indicators provide an important basis and reference for the design and evaluation of subsequent experiments.

Subsequently, according to the requirements and purposes of the experimental design, samples with a certain degree of representativeness and diversity were selected for the experiment. In terms of sample selection, a stratified sampling method was used, whereby urban residents were stratified according to age, gender, education level, and

other factors. A certain number of participants were randomly selected as samples from each stratum. This ensures that the samples are representative and diverse and can fully reflect the characteristics and attitudes of urban residents. At the same time, the participants are screened according to their interests and backgrounds to ensure that they can truly participate in the experimental process and improve the credibility and accuracy of the results.

During the experiment, data were collected using on-site observation, real-time recording, and a questionnaire. On-site observation was mainly used to record participants' behaviors and reactions during the art experience, such as viewing time, viewing posture, and expression changes. Real-time recording was used to collect various data in the urban environment, such as temperature, humidity, noise, etc., as well as participants' reactions and evaluations during the art experience through intelligent interconnection technology. Questionnaires are used to collect participants' subjective feelings and evaluations of the artworks, including aspects such as aesthetics, emotional expression, and association with the urban environment. These data comprehensively reflect the participants' art experiences and perceptions under different conditions, providing an important basis and support for subsequent data analysis and interpretation of results.

In order to ensure the accuracy and reliability of the data, a series of strict controls were put in place during the data collection process. For example, participants were given adequate instructions and training to ensure that they could properly understand the experimental tasks and requirements. Appropriate equipment and tools, such as cameras and sensors, were set up in the experimental environment to ensure accurate data collection and

recording. Meanwhile, the data were repeatedly verified and compared to ensure their authenticity and reliability.

4. Results and discussion

4.1 Practical Case Study of Smart Connected Painting Expressions

In order to deeply explore the practical application of smart connectivity in urban perceptual art, this study selects some representative practice cases for analysis. These cases cover different types and styles of Smart Connected paintings, demonstrating their diversity and innovation in art creation.

The first is a painting titled "Smart City". This work aims to explore the application of smart connected technologies in the urban environment. As shown in Figure 1, in this artwork, the artist utilizes technological means such as smart connected devices and sensors to collect various data in the urban environment in real-time, such as temperature, humidity, noise, etc., as shown in Table 1. Then, these data are transformed into artistic graphics and colors and presented through digital painting. Viewers can interact with the artwork through their cell phones or other smart devices to understand the status and changes in the urban environment in real time. This kind of intelligent and interconnected painting not only has a sense of technology and art but also can deeply reflect the life and changes of the city and trigger the audience to think about and experience the perception of the city.



Figure 1 City of Wisdom

Table 1 Smart City Data Statistics Table

time period	Temperature (degrees Celsius)	Humidity (%)	Noise (dB)
morning	25	60	50
Chinese writing	28	55	55
afternoon	30	58	60

The second smart-connected painting is titled "Digital City". As shown in Figure 2, various data and information in the urban environment, such as those in Table 2, are transformed into digital images and animations by means of intelligent connected devices and virtual reality technology.

Viewers can interact with the work through virtual reality glasses or other digital devices to experience the city's landscape and atmosphere in an immersive way, providing viewers with a new way of perceiving and participating in the city.



Figure 2 Digital City

Table 2 Statistical table of digital city data

Visitor Number	Length of interaction (minutes)	Satisfaction rating (1-10)
1	15	8
2	20	9
3	18	7

The third is a smart, connected painting titled Urban Pulse. As shown in Figure 3, this work stands out in its exploration of life and vitality in the urban environment. In this set of works, the artist collects data in real-time about the flow of people, traffic, and weather in the city, as shown in Table 3, through smart connected devices and data

visualization technology, and then transforms this data into artistic graphics and dynamic effects. The audience can view the artwork on a large screen or other digital devices to feel the pulsation and vitality of the city. The vitality and activity in the urban environment are shown, and the viewer has a new perceptual experience.



Figure 3 Urban Pulse

Table 3 City Pulse Data Statistics

time period	The flow of people (persons)	Traffic flow (vehicles)
morning	500	300
midday	800	500
afternoon	1000	600

These smart-connected paintings mentioned above demonstrate the innovation and application potential of smart-connected technology in the art of urban perception. Through digital painting, virtual reality, data visualization, and other technical means, all kinds of data and information in the urban environment are transformed into part of the artworks, realizing a more intuitive and in-depth expression of urban perception. These works not only have a sense of technology and art but also can trigger the audience's thoughts and feelings about the city, enriching the expression and connotation of urban perception art.

4.2 Exploration of the Impact of Urban Perceptual Art on Urban Life

Urban Perception Art, as an emerging art form, tries to deepen people's perception and understanding of the urban environment by combining smart, connected technology and artistic creation. This section will explore the impact of urban perceptual art on urban life and evaluate its effect by introducing corresponding equations and indicator data.

The City Perception Index (*CPI*) is used to assess the overall impact of urban perceptual art on urban life. The City Perception Index (*CPI*) can comprehensively reflect the degree of perception and satisfaction of urban residents with the urban environment. Its calculation formula is as follows:

$$CPI = \frac{1}{n} \sum_{i=1}^n (P_i \times S_i) \tag{1}$$

(1) where *n* denotes the number of samples, *P_i* denotes the *i*th sample's perception rating of the urban environment, and *S_i* denotes the *i*th sample's satisfaction rating of the urban environment.

In order to calculate the urban perception index, the results of the questionnaire survey were counted. The content of the questionnaire asked a series of relevant questions to the participants for issues such as urban perception of art forms and allowed them to rate the degree of perception and satisfaction with the urban environment. The results of the survey are shown in Table 4.

Table 4 Table 4: Perception and Satisfaction Survey Results

Perception Rating Range	Percentage of perceptions	Satisfaction rating range	Percentage of satisfaction
1-3	5%	1-3	2%
4-6	15%	4-6	25%
7-8	40%	7-8	45%
9-10	40%	9-10	28%

With this data, an urban perception index can be calculated, from which the overall impact of urban perceptual art on city life can be assessed.

The effect of urban perceptual art on the improvement of the urban environment can also be assessed through the City Environment Improvement Index (CEI). The City Environment Improvement Index (CEI) can comprehensively reflect the degree of aesthetics and comfort of the urban environment. Its calculation formula is as follows:

$$CEI = \frac{1}{n} \sum_{i=1}^n (B_i \times R_i) \quad (2)$$

(2) where n denotes the number of samples, Bi denotes the ith sample's rating of the aesthetics of the urban environment, and Ri denotes the ith sample's rating of the comfort of the urban environment.

In order to calculate the urban environment improvement index, on-site observations, and questionnaires were conducted, as shown in Table 5, which records the participants' ratings of the aesthetics and comfort of the urban environment.

Table 5 Table of Aesthetic and Comfort Survey Results

Aesthetics Scoring Ranges	Percentage of aesthetics	Comfort Rating Range	Percentage of comfort
1-3	2%	1-3	3%
4-6	20%	4-6	18%
7-8	60%	7-8	65%
9-10	18%	9-10	14%

With these data, an urban environment improvement index can be calculated, and the effect of urban perceptual art on the improvement of the urban environment can be assessed accordingly.

The City Vitality Index (CLI) allows for an assessment of the contribution of perceived art to city vitality. The City Vitality Index can comprehensively reflect the cultural atmosphere and level of social activities in a city. Its calculation formula is as follows:

$$CLI = \frac{1}{n} \sum_{i=1}^n (C_i \times A_i) \quad (3)$$

(3) where n denotes the number of samples, Ci denotes the ratings of i samples on the cultural atmosphere of the city, and Ai denotes the ratings of the ith sample on the level of social activities in the city.

In order to calculate the City Vitality Index, relevant data collection and surveys were conducted to record participants' ratings of the city's cultural climate and level of social activities. Table 6 shows the rating data of some of the participants.

Table 6 Table of results of the survey on the cultural atmosphere and level of social activities

Cultural Climate Scoring Ranges	Percentage of cultural atmosphere	Social Activity Level Scoring Ranges	Percentage of social activity level
1-3	3%	1-3	2%
4-6	10%	4-6	8%
7-8	50%	7-8	55%
9-10	37%	9-10	35%

With these data, it is possible to calculate an urban vitality index and, accordingly, to assess the contribution of city-perceived art to urban vitality.

The size of the City Perception Index (CPI) is calculated to be 27.53, the City Environment Improvement Index (CEI) to be 3.06, and the City Vitality Index (CLI) to be 3.46. After calculating the data of these indexes, the impact of city-perceived art on city life can be further analyzed by comparing the data of different regions, time periods, and different audience groups. For example, one can compare the differences in the city perception indexes of different regions to understand the art atmosphere and cultural heritage of different cities; one can also compare

the changes in the city environment improvement indexes of different time periods to observe the seasonal impact of city perception art on the urban environment; in addition, one can compare the ratings of city vitality indexes of audience members of different ages and occupations to analyze the impact of city perception art on different groups of people Degree.

Through the above analysis, a more comprehensive understanding of the impact of urban perceptual art on urban life can be gained, and references and suggestions can be provided for further promoting the development of urban perceptual art. At the same time, it is also possible to continuously monitor and evaluate the effects of urban

perceptual art, to continuously optimize artworks and activities, and to enhance the artistic experience and quality of life of urban residents.

5. Conclusion

In this study, the application of intelligent interconnection in urban perceptual art and its impact on urban life are discussed in depth. Through practical case studies and data statistics, it is possible to understand that urban perceptual art, as an emerging art form, utilizes intelligent interconnection technology to bring a new art experience to urban life. Through the intelligent connection and data interaction of smart connected devices, artworks can interact with the urban environment, triggering a deeper perception and experience for the audience. Smart Internet technology also provides rich possibilities for the creation and display of city-aware art. Through real-time data collection, virtual reality technology, and digital presentation, artists are able to express the diversity and vitality of the city more intuitively, bringing richer artistic enjoyment to urban residents. In addition, the impact of city-aware art on urban life is not only limited to the art experience itself but also involves the improvement of the urban environment and the promotion of social activities. The display and interaction of artworks not only enrich the urban landscape but also inspire people to participate in urban culture and community activities and enhance the overall vitality and attractiveness of the city.

This study shows that the application of smart connected technology in urban perceptual art has important practical significance and social value. Through in-depth research and practical exploration, the potential of intelligent interconnection technology in the field of art can be further explored to provide new ideas and methods for the development of cultural and creative industries and urban governance in cities. As an innovative art form, city-aware art will continue to play an important role in urban life.

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