Study of Interaction Design-Based Urban Architectural Space Optimization

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Abstract. In today's highly urbanized society, where science and technology are developing quickly, residents' quality of life has improved. Everyone is striving for a better life, and because urban residents must use and survive the urban space for a long time with a variety of defects brought on by the excessive process of urbanization, problems arising from the local context of on-demand optimization have become important. As a result, the primary area of research in this work is the study of interaction design-based spatial optimization of urban buildings. By analyzing the interactable scenarios in the city, the study methodology of this work summarizes the interaction method of space optimization. According to the study, the interactive aspects of urban space are primarily the ecological factors that change with the seasons, the material elements that deteriorate with usage and time, and the interactive technology elements brought on by technological advancement. Based on the interactive components of urban space that were summarized in the previous section, it is possible to draw the conclusion that the interaction of human behaviors, emotions, and senses with the interactivity of interaction design can be used to create a livable urban space.

Keywords: Interaction Design; urban design; architectural design; urban public spaces.

1. Introduction

The process of global urbanization has been greatly accelerated by the ongoing growth of the global economy and social productivity, which fosters the creation of new technologies. As a result of learning from and assisting one another, the living standards of people all over have significantly increased, and a higher standard of living has become the goal of everyone. Urbanization is the gradual formation of large clusters of people's lives from the original small villages that have overcome the limitations of geospatial space. It is also the transformation of the rural population into the urban population, a change in the mode of production, and a transformation of natural ecological areas into artificial ecosystems. There have been changes in residents' lifestyles, concepts of life, culture, and education, as well as the demand for facilities, as a result of the increased interaction between individuals, society, and urban structures. As a result, people are drawn to cities because they offer better living conditions, better infrastructure, and better social structures. The degradation of urban ecosystems, the burden on urban land, and the reduction in the standard of living of residents as a result of over-exploitation are just a few of the urban issues that result from over-urbanization and shouldn't be disregarded. In these situations, optimizing urban architectural space has taken on significance, while interaction design, as a type of humanistic design system, has emerged as a potent practical manual for optimizing urban architectural space in modern society that utilizes modern information technology. Traditional urban architectural design mostly takes inspiration from historical or global mainstream forms, combines form and function insufficiently, and creates relatively few distinct spaces [1]. Therefore, it is very important to investigate how to optimize urban space with the assistance of the interaction design idea and the present urban space human-centeredness design concept. This research classifies the optimized elements, investigates their forms of interaction, and offers suggestions for the optimization of urban architectural space based on the examination of the case study of interactive elements in urban space.

2. Overview of Interaction Design for Urban Space

2.1. Concepts for Interaction Design

The first examples of interaction design can be found in website and graphic design. The idea behind interaction design is to increase the accessibility and applicability of a system by fostering communication between humans and machines [2]. Now that it is user-centeredness, each object's content and structure are updated systematically through communication and interaction between the subject and each object. The design and update of the content are not only limited to the original electronic content, but also follow the advancement of science and technology, the passing of time, and multidisciplinary cross-service to mankind.

2.2. The Relevance of Urban Architectural Space and Interaction Design

Modern design is becoming increasingly diverse, digital, dynamic, and visual as new technologies proliferate, and human requirements have gradually changed from basic "survival" to better "life" as a result. The core principles of interaction design are to put the user first and improve system performance through interaction and communication, which is also the focus of current urban design. The word "interaction" itself represents the meaning of communication and interaction. On the basis of interaction design, interaction can be optimized through communication between people, the perception of space by people, the interaction between people and facilities, and the change of urban materials and space brought about by people living in the city.

Designers and users are unable to communicate simultaneously in the context of current architectural and urban design. While interaction design falls under the category of practicality, architecture is a discipline that combines art and technology. By combining the theoretical thinking of architecture with the practical improvement of interaction, it is possible to create a usable foundation for the user's psychology. This foundation must begin with a more applicable and simple-to-use urban space [3].

2.3. Results of Recent Research

At present, artificial intelligence is the main way that architecture and interaction design are combined. In architectural design, for instance, the automation of building roof canopies is controlled by the intelligent operation of interactions to turn them on and off when it rains and on when light and ventilation are required inside the building [4]. Intelligent electronic interactions for service objectives dominate current interaction design, with design techniques focused on the five senses of interaction between architectural urban settings and humans completing the rest.

3. Urban Space Interactable Element Research

3.1. Seasonal Materials

Urban design is influenced by a variety of factors, including plant systems and urban green spaces. The plant system is one of the simplest components of the urban fabric to see and engage with since it is so pervasive in city inhabitants' daily lives.

In the case of rapid urbanization and a substantial rise in the urban population, there is a significant increase in the demand for residential buildings. Additionally, the impact of urbanization and population growth has also led to an increase in the demand for employment, which has resulted in a significant increase in the number of public buildings, which has increased the number of opportunities to interact with the natural ecology of the urban construction of the city is less and less, and by the city of the space of the extrusion of the increase in the hard ground brought about by the increase in the number of urban flooding and many other problems. By taking into account the needs of the communities and the lives of the residents, pocket parks have been moved and constructed in urban corners and lost areas as a consequence of the study. Robert Zion, a landscape architect, first

proposed pocket parks in May 1963, referring to the dispersed establishment of small parks in patches in high-density urban centers. The United States was the first country to begin building pocket parks in the nation; similarly to the United States, the situation in Europe is similar. The development of pocket parks in China is primarily in the stage of rapid development. China's pocket parks are mainly in the rapid development stage of development [5].Pocket parks as patches distributed in the hard substrate of the city, where the plants that are the subject are the producers of the urban ecosystem, as well as the characteristics of the organisms, and the visible nature of the changes over time. Urban planning and design professionals create pocket parks to improve the quality of life for local residents. Because ecological elements that change with the seasons are an essential component of the interaction between designers, users, and the city, pocket parks' designability, visibility, and operability are all of the same nature as interactive design. Pocket parks have demonstrated a role that should not be understated. From the initial ecological and urban system separation to the current development of ecological landscape planning as the basis for the starting point for the reconciliation of urban design, people gradually come to understand the importance of improving the ecological environment in urban ecosystems. The user-participation principle serves as the foundation for the interactive aspect of pocket park landscape design, with planting serving as the focal point and water features, paving, and outdoor furniture enhancing user interaction [6].

As a soft ground in the city, green space controls the urban ecology, provides the urban ecosystem with the energy it needs, and so forth. Additionally, as a part of what users and designers see every day, green space is also the part that is most easily accessible to them. This type of material, when combined with the changes in natural time and different landscape effects, can create distinct cities and distinct users of design.

3.2. Variable Materials

In urban planning and design, the designer's design is typically one-way; the current design and construction of user opinions as well as references are collected to a low degree. The designer's planning and design are formed after a certain amount of time is typically needed to get the user's feedback, on the basis of which the improvement and refinement of the results can not be perfect. It can be seen that the general planning and construction of urban space is disconnected, lacks contact, and requires quick repair because this occurrence happens frequently in urban buildings. Therefore, the author thinks that planning in urban space needs to have a longer-term view of the changes that occur with the passage of time and the interactive usage of people's lives, as well as the location and role of change in the design. The author offers this as a user of urban space and as a student of this discipline.

From all four functions of a city can infer that transportation is one of the fundamental and crucial ones and that the urban road network is the fundamental component of traffic within the city.

The urban road network serves as the framework for the growth and development of a city. The urban road divides the various city spaces, providing a foundation for the city's numerous functional building pieces to be designed and connected. Urban roads can be classified as urban expressways, main streets, secondary trunk roads, and branch roads based on their traffic functions in cities as well as the services provided by the buildings that are located next to them. Because life and traffic on these two types of roads cannot be reconciled with the nature of the road and because there are various interactive elements, the next author will analyze a case involving these two types of roads with different natures.

Traffic roads connect different areas of the city and are mostly used by vehicles for medium and long-distance travel. Urban transportation is supported by a network of urban roadways rather than a single route, giving users additional options for how they want to go to their destinations. Similarly to this, the user must adhere to city traffic laws in order to reach his or her destination. In addition to using common sense, the user must also drive with consideration for the amenities placed along the route. In order to achieve the goal of reducing or even eliminating this cognitive bias, it is important to improve the design of user-centered concepts with the aid of interaction design. Signage guidance

systems were created as a result of user use, and urban and architectural signage designs are typically created by the designer based on their own experience in the space [7].

Living roads are those that are primarily used for people to travel to or visit on foot, and they are typically planned using the "through but not smooth, smooth but not across" design approach, which refers to the rationality of the spatial organization in accordance with local conditions. Green sets are frequently mixed with hard surfaces in daily life, but hard paving is utilized considerably less frequently than new paths created by trampling green lawns since users' path preferences tend to be quicker to access. As a result, unnecessary expenditures associated with multiple maintenances at a later stage can be avoided if changes in path selection caused by user interaction with the planned space and building organization can be taken into account while designing paths.

3.3. Technologically Innovative Materials

The advent of the big data era, the level of development of artificial intelligence technology, and the current level of scientific and technological development have greatly accelerated the process of urbanization. Traditional urban planning and architectural design is primarily through the space and the landscape to reach an interactive relationship with the user, and in the current level of scientific and technological development has great potential.

Digital media technology is based on the quick advancement of computer and communication technology as well as the integrated formation of a combination of images, audio, and video as well as other classroom interaction techniques of emerging technologies, through the virtual to the subject of the artistic presentation to the object to convey a novel interactive entity three-dimensional display [8]. The integration of architectural spatial aesthetics and the practice of physical three-dimensional display, makes the shaping of urban spatial interaction generate new possibilities in architectural design and the beautification as well as the design of urban public space. This is made possible by the interactivity of digital media technology as well as other characteristics of the outer skin material and the space it encloses or opens. In order to create a virtual reality scenario using computer technology and sensing technology and fulfill the goal of user interaction, virtual reality technology is built on digital media technology, through 3D modeling and other means [9]. The creation of intelligent megatrends has been the focus of urban space shaping. By combining this focus with virtual reality technology to mimic the molding of landscape space, urban design may be more complete and immersive.

4. Urban Development Interactions

4.1. Behavioural Interactions

Human behavior is primarily made up of conscious and unconscious behaviors. Whereas conscious behavior refers to human action under mindful brain control, unconscious behavior is the result of an individual acting unconsciously in response to their own inner needs while being subtly influenced by their environment [3]. Urban construction optimization can focus on these two behavioral patterns, taking into account the level of interaction between users and the space in the urban spatial environment and the primary media, and create a good interactive environment by fusing the needs of users to increase the vitality of the urban space, for example, by optimizing the color matching and division of paving to make the space clear and safe and optimizing the architectural vignettes with the help of scientific and technological means to create a sensible spatial ambiance, and so on.

4.2. Emotional Interactions

In order to strengthen the city's cultural heritage and achieve the educational benefit of strengthening the city's cultural lineage, emotional interaction should center on enhancing the user's experience in urban space. This way, imagery displayed in architectural and urban construction projects will resonate with the user's experience. To illustrate the significance of creating a healthy

urban environment, parks can be designed with interactive rain gardens that visitors can explore and learn from.

4.3. Sensory Interactions

Urban experiences are frequently founded on impromptu, transient perceptions of use, and materials play a major role in the construction of public places. Materials can offer a type of place-based interaction that involves citizens through interfaces or traces [10]. As the most popular interaction system available today, sensory interaction primarily involves the user being guided visually to experience various colors, scales, and other elements to create distinct spatial sensations, as well as physically feeling the material's spatial composition. Olfactory and auditory aspects are used less frequently. Auditory, through various sounds and materials to support the expression of various spatial imagery. For instance, in a quiet area surrounded by materials, it is possible to select sound-absorbing noise processing to immerse the user in a space shaped by the sense of smell, using artificial or natural materials to guide the user in selecting a different space.

5. Conclusion

Based on the research, this article concludes that interaction design is a design idea that aligns with the current purpose of human-centered urban architectural development and that it is realistic to conceptualize and practice interaction design as a means of optimizing urban architectural space. In order to optimize development with the aid of the already-existing interactive elements of the city, it can therefore try to improve the interactivity of the system composed of citizens and the city through behavioral interaction, emotional interaction, sensory interaction, and so on based on the needs of the user; which will make the urban construction more applicable and easy to use on the basis of usability, enhance the residents' sense of well-being in the urban life, and create a more humane urban environment. This study methodically examines the potential for improving urban architecture's spatial design through the use of the interaction design development concept, interactive elements in implementation, and interaction strategies that support the interaction of residents' and designers' perspectives to optimize urban space and create a more workable spatial design approach. Only a few of the urban spatial optimization measures are covered in this paper's current research; in the future, more variables can be distilled from each optimization classification, and real-time feedback can be given to summarize plausible optimization strategies.

References

[1] Wu Nan. An Introduction to the Application of Interaction Design in Architectural Landscape. Art Education, 2019, (10): 219-220.

[2] Wu Linghao. Interaction Design Research on Urban Public Seating Installations. Urbanism and Architecture, 2022, 19(07): 168-170.

[3] Zhong Yijie. Research on the Application of Interactive Landscape Design Concepts in Urban Lost Spaces. Jiangxi University of Finance and Economics, 2021.

[4] Shi Xiaobin. Interaction Design in Architectural Design. Industrial Construction, 2023, 53(06): 264.

[5] Chen Tingting, Wang Weidong, Shi Fuchao, Sun Baoteng. Current status of research and application of pocket parks in China. Chinese Horticulture Abstracts, 2017, 33(02): 81-83+149.

[6] Huang Yujing. Analysis of Urban Pocket Park Landscape Design Based on Interaction Design Concepts. Foshan Ceramics, 2023, 33(01):167-169.

[7] Zhao Gemian. Research on garden roads in landscape garden planning and design. Foshan Ceramics, 2023, 33(02): 173-175.

[8] Du Zhoufei, Li Yuhong. A Practical Exploration of Digital Media Art in Architectural Landscape Design. The Journal of Fashion Design and Engineering, 2023(01): 25-27.

[9] Cheng Yue, Han Yuhong. Research on Interactive Landscape Based on Virtual Reality Technology under Smart City. Packaging Engineering, 2023, 44(S1): 246-251.

[10] LINDA H., ELENI E., IRINA P., et al. Material Meets the City: A Materials Experience Perspective on Urban Interaction Design. 2022, 29(1): 58-63.