Lecture Notes in Networks and Systems 272

Jerzy Charytonowicz
Alicja Maciejko
Christianne S. Falcão *Editors*

Advances in Human Factors in Architecture, Sustainable Urban Planning and Infrastructure

Proceedings of the AHFE 2021 Virtual Conference on Human Factors in Architecture, Sustainable Urban Planning and Infrastructure, July 25–29, 2021, USA

Springer

Lecture Notes in Networks and Systems

Volume 272

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Editors
Jerzy Charytonowicz
Department of Architecture
Wroclaw University of Technology
Wroclaw, Poland

Alicja Maciejko
Institute of Architecture
and Urban Planning ul
University of Zielona Gora
Zielona Góra, Poland

Christianne S. Falcão
Doctorate Researcher in Design
Recife-PE, Brazil

ISSN 2367-3370 ISSN 2367-3389 (electronic)
Lecture Notes in Networks and Systems
ISBN 978-3-030-80709-2 ISBN 978-3-030-80710-8 (eBook)
https://doi.org/10.1007/978-3-030-80710-8

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Advances in Human Factors and Ergonomics 2021

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12th International Conference on Applied Human Factors and Ergonomics and the Affiliated Conferences (AHFE 2021)

Proceedings of the AHFE 2021 Virtual Conference on Human Factors in Architecture, Sustainable Urban Planning and Infrastructure, July 25–29, 2021, USA.

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Preface

The discipline of human factors in architecture, sustainable urban planning and infrastructure provides a platform for addressing challenges in human factors and engineering research with the focus on sustainability in the built environment, applications of sustainability assessment, demonstrations and applications that contribute to competitiveness and well-being, quantification and assessment of sustainable infrastructure projects, and the environmental, human, social and economic dimensions of sustainable infrastructure. A thorough understanding of the characteristics of a wide range of people is essential in the development of sustainable infrastructure and systems, serves as valuable information to designers and helps ensure design will fit the targeted population of end users.

This book focuses on the advances in the human factors in architecture, sustainable urban planning and infrastructure, which are a critical aspect in the design of any human-centered technological system. The ideas and practical solutions described in the book are the outcome of dedicated research by academics and practitioners aiming to advance theory and practice in this dynamic and all-encompassing discipline.

A total of two main sections are presented in this book:

1. Ergonomics in Building and Architecture
2. Ergonomics in Urban Design

Each section contains research papers that have been reviewed by the members of the International Editorial Board. Our sincere thanks and appreciation to the board members as listed below:

A. Szpakov, Belarus
R. Tarczewski, Poland
E. Trocka-Leszczyńska, Poland
D. Winnicka-Jaslowska, Poland

We hope that this book, which is the international state of the art in architecture, urban planning and sustainable infrastructure domain of human factors and ergonomics, will be a valuable source of theoretical and applied knowledge enabling human-centered design for global markets.

July 2021

Jerzy Charytonowicz
Alicja Maciejko
Christianne Falcão

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Ergonomics in Building and Architecture

Cultural Identity of the Cities—The Use of Narrative Design in Urban Spaces

Stefano Follesa(✉), Peian Yao, Shuang Liang, and Min Zhou

Dipartimento DIDA, Design of Relationship Spaces Laboratory, Università degli Studi di Firenze, Design Campus - via Sandro Pertini 93, 50041 Calenzano, Firenze, Italy
{stefano.follesa, peian.yao, shuang.liang, min.zhou}@unifi.it

Abstract. The Narrative process build histories. It exploits the ability of different human sensory experiences to trigger the imagination, evoke emotions, and capture universal cultural truths and aspirations. Cities need to use narratives to recreate a system of relationship between urban space and people. This paper explores the narrative design strategies for urban spaces and proposes the "Perception-Interaction-Make sense" narrative design model. The paper presents a case study of Iranian regional culture in the context of a workshop at Alzahra University in Tehran, Iran. The work also provides a vision of data as a tool for urban narrative in the era of smart cities. The value of this thesis is to provide a theoretical reference for the construction of regional distinctive culture in a global context, as well as a theoretical guide for the sustainable development of urban culture in urban renewal.

Keywords: City identity · Narrative design · Cultural diversity

1 Introduction

In the development of smart cities, technology is changing people's way of life and the social perception in cities in a way invisible to the naked eye. Human activity in cyberspace is closely linked to the influence in real environment. The way people perceive the city environment is increasingly not only limited to the experience in physical space, but more about overlaying the physical space with shared information layers and collaborative location-aware technologies that rely on emerging technological media. The saying "seeing is believing" is no longer applicable to the process of generating knowledge of a place. In many cities the perception of space by citizens is today much more complex than what happened not more than twenty years ago.

Due to rapid globalization and the continuous advancement of technologies, identifying relations and values that define humans and their environments in various ways has become crucial [1]. Following the development of the communication society, the fierce competition between cities has gradually developed from a single economic competition to a competition of social innovation and cultural vitality. Societies are increasingly admiring the innovative capability of urban life. The identity of a city is therefore increasingly important for the sustainable development of a city

J. Charytonowicz et al. (Eds.): AHFE 2021, LNNS 272, pp. 155–163, 2021.
https://doi.org/10.1007/978-3-030-80710-8_19

and the well-being of its society, also thanks to the economic benefits that a recognized identity can generate. According to The 2030 Agenda for Sustainable Development issued by the United Nations. Urban cultural inclusiveness is an important indicator of sustainable urban development and social peace and prosperity. This paper therefore focuses on the question of what aspects of urban identity are embodied in the city and how these aspects capture the dynamic and fluid character of human social self-expression.

2 City Identity and Spatial Narrative

2.1 Premise

In different disciplines, the word "identity" has specific reflections and diverse specific explanations. In order to avoid ambiguity, this paper first sets a premise on the meaning of the word "identity". The meaning of the term "Identity" in this paper mainly relates to the uniqueness of a local cultural environment and social relationship, which is quite different from other cultural forms.

The connotation of "City Identity" in this paper mainly refers to the social and spatial cultural value of one city that makes it different from other cities. This value creates an empathy and attachment to the city. It represents the collective field of experiential knowledge and psychological identification in the urban space. Citizens and visitors need to perceive, experience and learn in order to acquire this experiential knowledge.

2.2 The Spatial Narrative Constitution of Urban Identity

In many of the studies belonging to the same field of research, are identified some characteristic elements of urban space, such as colors, materials, light, buildings, furniture and so on. These tangible and intangible feature elements contained in urban space can be discussed as urban identity elements. Collecting them together, they are the chapters that make up the narration of the city.

In "The Production of Space" Henri Lefebvre argues that space is the product of social relation. His theory promotes people's attention to the spatial dimension of cities, not just the termporal scale. The various activities and changes in the city are shown through the spatial dimension.

In the semantics of urban identity, the concept of "space" takes on a completely new meaning. The Urban space is a medium for telling stories, expressing emotions and transmitting knowledge. Urban spatial narrative is a narrative carrier that focuses on human behavior as the core.

3 Analysis of Spatial Narrative Elements

The concept of urban space narration in this paper can be understood as: to think of space as the representation of all narrative activities in a city. The tangible and intangible elements in the space are seen as storytelling tools that can tell the story of the city to the people and define the transition from "space" to "place". The attentions are no longer to technologies and function but to people and events, to the many aspects of living that involve our emotions and our feelings. They focus on the phenomenon related to identity as the place where stories and things develop.

In the book "The Image of The City" Kevin Lynch explores five material form elements as city images: Path. Node, Landmark, Edge, District. People built their own city images through these five elements. From the perspective of the design discipline, there are many other tangible and intangible elements in the city that can express the "Genius Loci" of a place, that profoundly influence the perception of space, and that are the soul of the city. People perceive both tangible and intangible spatial qualities in space, and placemaking focuses on valuable intangible spatial qualities, such as aesthetics, neighbourliness, traditional culture and identity elements in urban spaces, which are closely linked to human perception. Through desk research and city scene analysis, this paper investigates the feature elements of urban spatial scenes, and makes quantitative analysis of these elements, so as to finally arrive at the classification of urban spatial narrative elements in the diagram (Fig. 1).

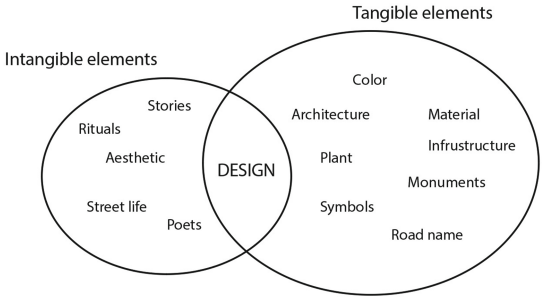

Fig. 1. The urban space narrative elements category

The narrative elements in urban space represent the realm of the common experience knowledge of the local people. "Space is freedom, place is security" [2] (Yifu Tuan, Space and Place 1977). There is a series of cognitive transformation processes from space to place for people's cognitive patterns of the place. In the book Space and Place Yifu Tuan describes the Warner Brown's learning maze experiment. From the experiments, it was concluded that: in a completely unknown space, people learn to understand a completely unknown environment by integrating a number of sensory modalities to perceive a range of actions in space. Ultimately "when one is completely familiar with the space, it becomes the place" [5]. It is the same situation when people first time enters in an urban space with different identity, firstly, people perceive the

various elements of the space through their senses. Secondly, one participates in the activities in the space, interacts with the elements or events in the space, and finally, one develops an emotion and memory of the place. At first people use their senses to perceive and learn about the various elements and activities in the space, then participates in the activities in the space, interacts with the elements or events in the space, and finally, people develops emotions and memories of this space. After this cognitive pattern, space becomes a place. From perceiving, interacting to make sense with the space, we are able to see in the space the common characteristics of local people that help us to communicate through it. Through this cognitive model, people will acquire the identification between alter and ego (Fig. 2).

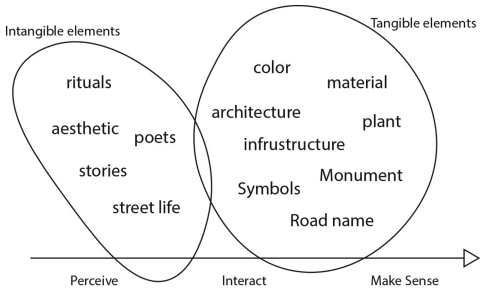

Fig. 2. The spatial cognitive model: from space to place

Through the analysis of spatial narrative elements and spatial cognitive model, this paper focuses on how this model can help the research analyses the growth patterns of different regional cultures. The growth patterns of different regional cultures are the same, or each has its own way of development? In the process of urban dynamic development to provide theoretical guidance for the potential human model.

4 Case Studies: Take Iranian Territory Culture as an Example

In order to test the results of the theoretical analysis presented in the initial phase of this paper and verify on the field the potential of a narrative model applicable to public space, we have developed a method of investigation and then apply it to a case study. In collaboration with the Department of Design at Alzarha University, Tehran, Iran, we organised the workshop 'City As A Book', which combines teaching activities to quantify and qualitatively analyze the cultural identity of Iranian cities.

The workshop considers urban space as an environment that provides an understanding of local values and cultural identity, analysing the diversified and multidimensional cultural identity of urban spaces, As well as discussing the possibility of digital technology as an interface to establish the identity of cities, urban data as an urban narrative method in the future.

The Workshop consists of two phases: the fieldwork phase and the theoretical concept phase. The fieldwork phase consists of two sessions: Urban Identity and Urban Narrative; Human Activities and Perception in Urban Public Space. In this phase the narrative elements of the city physical space and the people's activities and perceptions in the space are investigated. The theoretical concept phase consists of two sessions: Changes in Spatial Characteristics in Smart Cities; Digital Narrative Design of Urban Spaces. This phase discusses the new features of urban spatial narrative and the development framework of digital narrative in the era of smart cities. In the course we mainly use research methods such as field research in social studies and brainstorming in design discipline.

During the fieldwork phase, the scope of the urban space investigated was mainly the open public space in a particular area of the city. Such as, a square, a street, or a space in a crevice. In the investigation results of this phase, the students' investigation report mainly combines the city scene pictures with the text description. In the paper we will present some items as examples. The items in the Urban Space Narrative Elements Category are analysed in turn, culminating in a scenario analysis of the narrative elements of urban space, as shown in the Fig. 3.

Fig. 3. Students' investigation in the city public spaces

In the analysis of the scenario, a five-sensory map analysis was used to assess the quality of experience in the space and to analyse the specific perceptual elements (Fig. 4).

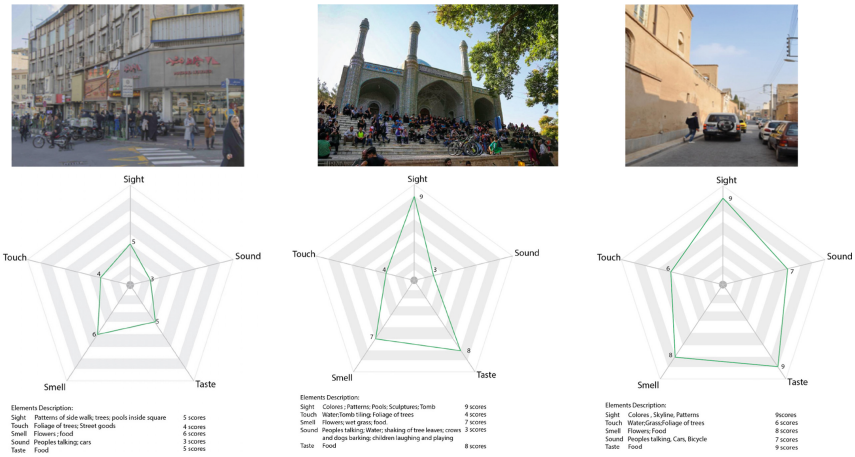

Fig. 4. Analysis of the five senses in urban public space

The public image of this space is analyzed by cognitive map method, and the residents draw the image map composed of various elements. A map (sketch) of the space is drawn on white paper by residents based on memory (Fig. 5).

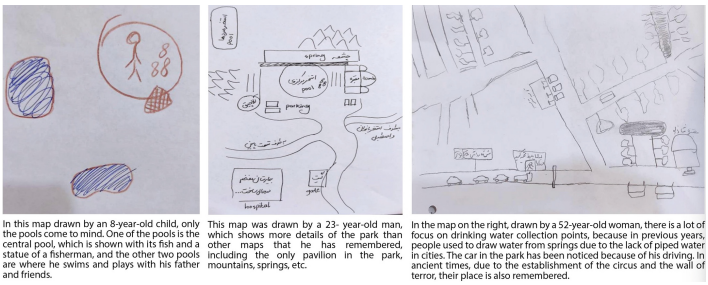

Fig. 5. Residents' cognitive map of the city public space

Result: This stage is analytical, examining the elements of cultural identity in urban spaces from the perspective of design discipline. The different sensory elements and human activities are analysed. The investigation revealed that, at macro level, there is the trend towards globalisation in the physical appearance of the city, which can be seen in the glass-covered buildings and the wide roads. At the micro level we find more elements of traditional culture. Such as the decorative use of traditional patterns, the yellow mud walls in the urban streets wich combine traditional colors and materials, the decorative shapes of street furniture, the colors of street signs, etc.

In addition, investigation revealed that the more closely related to people's daily activities, the more identifiable the characteristics. Such as the female dresses, food, diet, etc. Therefore, it is important to focus on people's life more in the future

investigations. More importantly, through the investigation we discovered that many aspects of the city identity are not linked to material level, but to cognitive level that related to the lifestyle, emotional belonging and religious beliefs of the local people, which are aspect can only be perceived. The study of urban identity cannot be confined to a fixed cultural paradigm, but needs to be dynamic, and with the help of the technology of this era. The second phase of the workshop has been an observation of new trends. A vision of a new narrative for the city of the future.

5 Data as City Narrative Tools

With the development of ICTs technologies, ubiquitous devices are designed to be integrated into the ordinary things of daily life. Today narratives have become more subtle, microscopic and fragmented through the use of emerging technological media. Pervasive computing is intertwined with the development of public space, where digital devices leave traces of people's activities in virtual space, creating a habitat in our virtual space. "Phones connect across distances; GPS locates people in space; Computer games and streamed media synthesize spatial environments; …Short text messages, or tweets, are propagated through the Internet and phone networks to signal the change in position of a friend ("I am in the park") or the state of arbitrary objects" [4]. (The Tuning of Place, Sociable Spaces and Pervasive Digital Media, Richard Coyne, 2010). All these devices are distributed in the space, occupying and creating environmental relevant features.

The popularity of IoTs technology in urban space makes it easier to collect real-time dynamic data covering physical space and forms a new information layer about our urban environment, which we can imagine as a digital city model of virtual space. These abundant data layers provide people with the opportunity to observe ourselves and our environment. It is possible to drive the user's sense of place and to establish a connection between the user and the place. The way digital devices transmit information about the world around us has also helped us begin to create an urban narrative that spans space and time. These data constitute a "digital memory" of a place, a city, or an event. In an IoT environment, sensors can sense physical space in real time, and individual objects can collect data about a place through a combination of sensors and location tags. The data is then transmitted across distances via the network to actuators, which ultimately intervene in the state of things in real space and interact with people. Through this process, it can eventually connect things and people in physical space with database in virtual space, thus creating interaction between different dimensions. In the IoT environment, People-Object-Space interact system formed, and in this system different dimensions are interacted.

This paper attempts to construct the digital narrative design framework of urban space, and to analyze the potential of design discipline in deploying strategies to help people both understand and create the city environment. In the envisaged digital narrative framework. As shown in the figure, real-time data is collected through IoT sensors in the corresponding urban public facilities, processed by computer algorithms, and the results are output to the objects (which can be objects, buildings, sculptures, flower beds, etc.) to interact with the people in the city spaces. Eventually people can

interact directly with the inherent objects in their space and perceive the meaning of their space, instead of perceive the space through extra-designed electronic devices (Fig. 6).

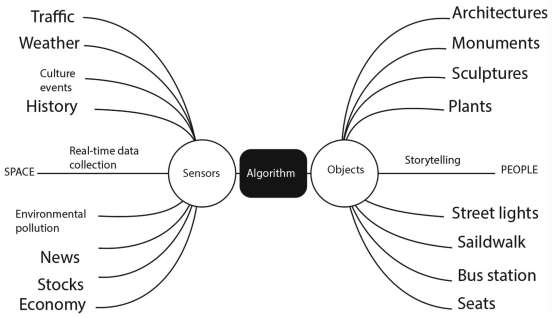

Fig. 6. Digital narrative design framework

The elements that characterize the identity of a place are themselves the best narrative tools; their constitution and aesthetics, often generated by the material traditions of the place have a narrative value much higher than that of most technological objects used with a communicative function. Such technological devices almost never have a relationship with the place where they are installed. The technology should be invisible in the environment and not cause semantic disturbance to the environment itself. In the framework of object design for digital fiction, designers should think about how objects interact with people in space and about more accessible interfaces in the People-Object-Space system.

6 Conclusion

Cities have always been storytelling tools. The walls of our suburbs are the white sheets through which street artists of every city are decoding our society.before the advent of digital technology, people express their stories through words and paintings. Objects and paintings from the past tell extraordinary stories and events. Thinking to Italian Renaissance wedding furniture - Cassone (marriage chest), paintings on cassone depict stories related to marriage and family, such as the famous Story of Lucretia. Narrative is always present in all places, people appreciate and scrutinise the fragments of the city: Small monuments, pavements, stones, tablets, folk tales, feelings, affections and the memories that exciting people. As painting art in Renaissance, digital technology is the main way modern cities tell stories. Data narratives act as a tool to link citizen with spaces, helping people to perceive the culture, identity, memory and historical significance behind the environment and urban form.

The most important feature of digital narrative is its diffusion in different spatial and temporal dimensions, when individual or social perceptions can come together around stories that generate meaning, it is the beginning of the formation of solidarity, empathy and identity.

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