COGNITION AND USE OF THE BUILT ENVIRONMENT, TOOLS AND METHODS OF ANALYSIS

1 Introduction

The main content of the architectural design is to unfold the relationship between people and the built environment, which is embodied in how people cognize the built environment and then use it for forming an overall consciousness of their external world. Therefore, it can improve the design for architects to understand people's think and experiences in the built environment. This dissertation discusses and analyzes people's cognition patterns and usage patterns of the built environment, which architects usually ignore in the current architectural design procedure. During the research activity, the Ph.D. candidate has the opportunity to take part in two research projects closely connected with the research topic: *Green Public Architecture Design Patterns and Demonstrations* guided by Professor Mei Hongyuan from Harbin Institute of Technology, and *Sm^{2}art* with the scientific coordinator Professor Pagani Roberto, and tutored by Professor Bosia Daniela and Doctor Savio Lorenzo from Polytechnic University of Turin.

Green Public Architecture Design Patterns and Demonstration is a research project supported by the Ministry of Science and Technology of the People's Republic of China aimed at a multi-agent and multi-professional architectural design platform for developing the design theory and collaborative system of cold region architecture to improve the people's environmental suitability.

Sm^{2}art is a research project supported by the Italian Ministry of Research Education and University aimed at the design of innovative street furniture, in which digital technologies are integrated, whose solutions are meant to renew the public space, also aggregating existing functions, and generating an offer of wellbeing, which, in turn, stimulates a further "demand" for increasing the efficiency of urban services.

2 Research aim and scope

The lack of understanding people's cognition pattern and usage pattern of the built environment leads to the design usually revealing more about the designers' subjective intentions and the requirements in their imagination without any actual usage context. This dissertation claims that the key to improving urban design is understanding people's cognitive process of the built environment. The user's perspective can be added to the design by the cognition constructing reflection, which is helpful for architects and designers in the built environment design to meet people's multiple needs. Meanwhile, the relationship between people and the built environment has a traceable "figure–background" structure reflecting how people think and experience the built environment. This research applies this paradigm and improves the existing architectural design and urban facility's placement design flow by constructing the people's cognitive structure and behavior pattern of the built environment and then applies the result to a specific project to deepen it. The architects can follow this cognitive structure of architecture to understand the multiple relationships between the place and the local people, then apply the multi-scale urban design flow proposed in the built environment design.

The research considers the built environment as the investigation object, including multi-scale design objects, such as architecture, urban facilities, and public space.

Starting from specific case studies, the outcomes and the analysis provided can reference other contexts.

The dissertation includes two parts (see Figure 1):

- Part I constructs the cognitive process from the architecture to the built environment with architecture as the study object and public space as context developed in Harbin;
- Part II proposes the placement design strategies according to the environment-behavior pattern with the urban facility as the study object and public space as context developed in Turin.

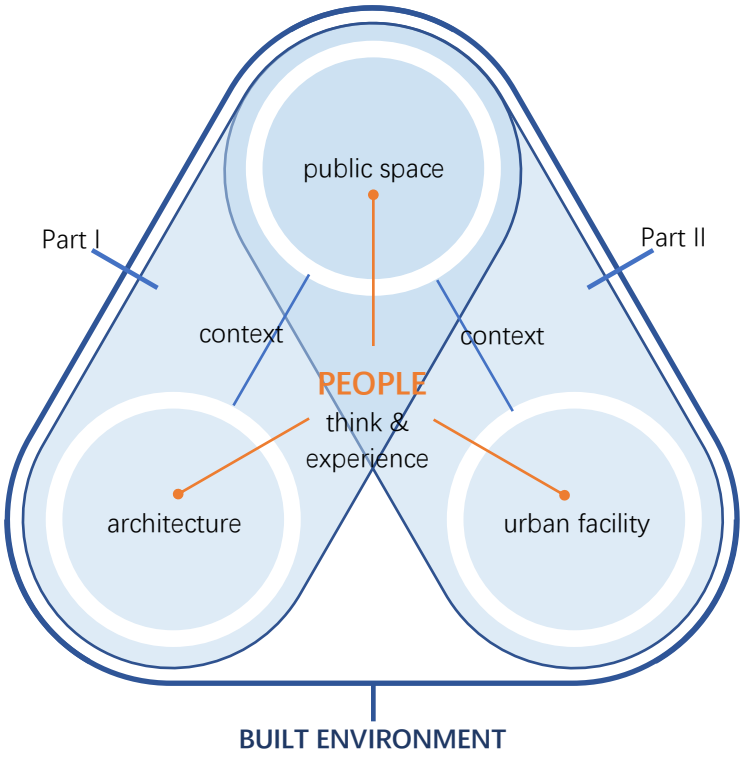

Fig. 1 The structure of this dissertation according to the relationship between the built environment and people

Both parts propose a people's cognition pattern and usage pattern of the built environment and combine two supporting research projects. Part I mainly theoretically analyze the people's cognition construction from architecture to public space with the social scientific method; Part II principally pays attention to the practical use pattern of urban facilities and open public space with the natural scientific method, to jointly realize the research objective.

3 Research methods and tools

In this dissertation, different tools and methods are used to develop the analysis at different aims and scales, the most theoretical as the phenomenology in Part I, and the more analytics and data collections as Space Syntax and PSPL in Part II.

(1) Phenomenology: the cognition pattern analysis

Phenomenology is a qualitative research method within the interpretivist paradigm, that investigates the structures in which people experience something or think something.

From the built environment perspective, the phenomenology applied in this dissertation, as both a conception and method, of which basis experiences, aims to

construct a people's cognition structure of architecture with obvious orientation, integrity, and process, and implies people's subjective determinacy during the cognition forming.

This dissertation proposes that people's cognition of architecture starts from a series of architectural images according to image consciousness as an existing cognition paradigm. Then the people's cognitive process of the built environment, through the analysis and synthesis of experience, perception, and association, is obtained by projecting and mapping from the external world to the internal world based on the phenomenological cognitive originary. Furthermore, people's cognitive construction from architectural images always points to their environmental consciousness.

(2) Space Syntax: the configuration index analysis

Space Syntax is a concept developed by Professor Bill Hillier and his research team from University College London (UCL) in the 1970s; it focuses on the solution to the visualization of city space indexes by explaining the connection between people and the public space they take activities in with data. DepthMap is the corresponding software platform to perform computer simulation and works at various scales from city to district to place levels. It has considerable potential to develop a walkability index with 70% reliability and is fundamentally concerned with the street network.

In this dissertation, Space Syntax measures urban open spaces of different scale layers and supports the street network analysis to understand social processes within the built environment and people's behavior patterns with historical and experiential significance. Furthermore, specific local behavior rules could be discovered by comparing walkability according to the spatial configuration and actual residential movement combined with other methods.

(3) PSPL: the in-field data analysis

Public Space & Public Life Survey (PSPL) is a kind of evaluation method aiming to improve urban public space and citizens' public lives, including studies of the physical environment of public space and the state of social life in the air. According to people's activities in the built environment, the urban public space's quality and living conditions are evaluated.

In this dissertation, PSPL is introduced to give the open public quality survey, especially in Part II, for the data collection, problem mining, and principle summary to find the people's behavior pattern in the open built environment, according to which the cognitive pattern for citizen's think of their environment could be discussed and analyzed.

The specific research methods applied include counting, mapping, shadowing, observation, and others to get the activity information such as activity time, walking speed, and walking path. The survey runs through different stages of the dissertation.

Besides, PSPL supplements multi-direction spatial analysis to the built environment research around Space Syntax, which mainly focuses on the horizontal interface analysis (for example, traffic analysis, horizon analysis), supports the accuracy of related simulation results.

4 Part I: *Analysis of the built environment: architectural scale*

This part firstly analyzes the architectural thingness structure according to the thingness of the thing and then indicates that it could be unfolded from these three layers:

- intuitive thingness, without change with the transfer of cognitive subject, is the presence of architectural materiality;

- instrumentality, whose existence without change with the transfer of cognitive subject, but the way instrumentalization does, is the perception of architectural space;
- artistry, whose existence and way depending on the cognitive subject, is the consciousness of the architectural field.

The above structure embodies the different stages of understanding architecture by taking people as the cognitive subject and image consciousness as the cognition paradigm.

Secondly, according to the unfolding structure of the architectural thingness proposed before, the people's cognitive structure of architecture contains the following three cognitive sub-structures under image consciousness:

- from cognitive objectivity, the cognitive sub-structure centered on the intuitive presence of architectural material;
- from cognitive subjectivity, the cognitive sub-structure centered on the perception of architectural space;
- from cognitive intersubjectivity, the cognitive sub-structure centered on the consciousness of architectural field.

The above achieves the originary deconstruction of architecture, which means all the people's cognitive structures constitute an overall cognitive process, with all the cognitive results lead to the people's understanding of the built environment.

5 Part II: *Analysis of the built environment: public space scale*

This part firstly puts forward a people's usage structure of the built environment to show that the behavior patterns in public space should be studied from different scales and various aims. Based on a people-oriented premise, the structure comprises three main principles: function, unity, and identity by discussing the importance, reasons for, and details of the premise, principles, and sub-principles and the correlations between them, with case studies and collaborative design projects as examples. These principles are equally essential and coordinate and interflow with one another: the fulfillment of one principle can contribute to the achievement of others and vice versa. Rather than listing every design detail of every type of urban facility, the structure instead presents all possible areas of concern that should be considered when designing.

Secondly, according to the usage structure constructed above, a design flow of the urban facility's placement is established by discussing and concluding the cognitive and use patterns of the multi-scale public space to meet people's multiple needs in different plan phases.

Finally, *Sm^{2}art* project in Turin, as a case study, is investigated how to decide the new-generation street furniture's location according to the survey on local people's behavior pattern and analyzed the impact on the people's behavior in open public space caused by the built environmental change.

6 Conclusion

The design should be a bridge to connect people and their environments instead of a blind pursuit of an attractive image or a comprehensive functional installation. That connectivity is reflected in the people's cognition patterns and usage patterns of the built environment.

In this dissertation, Part I proposes that people's cognitive process of architecture has a particular structure paradigm. As a result, people can perceive different architectural thingness combined with the specific environment according to different cognitive stages step by step and finally form an integrated consciousness of the architecture and built environment. Therefore, understanding the people's cognition pattern is helpful

for the architects to promote the people's place-identity and place-attachment through multi-level design from a user's view.

Part II establishes a placement design flow of urban facilities following the city layer, district layer, and place layer to match the people's multiple needs in different scales of public spaces. Then, the relevant design strategies in the multi-scale public space and collaborative streetscape could be concluded according to the in-field study and reliable computer simulation and analysis supplied by the flow. Finally, especially to *Sm²art* in Turin, a rudimentary series of street furniture's placement design principles are first drafted by applying and extending the use and cognition of the built environment based on PSPL survey and Space Syntax theory.

The main findings and contributions in this research are as follows:

- Construct the triple structure theory of architectural principle under image consciousness;
- Construct the multi-level and multi-object cognitive structure of the architecture, including the intuition–material structure of the architectural material cognition based on cognitive objectivity, the perception–space structure of architectural space cognition based on cognitive subjectivity, and consciousness–field structure of the architectural field based on cognitive intersubjectivity;
- Propose a reflective paradigm of architecture under image consciousness and reconstructs the cognitive system of architectural consciousness;
- Propose the people's behavior pattern in public space is impacted by both multi-scale environment and the corresponding multiple demands;
- Propose a placement design flow to provide professional designers and managers with a detailed approach about the location selection of urban facilities;
- Propose the design and plan aim of the new street furniture: adaptable, sustainable, and flexible, and the corresponding intelligent street furniture type: service station composed by the support structure and functional component;
- Explain the street furniture's placement design flow by applying it to the *Sm²art* project in Turin as a case study.