



Section 1 DAD Introduction

Section 2 The Springer DAD Book

Section 3

DAD Application for Creating Future Cities



DAD INTRODUCTION

Definition



数据增强设计*

一新数据环境下的规划设计回应与改变

Data Augmented Design: Urban Planning and Design in the New Data Environment

龙 瀛 沈 尧

文章编号1673-8985 (2015) 02-0081-07 中图分类号TU981 文献标识码A, B

Empowered by emerging big and open urban data, together with quantitative spatial analysis and statistical approaches and cutting edge techniques like artificial intelligence, DAD provides a supporting platform for the whole planning and design process, ranging from field investigation, existing condition analysis, future forecasting, scheme design, operation evaluation, and feedback. It is hoped that the application of DAD in planning and design practice could improve the scientific level of planning and design and inspire planners and designers (Long and Shen, 2015).

DAD belongs to a new planning and design support form after CAD (Computer-Aided Design), DSS (Decision Support System), GIS (Geographical Information System), and PSS (Planning Support System). (CAD->GIS->DSS->PSS->DAD)

Comparison of DAD to other planning and design support formats

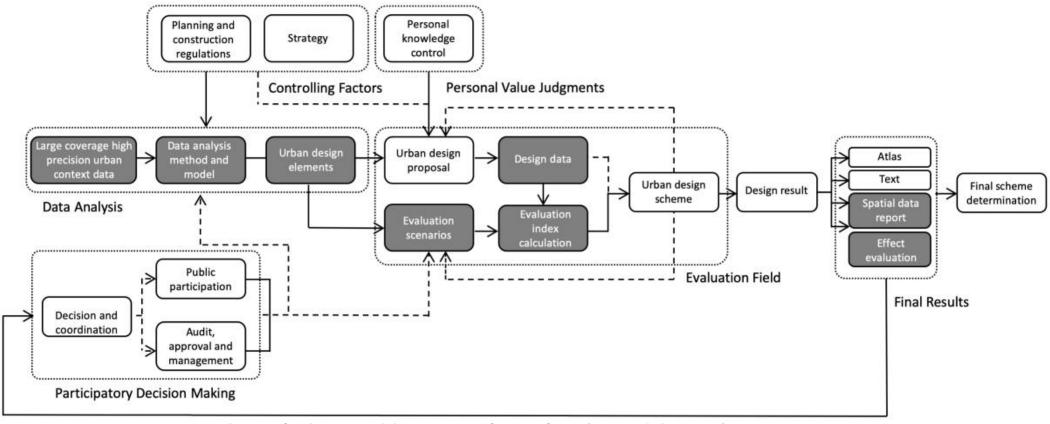
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1011- MA	School of Architecture, Tsinghua University

Concepts	Core Function	Period	Driving force	Process	Scale
ES	A process based on	Long-term	Experience-and	Classification, diagnosis,	Whole scale
(Expert System)	knowledge and expert		knowledge-driven	monitoring, design, scheduling,	
	experience for finding			and planning for specialized	
	solutions to problems			endeavors	
CAD	Planning and design	Short-term	Data-driven	Design generation	Whole scale
(Computer-Aided	support software tools				
Design)					
GIS	Planning and design	Short-term	Data-driven	Existing condition analysis,	Whole scale
(Geographic	support software tools			design generation, and	
Information System)				visualization	
DSS	A collection of tools for the	Short-term	Model-driven	Decision making	Macroscale
(Decision Support	decision-making process				
System)					
SDSS	A collection of tools for the	Short-term	Model-driven	Decision making	Macroscale
(Spatial Decision	spatial decision-making				
Support System)	process				
PSS	A collection of tools and a	Long-term	Model-driven	The whole process of planning	Macroscale
(Planning Support	framework for the planning				
System)	process				
DAD	A collection of tools and a	Long-term	Data-driven	The whole process of planning	Mesoscale
(Data Augmented	framework for the planning			and design	and
Design)	and design process				microscale

Process of DAD



- Inspire the extraction of design elements and the generation of concepts;
- Augment the optimisation of planning and design;
- Support the output expressions of planning and design;
- Help to reduce communication costs;
- Lead to a more transparent urban management atmosphere



The specific planning and design support format of DAD (Long and Shen 2015)

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Research network and annual conferences

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The DAD research network was established in 2015 as a community for DAD and led principally by a Tsinghua University team.

- In April 2016, Tsinghua University Henglong Real Estate Research Center established a DAD research lab.
- In December 2016, the Chinese Society For Urban Studies established Technical Committee for Urban Big Data.

The DAD symposium, as an annual conference for the DAD research network was launched to facilitate the dissemination of up-to-date DAD research and applications from members of the research network.

- Beijing Jiaotong University (2015)
- Tsinghua University (2016)
- Southeast University (2017)
- Tsinghua University (2018)
- China Architecture Design & Research Group (2019)
- Tongji University (2020)



Posters of annual conferences

Education-School of Architecture, Tsinghua



Big Data and Urban Planning,

Structural Urban Design,
Urban and Rural Comprehensive Survey,
Introduction to Urban Modelling,
The New Science of Cities.

- 1. Theoretical courses expand students' visions and promote the acceptance of new data and cutting-edge technologies
- 2. Practical courses encourage students to apply the DAD framework and philosophy in design studios and workshops









DAD in urban planning and design practice



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Urban planning and design project

- Urban design of Xiong'an New Area
- Urban design of Tongzhou Sub-center

Urban planning and design competition

- 2016/2017/2018 Shanghai Urban Design Challenge
- Yilong Futuristic City International Design Competition
- Big Data Supported Space Planning and Design Competition
- Urban Planning and Design Workshop for Shrinking Cities

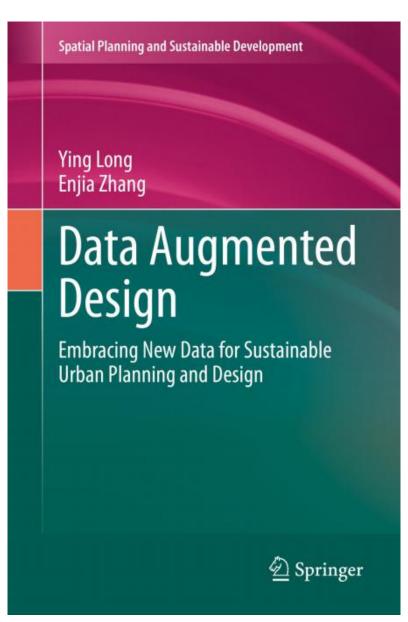




THE SPRINGER DAD BOOK

2 The Springer DAD Book





- Part I Overview
 Chapter 1-3
- Part II Understanding the Elements of a Site to Better Design Sites
 Chapter 4-6
- Part III Learning from Other Cases to Better Design Sites
 Chapter 7-8
- Part IV Embracing Advanced Technologies and Transitioning of Cities into Better Designed Sites
 Chapter 9-10
- **Appendix**Appendix 1-3









Big data and cloud computing



Mobile Internet(4/5G)



Sensor network and Internet of Things



Mixed Reality(VR/AR/MR)



Intelligent construction





Blockchain





Future Cities from the Lens of Space



For more information (Chinese and English Version):

https://www.beijingcitylab.com/projects-1/48-wespace-future-city-space/

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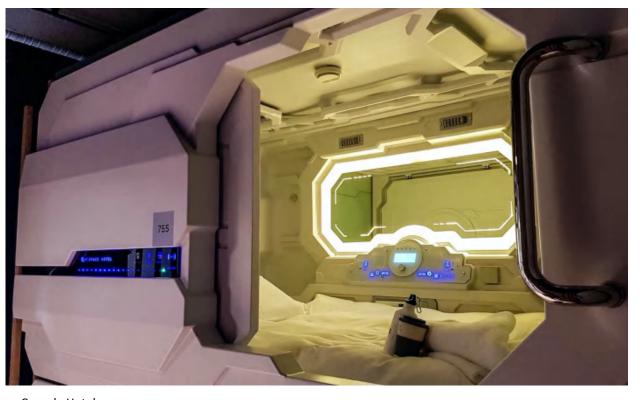


Chapter 1 Cities in Transition

- **Residence: Functional transformation and reconstruction**
- Spatial fragmentation: The living space shows fragmentation development and more small living spaces meeting the instant needs have appeared.







Prefabricated container residence

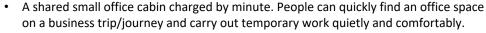
Capsule Hotel

Employment: Functional transformation and reconstruction

- Space fragmentation: The further fragmented office space can make up the shortcomings of traditional single-function/scale land development model.
- The commercialization and specialization of the third space: The forms designed for office workers such as office coffee shops, study rooms, libraries, shared office spaces, etc. are more abundant.









 The soundproof booths in the office can • meet the needs of remote working and conference discussion, etc.



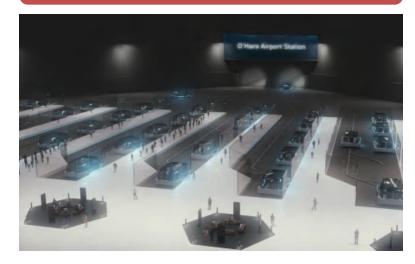
SMART LOUNGE is divided into different forms of working areas



Transportation: Location change and structure

• Three-dimensional and underground transportation: The logistics and fast lanes have been moved to underground, further using the underground space and urban gray space.

Underground unmanned driving transportation and parking



Boring underground driverless tunnel and public transportation system

Underground logistics



• Underground logistics system in Xiong'an

Underground garbage transportation



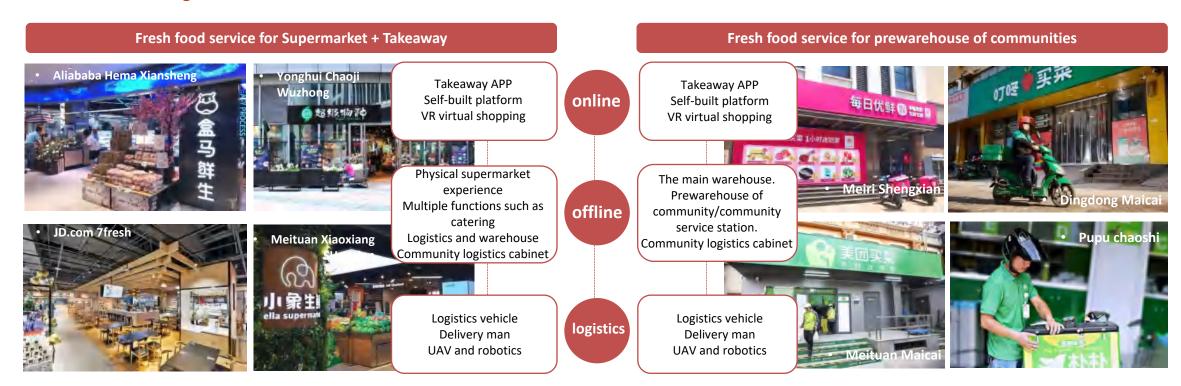
• The vacuum garbage collection system is constructed in Jiangbei New District, Nanjing.





Recreation-shopping: Functional transformation and reconstruction

• OMO (Online-Merge-Offline): Provides convenient living services based on location, and is equipped with personalized logistics, delivery and warehouses centering on communities.



■ Recreation-entertainment: Functional transformation and reconstruction

• Space experience: The superposition of digital facilities enables public space to provide people with personalized interactive experience and enhance the attractiveness of public space. In the future, offline space + interactive facilities, "offline space + live stream", "offline space + AR/VR" models will become the development tendencies of public space.

Offline space + digitalized interactive facilities



Digital waterside pavilion /Carlo Ratti Associati



Interactive bubbles/UNSENSE



Interactive facilites/ DreamDeck



The interaction od lightwater interaction /DreamDeck



Immersive, interactive display facility/ MIT SENSEable City Lab



Gravity fountain design / DreamDeck



Interactive projection facilities/ DreamDeck

TOP100 designs of public space of architecture firms are integrated more interactive experience facilities.

Offline space +AR/VR/live stream



• Columbia "AR" Virtualness and Reality integrated public recreation space

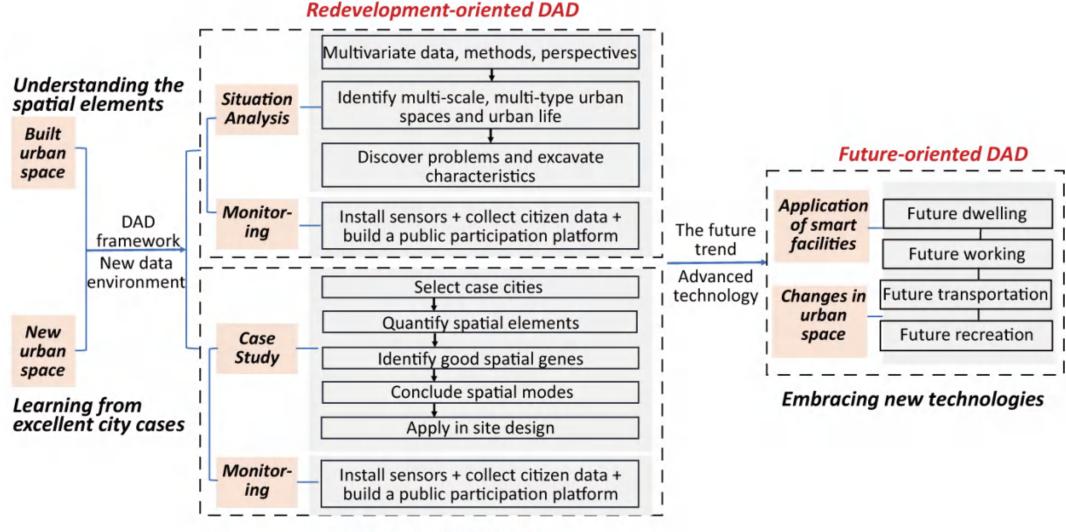
Part I Overview



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Chapter 2
Data Augmented Design (DAD): Definitions, Dimensions, Performance, and Applications

itions, Dimensions, Performance, and Application



Expansion-oriented DAD

Three typical applications of DAD for different design types

Part I Overview

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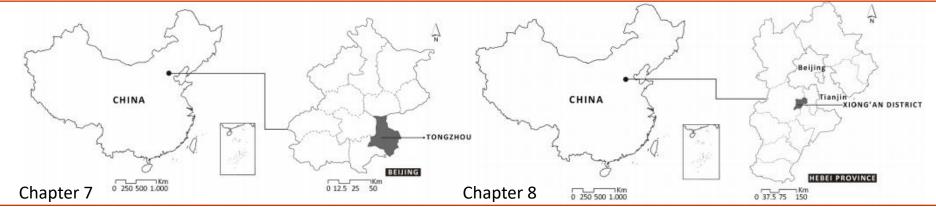
Chapter 2

Data Augmented Design (DAD): Definitions, Dimensions, Performance, and Applications

1. DAD for redevelopmentoriented planning and design: Understanding the Elements of a Site to Better Design Sites Chapter 4-5 O 250 500 1.000 Chapter 6 O 250 500 1.000 Chapter 6 O 250 500 1.000 O 555 110 220

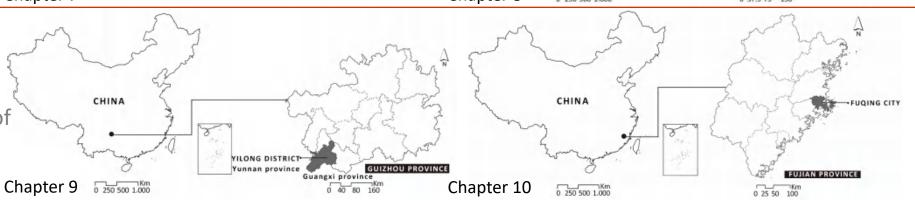
2. DAD for expansion-oriented planning and design :

Learning from Other Cases to Better Design Sites



3. DAD for future cities:

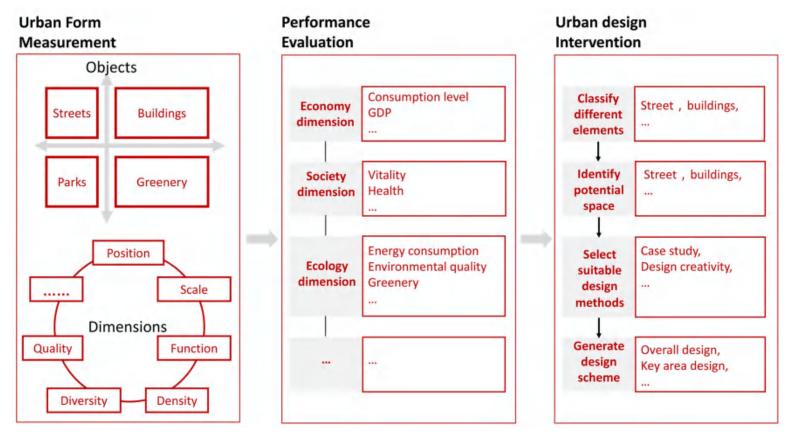
Embracing Advanced
Technologies and Transitioning of
Cities into Better Designed Sites



Chapter 3

Human-scale Urban Form and Its Application in DAD

Human-scale urban form is closely related to human attributes, which can be seen and felt by human beings. Streets, buildings, and attributes of the sur rounding physical environment are the components of human-scale urban form.



Landson and Drive Phoning 191 (2019) 101012 Contents lists available at redess of the Landscape and Urban Planning Measuring human-scale urban form and its performance

This special section of Landscape & Listen Flaming (LAND) "Measuring human scale urban from and its performance" represents a collection of approaches to analyzing, describing and understanding the physical fabric of human-scale orban form and its corresponding sodoesnomic and environmental performance. The rapid development of information and communication technology (ICT) is gradually be coming integrated with the built environment, which leads to the rise of new urban science manifesting as a new infrastructure of sensing, datacollection, and analysis of urbanism (Foressend, 2015).

Throughout the history of architecture, urban planning and landscape inchitecture, most existing theories about human-scale urbanform that can be directly seen by the eyes or touched by the hands have been generated using social science approaches, such as surveys, or even through subjective insuition and practical experience. Herein, the "human-scale" means a fine-scale characterized by the human body and its surroundings, i.e., a scale that is directly visible, tour hable, and appreciable in a person's daily life (Long & Yr, 2016). Recently, sechsological advances made possible the objective study of how people interact with their surrounding environment. By integrating multisource urban data and prospatial analysis with muchine learning algorithms, it is now possible to gain insights into how people use urbanspaces, how they feel about them, and how spaces perform in various kinds of structions (Zhang, Ye, Zeng, & Chramitis, 2019).

Examples of such data include Street View Images (SVIs) provided by Internet companies such as Google and Baidu, 3-D models of buildings and greets generated by laser scanning (LiDAR), gestagged photos uploaded by users to websites such as Flickr, digital footprints of human being tracked by sensors such as mobile abouts, wearable devices and social media records. These data depict the physical and complysical dimensions of urban form and Usenvironmental, energetic and thermal performances, in addition to describing people's mobility activity, and emotional states as they live within other areas, at ther temporal and spetial scales. Meanwhile, newly developed analytical techniques, including geospatial analyses, machine learning, data mining and virtual reality, also supplement an objective and direct understanding of human-scale orban form by uniking use of the new emerging data. Scholars are now able to objectively measure humanscale urban form with these took.

This special section provides an exploration of a sovel less through which to understand small-scale urion form and its social performance. thus facilitating planning and design at such a scale. We aim to address theoretical, methodological, and empirical topes in human-scale urbanform and its performance using new emerging data and catting-edge

2. Background

The couly of human-scale urban form, i.e., the slopes, plans, and structures of the built fabric, and its associated surformance has been regoing since the 1960s. As a rethinking of modernist plaining and design, a series of pioneering tritunists, such as Jacobs (1961) and Leichyre (1962), sitially described the characteristics of human-scale urban from and how it contributes to positive social and cultural per Inmance: Pollowing this stovement, subjective descriptions of human scale urban from and how in benefits centers of activity were then given by Geld (1871) Upuch (1981) Where (1980), fel 130081, and others. Oursainstree studies have been made as a further exploration on human-scale, physical form and perceived quality (Smith, Nederber, & Perkins, 1907; Dh. 1908; Jackies, 2007; Fan & Khattah, 2009). In response, Buring and Chementer (2013) noted that it is possible to measure elusive qualities that were previously unmeasured is the book Measuring Urban Design: Mentes for LiveNe Places. Since the publication of that book, scholars have gradually extended this field of recent (Marco, Roylance Fred, & Bartiel, 2015; Modley, Lo. Childrin, Klein, & Schmitt, 2018; Lt., Sadar, & Ban, 2018; Long & Huang, 2019, Ye, Xie, Yong, Hung, & Wang, 2019, Middel, Lukmezyk, Zakewschi, Arneld, is Marsonwski, 2019).

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New research potential has emerged due to the widespread use of new data theories and analytical methods. Pirst, open data and big data with detailed pro-references provide an opportunity to quantitatively reflect on both urban form and its performance (Those & Long. 2016; W. & Los, 201 H). On the one hand, an explosion of hig data and open data with the development of improved computing capacity have opened up a human-centered perspective by enabling the measurement of how people experience urban form in a new, accurate and apparatum way Numerous types of data, including cell phone data, social media data and geotagued photographs, provide a human-orniered approach that can deeper urbanists' understandings of urban form's various perfor stances in the spatial and temporal dimensions (Perceits, Pars. Vi-Pebe, d-Silva, 2013, Durkel, 2015; Glasser, Romborn, Luca, & Nak 2015; Sons, Long, Wo. & Wang. 2018; Vanderbaeger & Carriers, 2017) On the other hand, the new data environment also helps provide a detailed and quantified illustration of urban form. In addition to the inemiorily used Onen Street Man (OSM), which provides a finite obsdeal framework, there are many other data generated on the human scale that have been used in recent years. For mutance, Google Street View has been used to inform aspects of 3-17 ctry model construction. (Toti, Havison, & Faults, 2079), to quantify greet greenery (11 et al., 2019; Long & Lin. 2017), and to layer interpretation with respect to the pround, pedestrians, vehicles, hulldings and sky (Vin in Vining 2016). Second, many new small-time methods also contribute to the human

scale understanding of orbin form and its performance. Machine

Special Issue in Landscape and Urban Planning

(Long and Ye 2019)

Part II Understanding the Elements of a Site to Better Design Sites



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Chapter 4 Data Adaptive Urban Design: A Case Study of Shanghai Hengfu Historical District

Historical district

Adaptive urban design

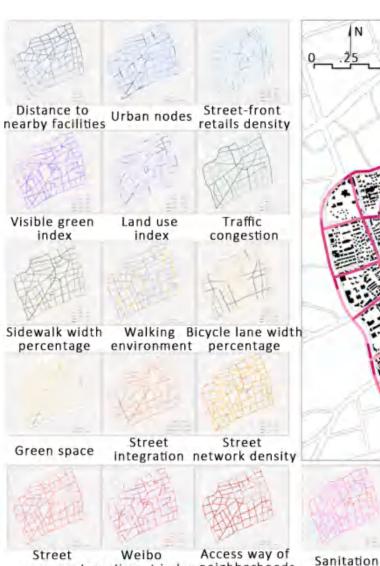
Online data platforn

Motorized

Interaction website for information sharing and public participation



Bird's eye view of type A streets



ornament sentiment index neighborhoods

Street score results

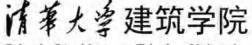


Small

Buildings

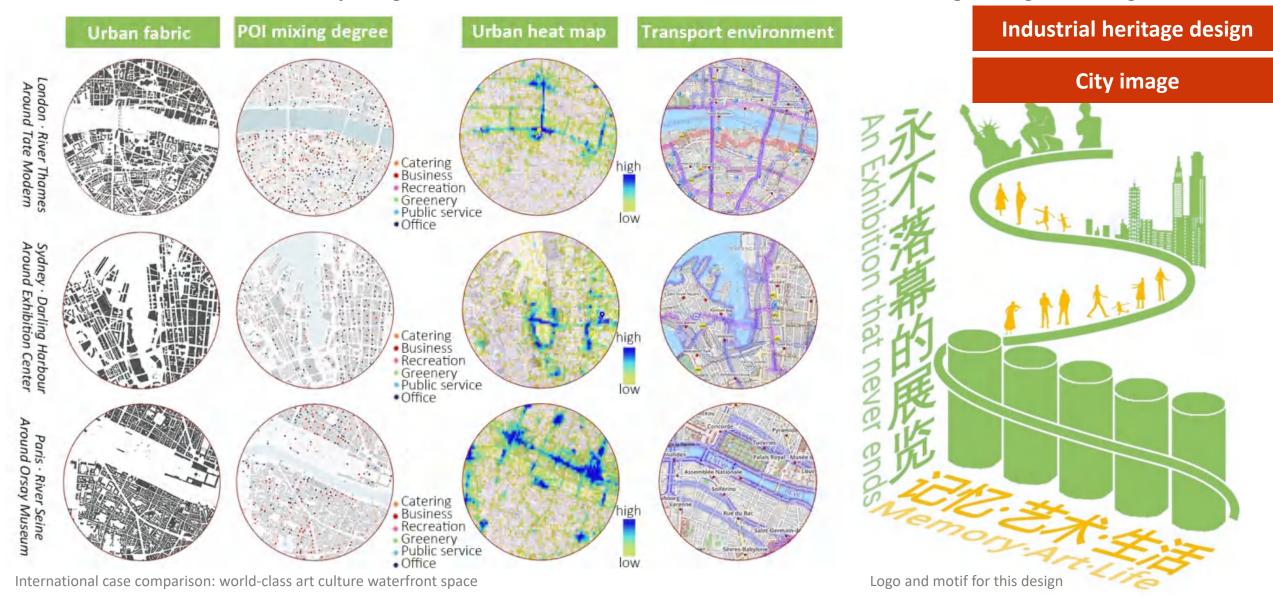
Part II Understanding the Elements of a Site to Better Design Sites





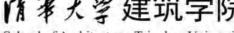
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Chapter 5
Multidimensional Data-Based City Images: Cultural Reactivation of Waterfront Industrial Heritage Design in Shanghai



Part II Understanding the Elements of a Site to Better Design Sites

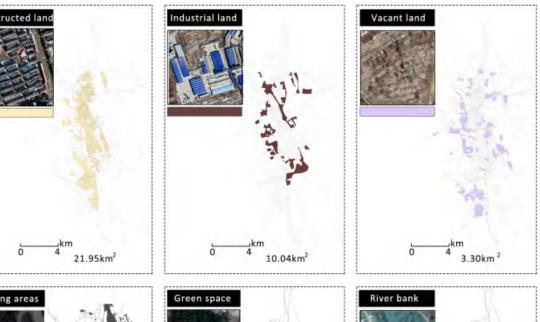


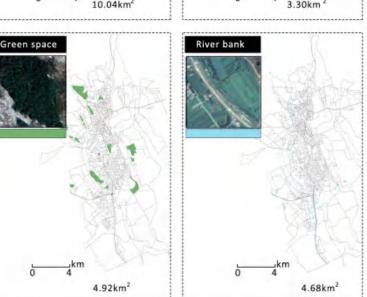


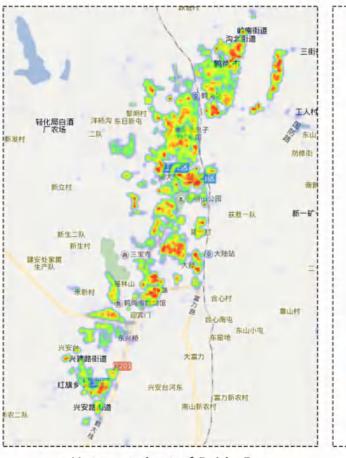
Chapter 6 Fine-Scale Recognition-Based Design Guidelines for Dealing with Shrinking Cities: A Case Study of Hegang

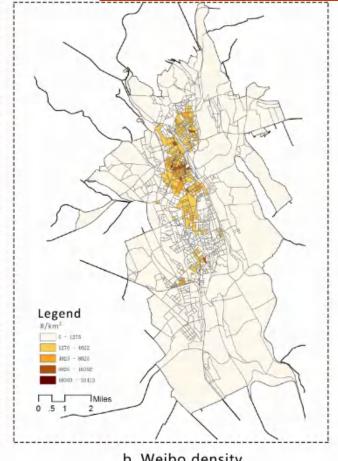
Shrinking city design

Urban design guidelines









a. Hot spot chart of Baidu Eye

b. Weibo density

Six types of land use identified by remote sensing images

The distribution of Baidu Eye (left) and Weibo (right). (a) Hot spot chart of Baidu Eye. (b) Weibo density

Part III Learning from Other Cases to Better Design Sites





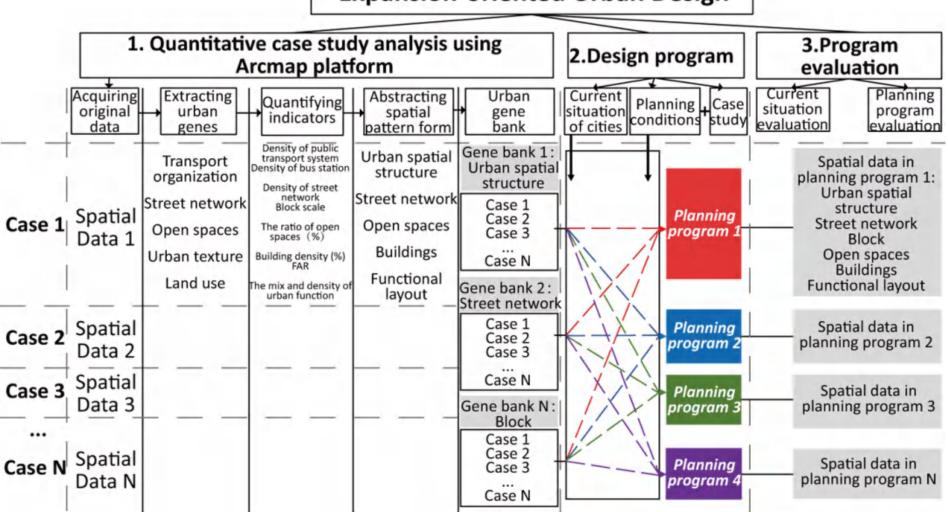
Chapter 7

Quantifying Urban Form as a Case Study in Expansion-Oriented Design: Design Practices in the Tongzhou Subcenter

Expansion-oriented Urban Design

Quantitative case study of similar subcenters

Gene bank of urban form



Research framework



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Chapter 8

Defining the Density of the Xiong'an New Area Based on Global Experience



Waitan, Shanghai

French concession,





Old city, Beijing





Quantitative case study of similar functional areas

> Various urban form indicators









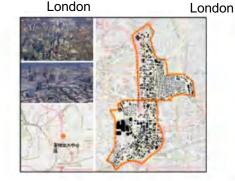




St. James, London

Potsdam square, Germany







Hamburg Port new town, Germany

Case cities

Atlanta, USA

Saint Louis, USA

Milbank, London

Friedrich, Berlin

Part IV Embracing Advanced Technologies and **Transitioning of Cities into Better Designed Sites**



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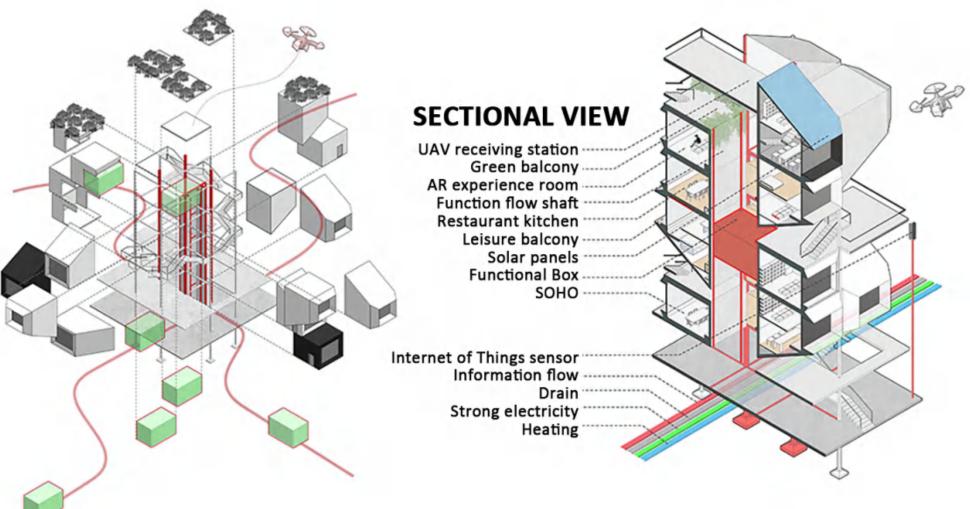
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Chapter 9

The Next Form of Human Settlement: A Design for Future Yilong City

Modular buildings

Various new devices



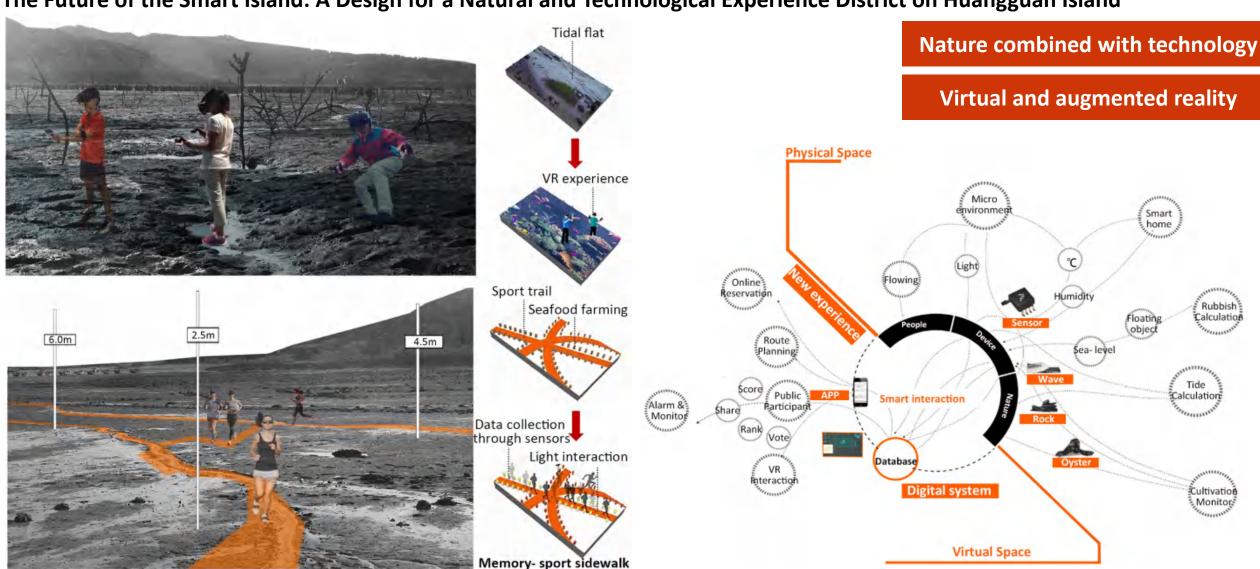
Part IV Embracing Advanced Technologies and Transitioning of Cities into Better Designed Sites



Chapter 10

The state of the s

The Future of the Smart Island: A Design for a Natural and Technological Experience District on Huangguan Island







DAD APPLICATION FOR CREATING FUTURE CITIES



From Smartly Design to **Design Smart**



Three Ways to Promote Urban Research and Practice with Emerging Technologies



City Laboratory

Provide new data and method to understand the city

Recogniation

Method level

New City

Influence the urban life and urban space

Transition

Cognition level

Future City

Help future-oriented urban planning and design

Creation

Practice level









Spatial Intervention, Place-Making and Digital Innovation (SIPMDI)

Spatial Intervention, Place-Making and Digital Innovation (SIPDI) refers to using various smart methods and intelligent facilities, combined with traditional space intervention and place-making design methods, to create smart urban space. It aims better to meet the current needs of people's activities, achieve self-adaption and energy-saving, improve the usage and management efficiency of the space, and increase the space's vitality.

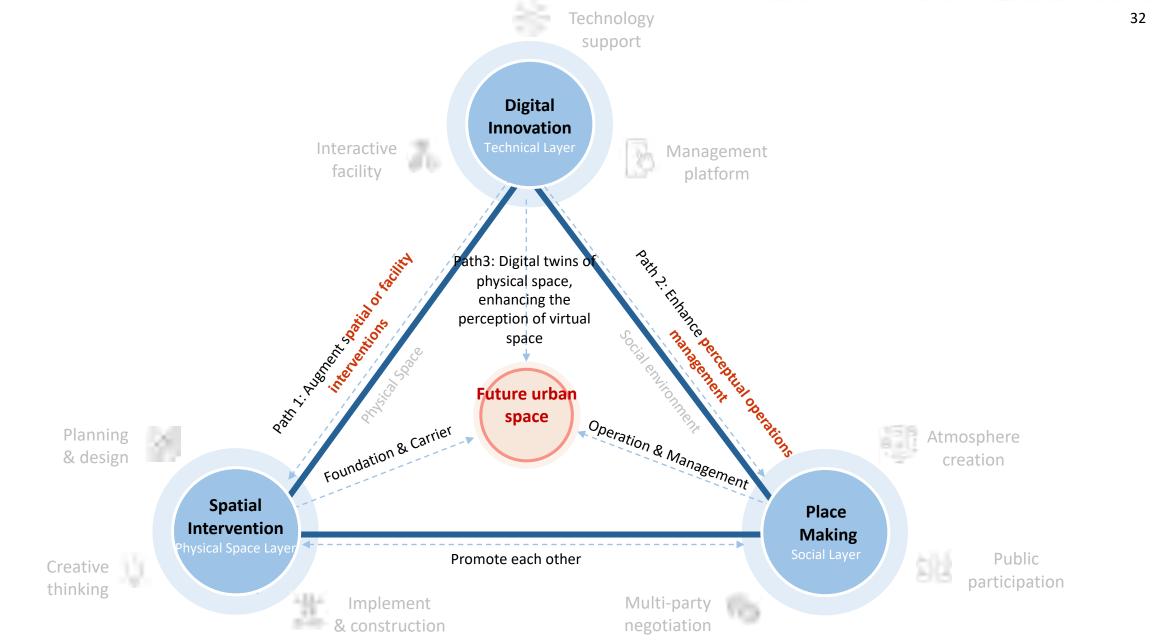


- Urban space mainly covers human-scale urban space elements, including buildings and outdoor public spaces such as green spaces, parks, squares, street nodes, and streets.
- Therefore, "design" includes a broad category of built environment design, including urban design, landscape design, and architectural design.



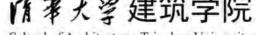
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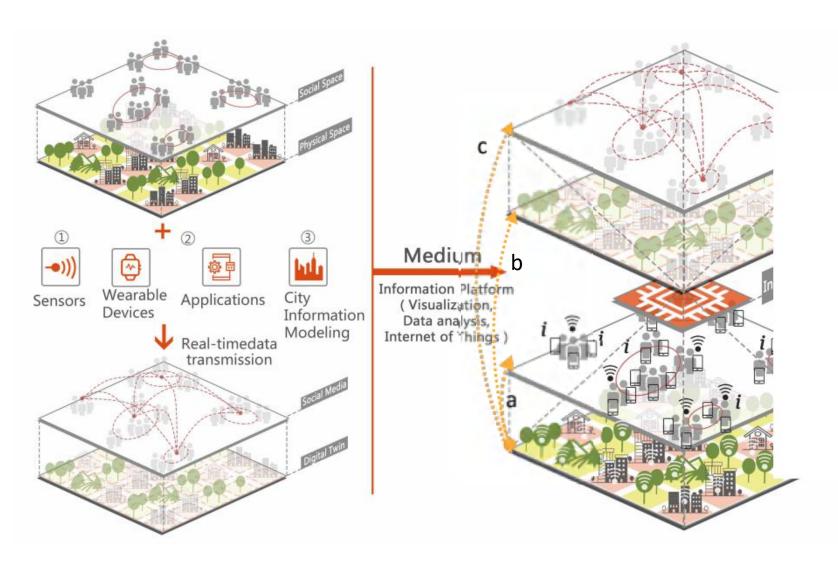








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- a. Enhanced perception of people in urban space
- b. Digitization and virtualization of urban space
- c. Interaction between urban space and social media
- d. Enhanced interaction between people and urban space
- e. Interaction between human and digital twin space
- f. Human interaction in the social media



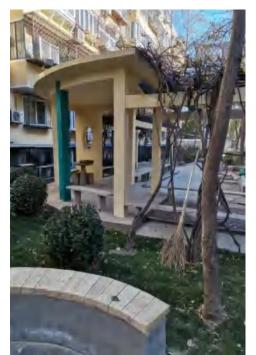


双井可持续更新

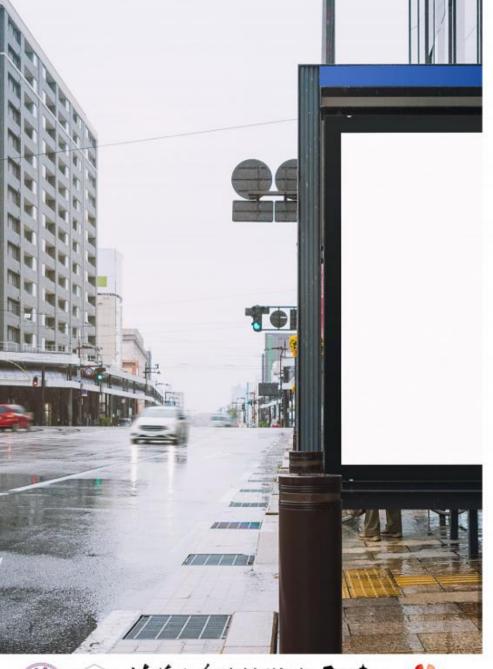














Analysis on the future spatial development direction of smart city technologies in China











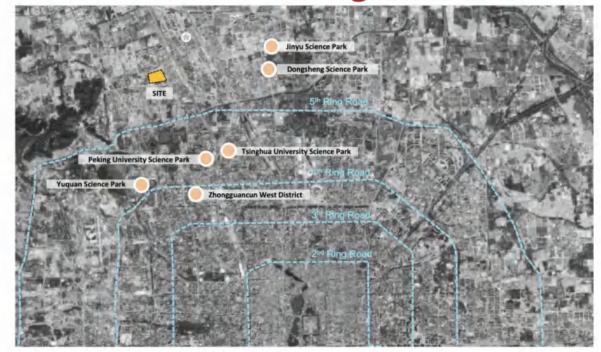




HOME PROJECTS MEMBERS DATA RELEASED COURSES WORKING PA

RANKING LINKS&PARTNERS ABOUT UPDATES

2021 EPMA urban design studio 3



The profile of shared data



The detailed discription for the data.pd Adobe Acrobat Document [2.4 MB]

Download

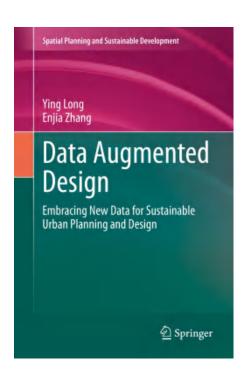
Street view images

Remote sensing images in different years

Big/open urban spatial data for our site

Data download:

https://www.beijingcitylab.com/epma2021



Thanks for your attention

Ying Long
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