新城市科学

数据增强设计与未来城市空间

A Brief Introduction to "The New Science of Cities"

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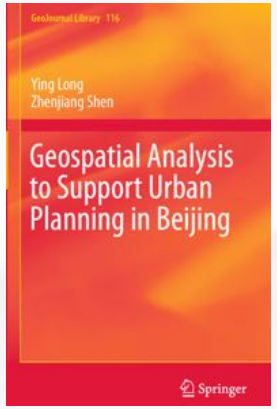
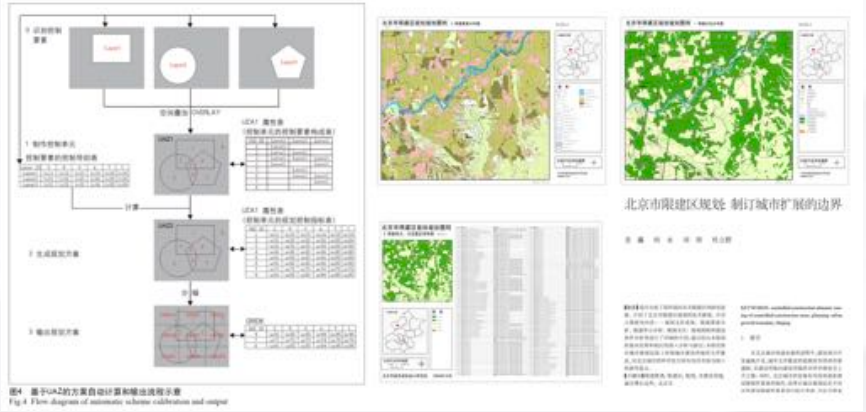
清华大学建筑学院
2019年12月19日

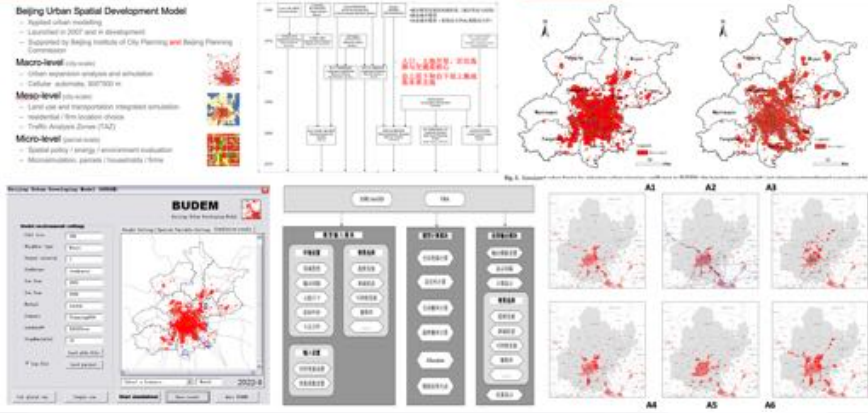
团队已有研究



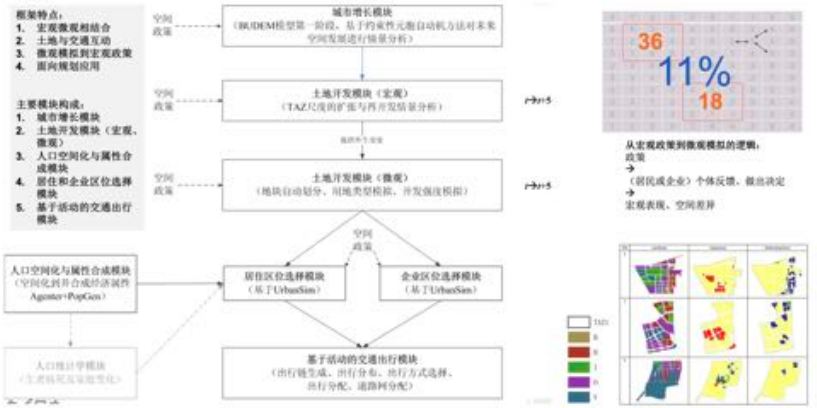
北京市限建区规划支持系统
110个限建要素、30万个限建单元、三个限建分区（2005年）



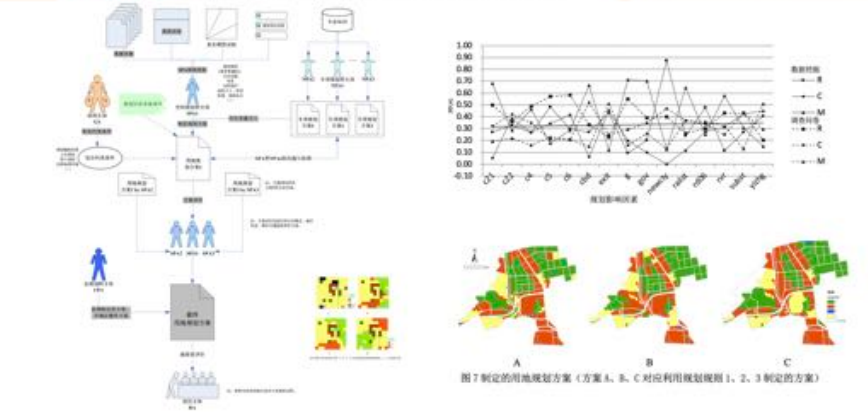
北京城市空间发展分析模型
BUDEM（2007-2015年持续研发）



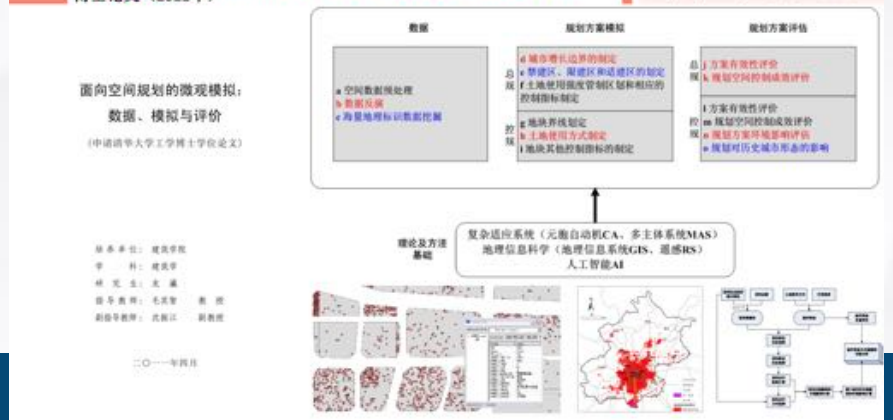
北京城市空间发展分析模型
BUDEM2（2007-2015年持续研发）



规划师主体
通过调查问卷、规划成果数据挖掘等识别用地规划规则以仿真规划师



面向空间规划的微观模拟：数据、模拟与评价
博士论文（2011年）



规划支持系统框架体系
系统梳理支持不同类型城市规划的模型、方法和工具（2012年）

清华大学本科生通选课《新城市科学》，龙 瀛，

PSS在规划实践中的应用有限

- 多个规划学者发表文章表达了这一观点（2014）
  - 规划支持系统PSS的应用有限

doi:10.1068/b130040p

Knowledge in communicative planning practice: a different perspective for planning support systems

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experience of doing so (Vonk et al, 2005).

Two reasons for this underutilization can be distilled from the academic literature. First, there is the notion that technology implementation takes time and has to overcome a diversity of bottlenecks and barriers, such as resistance to change and working habits that have been in place for years (Timmermans, 2008; Vonk et al, 2005). The second reason is that PSS are considered insufficiently sensitive and attuned to the specific demands of planners and the characteristics of the planning process (Geertman, 2006; 2008; te Brömmelstroet, 2010). Van Kouwen et al (2009, page 64) even argue that: "DSS [decision support systems] and PSS tools do not bridge the gap between knowledge and policy making, but are rather part of the problem."

This problem can be understood better by focusing on how the role of planning support is perceived. Traditionally this role has been envisioned in scientific–analytical terms; simply stated, it was assumed that there is a linear relationship between the way in which scientific knowledge is generated and provided, and its usage in practice. A result of this scientific–

Pelzer et al. (2015) "argue that one of the reasons for this is that too much emphasis is put on the instrument rather than the usage and planning context. A better understanding of the relationship between planning practice and PSS is needed in order to improve the role of the latter. We argue that communicative and analytic approaches to planning should be combined."

城市模型的回顾与展望
——访谈麦克·巴蒂之后的新思考
A RETROSPECT AND PROSPECT OF URBAN MODELS: REFLECTIONS AFTER INTERVIEWING MIKE BATTY

刘 伦 龙 瀛 麦克·巴蒂
LIU Lun; LONG Ying; Mike Batty

【摘要】基于对城市模型相关重要学者麦克·巴蒂的访谈，对城市模型的发展历程、现状与前景进行了回顾、评述与展望，介绍城市模型的发展脉络，分析20世纪第一次发展高潮中城市模型在规划应用中的实际困难与受到批判的原因，梳理了当前第二次城市模型发展高潮期的模型门类，并指出精细化城市模型是当前研究热点，模型建模方法得更加侧重"自下而上"与"自上而下"的结合，"问题导向型"以及应对城市日益增长的复杂性与不确定性，同时大数据时代的来临也为城市模型的发展带来了重要契机，但相关研究需要吸取第一轮研究热潮中的经验教训，促进城市模型与规划实践的结合。最后介绍了麦克·巴蒂的城市"新科学"思想，城市定量研究教育的起步以及新近成立的定量城市研究方向大力发展的北京城市实验室。
【关键词】城市模型；定量城市研究；大数据；北京城市实验室；中国

ABSTRACT: Based on an interview to Mike Batty, a leading scholar in urban modeling, this paper reviews the history of urban models, comments on their present developments, and pictures their prospects. The first section briefly introduces the family trees of urban models and then looks further into the causes for their failure in planning application in the first upsurge of research in the 1960s and 1970s. The second section summarizes the current development of urban models, which can be counted as the second upsurge of research. It is estimated that more research attention will be paid to building dynamic, disaggregate, micro and problem-oriented models, with a combination of top-down and bottom-up modeling methods, which can be more trends in the theoretical, educational, and research development of urban models, i.e., the idea of "new science of cities" by Mike Batty, the start-up of quantitative urban research education, and the establishment of Beijing City Lab.
KEYWORDS: urban model; quantitative urban research; big data; Beijing City Lab; China

宏观城市科学的发展历史，从对城市现象的记载、描述，到对其进行归纳、总结，再到对城市事物之间的关系描述，最后发展到用系统的观点看待城市，其发展历程经历了一个从定性到定量的过程，在这样的发展规律下，"城市模型"（urban model）在城市科学中逐渐成为重要分支。城市模型是在对城市系统进行抽象和概念化的基础上，对城市空间现象与过程的抽象数学表达，是理解城市空间现象变化、对城市系统进行科学管理和规划的重要工具，可以为城市政策的执行及城市规划方案的制定和评估提供可行的技术支持。

在我国城市规划逐渐由过去二三十年的"大拆大建"向精细化编制与管理转型的背景下，城市模型研究也在逐渐兴起。为了更好地了解城市模型研究的发展历程与发展方向，笔者于2013年12月采访了城市模型领域重要学者、英国伦敦大学学院(University College of London, UCL)教授、UCL高级空间分析中心(Center of Advanced Spatial Analysis, CASA)主任麦克·巴蒂(Michael Batty)。笔者并非试图对城市模型的发展历程展开全面综述，而是结合访谈内容，就城市模型的发展脉络、门类谱系、应用表现、发展方向、规划教育、相关科学发展等方面提出一系列新思考，希望引发国内学界的关注与进一步研究。

【文章编号】1002-1329(2014)06-0063-08
【中图分类号】TU984, TP391
【文献标识码】A
【doi】10.11918/qxzx20140611a
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刘 伦(1990–)，女，剑桥大学土地经济系博士研究生。
龙 瀛(1980–)，男，博士，北京城市规划研究院高级工程师，英国剑桥大学建筑系，访问学者。

刘伦、龙瀛和麦克-巴蒂(2014)在城市规划的综述也谈到了这一点及其原因（被遗弃的PSS？）

BUDEM/BUDEM2/框架体系/博士论文/规划师主题/限建区规划支持系统

PSS在规划实践中的应用有限

- 主要源于三方面原因

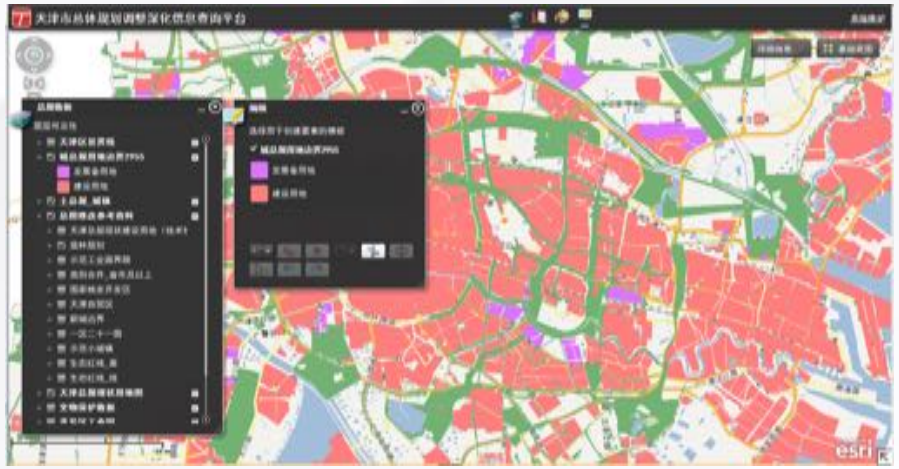
- 自身原因：
  - 城市科学尚处于发展初期阶段

- PSS原因：
  - 对规划过程的过度简化
  - 系统的设计开发者对规划业务的有限认知
  - 复杂方法驱动，学习成本较高
  - 提高规划效率但对规划科学性提升有限

- 规划师原因：
  - 建筑与设计教育背景，量化基础薄弱
  - 规划业务过于繁多，无暇顾及
  - 没有硬性规定，可用可不用

新数据城市规划的标配

- 也是数据/互联网公司对规划行业的收割？



规划师热情拥抱“大”数据

- 从“被动接受”到自掏腰包“主动学习”

国家发改委大数据应用培训班成功举办

来源：国家发改委网站 时间：2016-05-06

按照委党组关于综合运用大数据等技术提升宏观调控能力的要求和我委2016年干部培训计划，办公厅会同国家信息中心于4月28日在京举办了国家发展改革委大数据应用培训班。全委各司（局、室），各直属联系单位，国家能源局约200余人在京参加了培训。同时，为加强全国发展改革系统上下联动，增强培训效果，利用视频会议系统向各省、自治区、直辖市、计划单列市及副省级省会城市、新疆生产建设兵团、黑龙江农垦总局发展改革委、物价局和地市级发展改革及物价部门进行了直播，约4000余人在线参加了培训。

5月城市规划大数据集训营活动通知

“数据之美”
——城市规划大数据集训营

【武汉大学·第五研究小组】

号外|【智慧城市规划师】【大数据分析师】认证培训开班啦

2016-09-27 17:09 来源: 国脉智慧城市网 浏览量：774 收藏：0 分享

【智慧城市规划师】【大数据分析师】认证培训

智慧改变生活 科技改变城市

光环大数据 AURA BIGDATA

http://hadoop.aura.cn

光环大数据--大数据培训知名品牌

大数据激发城市群的群体智能_光环大数据培训

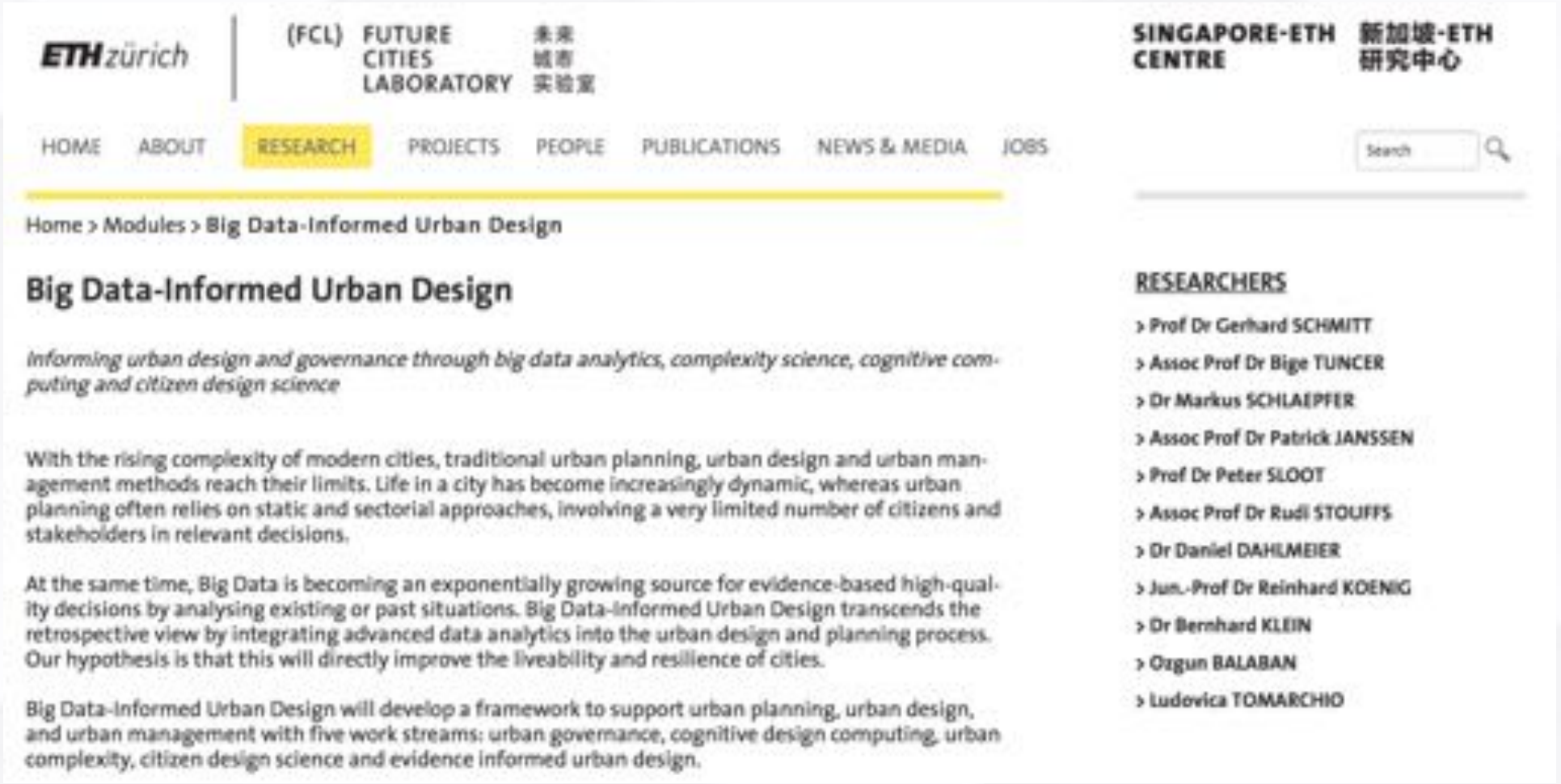
Evidence based Design

- 循证设计 EDBjournal

- http://ebdjournal.com

Big Data Informed Urban Design

- ETH 未来城市实验室



- http://www.futurecities.ethz.ch/module/big-data-informed-urban-design/

Design with Data

- 哈佛大学

Harvard University
Graduate School of Design

Menu A-Z Search

Courses

DESIGN WITH DATA: Informed Urban Design/Planning decision-making through data-driven design process and analysis – CANCELED

Instructor: Ken Goulding, Principal at Sasaki
Chanwoo Kim, Associate, Urban Designer at Sasaki Associates
(MLA IAP and MAUD 2013)
Max Enrollment: 20
Date/Time: Jan 4, 6, 8/3 p.m. – 6 p.m.
Location: TBD
Description: Bold and poetic design transforms the built environment and the lives of those who inhabit it. In this age of increasing connectivity and immense amounts of information, the question is how designers can leverage information to improve our

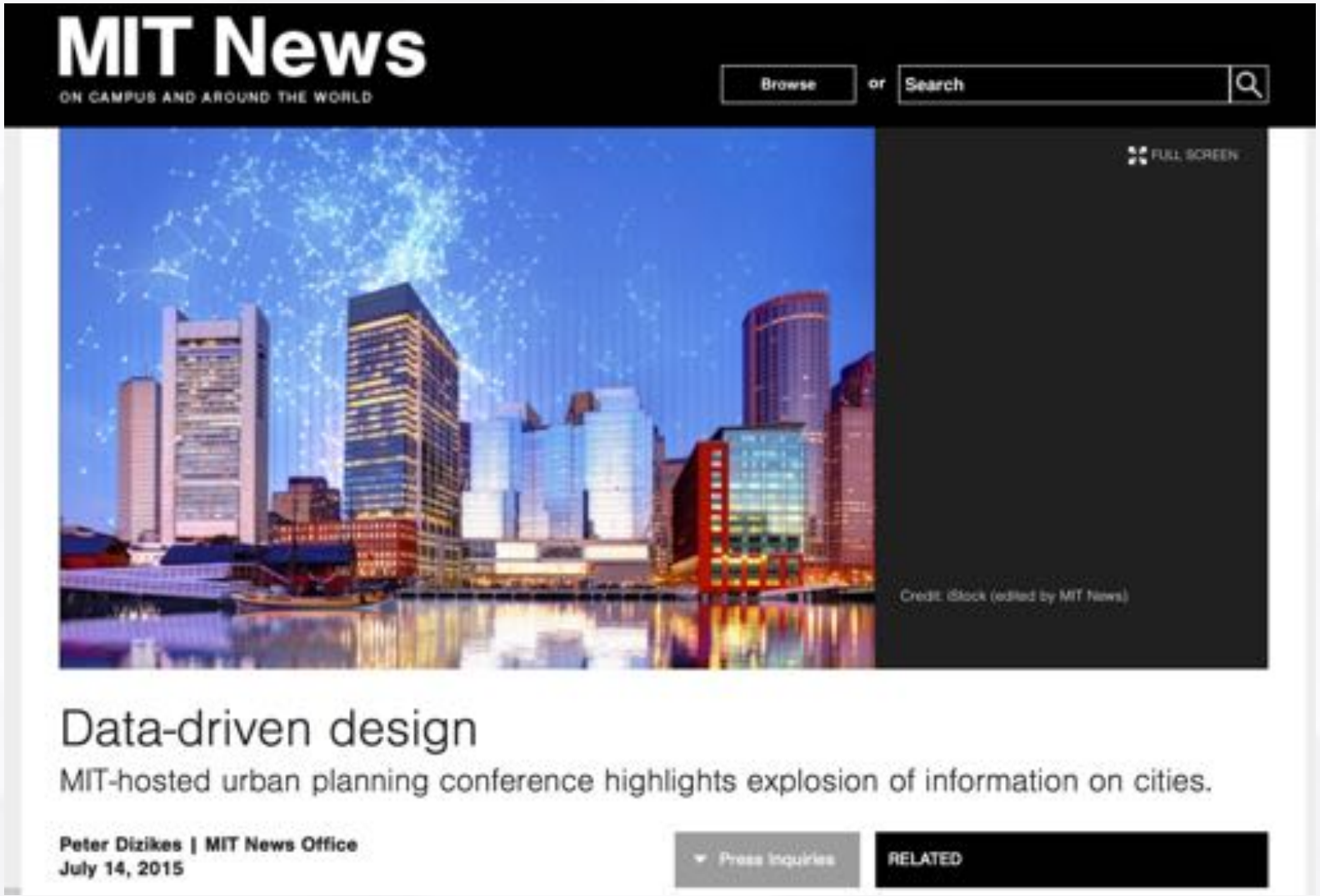
Course Number
INT-00003-00
January 2016
Independent Study
+ Website

Departments
Architecture
Landscape Architecture
Urban Planning and Design

- http://www.gsd.harvard.edu/course/design-with-data-informed-urban-designplanning-decision-making-through-data-driven-design-process-and-analysis-canceled-january-2016/

Data Driven Design

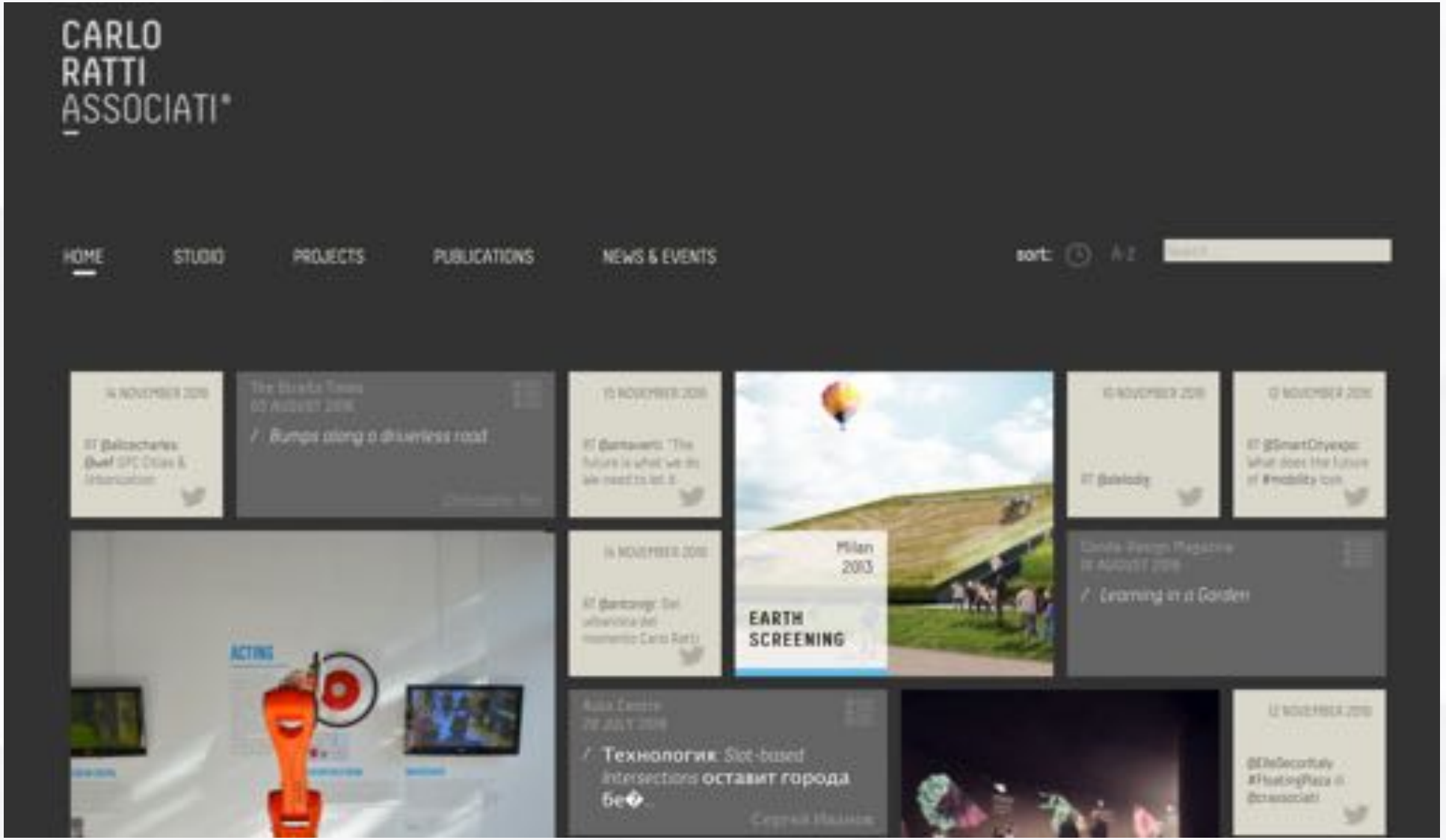
- 麻省理工学院



- http://news.mit.edu/2015/data-design-city-planning-0714

CARLO RATTI ASSOCIATI

- 先锋建筑事务所



- http://www.carloratti.com

数据化设计

- 北京交通大学

2015-06-28 张灿，隰小宇等 数据化设计

[数据化设计案例]
“城市的镜像”

北京交通大学建筑与艺术学院
School of Architecture And Design

内容概要：2015年北京交通大学-辛辛那提大学“韧性城市”联合教学工作坊学生作业。
关键词：亦庄、慢性交通体系、城市活力、空间句法
发布时间：2015-06-27
设计团队：张灿、隰小宇、陈思思、田玮豪

REFLECTION OF THE CITY

- https://mp.weixin.qq.com/s/h_GjkuoL6ldCLM4oHCVTCQ

数据化城市设计

- 东南大学

- 王建国 | 杨俊宴

数据增强设计 DAD

- **Data Augmented Design**

- 定义：DAD是在新的数据环境下，通过定量城市分析驱动的规划设计方法。通过数据分析、建模、预测等手段，为规划设计的全过程提供调研、分析、方案设计、评价、追踪等支持工具，以数据实证提高设计的科学性并激发规划设计人员的创造力。
  - DAD中的“设计”，对应规划和设计，比如总规、控规和城市设计等
  - 大规模数据，不限于大数据（big data）

- 定位：现有的规划设计体系（标准、法律、法规和规范等）下的一种新的规划设计方法论
  - 不是艺术设计的背叛者，而是强调定量分析的启发式作用的一种设计方法，其致力于减轻设计师的负担而专注于创造本身的思考，同时增加结果效应的可预测性和可评估性（增强而不是支持）
  - 计算机辅助规划设计手段的新模式（CAD->GIS->DSS->PSS->DAD）

- 特点：利用简单直接的方法，充分利用传统数据和新数据，强化规划设计的方案生成或评估的某个环节，易于推广到大量场地，同时兼顾场地的独特性
  - DAD将提高规划方案的可阅读性以及公众参与度，规划设计将得到更多关注和参与

论著发表

- 上海城市规划，2015年第3期

数据增强设计*
——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

摘 要 由大数据和开放数据构成的新数据环境，对城市的物理空间和社会空间进行了更为精细和深入的刻画。新数据环境下所开展的定量研究较多，但多为针对城市系统的现状评价和问题识别，少有面向未来的规划和设计的研究与应用。提出了数据增强设计（DAD）这一规划设计新方法论，它以定量城市分析为驱动，通过数据分析、建模、预测等手段，为规划设计的全过程提供调研、分析、方案设计、评价、追踪等支持工具，以数据实证提高设计的科学性，并激发规划设计人员的创造力。从数据增强设计的定义、理论和实践的维度，内涵、设计流程、特点与概念辨析，常用方法与工具，以及应用场景等角度，阐述了对DAD的认识；最后给出了关于DAD的研究案例和设计案例。

Abstract The new data environment composed by big data and open data has described urban physical and social space in a more detailed way. Currently, numerous quantitative urban studies have been conducted under new data environment. However, most studies concentrated on status quo evaluation and problem identification of urban system, and few of them have a perspective into future-oriented urban planning and design. A new planning and design methodology termed Data Augmented Design (DAD) is presented in this paper. Empowered by quantitative urban analysis, utilizing approaches such as data analyzing, modeling and forecasting, DAD provides supporting tools covering the whole planning and design process from investigation, analysis, project design, evaluation and feedbacks. Empirical data analysis in DAD improves the scientific level of planning and design, and inspires the creativity of planners and designers. This paper illustrates our knowledge and understanding of DAD from the following aspects: its definition, theory & practice, features & conceptual distinctions, frequently used approaches & tools, as well as its expected applicable situations. Case studies of DAD both in research and design are presented in the last section of the paper.

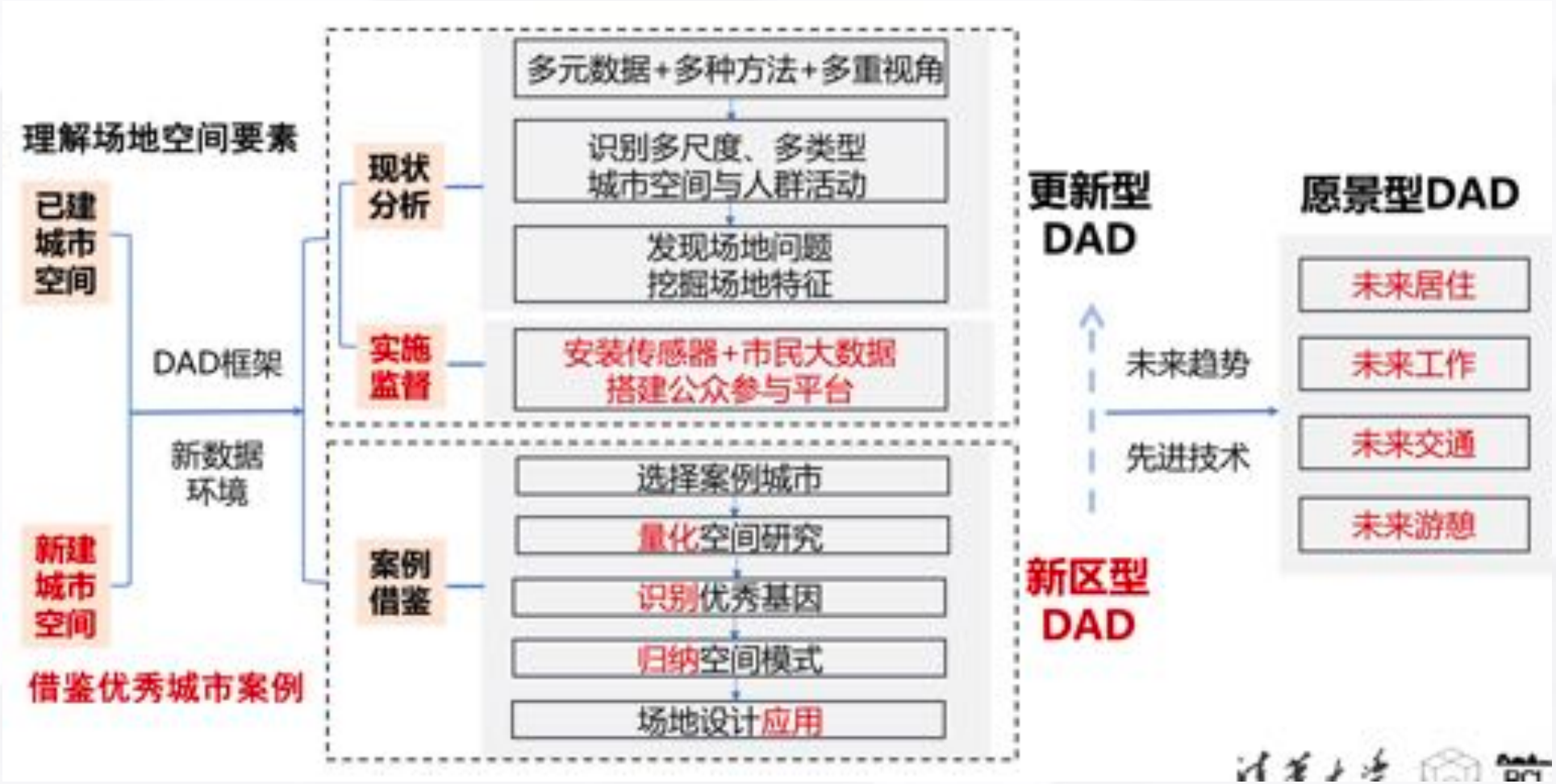
龙瀛、沈尧：“数据增强设计——新数据环境下的规划设计回应与改变“，《上海城市规划》，2015

CAD→DAD

Computer vs Data
Aided vs Augmented

数据增强设计 DAD

- 三种应用范式



传统规划设计过程 vs DAD

- 在多个维度都体现了较大的差异

传统的规划设计过程	数据增强设计 DAD
个人知识以及经验	个人知识经验结合实证定量分析
对预期实施效果不明确	了解预期效果成为可能
偏主观	主客观结合、相互支撑
数据使用少	大量依赖数据
案例by 案例	适合推广到大场景
人群更均质化	异质需求和行为
操作实体较为单一（空间）	操作实体多样
项目动机一般为空间开发	项目动机为改良城市质量
不利于沟通与公众参与	利于公众理解与参与
追求概括性（参照规范）	兼具通用性以及特殊性
自上而下	自上而下与自下而上结合
弹性不足	弹性规划
图纸+文本	图纸+文本+数据报告+效应评估
尺度差异	尺度整合

DAD的特点

- 可应用性：直接面向规划设计实践
- 多维度：一种将空间属性与社会经济数据结合的模型
  - 从物质空间回归社会空间，通过社交网络、兴趣点、人类活动和移动等数据以及定量评价方法作为连接
  - 感知维度：对应于设计中讲的“场所精神”，“借助新的数据和方法实现望山见水记乡愁”
- 精细化：强调对背景（context、环境和人群）的精准理解，充分考虑人群和环境的细分，分析现有规律，并建立不同的组合模式，为提供专项规划设计提供支持
- 因地制宜：通过致力于了解环境与人们活动的定量关系来创造更好的人和环境的关系

DAD的特点

- 虚拟世界与现实世界结合：多角度了解场地的核心问题
- 集智：众包众规，网络化的公众参与
- 设计方法工具化：设计的方法将会在模型工具中得以体现，定量关系成为设计原点
- 设计任务量化：基准效应将成为设计任务和目标
- 可追溯、可评估：后续的效应将不断地强化或者纠正定量设计的模型以及评价方法

上海城市设计挑战赛

- 2016年开始每年组织

- http://sudc.qxqy.sh.cn

DAD三方面的实践应用

- 存量型 | 增量型 | 未来型

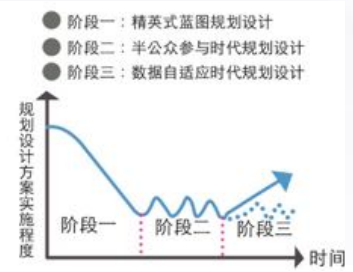
理解现实场地内的城市，创造场地的未来	借鉴其他优秀城市，创造场地的未来	超越目前建成环境，拥抱当下最先进的技术和未来短期内实现的技术，创造场地的未来
2016上海城市挑战赛“数联衡复，优活代谢”	通州新城总体城市设计	义龙未来城市设计国际竞赛“The Next Form of Human Settlement”
2017上海城市挑战赛“数联影动，幸福番禺”	雄安新区总体城市设计	2018福州海岛工作坊“Smart ‘O’ ”
2018上海城市挑战赛“永不落幕的展览”		2018上海城市挑战赛“自愈城市”

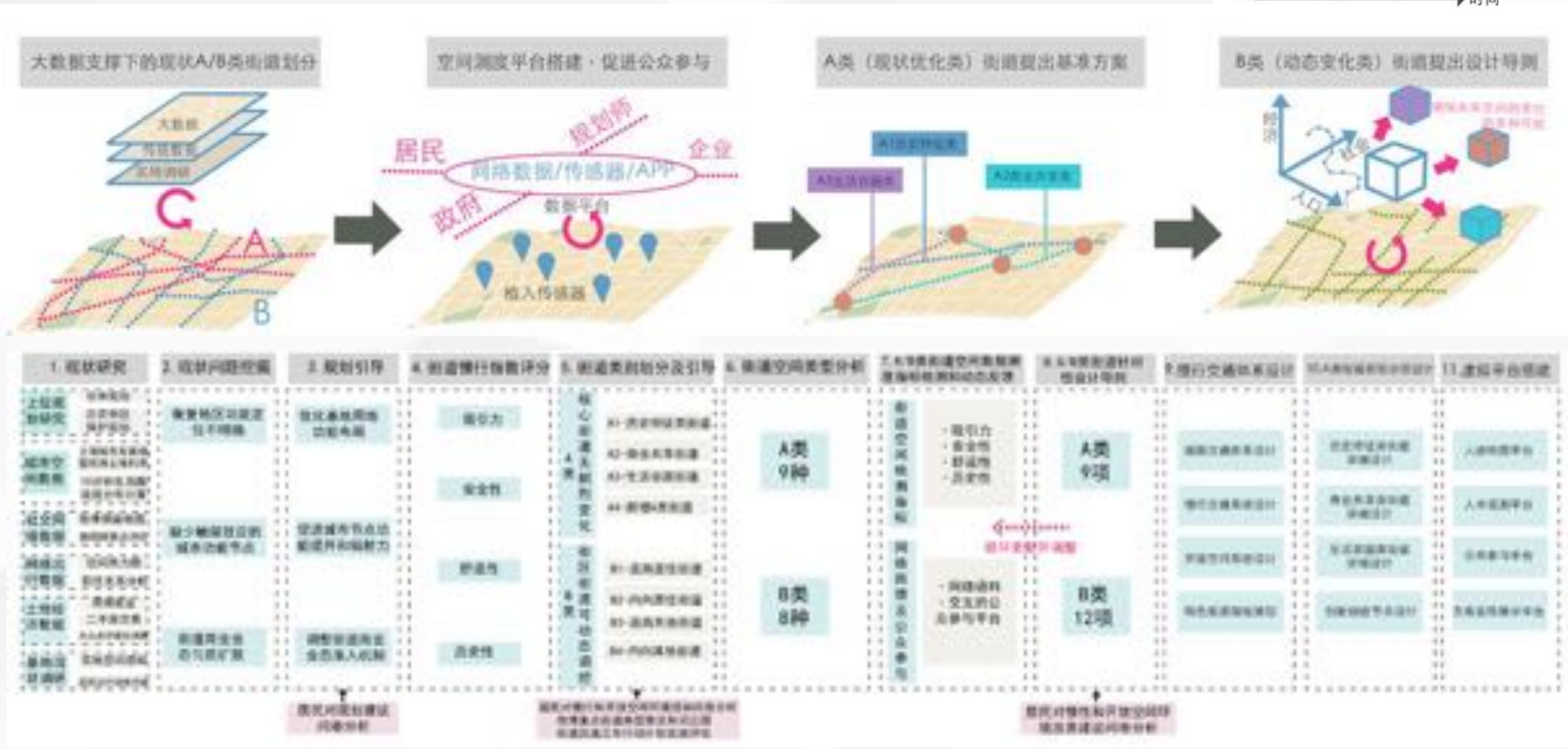
2016上海城市设计挑战赛

- **数联衡复，优活代谢**

清华大学建筑学院：曹哲静 刘希宇 刘钊启 等

存量型DAD





2017上海城市设计挑战赛

- 数联影动，幸福番禺

清华大学建筑学院：苏天宇、周宏宇、裴昱 等

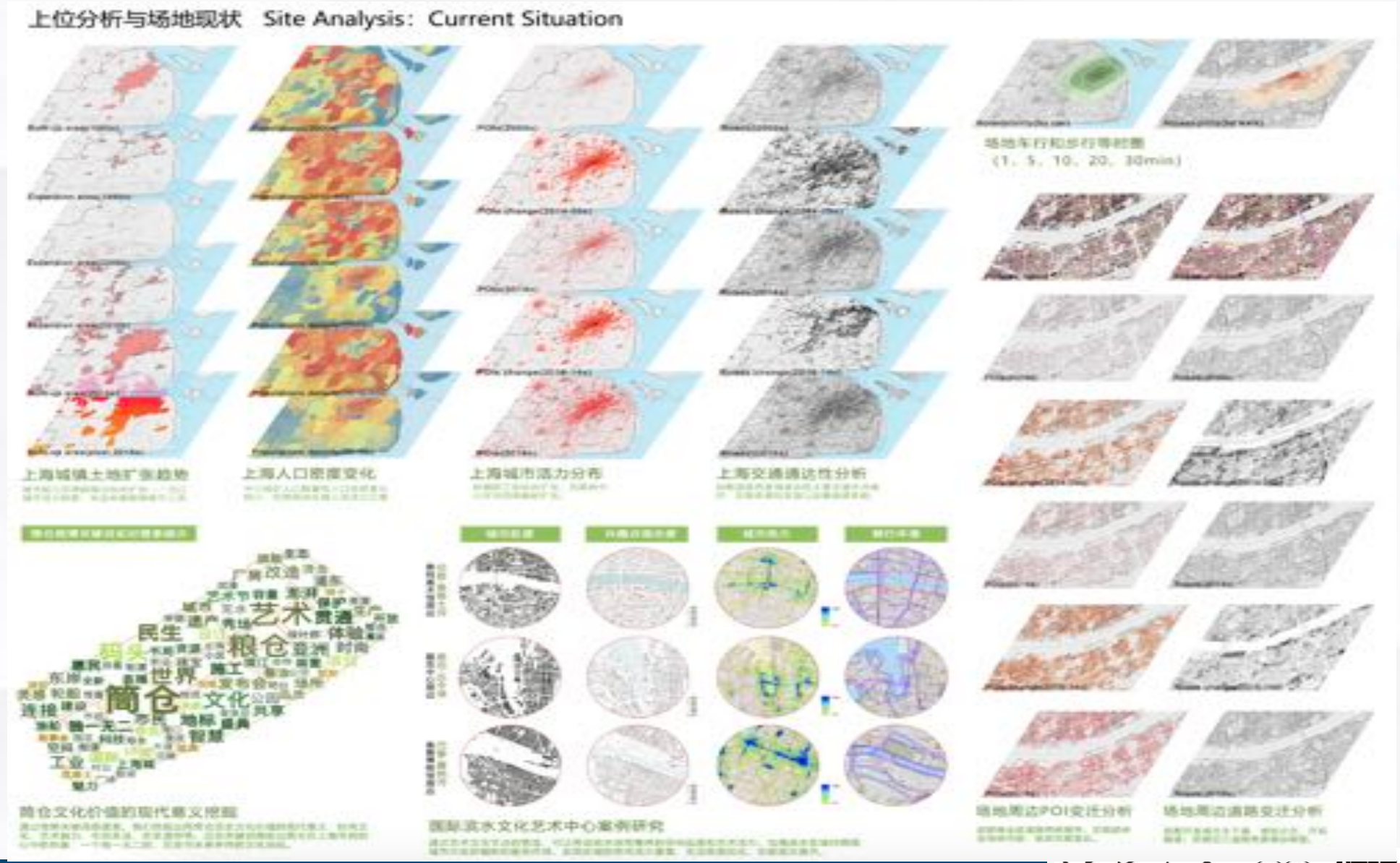
存量型+增量型DAD

2018上海城市设计挑战赛

存量型DAD

- 永不落幕的展览

清华大学：陈婧佳，姜之点，罗卉卉，冉紫愚，王宇慧，吴雅馨，张东宇等

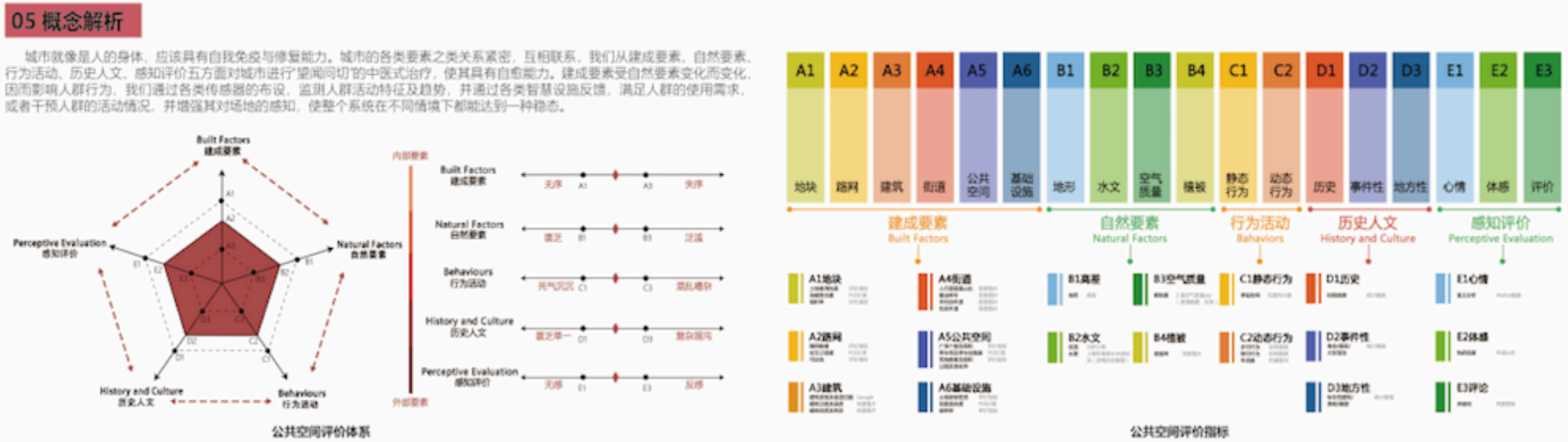


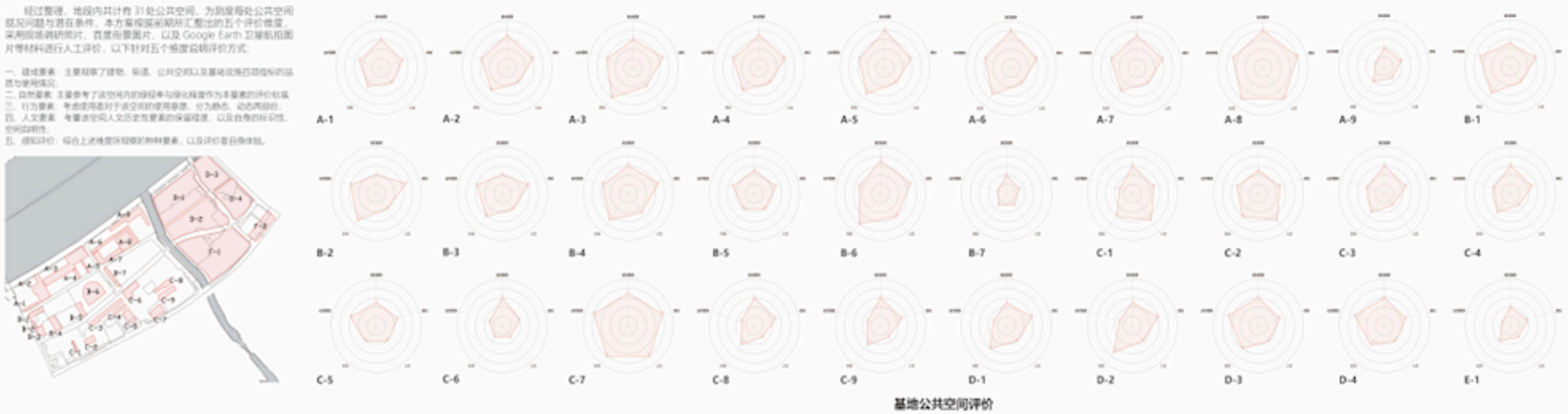
2018上海城市设计挑战赛

存量型DAD

- 永不落幕的展览

清华大学建筑学院：张昭希，张恩嘉，张耘逸，侯静轩，谢菡亭，徐婉庭，周宏宇等





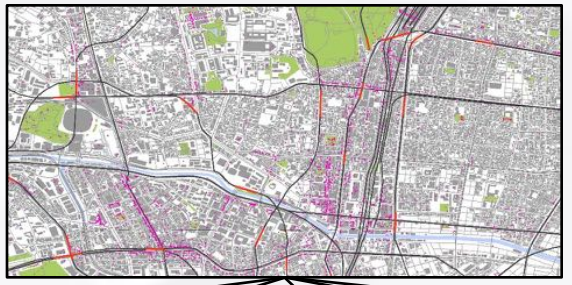
通州副中心总体城市设计

- 提出量化案例借鉴方法论并进行应用

案例城市分析

增量型DAD

1. 案例城市原始数据获取：openstreetmap

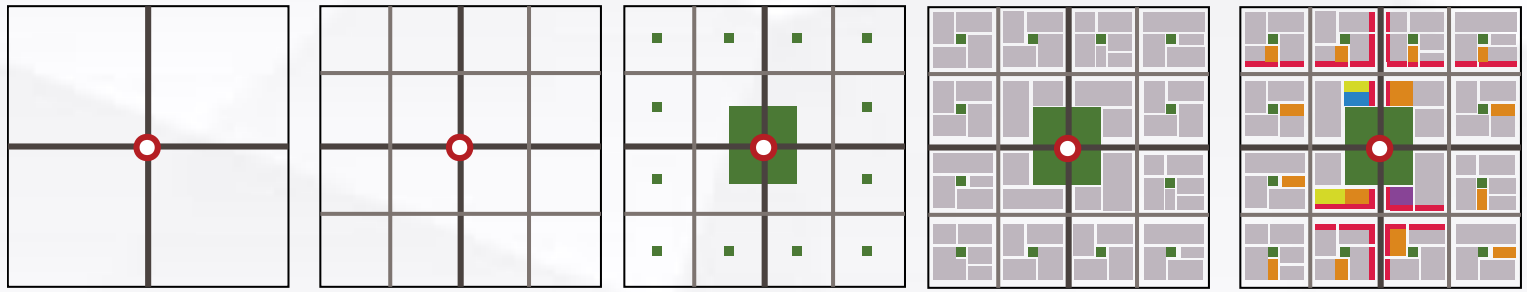


2. 基因分层提取（定性）

3. 指标计算（定量）

交通组织	路网特征	开放空间分布	建筑肌理	城市功能分布
公共交通线网密度（KM/KM2） 站点密度（个/KM2）	路网密度（KM/KM2） 地块尺度（公顷/地块）	开放空间比例（%）	地块尺度： 建筑密度(%)：建筑底层面积/地块面积 容积率：总建筑面积/地块面积	城市功能混合度：MIX 城市功能密度（个/KM2）

4. 模式提取（城市层面+地块层面）



雄安新区总体城市设计

增量型DAD

- 量化案例借鉴方法对全球建成环境进行分析

未来城市：空间干预与数字创新

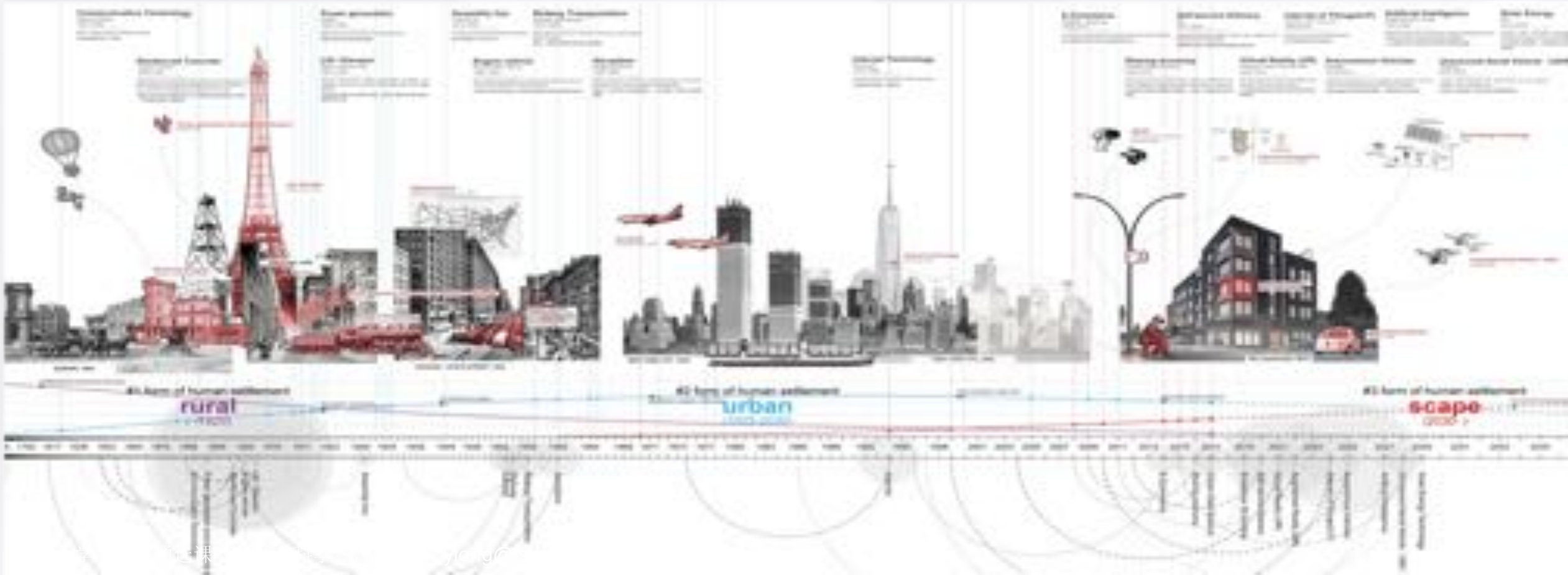
Spatial Intervention and Digital Innovation for Future Cities

Technology's EYE

with living form's evolution

We have sorted out all the technical inventions that have made a significant impact on human settlement since 1700s and observed the evolution of human settlement for these three centuries. We came to the conclusion that human beings have so far undergone two typical types of human settlement, respectively, rural and urban. The typical difference between the two states is the maturity of the construction technology, the use of concrete, the emergence of elevators, such as the popularity of vehicles makes the road network system, the height of the building become a major urban skeleton and urban elements. And we can foresee a series of new technologies such as autonomous vehicle, smart logistics, VR, UAVs, artificial intelligence, sharing technology and so on, which have a tremendous impact on the form of human settlement, are rapidly maturing, which has accelerated our historical progress towards the next human settlement.

我们整理出了从有 1700 年以来对人居形态影响较重要的技术发明，并观察了这三百年来的人居形态的演变过程，得出了这样的结论：人类迄今经历了两种典型的人居形态，分别是农业人居（rural）和城市人居（urban），两种状态的典型区别在建造技术的成熟、混凝土的使用、电梯的出现、汽车的普及等使得道路网、高度的建筑成为了主要城市骨架和城市元素，而我们能够预见到无人驾驶、智能物流、VR、无人机、人工智能、共享技术等一系列对城市形态产生巨大影响的新技术正在迅速崛起着，这加速了我们迈进下一个人居形态的历史进程。



The fourth industrial revolution and its disruptive technologies have transformed daily life and space

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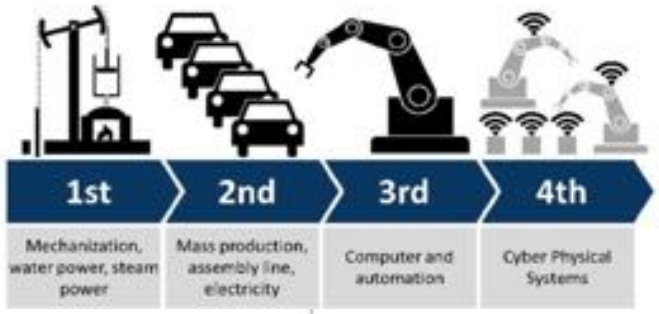
（新）城市科学：利用新数据、新方法和新技术研究“新”城市

(NEW) URBAN SCIENCE: STUDYING "NEW" CITIES WITH NEW DATA, METHODS, AND TECHNOLOGIES



摘要

以互联网产业化和工业智能化为标志，以技术融合为主要特征的第四次工业革命正以一系列颠覆性技术深刻地影响和改变着我们的城市，人们的思维方式从传统的机械思维向大数据思维转换，认知方式也逐渐向虚实结合的体验过渡，而我们赖以生存的城市，其资源利用、社会状况和空间利用也正经历着一系列变革。随着以计算机技术和多源城市数据为代表的新技术和新数据的迅猛发展，（新）城市科学在过去的十几年间逐渐兴起，成为一门融合了城市计算、人工智能、增强现实、人机交互等方向的交叉学科，为城市研究和城市规划设计带来了变革可能。目前全球范围内已涌现了多家聚焦于该领域的研究机构和多个研究项目。同时，世界各大院校也先后设置与（新）城市科学相关的学位、开设相关课程，培养更加符合新时代需求的新城市研究人才。

关键词

新城市科学；第四次工业革命；城市空间的重构与转型；大数据；颠覆性技术

ABSTRACT

The Fourth Industrial Revolution is profoundly changing our cities with a series of disruptive technologies, characterized for the boom of Internet industries and the everyday application and wide integration of intelligent technologies. Individuals' traditional mechanical thinking has changed into a mindset based on big data, whose cognition also relies more and more on a combination of both virtual and physical reality experience. At the same time, cities, where we live, are witnessing a significant revolution in resource utilization, societal conditions, and spatial use. Along with the surge of new technologies and new data represented by computer technologies and multi-source urban data, the (new) Urban Science, as a transdisciplinary combination of urban computing, Artificial Intelligence, augmented reality, and human-computer interaction, rises over the past decade. Research institutions and programs on the (new) Urban Science are flourishing globally, and increasing related degree programs and courses are offered by colleges and universities worldwide to respond to the needs of this new era.

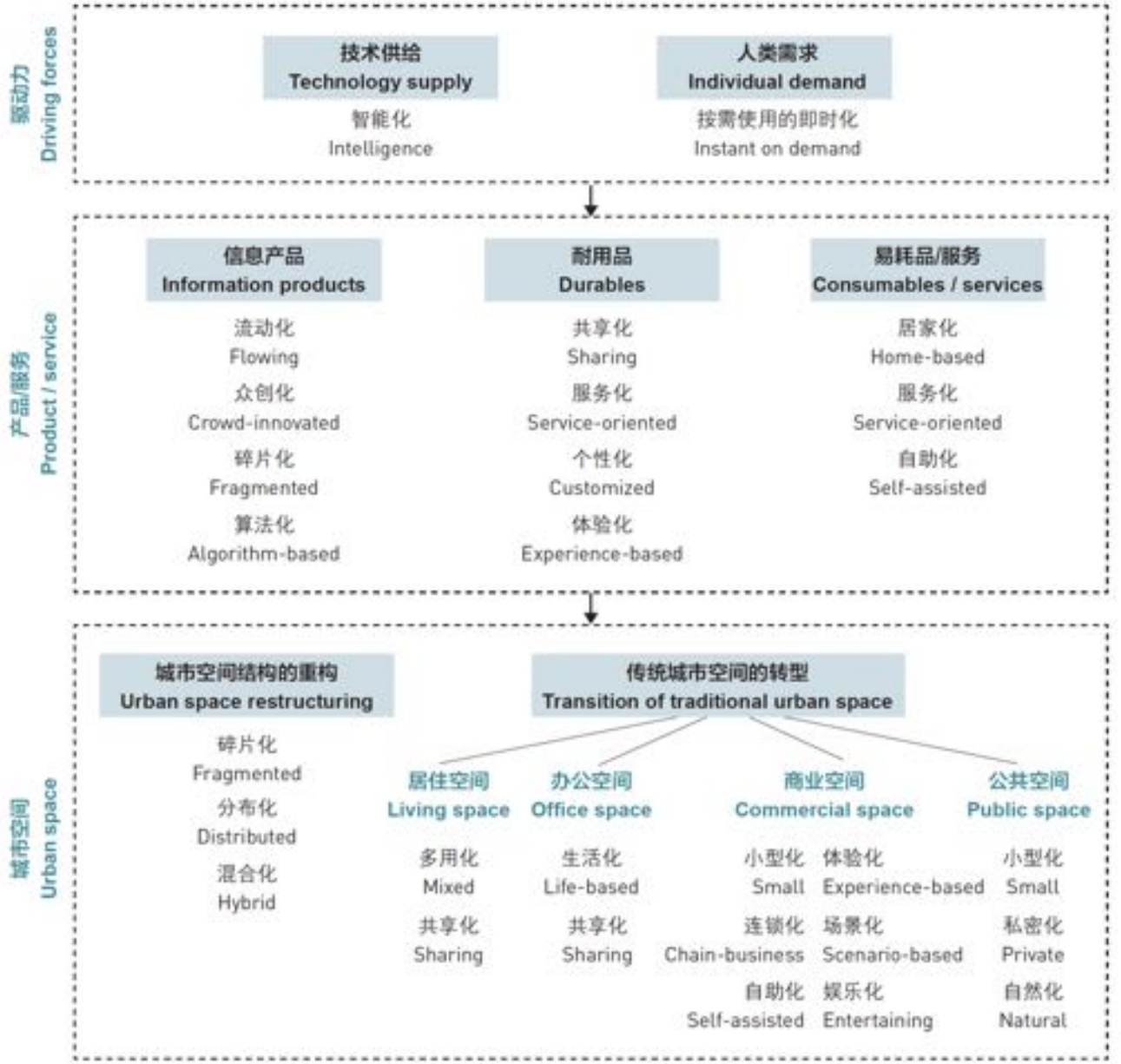
KEY WORDS

New Urban Science; The Fourth Industrial Revolution; Urban Space Restructuring and Transition; Big Data; Disruptive Technology

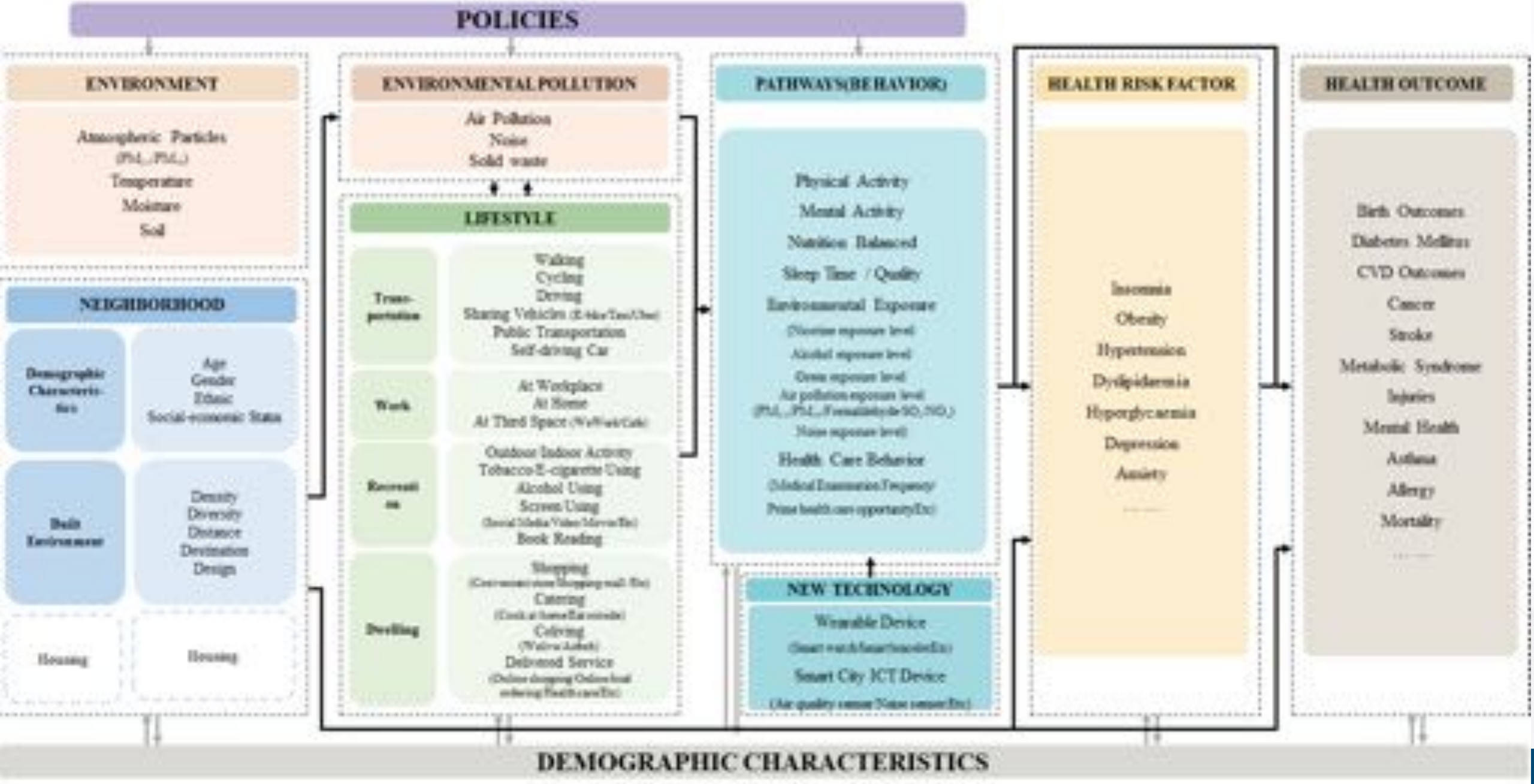
1 催生新城市科学的背景

科技成果的日新月异使人们的生活方式发生了巨变，同时也影响了城市运行的各个层面。基于城市正在发生的种种变化，传统的城市规划设计理论与工具已无法应对新时代背景下的城市问题。然而，技术革新同时也为城市研究与实践带来了机遇——不仅促进了城市规划技术和工具的突破与创新，更在信息通讯技术快速发展的环境下，带动了数据存储、挖掘和可视化等技术的完善，赋予了人们审视城市环境的新视角[1]。

EDITED BY Tina TIAN TRANSLATED BY Tina TIAN



New lifestyle and behavior in space



How to achieve future cities?

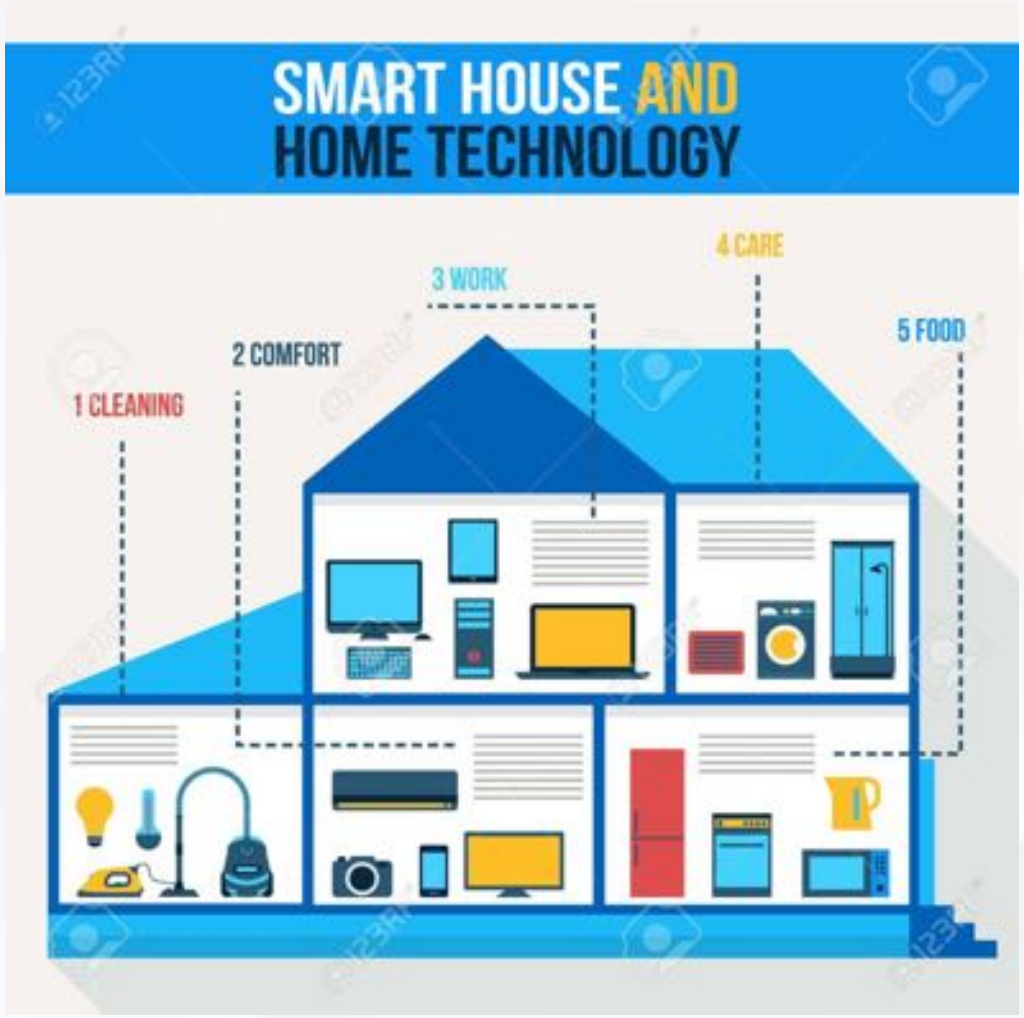
Scientifically understanding the present and the past is not enough.
We can create/invent them!

Future Cities未来城市

Nature 认识论 | Methodology 方法论

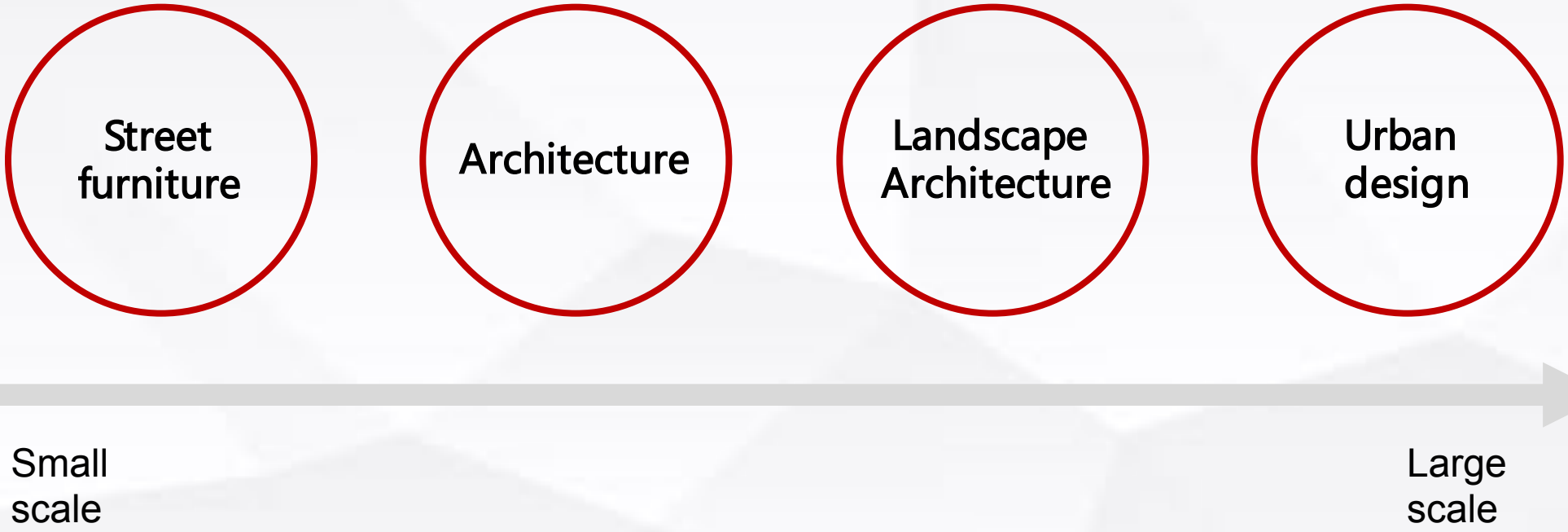
Advances in smart self and home

Smart self



Smart home

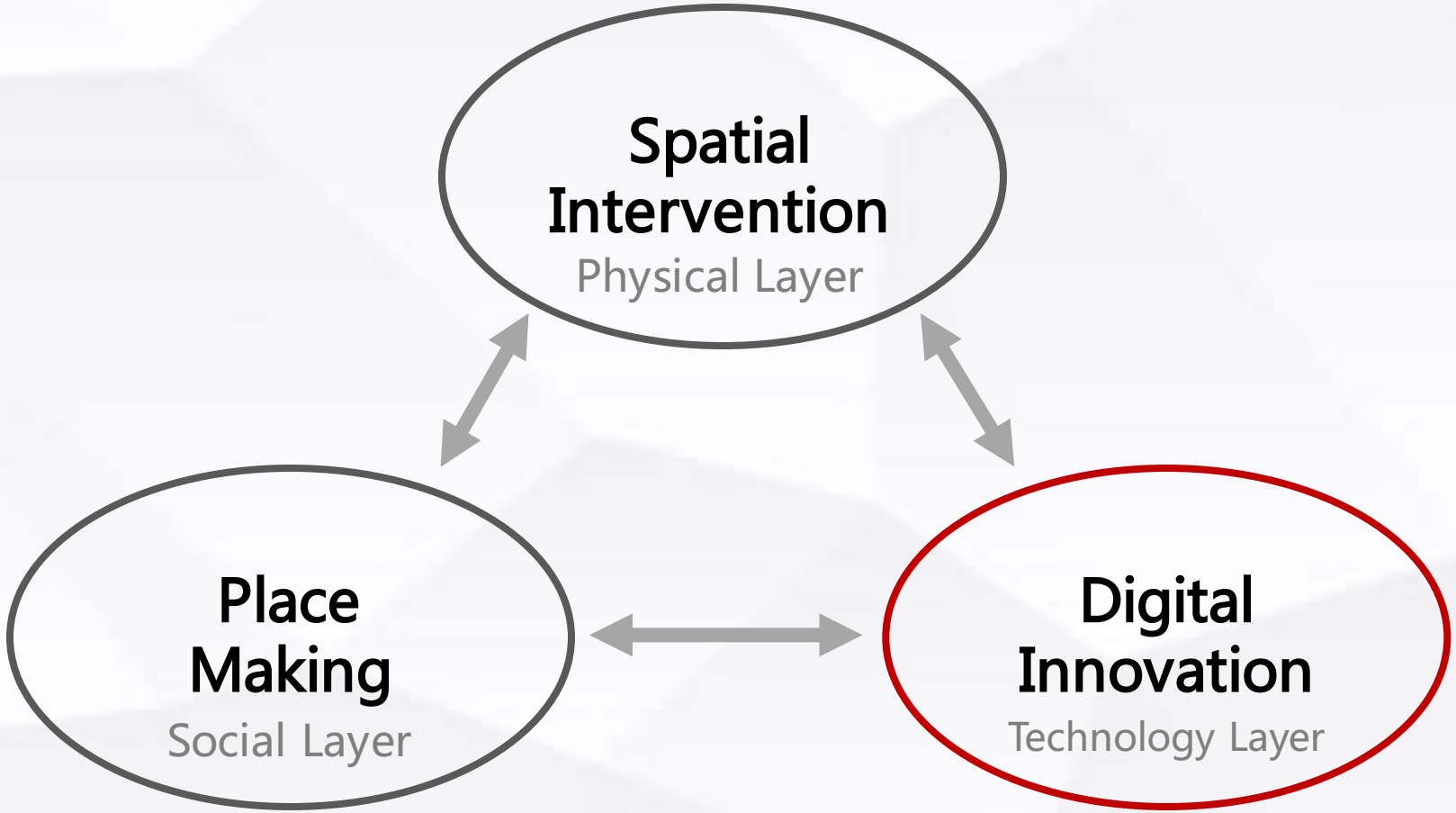
Conventional, we heavily rely on spatial intervention to create city space



1

Theory

My philosophy is SI is not enough for creating future cities (city space)



Definition of Digital Innovation (DI)

Digital technologies that can be combined with spatial intervention or beyond physical space for improving quality of physical and social space.

Two strategies for dealing with the over hot condition in a train car:

Spatial Intervention and Digital Innovation (SIDI)

01 Solve existing problems

- Space is not flexible enough
- Space use is insufficient
- Waste of resources

02 Adapt to changing needs

- Interactive facility
- Flexible space usage
- Timely help and convenience

03 Promote future public activity

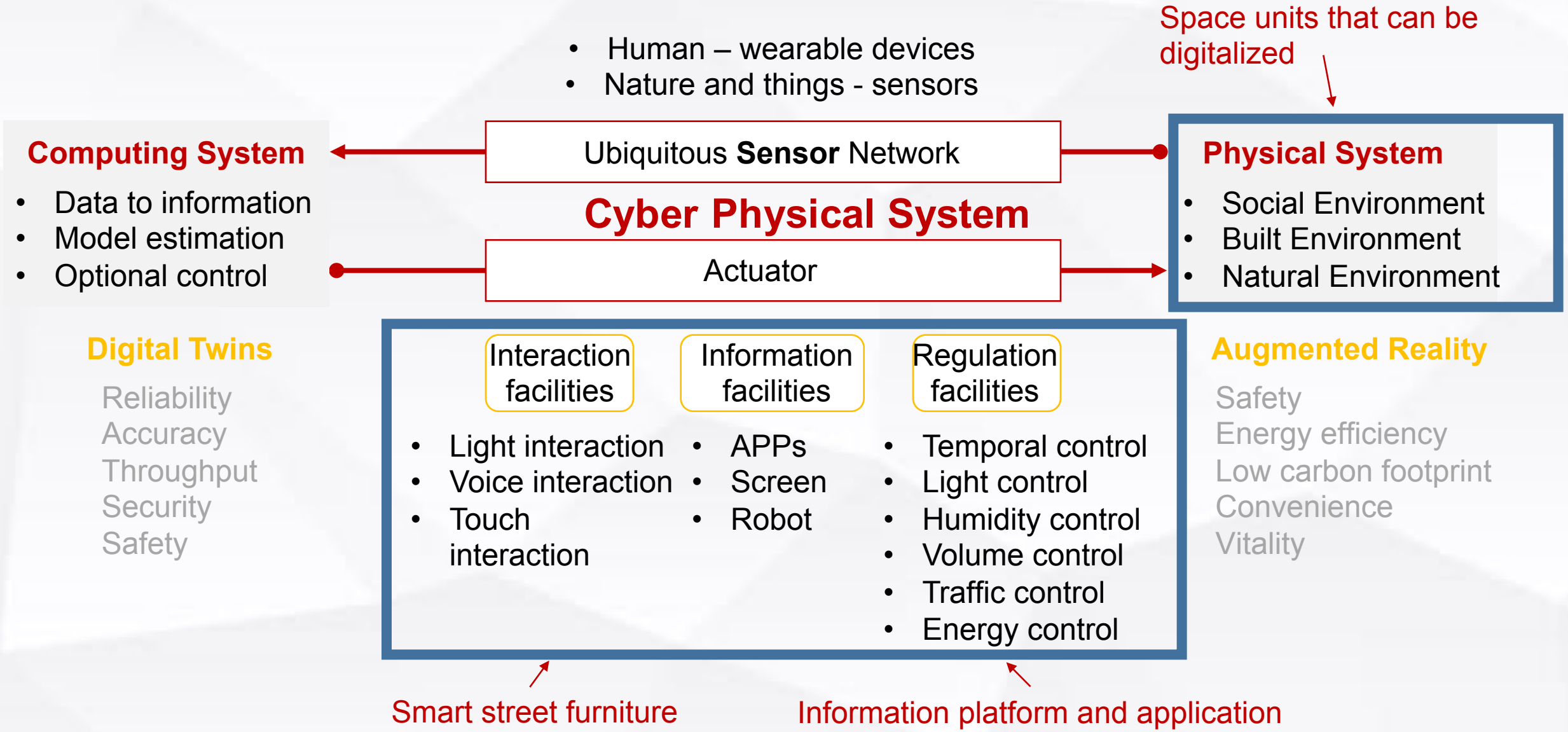
- Participation
- Vitality
- Sustainable development goals

From smartly designing to designing smart (public) space

2

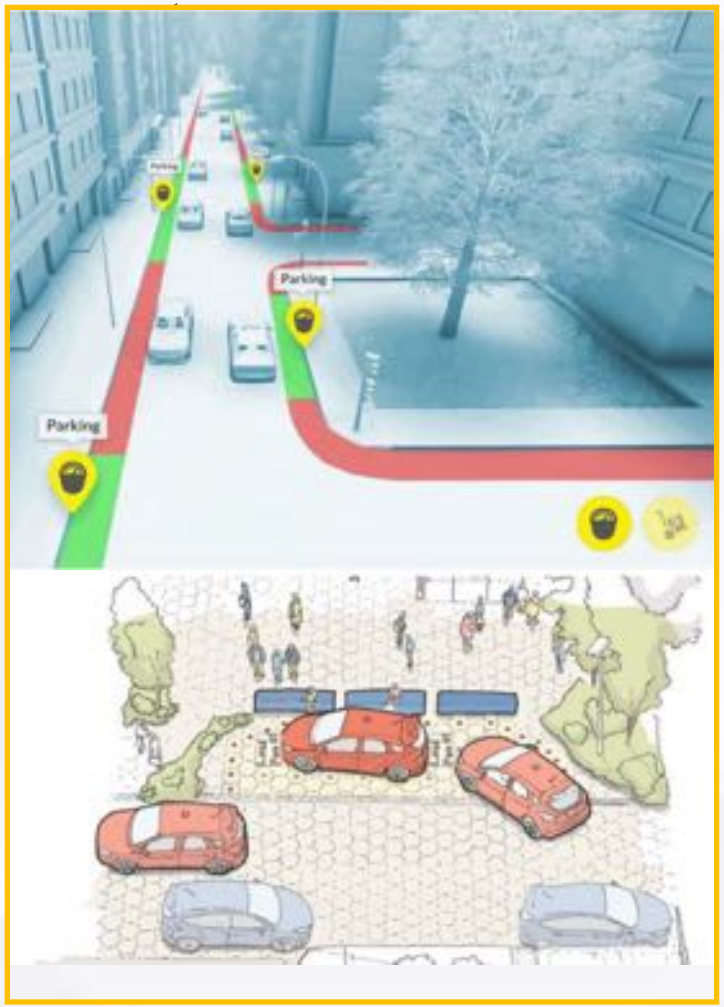
Methodology

Technologies/components of DI



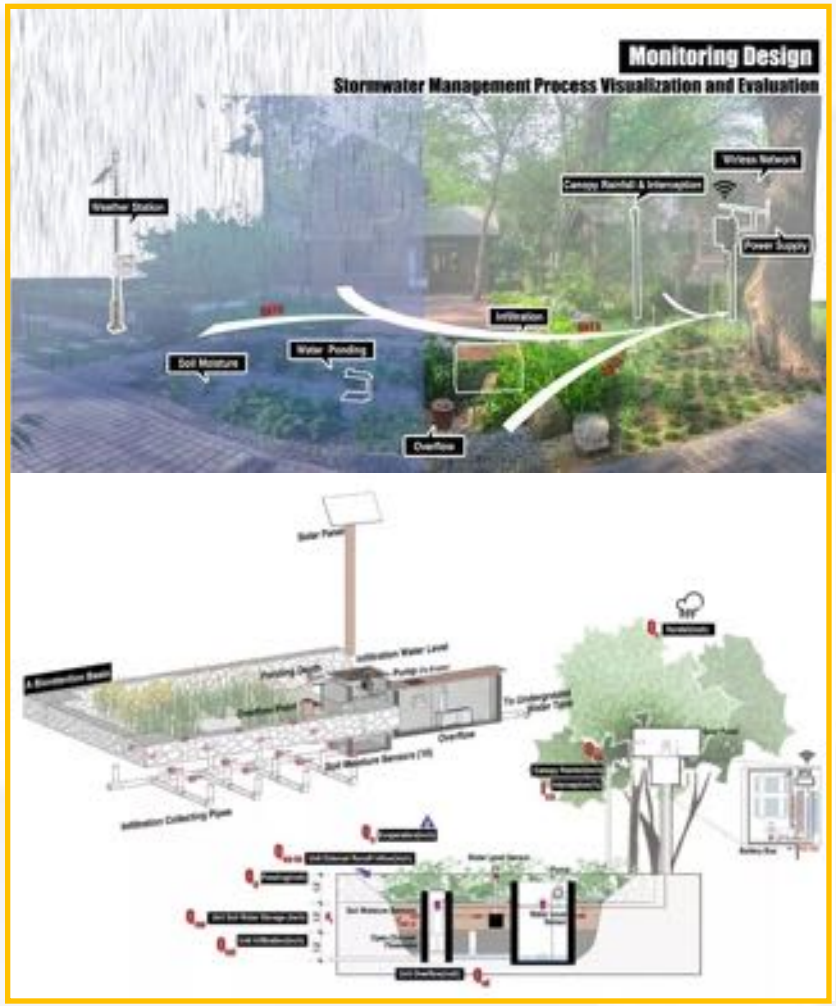
Space units that can be digitalized

- **Boundary and guide**



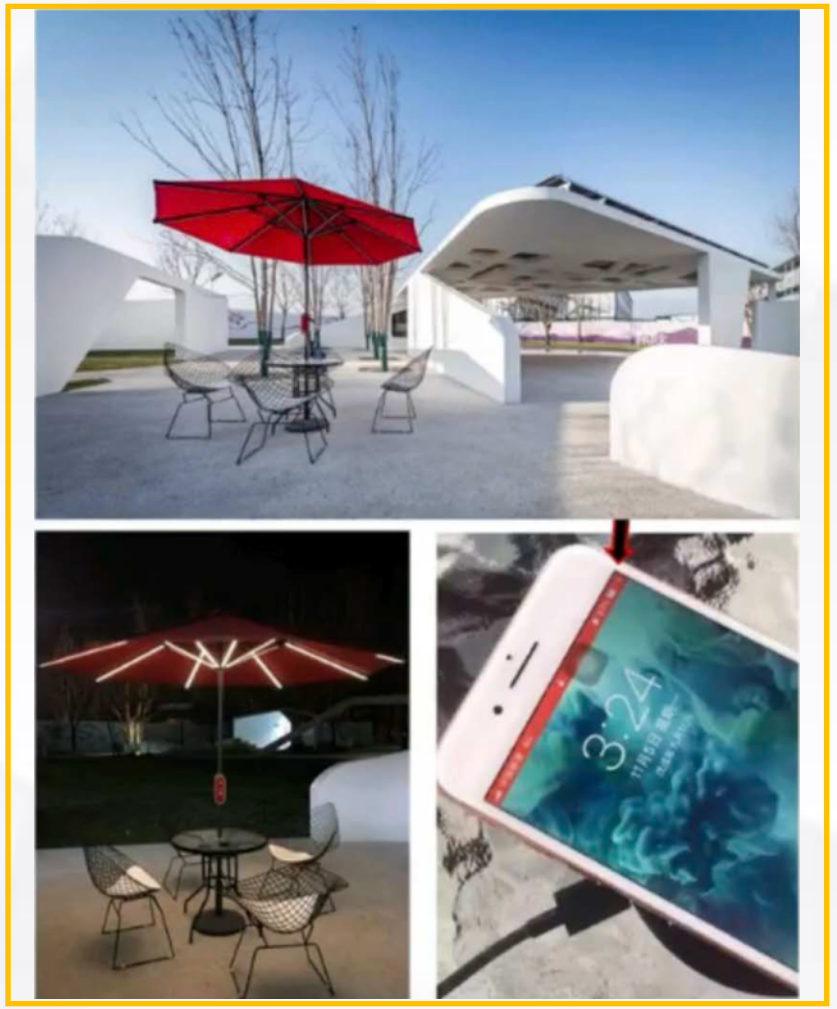
Smart transportation system

- **Monitoring and management**



Smart landscape system

- **Space sharing and dynamic facade**

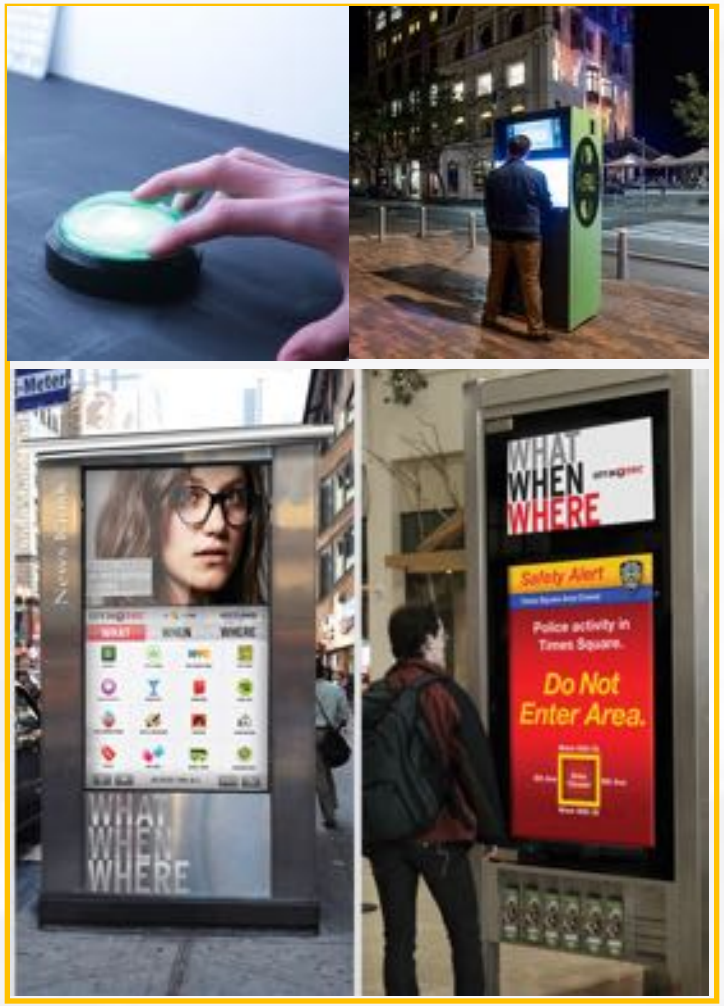


Smart square system

Smart street furniture

High demand

- **Smart infrastructure**



Trash can | Advertising screen

- **Interactive entertainment facility**

Sound interaction | Light interaction

- **Smart structure**

A new form of expression

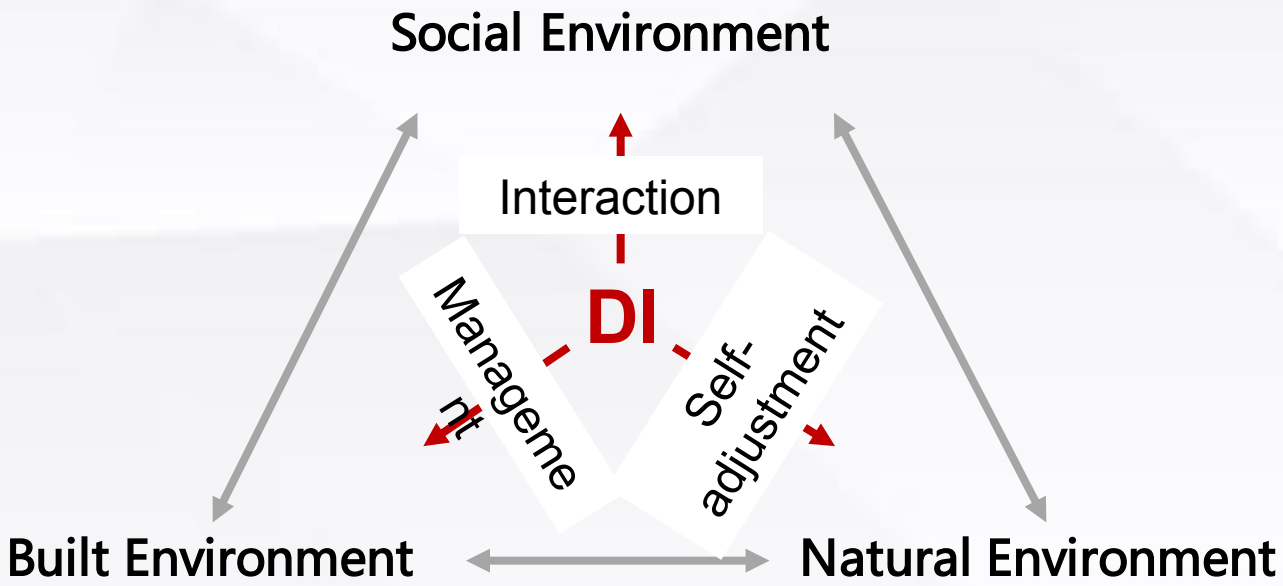
Information platform and application

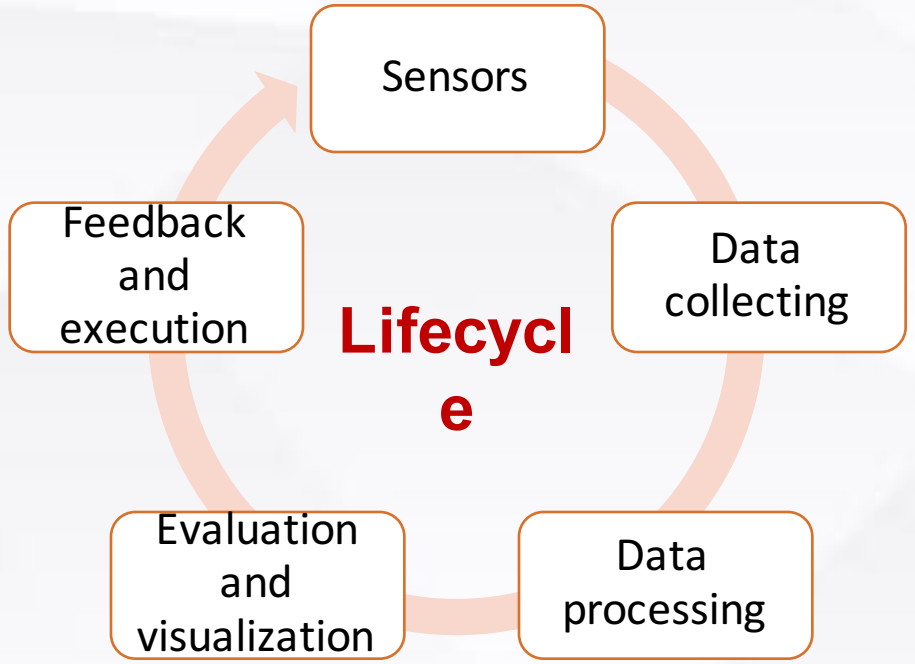
- Apps

- WeChat applet

- Mixed reality

How does DI generate effect?





- **Interaction**

- **Management**

- **Adjustment**

The relationship between technology and space

1 Interact

- Human and nature
- Human and space
- Nature and space

- Offline and online

2 Augment

- Safety
- Comfort
- Perception
- Happiness

3 Replace

- Boundary
- Signal light

4 Supply

- Wi-Fi
- Charging
- Information
- Advertisement
- Guide

5 Active

- Event making
- Public participation

6 Diversify

- Mixed function
- Flexible function

Performance of DI + SI

Green / environment friendly

- Greenery
- Energy saving
- Recycling

Flexible

- Space
- Time
- People

Entertaining

- Relax
- Display
- Interaction

Equal / accessible

- The old
- Children
- The disable

Scenarios of applying SIDI

- **Only SI: Traditional design**
  @ High Line Park

- **Only DI**
  @ Fuzhou

- **Both SI and DI**
  @ Shanghai

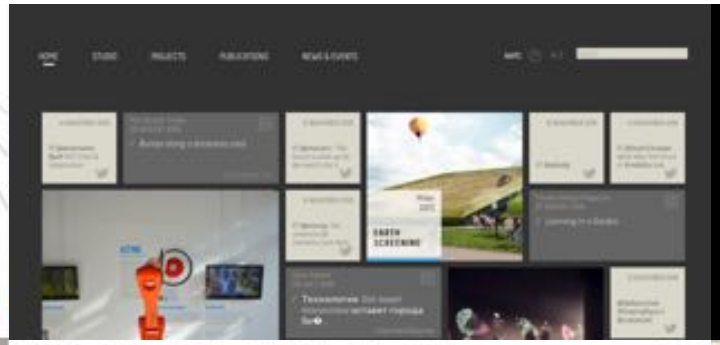
3

Existing Practices

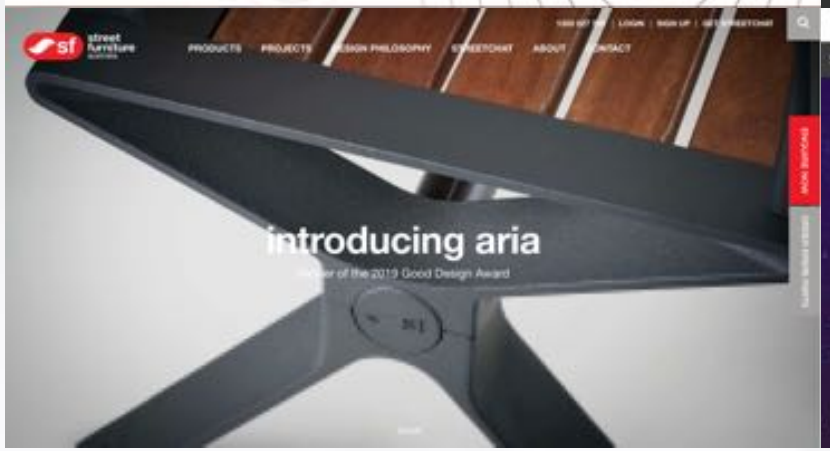
Emerging agencies on the planet

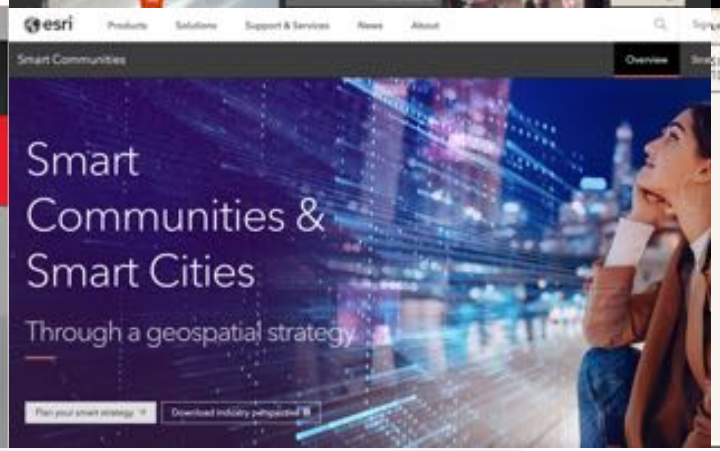
UNSense

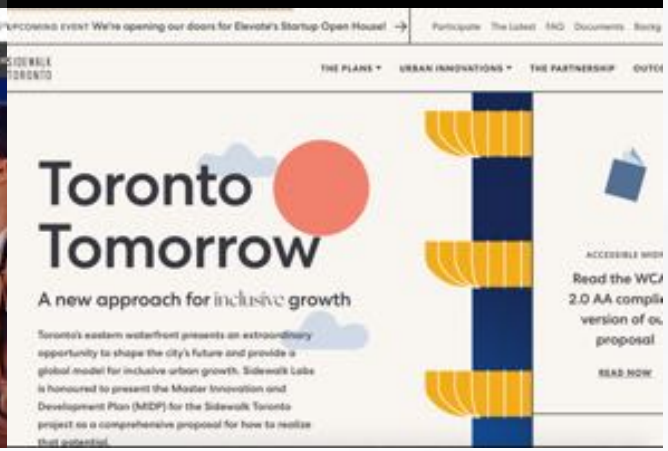
The arch tech company founded by UNStudio

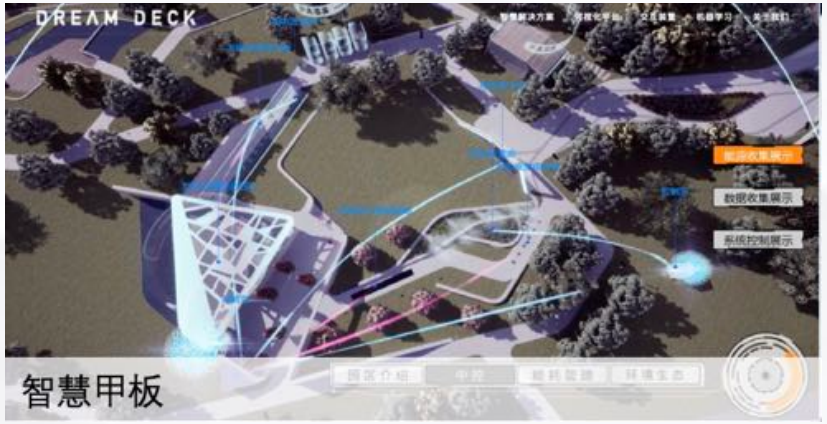


umbrellium









Space units that can be digitalized

Boundary and guide system

Umbrellium

- **Footstep energy**

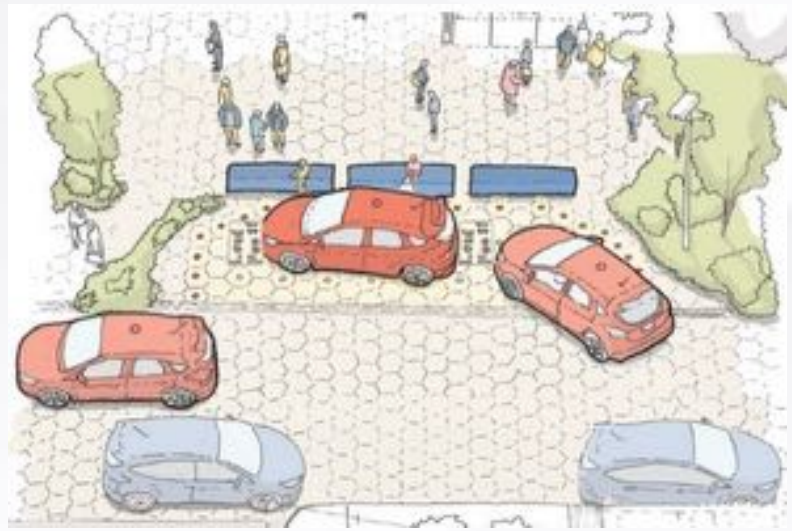
Pavegen is a start-up from London that has created a patented flooring technology which converts the kinetic energy from footsteps into off-grid power and data.

SWARCO

- **Green wave**

This bike lane in Copenhagen uses a “green wave”: a signal coordination system,shown here through green pavement lights, that helps cyclists safely maintain higher speeds for longer distances.

Sidewalk Toronto



- **Dynamic curb**

The dynamic curb can be designated as a passenger pick-up or drop-off zone through lighted pavement, then easily converted into pedestrian space during low-traffic periods.

Space units that can be digitalized

Monitoring and management system

Carlo Ratti Associati

- **EARTH SCREENING**

In the same way as self-driving cars are expected to revolutionize urban mobility, advanced robotic technologies are reshaping agriculture, with a new wave of innovations helping us to better respond to local terrain conditions.

智慧甲板

- **Energy saving system**

Monitoring the environment and automatically adjusting landscape facilities.

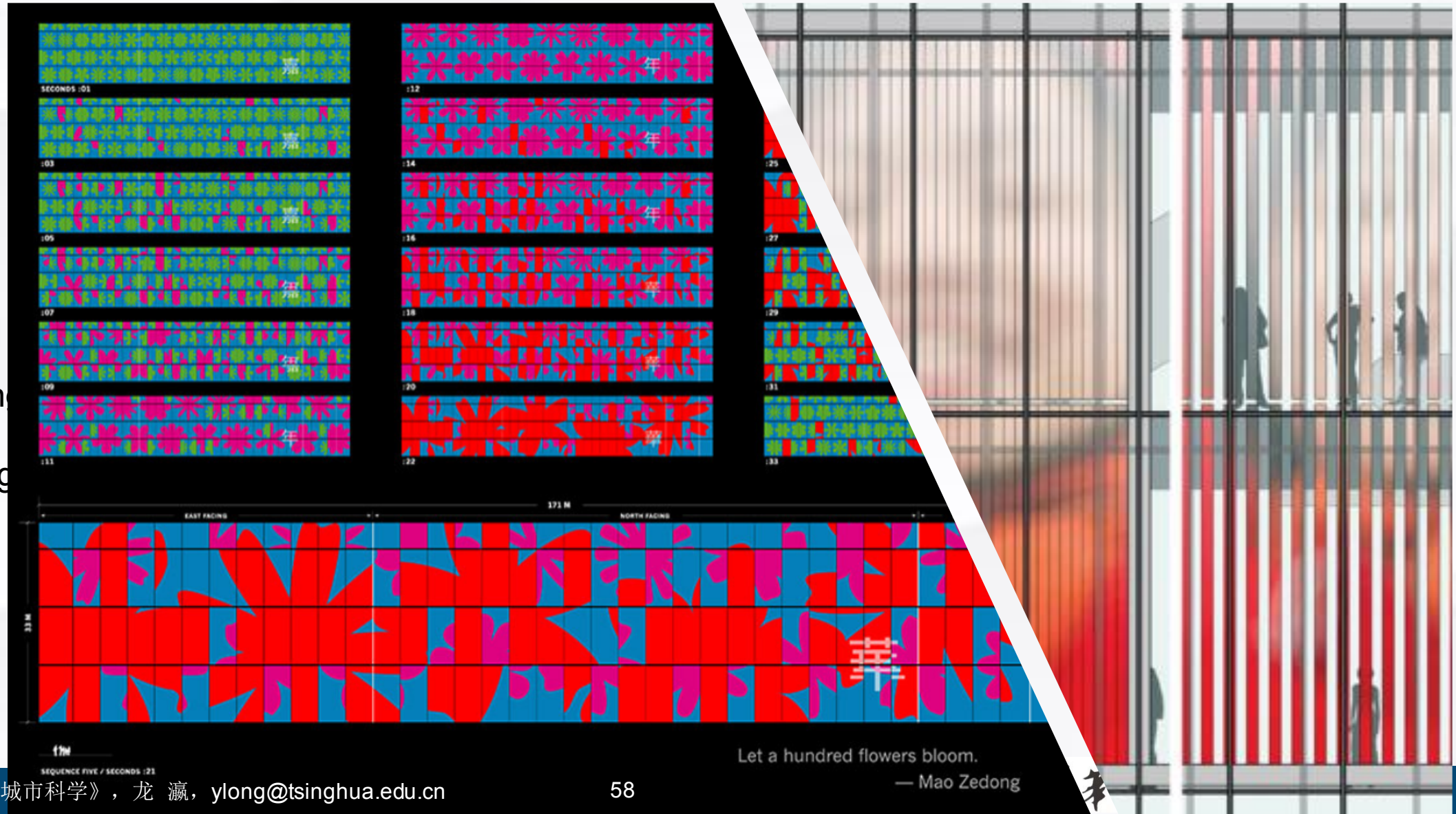
Space units that can be digitalized

Space sharing and dynamic facade

SOM

- **Dynamic façades**

made of 148 rotatin
panels are
controlled by coding
programs



Smart street furniture

UNSENSE

- **S-Park**

S-Park is the world's first system that lets bicycles generate electricity. The technology gives a further sustainable dimension to this modal choice already much admired by many Amsterdammers.

Street Furniture

- **PowerMe tables**

There will be PowerMe tables that allow for General Purpose Output, USB and wireless charging and inbuilt power monitoring, park tables with charging feature and ash cylinders with a temperature sensors.

智慧甲板

- **Ai Robot**

Language guide, campus introduction, environment awareness, one-click alarm.

Smart street furniture

Interactive entertainment facility

Carlo Ratti Associati

- **Digital Water Pavilion**

An interactive structures made of digitally-controlled water curtains.

UNSENSE

- **The Burble**

Night-time event and spectacle for thousands of people. Dramatic interactive Burble structure (usually for one night, or longer periods if necessary). Custom interactive app and/or twitter integration.

智慧甲板

- **Interactive facilities**

A wide range of interactive facilities make the space more vibrant.

Smart street furniture

Smart structure

SOM

4

Our Practices

2016上海城市设计挑战赛

2016 SHANGHAI URBAN DESIGN CHALLENGE

赛事介绍 Content | 报名报名 Registration | 下载中心 Download

报名截止时间 | 专业组 2016/8/15 | 公众组 2016/9/15

空间数据传感布置

塔立面采用交互照明装置，人际地铁上人流越大，塔身越亮，即使远在几千米外也能感受到衡复中心的活力程度

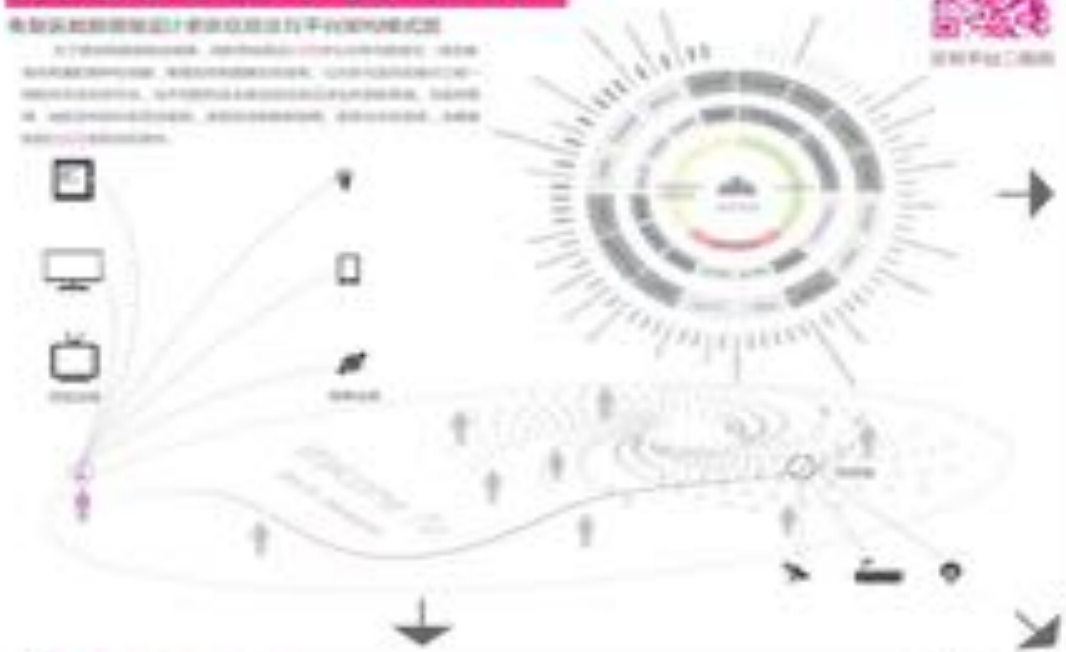
顶层作为观光塔，形成衡复历史街区的新地标

中层作为数据处理与研发的创新中心，鼓励创业团队入驻

广场立设置电子屏幕，显示人迹地毯搜集并动态更新的数据，并结合VR装置，增强历史体验

在衡山路-乌鲁木齐南路铺设结合灯槽照明的人际数据交互感知地毯，动态搜集人流与车流的多种数据，包括流量、路径，并结合wifi探针的用户画像和摄像头的人脸识别功能

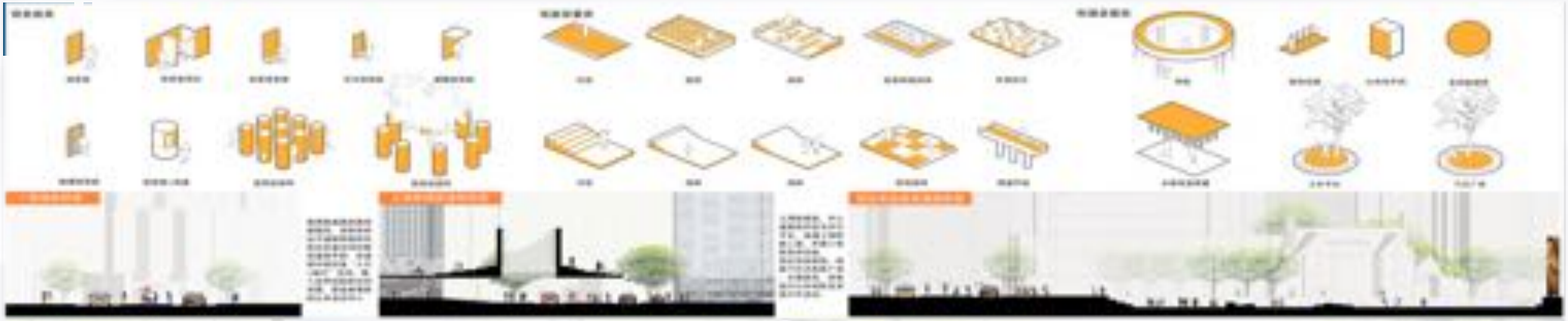
信息交互平台设计



A3街道社区更新平台

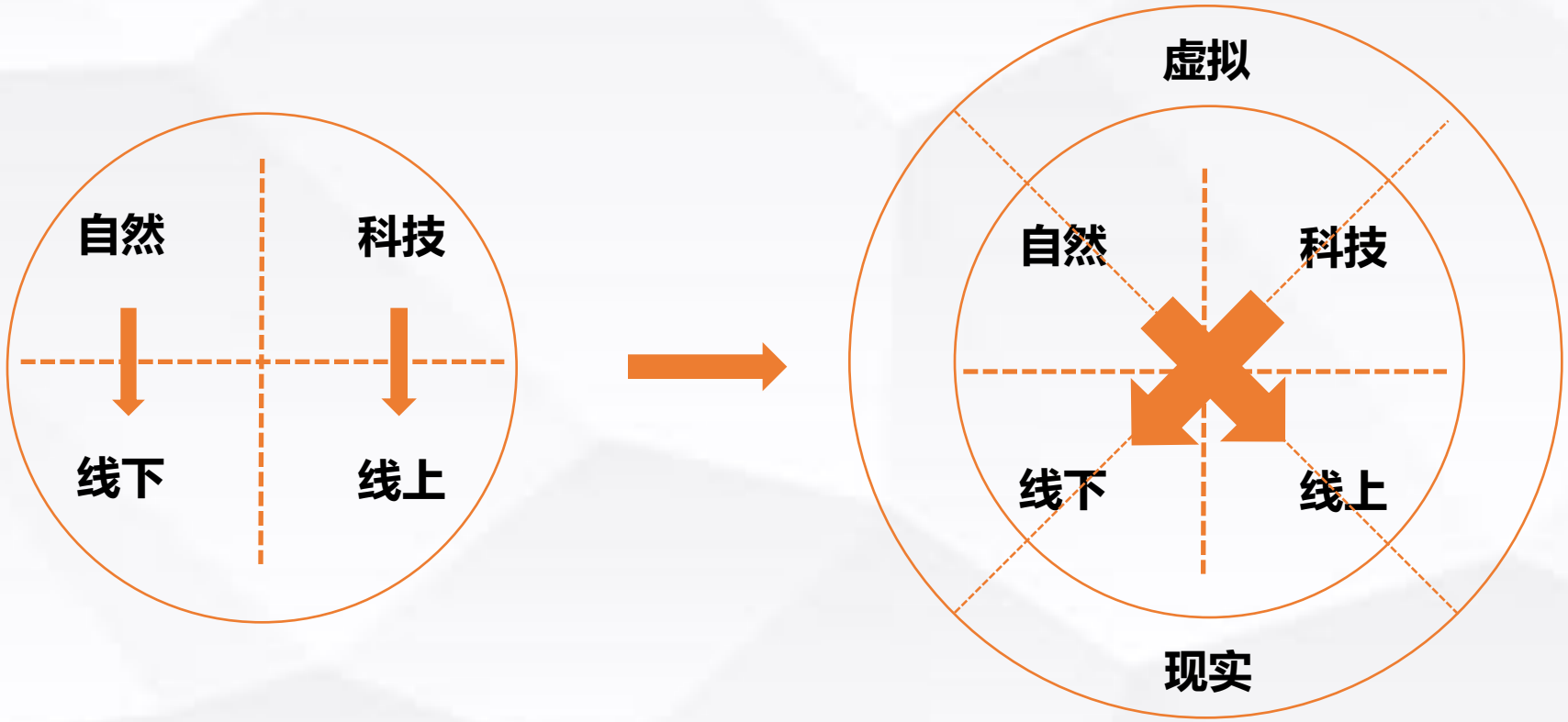
人本观测平台

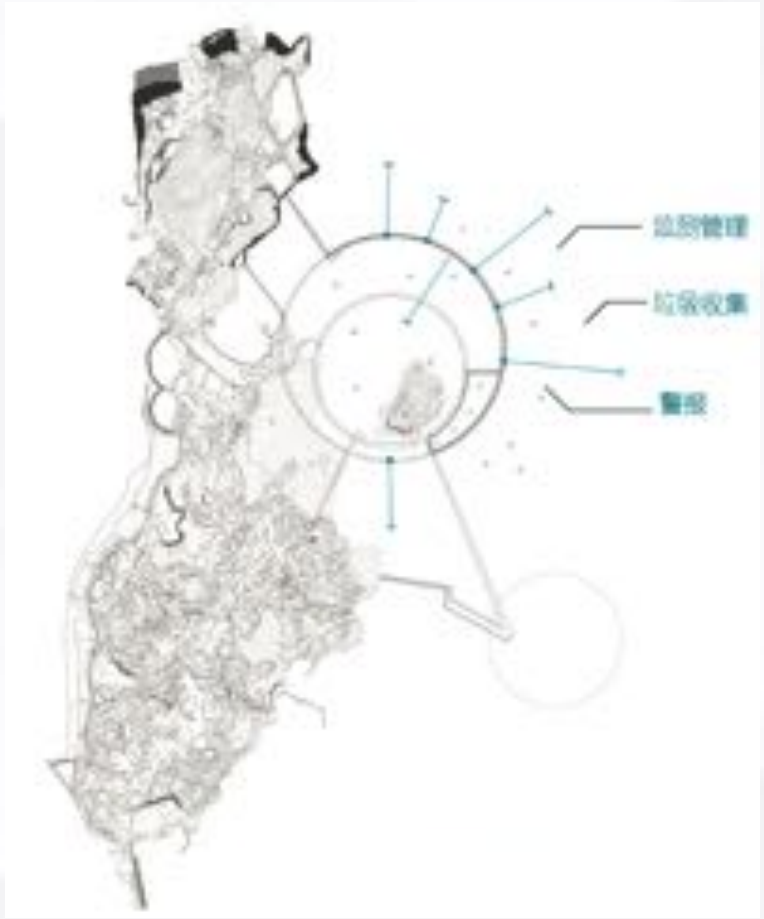
衡复规划设计方案

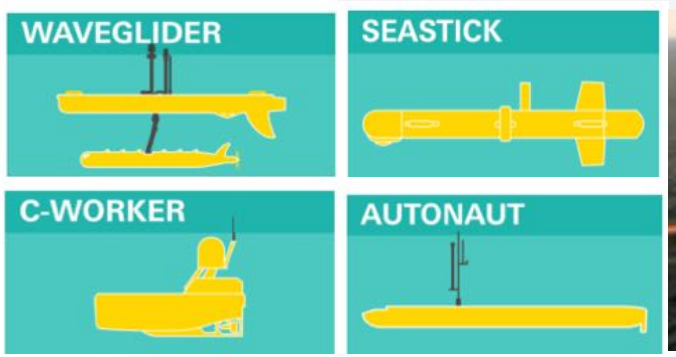


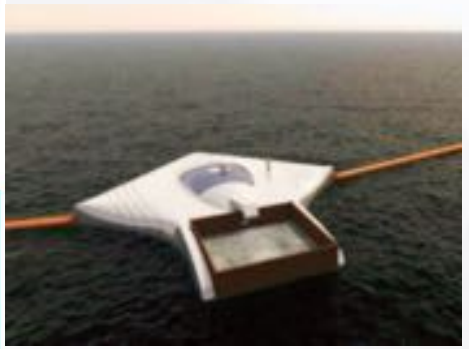
街道数据采集互动信息板

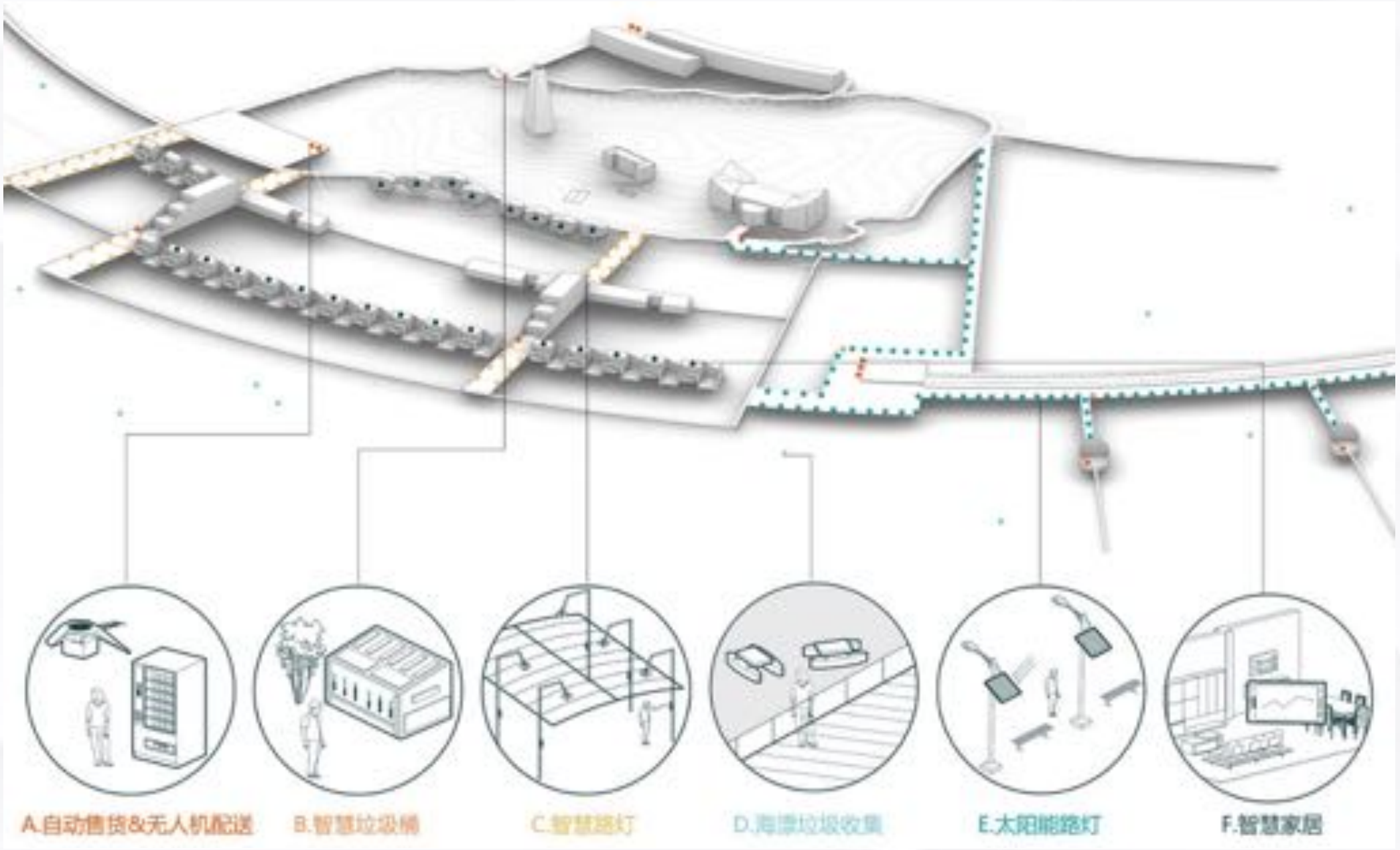
街道数据采集互动信息板

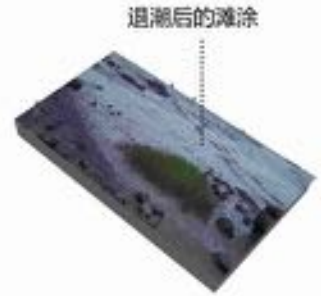

自然
科技
线下
线上
虚拟
自然
科技
线下
线上
现实

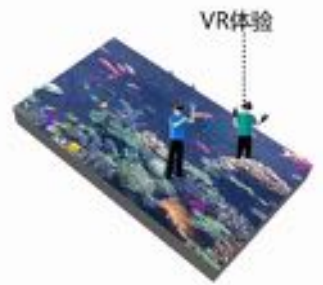


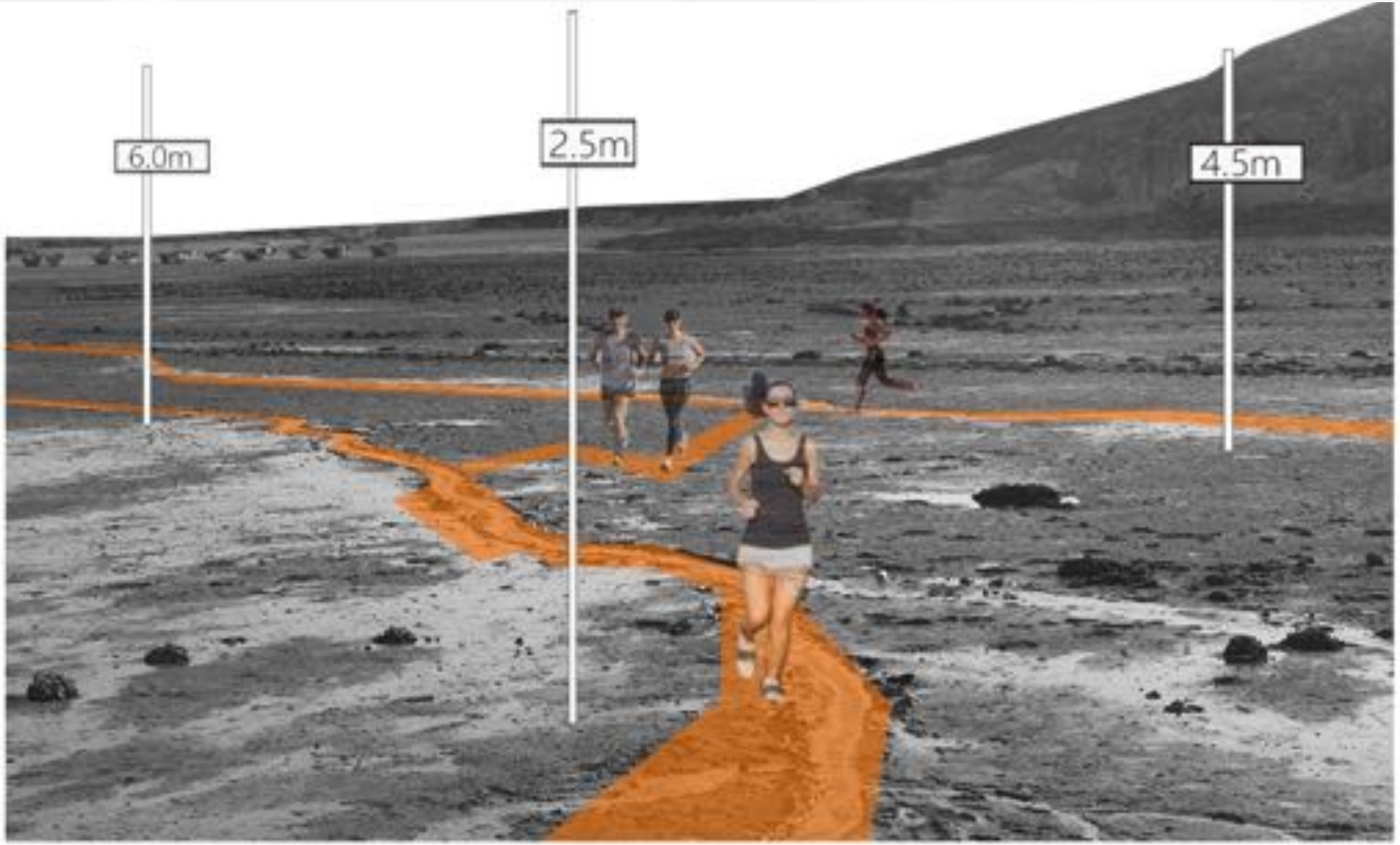

WAVEGLIDER
SEASTICK
C-WORKER
AUTONAUT

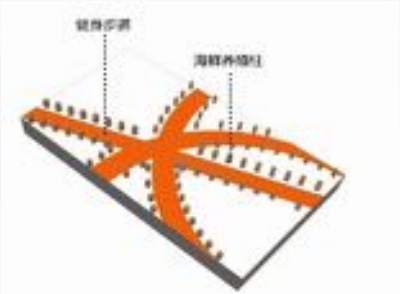



A.自动售货&无人机配送
B.智慧垃圾桶
C.智慧路灯
D.海漂垃圾收集
E.太阳能路灯
F.智慧家居

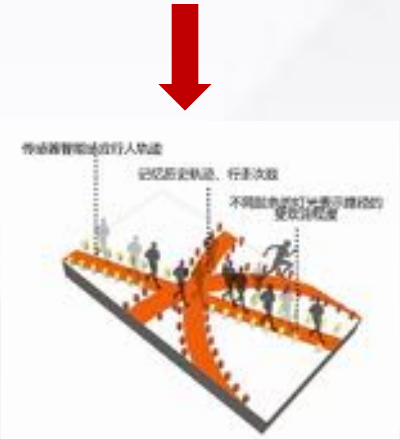

退潮后的滩涂


VR体验



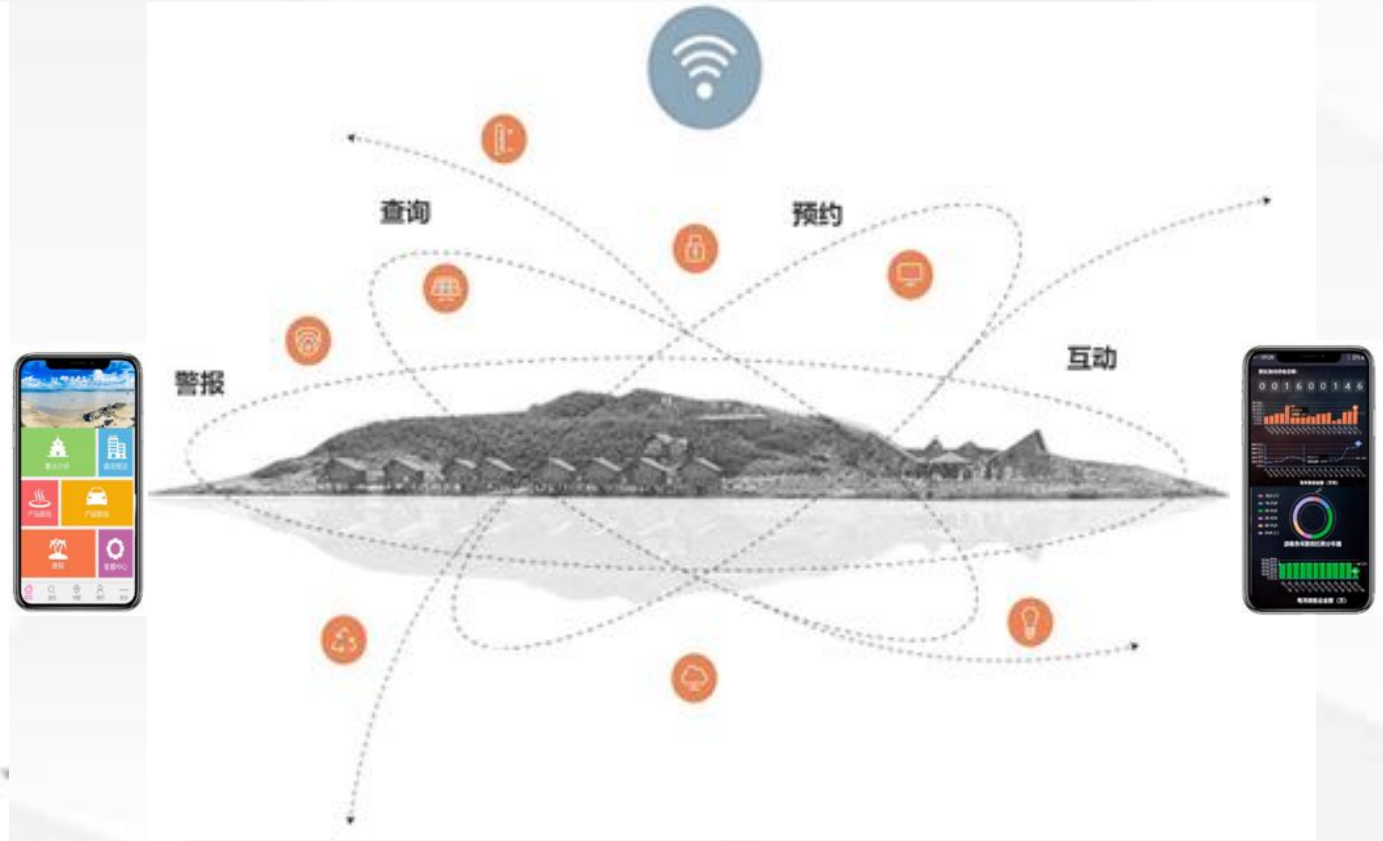


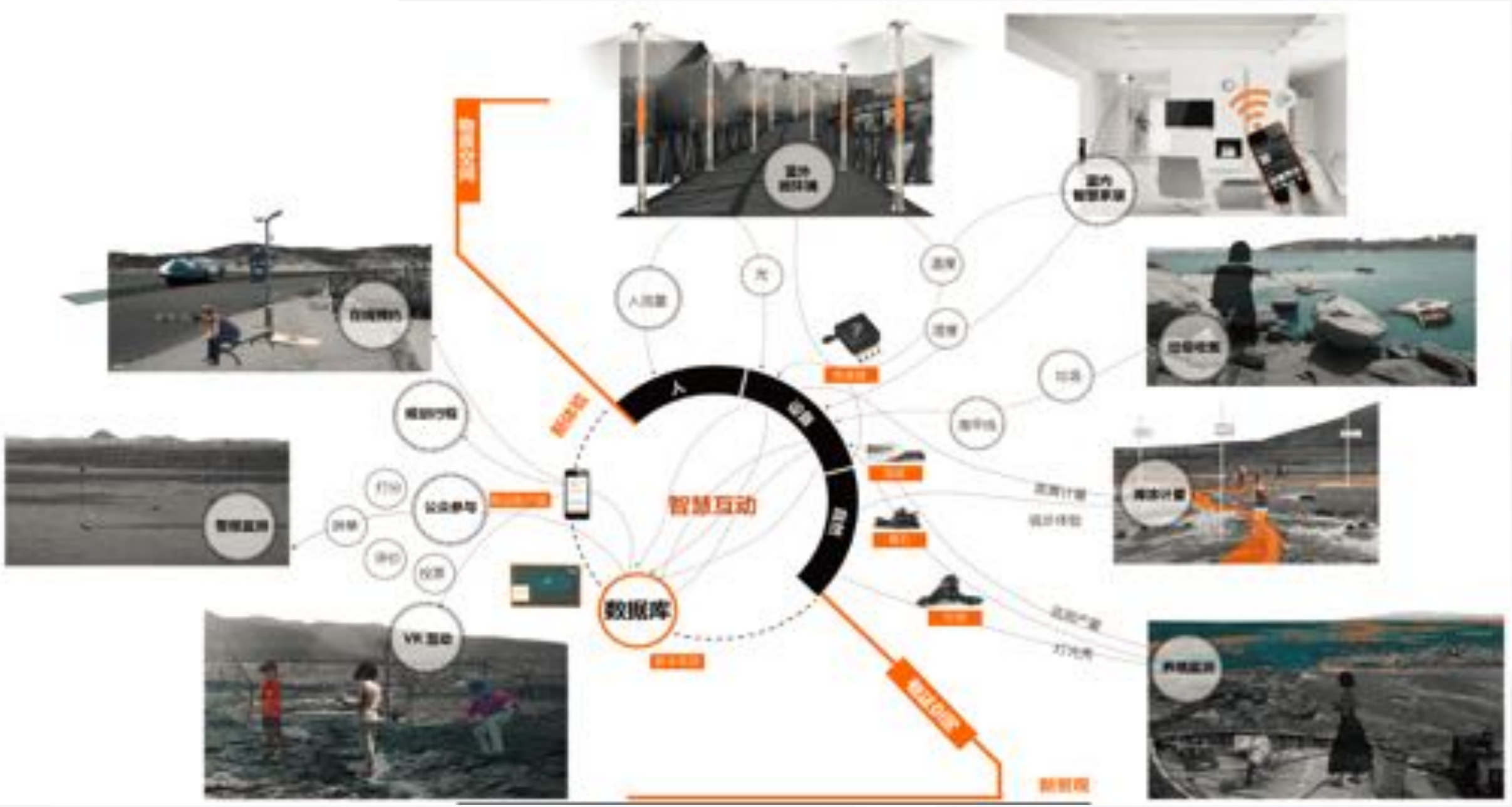
滩涂健身道



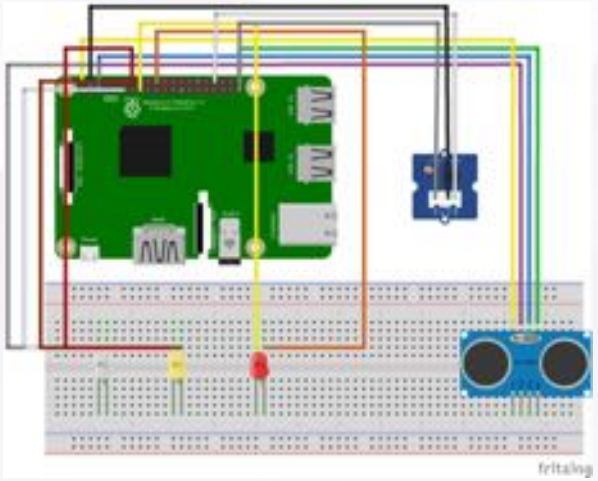
记忆健身道

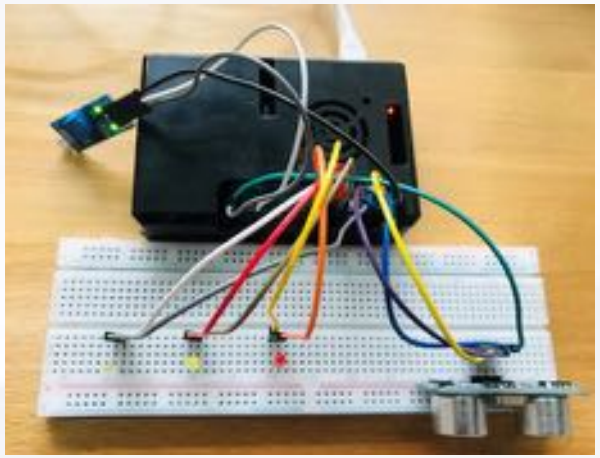

Wifi
Platform
App
虚拟环

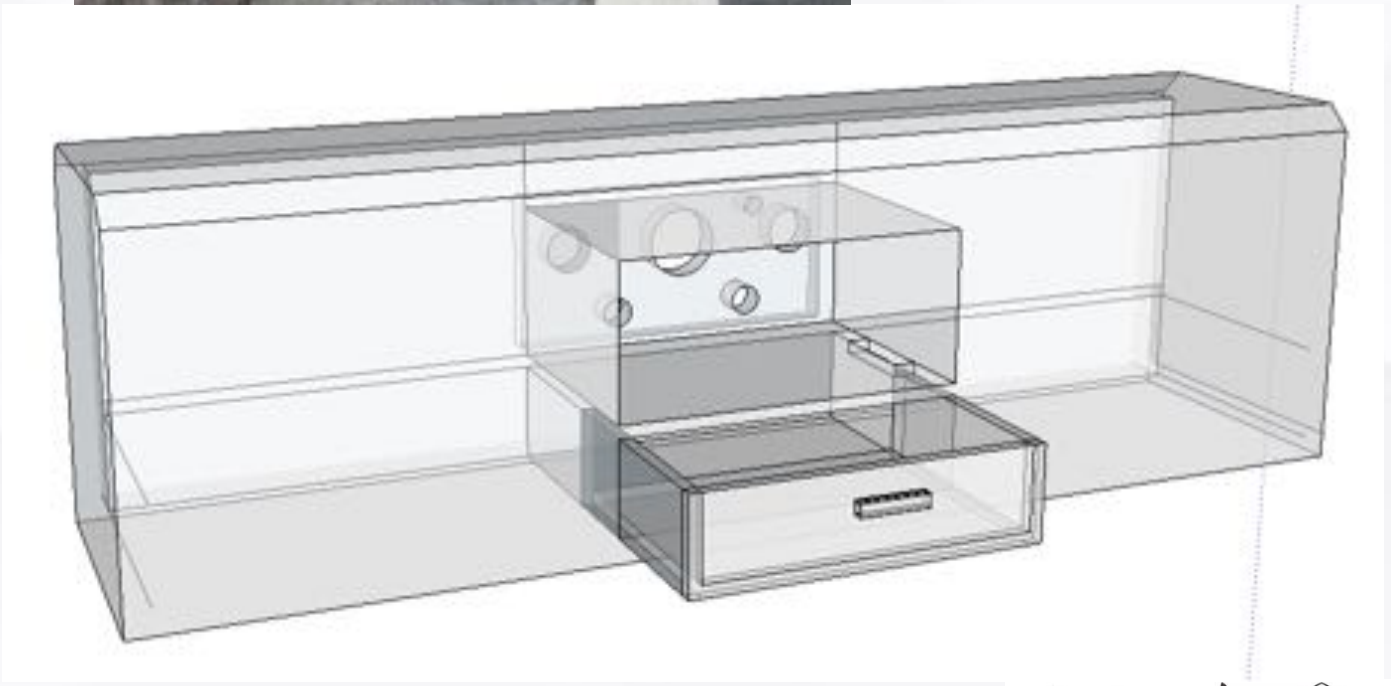

查询
预约
警报
互动


人
动
智慧互动
数据库

Smart curbstone 路缘石 as the basic unit of smart cities







Smart Ground Lighting

light-on-demand solution

As soon as a sensor detects human presence, the neighbouring lights brighten up to a pre-defined level. They will be surrounded in a safe, warm circle of light. By adopting this solution, you can prevent the overwhelming waste of electricity that occurs when the lights burn for nobody, without affecting the citizens' comfort.

Smart
Traffic Flow Counting

Real-time traffic flow counting

Smart Kurb is equipped with ultrasonic sensors, which can count the number of pedestrians and non-motor vehicles passing by.
The detection range is 4 meters and the detection angle is 15 degrees.

Check Ped-Bike Street Congestion

Users including cyclists and pedestrians can use smartphone APP to view real-time slow traffic data collected by Smart Kurb and then determine destination and route.

Ped-Bike Street Heat Map

For urban managers, real-time Ped-Bike street maps obtained from smart kurb can be used to analyze Street vitality and congestion.

Smart
Parking Management

Real-time parking monitoring solution

Compared with traditional parking, Smart Kerb parking can help drivers locate parking spaces accurately in advance and assist parking.
For urban managers, illegal parking can be managed in real time remotely.

Searching for Parking Space

Users can check which section of the road can be parked on their mobile phones and locate the vacant parking space accurately.

Vehicle-to-Infrastructure cooperation

Help users to park.
When the vehicle is too close or too far from the kerb, it will be reminded.

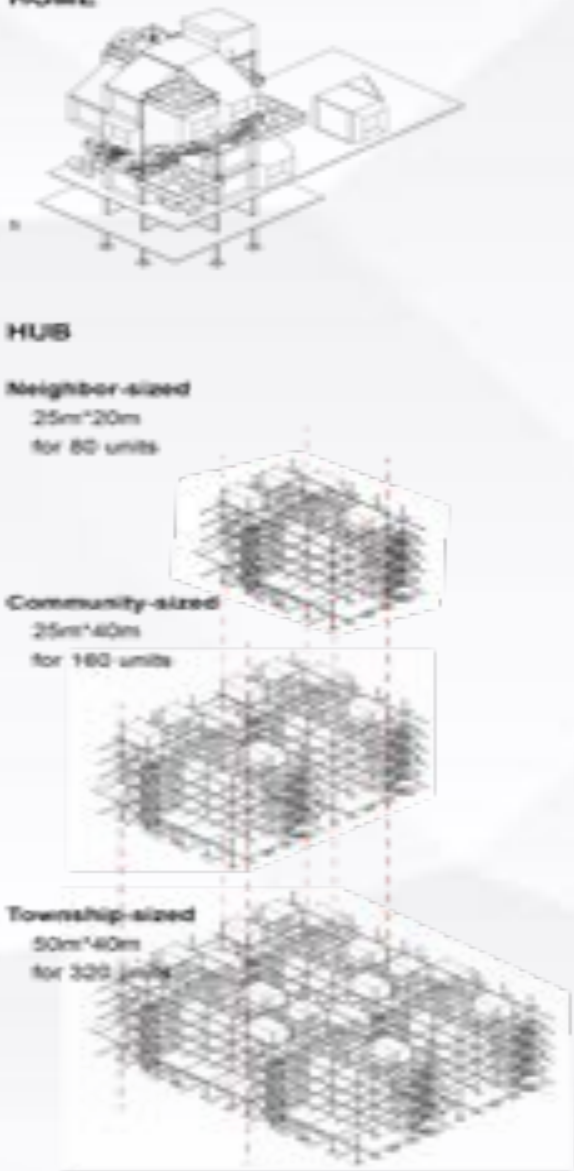
Illegal Parking Management

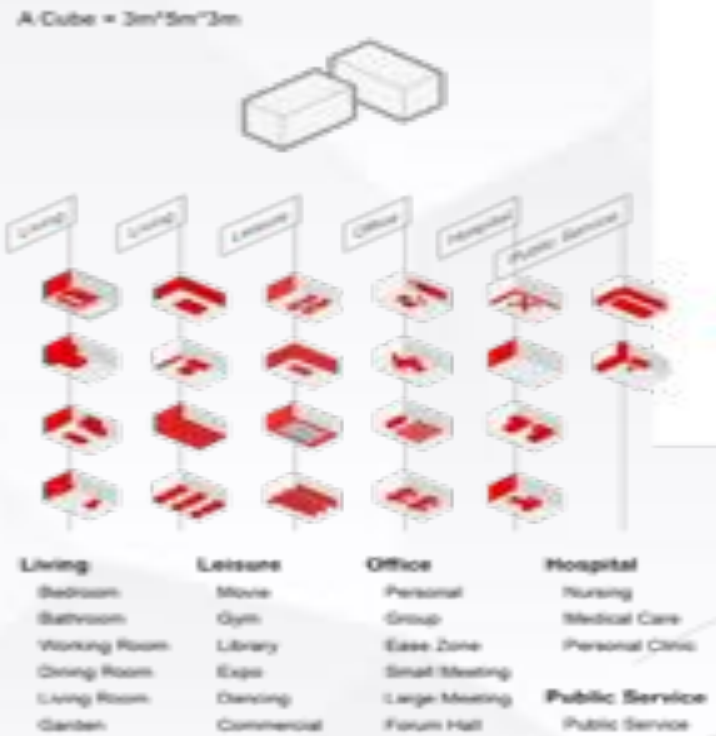
Urban managers can see remotely whether illegal parking exists in the parking-prohibited area and deal with it in time.

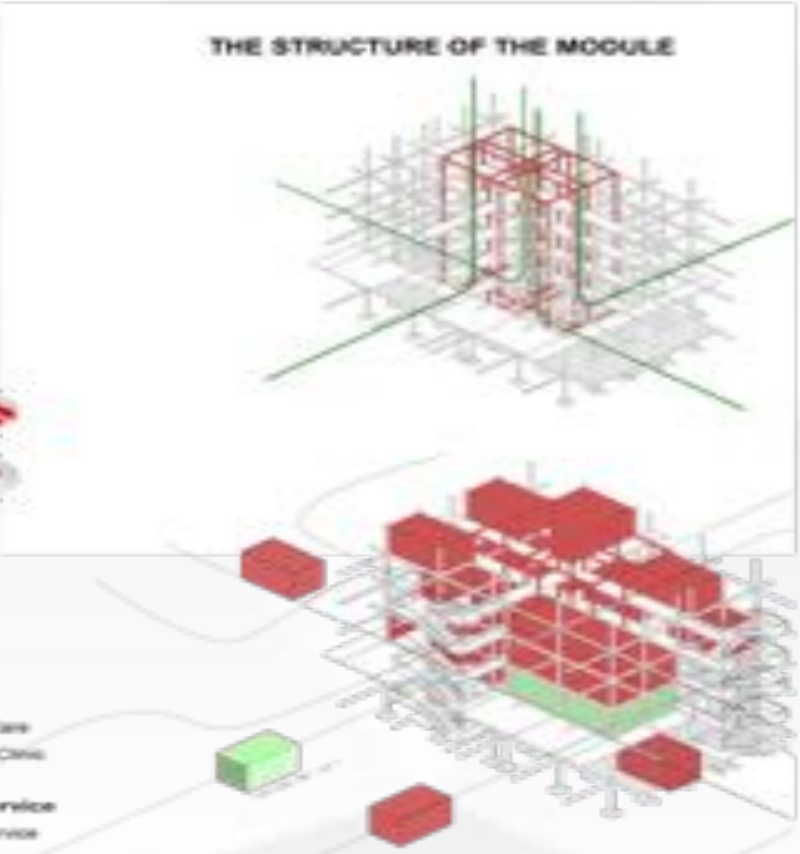

NEXT FORM OF HUMAN SETTLEMENT
#END
THE NEXT FORM OF HUMAN SETTLEMENT

Module

along with different forms of human settlement



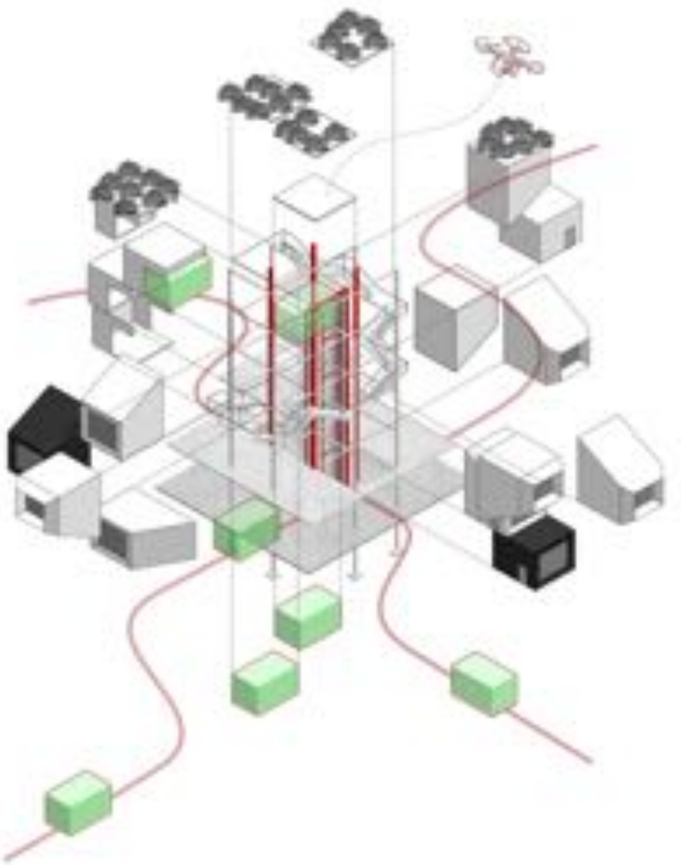




We assume that in the future, the living environment supporting by the new technology, for instance, UAV and self-driving cars, will be more flexible and humanity. People won't be able to tremendous travel or transport to the destinations anymore. Instead of using modules, most of the function would be directly transport to where people need. As a result, standardized and detachable Functional Cubes have been designed to carry various functions, while the fixed module, which is divided into two types. One is Hub which is designed to be a collection center. The other one is Home, the module where people lives in.

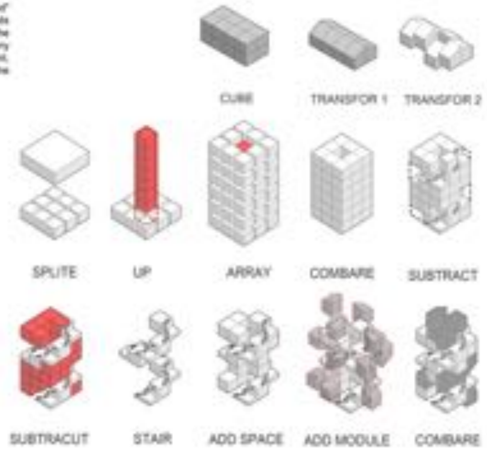
我们设想未来的人居环境因应技术，所有功能都可以借助无人机、无人驾驶而作流动，人不再需要大量长途跋涉或借助交通工具来移动至目的地，而是藉由模块将功能，直接传达至人的居住地。因此设计了标准化、模块化的 Functional Cubes，以承载各种功能，以及固定的模块，其中又分以作为移动模块集合中心的 Hub，和人类的居住单元 Home。

Architecture



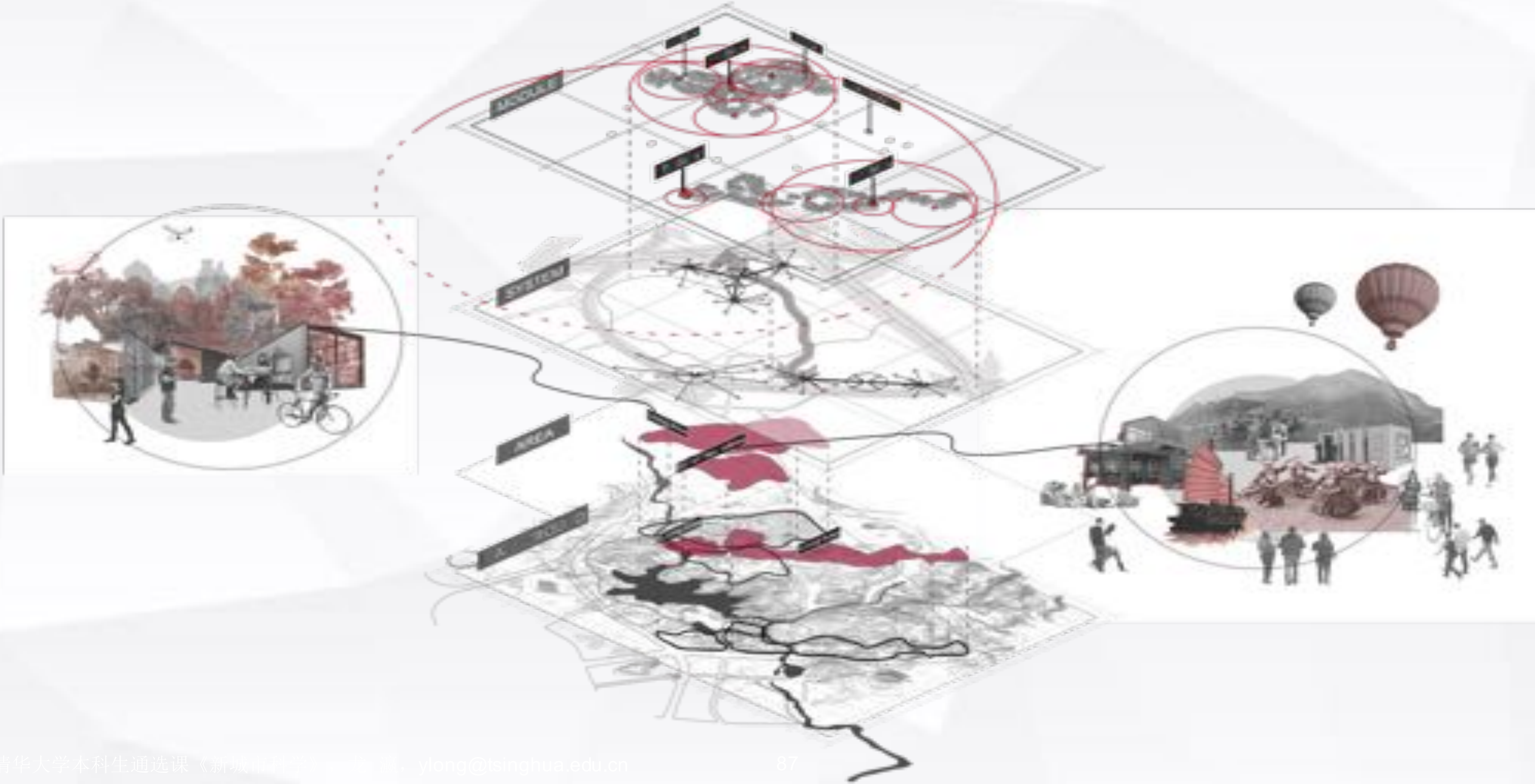
Architecture Concept

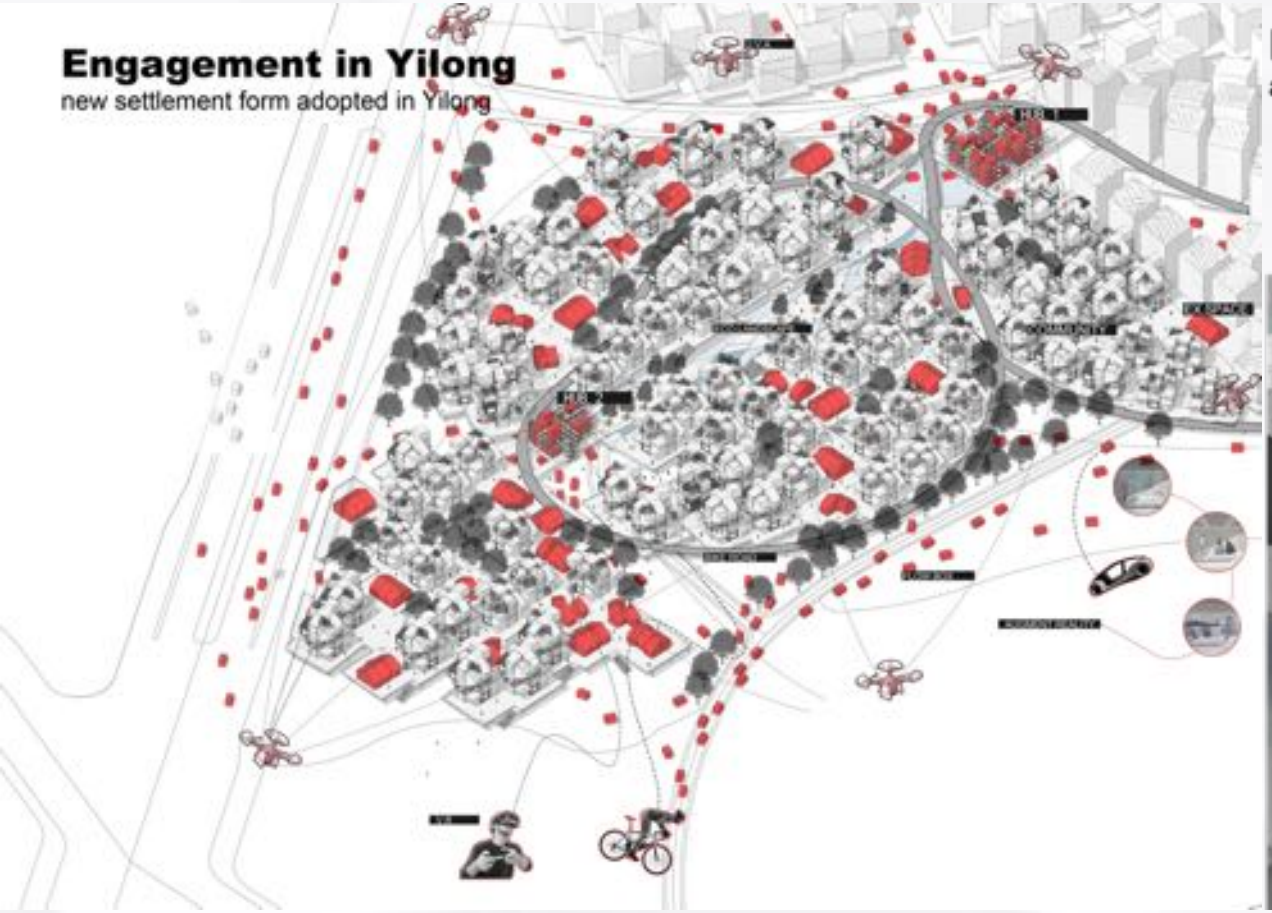
Mountains and mountains is a major feature of Guizhou region, the traditional local architecture will be based on different geographical and hydrological reasonable "growth" to form a unique geographical and cultural landscape.
In this architectural design, we use the "traditional" architectural language of "sloping roof" in combination with the concept of "modularity" to freely combine the spaces and deepen the design to form the unique "Karma Stewart "image.
The building itself will also be reasonably "metabolized" according to the different needs of different periods to maintain the status quo and meet the needs of the times while promoting the national culture in city. Many scholars began to focus on sustainable development, low carbon, the relationship between the city and the



Layout

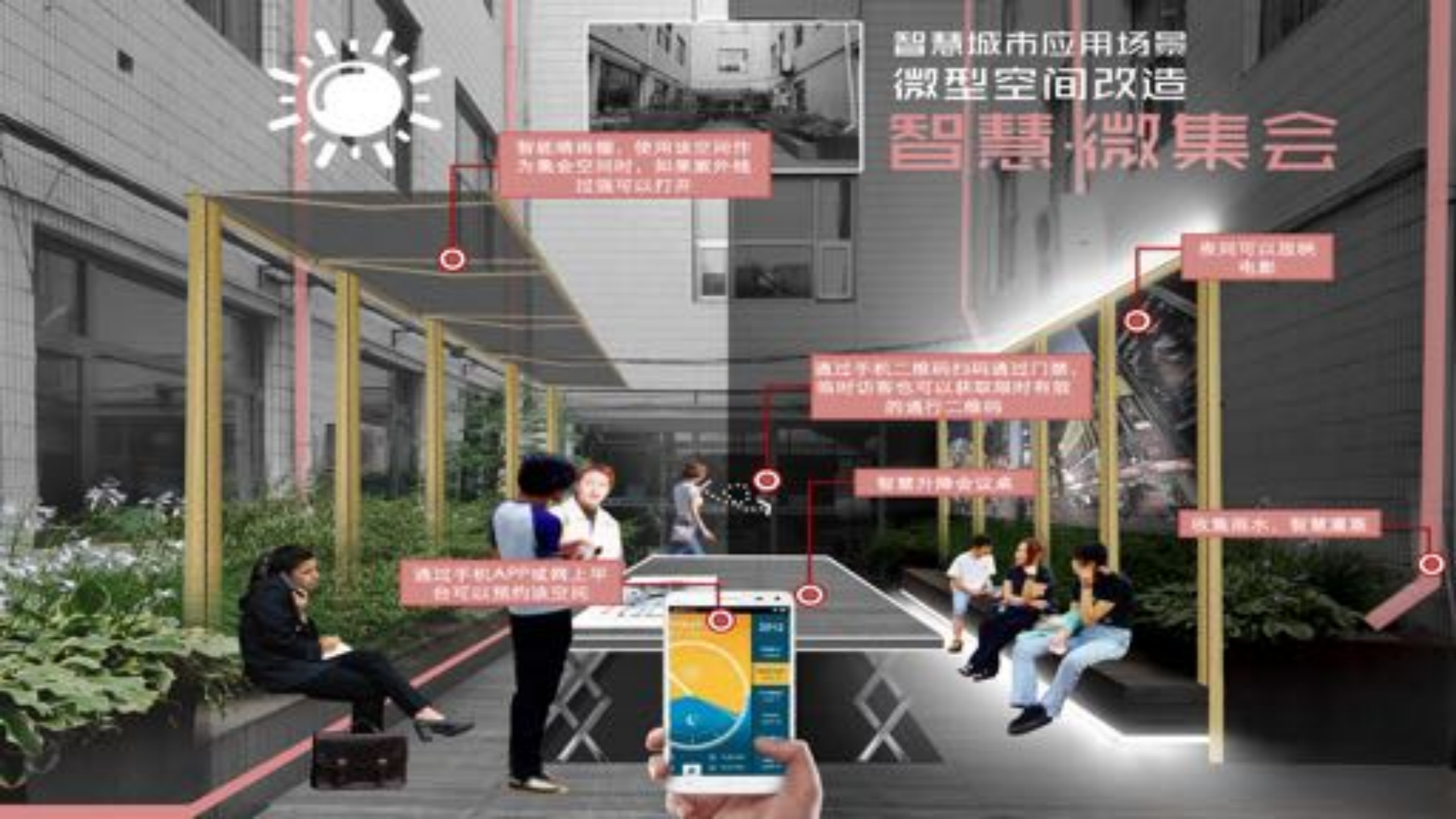
along with different forms of human settlement





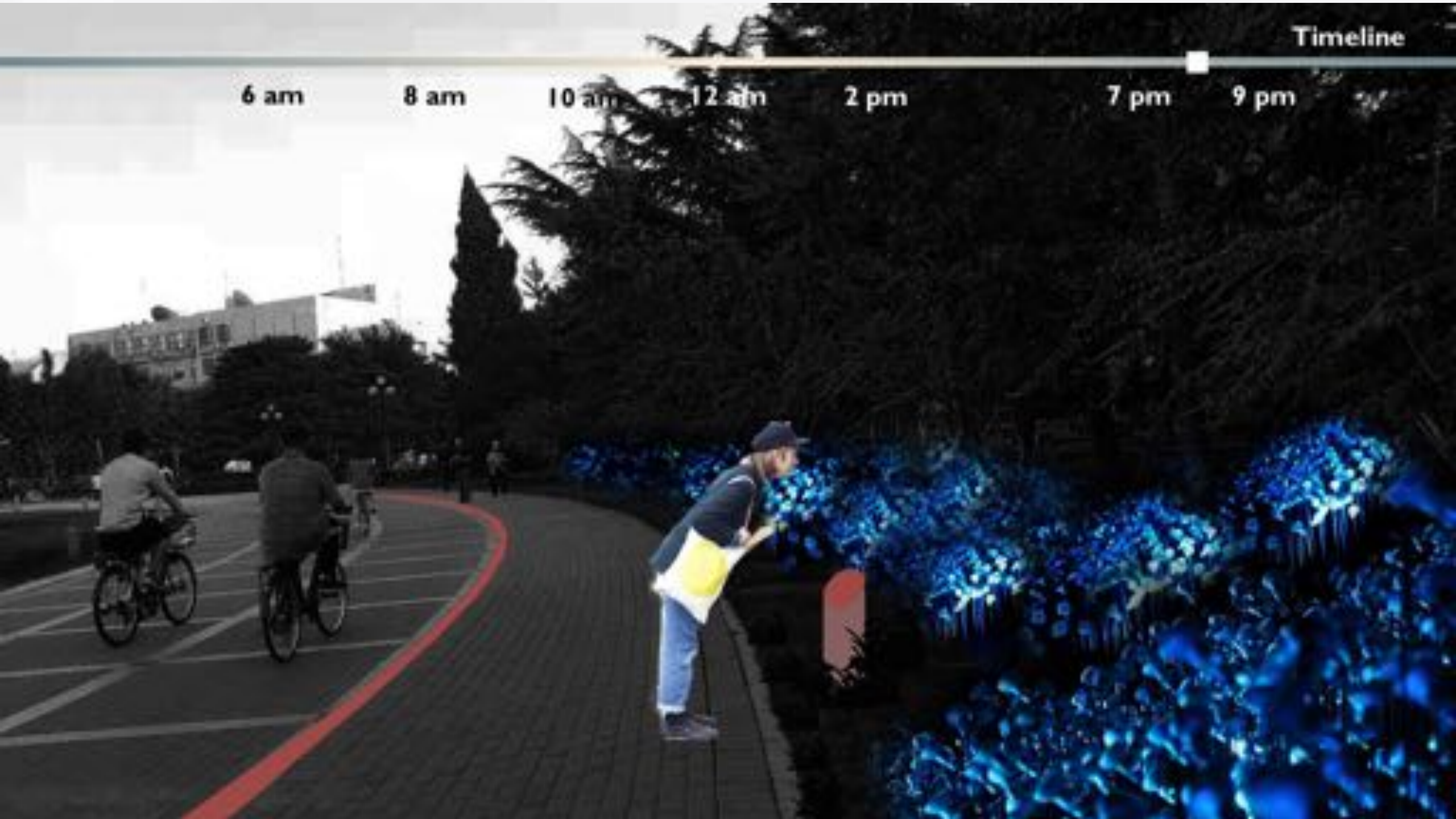
Design Sketch

a daily perspective in future Yilong


智慧城市应用场景
微型空间改造
智慧·微集会


智慧微健身
智慧城市应用场景
微型空间改造
共享健身盒子
垂直绿化
行人检测器，可与手机连接，记录使用者跑步时长与距离
紫外线、空气质量、空气湿度等显示器
智能座椅，可以将太阳能转为电能，为手机充电，为座椅提供音响供电
智慧跑道，当使用者跑步经过时，会形成不同颜色，同时可以收集动能转为电能


Smarter Beijing
2019
北京智慧城市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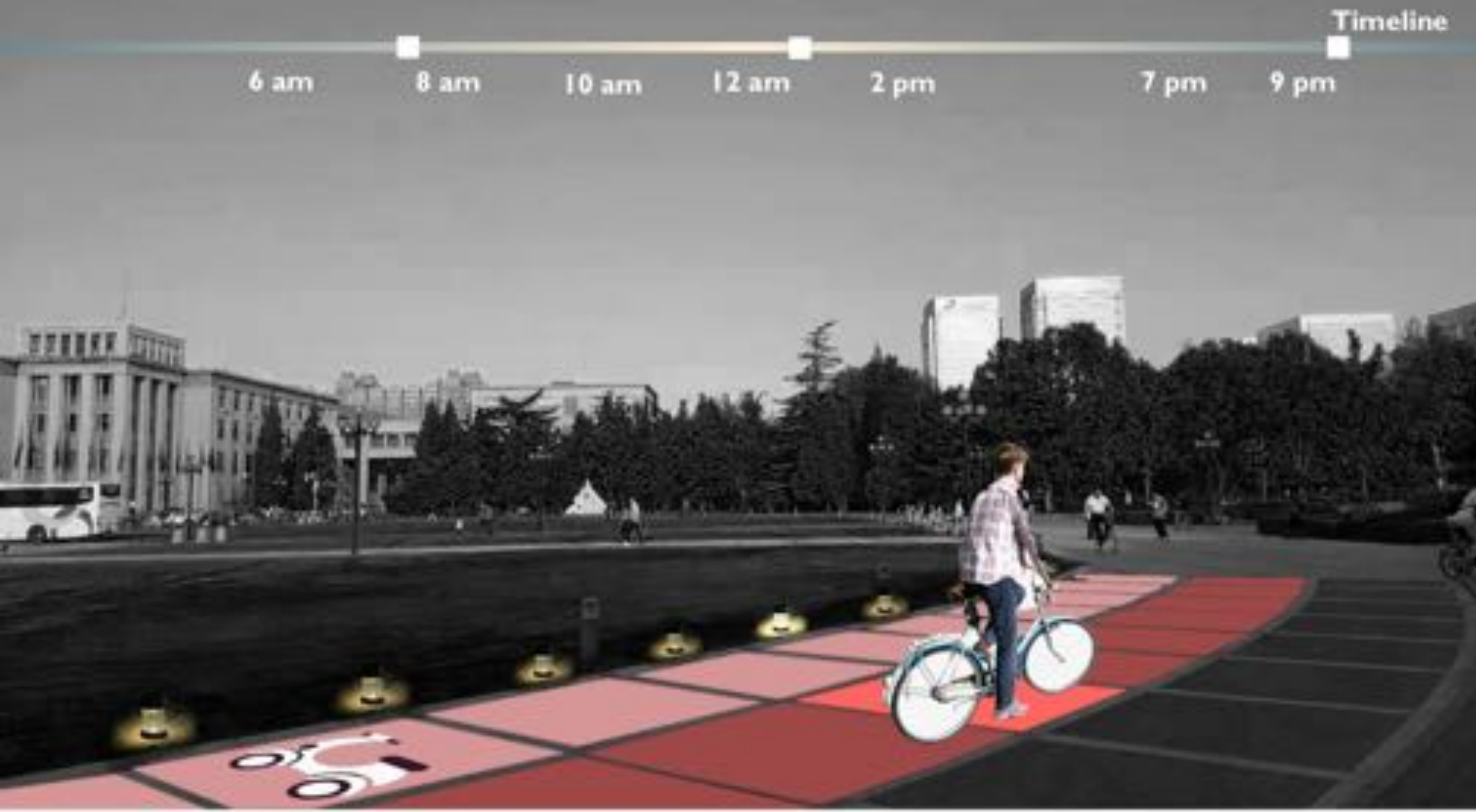
10 am
12 am
2 pm
7 pm
9 pm


Timeline
6 am
8 am
10 am
12 am
2 pm
7 pm
9 pm

课后安排

- 阅读材料和课件将更新到网络学堂

- OPEN OFFICE HOUR
  - 每周五上午08:00-09:15
  - 需要提前通过info预约
  - ylong@tsinghua.edu.cn, 新建筑馆501, 13661386623

- 答疑邮箱
  - ylong@tsinghua.edu.cn