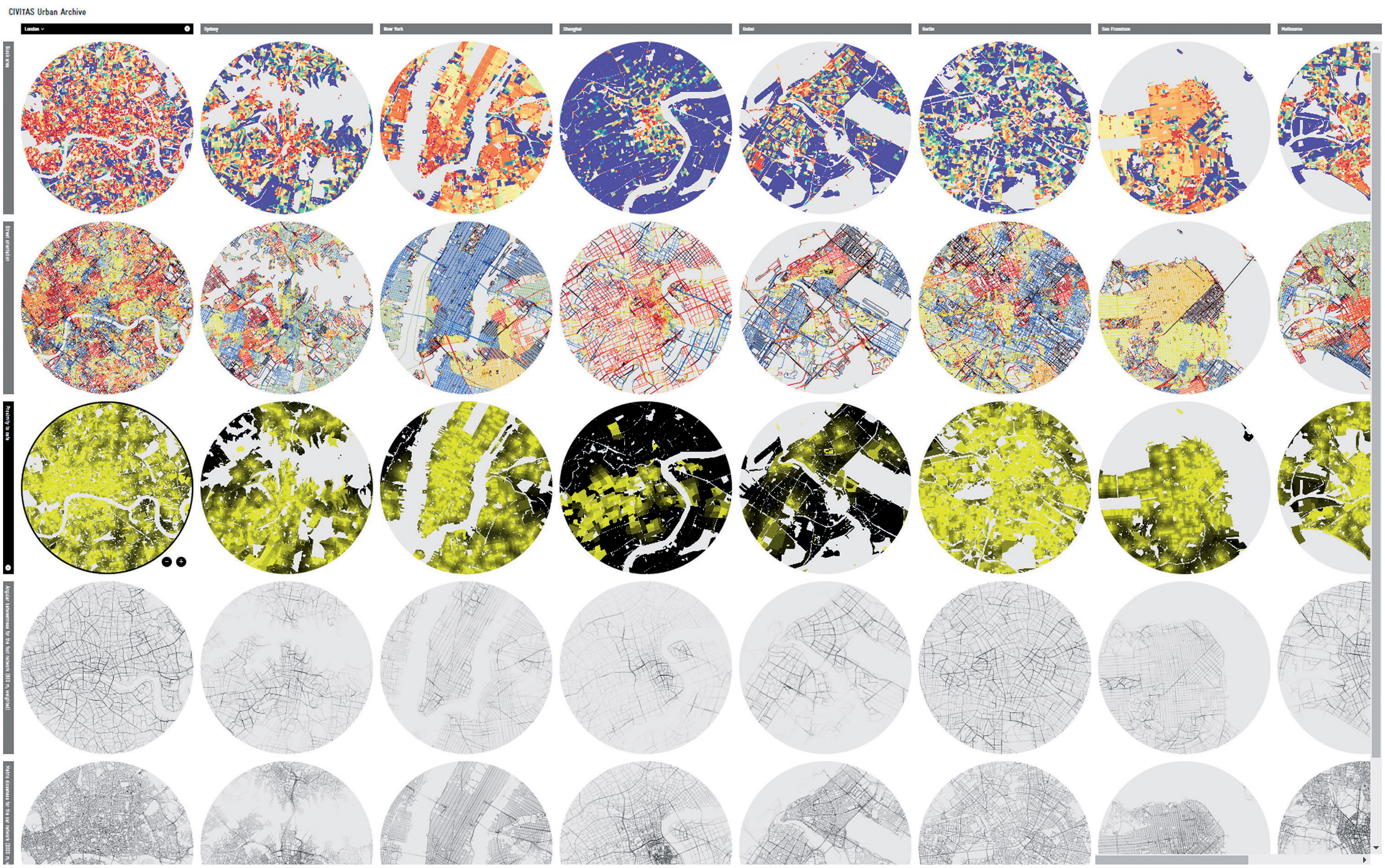

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1.　城市档案馆界面示意图——伍兹贝格建筑设计事务所建立的城市数据库，可基于任何全球性城市生成空间数据。

1.　Interface example of Urban Archive: the Woods Bagot urban database to generate spatial data for any global city.

基于全球性城市中地方社区的数据体验

THE DATA EXPERIENCE OF LOCAL NEIGHBORHOODS IN GLOBAL CITIES

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摘要

本文着重介绍了一款用于评估城市环境状况的搜索引擎平台——CIVITAS。该平台由伍兹贝格建筑设计事务所的SUPERSPACE团队设计和开发，可帮助用户判断某处地域的宜居性或城市体验是否符合其预期或特殊要求。基于空间特征、空间连通性和土地利用密度三类指标，用户可从大量的社会空间数据集中选取所需数据，对整个城市或社区、建筑物甚至具体楼层进行定制化分析。CIVITAS适用于不同的城市，其内部汇编了一套服务于各项城市指标的数据库，并正在将越来越多的全球性城市纳入其中。本文呈现了利用此平台在全球性城市的地方社区中所开展的研究。

关键词

数据；CIVITAS搜索引擎；宜居性；可视化；指标

ABSTRACT

This article introduces CIVITAS, a search engine for urban conditions designed and developed by SUPERSPACE of Woods Bagot to allow stakeholders to identify qualities of liveability and urban experiences that suit their tacit desires and explicit requirements. Large data sets of socio-spatial quantities are selectable to create bespoke analytics across scales from whole city to neighborhoods, buildings, and even floors based on three categories: spatial character, connectivity, and land-use densities. CIVITAS is applicable across cities and a database for urban metrics has been compiled in-house that contains an increasing number of global cities. This article showcases research into neighborhoods within global cities using the platform.

KEY WORDS

Data; CIVITAS Search Engine; Liveability; Visualization; Metrics

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1 引言

2008年，澳大利亚SUPERSPACE团队（原凯达建筑事务所研发中心）开发了一个概念验证模型，用于模拟可持续的城市密度增长过程。团队选取了迪拜和伦敦两座城市作为研究对象，试图探讨当一座新的高层建筑嵌入城市肌理中时，城市密度的增长会发生怎样的变化。商业建筑用地的供给和主要交通方式的可及性这两个因素构成了这一模拟实验的基础。就结果而言，无论是对于拥有发达的地下公共交通系统的伦敦，还是依赖汽运交通的迪拜，多层次反馈模型都能清晰地反映其扩张程度和密度增长程度（图2）。

该模型的理论基础是一种被称为“元胞自动机”的自组织式技术，自20世纪70年代以来，学术界一直使用这一技术来模拟城市的增长。随后，比尔·希利尔等学者指出了衡量城市可持续性的关键绩效指标，包括决定城市弹性结构的道路连通性以及建造用地、混合用地和居住用地的密度[1]。这些取决于动态交通结构的指标逐渐成为了城市设计准则中的主要评价标准，诸如英国环境、交通和区域事务部城市工作组（DETR）的报告《走向城市复兴》[2]，英国建筑和建成环境委员会（CABE）的报告《借助设计》[3]等，均将关注点从简·雅各布斯所推崇的以街道和社区活力作为对空间基础设施进行定性评价指标的做法回归至对空间基础设施的定量评价。

针对2007~2008年英国政府资助的研究项目“城市活力——建设可持续社区”，SUPERSPACE团队建立了首个城市规划数字设计模式，即空间规划智能解决方案（SSSP）[4]。该方案依据从城市设计公司和伦敦自治市镇规划人员处汇集而来的各类设计准则，推算出了有助于实现可持续性城市设计与更新目标的城市结构。由于开源城市数据自2012年起才进入快速发展阶段，因而SSSP在面世时尚未获得大量开源数据的支持。自2014年起，人们对于城市社会空间可持续性的关注点已由设计过程转向基于城市大数据分析的评估过程，以更好地定量分析城市环境，提升城市管理水平。

自2014年以来，SUPERSPACE团队在SSSP的基础上对计算机辅助城市设计与规划框架进行了完善，发布了大型城市数据

项目团队：
伍兹贝格建筑设计事务所SUPERSPACE团队
项目时间：
2015~2016年

PROJECT TEAM:
SUPERSPACE of Woods Bagot
PROJECT PERIOD:
2015 ~ 2016

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分析和可视化平台——CIVITAS[5]。这一举措旨在量化“城市活力”和“宜居性”等抽象概念，进而评估和制定各项干预性措施，并将其融入城市发展中，或用于增强社会空间的可持续性。

1.1 CIVITAS——城市搜索引擎

CIVITAS平台旨在对城市的性质及潜在发展区域进行评估。为简要了解某处场地并评估其在何种状态下能够同时满足开发商的开发需求与社区的使用需求，需寻找到能够体现场地性质的动态特征。尽管这些特征多数难以被量化，但我们依旧可以对一系列能够反映社会可持续性——例如《借助设计》导则和联合国人居署的城市规划指南所作出的相关定义——的相关空间性能进行估算。这些不断变化的动态特征是各个城市系统的写照，因此我们必须在更大的有机体中理解城市，而非囿于其中的单个场地或某一即时语境——“不是场所组成了城市，而是城市造就了场所。”[1]

CIVITAS平台主要可应用于都会区、社区和街区三种尺度（必要时也可扩展至具体建筑物和具体楼层尺度），不同尺度间可实现数据共享，以便于对结果进行整合分析。这种不同尺度间数据的整合可以保障研究的连续性，同时也确保能够对不同尺度下的关键绩效指标进行拟合测试，而不受不同区域规划立法的限制。CIVITAS平台中专业数据的公开程度依据空间尺度的不同而有所差异，且自成体系。尽管人们普遍认为大数据无处不在，但CIVITAS所使用的数据只有20%~30%来自开源途径或由客户提供，大多数数据需经过SUPERSPACE团队的计算才能获取。

1.1.1 都会区尺度

开源数据通常为城市尺度的数据，部分城市市政府已开始建立汇编后的数据库，如纽约市开放数据库①和伦敦数据存储库②。这些城市数据主要涵盖三大领域，即城市结构、土地利用密度和便利设施可及性。每一类数据又包含基本指标和特定指标。在CIVITAS平台的具体操作中，可选择一组符合项目概况或满足用户需求的指标，随后用户可通过在线城市搜索引擎中的图形用户界面（GUI）获取这些指标，搜索引擎同时与SUPERSPACE开发的名为“城市档案馆”的城市数据库相关联。目前，每类数据中的指标均可根据项目目标进行加权，而后城市地图可实时呈现符合权重值的地点。该模型甚至可以完全转变战略规划和项目初期规划中空间上地点的权重值，以帮助用户预测项目终端使用者的位置分布（图3）。

1.1.2 社区尺度

根据不同指标之间的关系，都会区尺度模型能够界定场地属性，并划定社区范围。当确定社区范围后，基于街道层级的一系列空间分析赋予了每条街道另一套不同属性，更为详尽地描画出了社区情况。具有辅助认知功能的导向标识系统、围墙，以及土地混合利用、便利设施、建筑方位和客流量等空间指标数据随之在社区范围内生成，并以二维和三维的场地可视化图像的形式呈现。在社区尺度下生成的可视化图像将

① 更多有关纽约市开放数据库的信息，可访问https://opendata.cityofnewyork.us。
② 更多有关伦敦数据存储库的信息，可访问https://data.london.gov.uk。

2. 由SUPERSPACE团队建立的模拟模型清晰地反映了基于两种不同类别的交通系统的城市密度增长和便利设施供应情况：左图为拥有发达的地下公共交通系统的伦敦，右图为依赖汽车交通的迪拜。

2. The simulation model created by SUPERSPACE illustrated clearly the levels of densification and amenity provision for two types of transport models — London with a dense public underground transport system (left) and Dubai with a car-dependent transport system (right).

被编码并存储于数据库中，这些反映局部城市特性的可视化资料可用于建筑尺度的研究，或城市尺度的总体规划和场所营造之中（图4）。

1.1.3 建筑尺度

赋值后的都会区尺度（在地图中呈现为街区区块）和社区尺度（在地图中呈现为街道）中的指标将被应用于建筑尺度的模型中。此外，选定范围内的所有建筑物（通常是已确定的社区和开发区）均被分解和量化为各项空间、环境和经济指标。同样地，根据项目或用户的需求，平台将选定一系列关键绩效指标和目标场地，并将其输入到GUI中，可供用户搜寻符合自己预期的社区中的建筑物或具体楼层。在建筑尺度下，对于建筑物和具体楼层的选择主要基于社区尺度中便利设施供给或其可及性、建筑性能，以及空间组织需求（如空间使用）等（图5）。随后，平台还将建立根据特定标准排序的指标列表，以为未来的标准制定提供依据。

1.2 城市档案馆

城市档案馆是由SUPERSPACE团队开发的另一种可供查询数据的定制平台，所有都会区尺度的数据均由此生成，用户可从中导出数据集和可视化资料。借助这一平台中基于网络的GUI，用户可通过在定制化应用程序界面中进行操作，激活一系列空间分析模型。此外，针对伍兹贝格建筑设计事务所及其客户所面向的各大城市，城市档案馆生成了8项基本指标，由于该数据库同时也存储了CIVITAS平台中社区和建筑尺度模型的数据，因而这8项指标可通用于CIVITAS平台。目前，城市档案馆已收集了10座城市的数据资料，未来还将不断囊括新的城市样本（图1）。

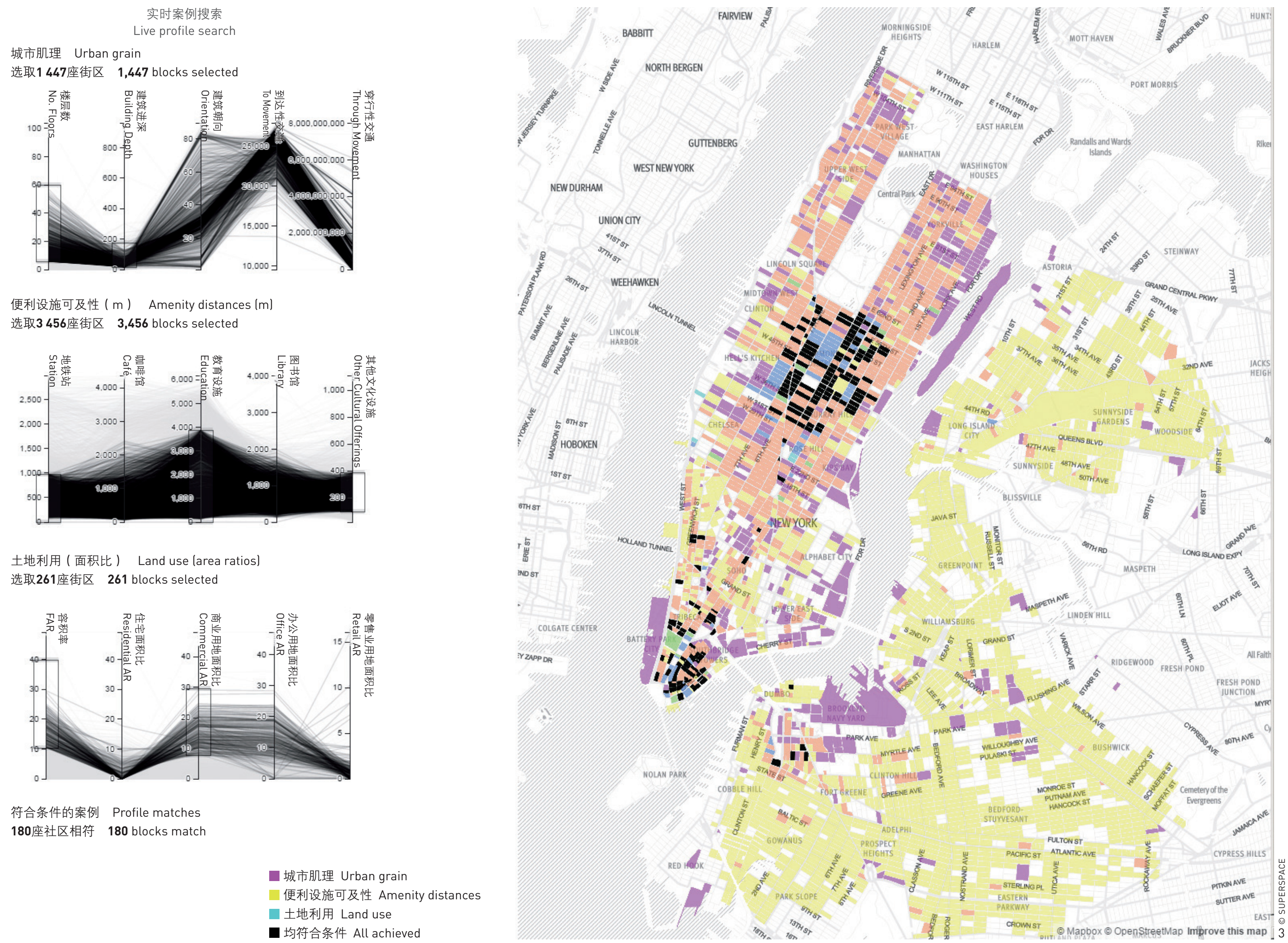
以数字化总体规划、CIVITAS和城市档案馆三个平台为核心的数字化框架已被应用于伍兹贝格建筑设计事务所的各类项目中，并为客户提供了直接的咨询服务。该框架的应用范围涵盖场地投资检索、战略规划、可行性研究、总体规划和场所营造，其优势在于通过强大的多尺度数据分析，交叉模拟各类城市规划和设计流程。基于此，我们可以1）生成更为严谨和复杂的方案；2）将针对社区和城市弹性的敏感性分析纳入设计过程；3）降低规划中可能存在的风险；4）对当前来自不同咨询方的分散的分析结果和数据进行整合，建立完整的方案规划流程（图6）。

2 基于城市尺度和社区尺度的比较

CIVITAS平台可用于解决城市和社区尺度下的研究和咨询问题。例如，本文通过案例对比，呈现了能够吸引创新科技产业（以及计划随后引入的金融产业）入驻的社区的特征，彰显了能够应用于全球各个城市间进行比较的指标的优势。

肖迪奇园区、熨斗园区和欧缇莫园区是分别位于伦敦、纽约和悉尼的创新科技产业园区。我们对这三座城市和三个园区进行空间分析得到的便利设施可及性数据进行了可视化分析，结果显示：尽管这三座全球性城市的便利设施可视化图天差地别，但这三个园区的便利设施可视化图却很相似，似乎创新科技产业在全球性城市中选址时均基于类似的考量因素。而针对创新科技公司进行的研究则证实了这一假设：研究表明，确定办公地点的关键性客观因素之一即是要兼顾便利设施和特殊服务设施（如咖啡馆和为人才储备提供的教育设施）的高度混合性和可及性[6]。换言之，创新科技公司的员工更喜欢在满足上述条件的宜居社区中工作。

我们选择了5项能够代表创新科技公司需求且属于社区公共设施范畴的便利设施：车站、教育设施、咖啡馆、图书馆和其他文化设施，发现各园区内同种便利设施的平均可达距离很相似（车站约为500m，教育设施约为300m，咖啡馆约为100m，图书馆约为250m，其他文化设施约为300m）。而从城市尺度来看，同种便利设施的平均可达距离却差别巨大，无统一规律可循，这表明各个城市在结构、地形或管理方式方面存在差异（图7）。



3. CIVITAS平台基于都会区尺度的应用：该在线城市搜索引擎的用户界面可用于识别社区和街区的信息。图中所示案例呈现了纽约市的便利设施分布与街区密度之间的关系。

3. CIVITAS Metropolitan: the user interface of the online urban search engine is used to identify neighbourhood and block profiles. This case shows the relationship between urban amenities and block densities in New York City.

在完成便利设施可及性的相关调查后，我们决定将城市结构和人口统计等方面的因素也纳入考量，以扩充用于这种特定比较的指标类型，并探求在各个城市的特征千差万别的前提下，社区尺度的相似性关系是否依然存在。此外，我们将城市及社区的数量增加至5组，即旧金山、纽约、伦敦、墨尔本和悉尼，以及各城市中的中央商务区和创新科技区两种社区。正如在伦敦只有伦敦城能够被称作中央商务区——于20世纪中期左右建立的中央商务区无一例外都位于每座城市的老城区，且因此展现着具有时代特色的城市结构。除了比较这些中央商务区外，对老城区、其所在城市和创新科技区进行横向比较也同样不可或缺（图8）。

2.1 用于比较的指标

为了评估每座城市和每个社区之间的差异，我们设定了10项涉及城市形态、人口统计和管理方式等方面的指标，包括：1）街道密度，2）收入中位数，3）医院可及性，4）街区面积，5）文化设施可及性，6）整

合度，7）学校可及性，8）便利设施密度，9）居住区密度，10）流动性，并依据这些指标为每座城市绘制了一张可视化图。为了探索各个指标下城市间的异同和同一城市中不同指标的数值波动，我们总结并制作了两种不同的可视化图。

2.1.1 指标可视化图

在比较各个指标下城市间的差异时，我们发现了一定的规律：虽然每个单独数值间可能差异巨大，但社区中值（彩色短线）与城市中值（黑色长方条）之间的变化规律似乎是相似的。尽管某一城市的数值在某些指标下可能呈现异常，但在大多数指标下这一结论都是成立的（图9）。

2.1.2 城市可视化图

城市可视化图中的灰色、绿色和橙色分别代表整座城市、中央商务区和创新科技区，其中各尺度的中值差异一目了然。与城市中值相比，社区尺度的中央商务区和创新科技区的中值大都较高。此外，在每座城市中央商务区和创新科技区的可视化图中，二者在绝大多数指标上的差异都很小。通过用正差值和负差值分别代表高于和低于城市中值连线的部分，城市折线图直观地展现出各尺度间的区别，高于中值线表示区域内该指标表现较好，而低于中值线则表示表现较差。然而一些特定指标却呈现相反的情况，例如在所有的可及性和街区面积指标中，更小的数值反而代表更好的城市空间表现（图10）。

2.2 结果分析

从数据可视化图中我们可以顺势得到以下更深层次的结论：

2.2.1 城市肌理与便利设施密度

从中央商务区的可视化图中可以看出，街区面积越小，便利设施密度往往越高，有时甚至会高于城市中值若干倍。创新科技区的情况也是如此，便利设施的位置由“公开街道地图”众包数据中标记的兴趣点反映，因此该指标是由参与标示的每位活跃的标记人主观决定的（图11）。

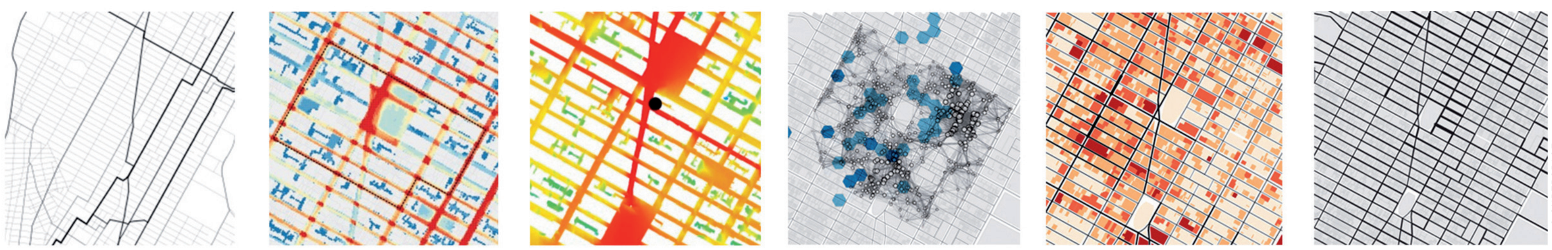
2.2.2 增强连通性

在城市街道网络中，中央商务区占据着优越的地理位置——这一假设在5座城市中均得到了证实：中央商务区的整合度明显高于城市中值。如图12所示，仅旧金山的创新科技区在街道连通性这一指标上未能明显高于该市中值。考虑到街道整合度由街道连通性决定，且与小型街区面积和便利设施密度相关，我们发现，在机动车出现之前，这些城市的老城区都拥有符合可持续城市规划标准的相似的形态特征。换言之，这些城市最初的结构是适宜步行的。如格雷戈里·斯宾塞所说，这一发现为我们早前研究创新科技公司选址的客观影响因素提供了依据[6]。

2.2.3 利用率

然而，上述结果并不能代表实际的利用率——兴趣点或便利设施的密度越高未必意味着更加多样化的活动或更持久的活力，也就是说，利用率并不能够反映宜居性。

一项关于伦敦交通量的早期研究致力于



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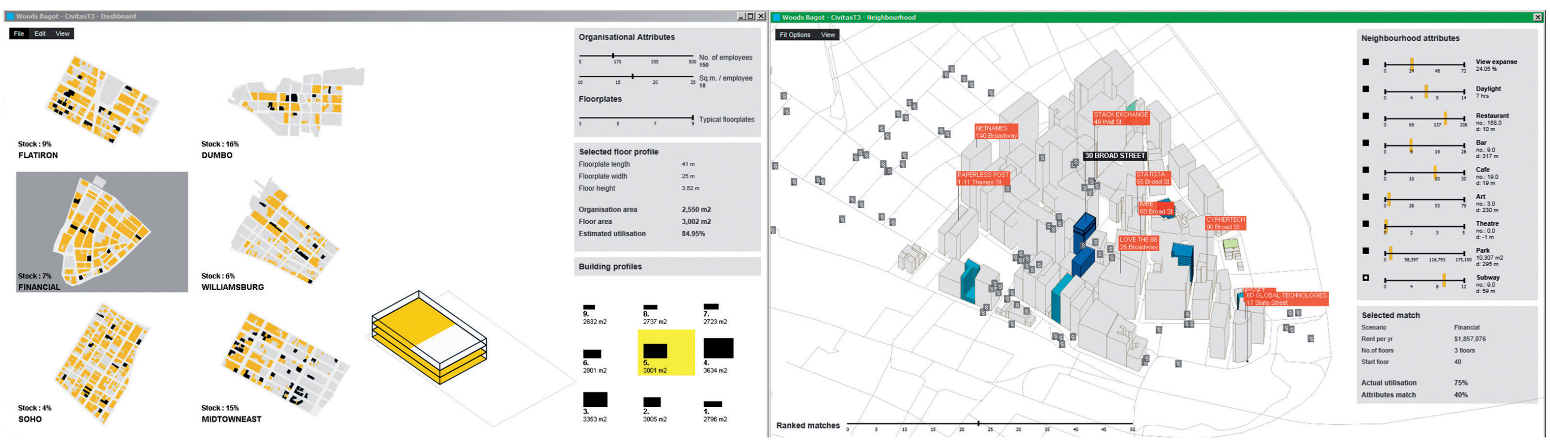


5 © SUPERSPACE

4. CIVITAS平台基于社区尺度的应用：可利用一组分析模型生成能够描述城市特征的一系列认知和空间指标。以熨斗园区为例，图中所示案例呈现了与空间网络属性、导向标识系统和便利设施提供等相关的6项指标。
5. CIVITAS平台基于建筑尺度的应用：主要分为两个步骤，第一步是在确定的街区范围内搜寻目标库存（如左图所示）；第二步是在选定的社区范围内搜寻具体建筑和楼层（如右图所示）。

4. CIVITAS Neighbourhood: a set of analytical models generate data for a series of cognitive and spatial metrics that describe place profiles. This case takes Flatiron district as an example to show six metrics from network properties to way-finding and amenity provision.
5. CIVITAS Building: two stages are conducted with a stock search within identified neighbourhoods (left) and building and floor search within a chosen neighbourhood (right).

评估那些用地性质高度混合且同类用地相对集中的社区（比如几乎只在工作日处于活跃状态的金融区）的差异。我们在伦敦的5类不同的社区中选定了10座车站，统计每日及分时的进出站人数，并对它们的可视化图进行了比较。结果发现，位于传统金融区（伦敦城）内的车站在工作日时人流量很大，而周末或深夜的人流量却很低（圣保罗车站这类旅游目的地等例外情况除外）；在傍晚时，创新科技区内的车站活跃度高于中央商务区；而在周末，它们的活跃度也居高不下。这足以证明创新科技区更加宜居，这一点从人口统计特征上来看也非常明显（图13）。

2.2.4 人口统计特征

尽管中央商务区的容积率远高于城市中值，但其居住区密度却很低（墨尔本除外）。通过参考已有研究，我们选定了包括学校可及性在内的与居住区特征相关的新指标进行研究。尽管处于城市中心且拥有高度连通性，但中央商务区的相关分值却几乎与城市中值持平。在所有纳入研究的城市中，创新科技区的学校平均可达距离都更短，意味着它们距离学校的路程均比中央商务区更近（图14）。

我们还探究了人口统计特征的另一相关因素——住房拥有率，并发现：创新科技区的住房拥有率普遍很低，而各中央商务区的数值无统一规律可循（伦敦和纽约高，其他三个城市低，图15-1）；创新科技区的租房率远高于城市中值；中央商务区的高层建筑密度和容积率远高于创新科技区，但居住区密度却相对较低，这意味着中央商务区的居住率和活跃程度要低得多（图15-2）。因此，具有更高的居民活跃度和土地利用混合度的创新科技区显得更加生机勃勃。

2.3 社区研究小结

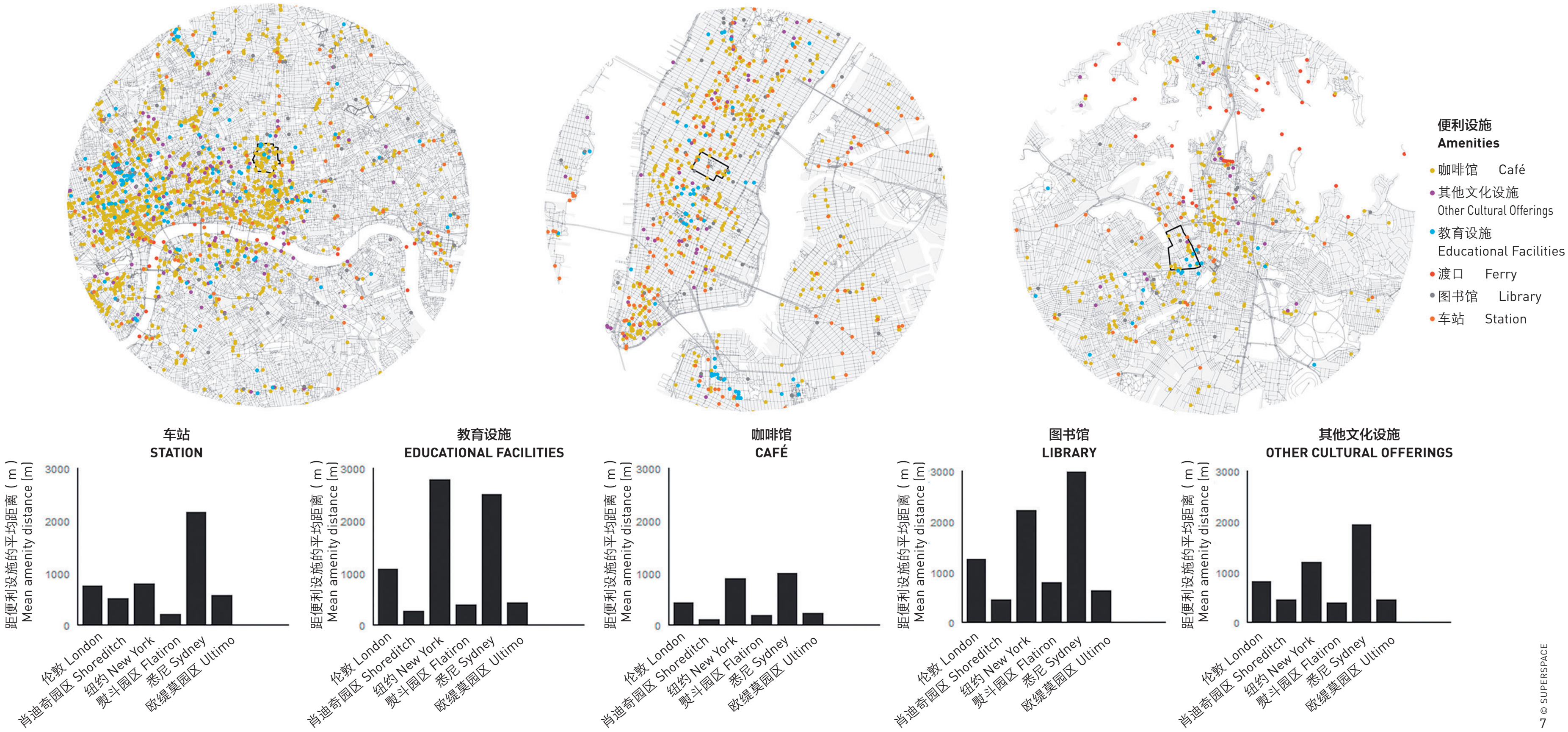
基于对2016年伦敦、纽约和悉尼三座城市中便利设施的可及性，以及对肖迪奇、熨斗和欧缇莫三个创新科技区相关数据的初步比较，发现这些社区之间的共性比其所在城市之间的共性更为显著。而一旦研究范围突破这三座城市和三个园区，且纳入更多的考量指标，这种规律性可能会减弱，但也会有新的发现产生。

每座城市的中央商务区和创新科技区在城市结构这一指标中都有着较为相似的表现，而在便利设施供应和人口统计特征方面

6 © SUPERSPACE

6. 精准到场地的策略：由CIVITAS平台、城市档案馆和数字化总体规划构成的数字化框架可用于对项目投资的战略咨询（如左图所示），以及城市尺度的总体规划和场所营造（如右图所示）。
7. 伦敦、纽约和悉尼及这三座城市中三个创新科技区的便利设施可及性比较。在每个条形图中，第一、三、五个条形为每个城市中到达5种便利设施的平均距离；第二、四、六个条形为园区范围内到达这些便利设施的平均距离。

6. Strategy to Place: applications of the digital framework of CIVITAS, Urban Archive and Digital Masterplanning comprise projects from strategic consulting for investment (left) to masterplanning and place making (right).
7. Proximity to amenities comparison between three cities — London, New York, and Sydney — and three creative tech neighbourhoods within those cities. The first, third, and fifth bars show the average distance to each of the five amenities for the city while the second, fourth, and sixth bars show the average distances within neighbourhoods.



则不尽相同。前者之相似主要缘于这些城市的街道连通性和街区面积等历史结构较为相仿，而后两者的差异则突显了不同城市在活力指数和宜居性方面的根本区别。为满足员工对活力社区环境的偏好，创新科技公司和其他服务型公司往往更青睐于在创新科技区中落户，因而中央商务区的宜居性显然不及创新科技区。

当基于全球尺度进行比较时，不同城市的中央商务区和创新科技区在单个指标上的结果不如预期般一致。但是社区指标的结果与所在城市中值的偏差是相似的，表明尽管在城市结构上略有不同，这些社区却给人以相似的体验。

众所周知，士绅化的等级划分观念往往会让人们在定义创新科技区时将小型创新科技公司和一般的创新和服务公司排除在外，但相比中央商务区，这些被忽略的区域仍然拥有更高的宜居性。尽管目前在全球范围内人们有意于建立具有“独特性”的“创新”区域，但由于空间处理方式极为相似，同质化现象不断加剧。正如各类城市规划准则和本文的研究结果所呈现的，以人口多样化发展为目标的土地混合利用才是激活社区的关键。

3 结语

综上所述，CIVITAS为伍兹贝格建筑设计事务所提供了一个独特的城市数据分析平台，可有效应用于研究、咨询和居住区总体规划项目中。当面对城市中不同性质的区域（如中央商务区和创新科技区）时，CIVITAS平台可以通过特定的衡量指标和方法针对性地对其进行深入探究。

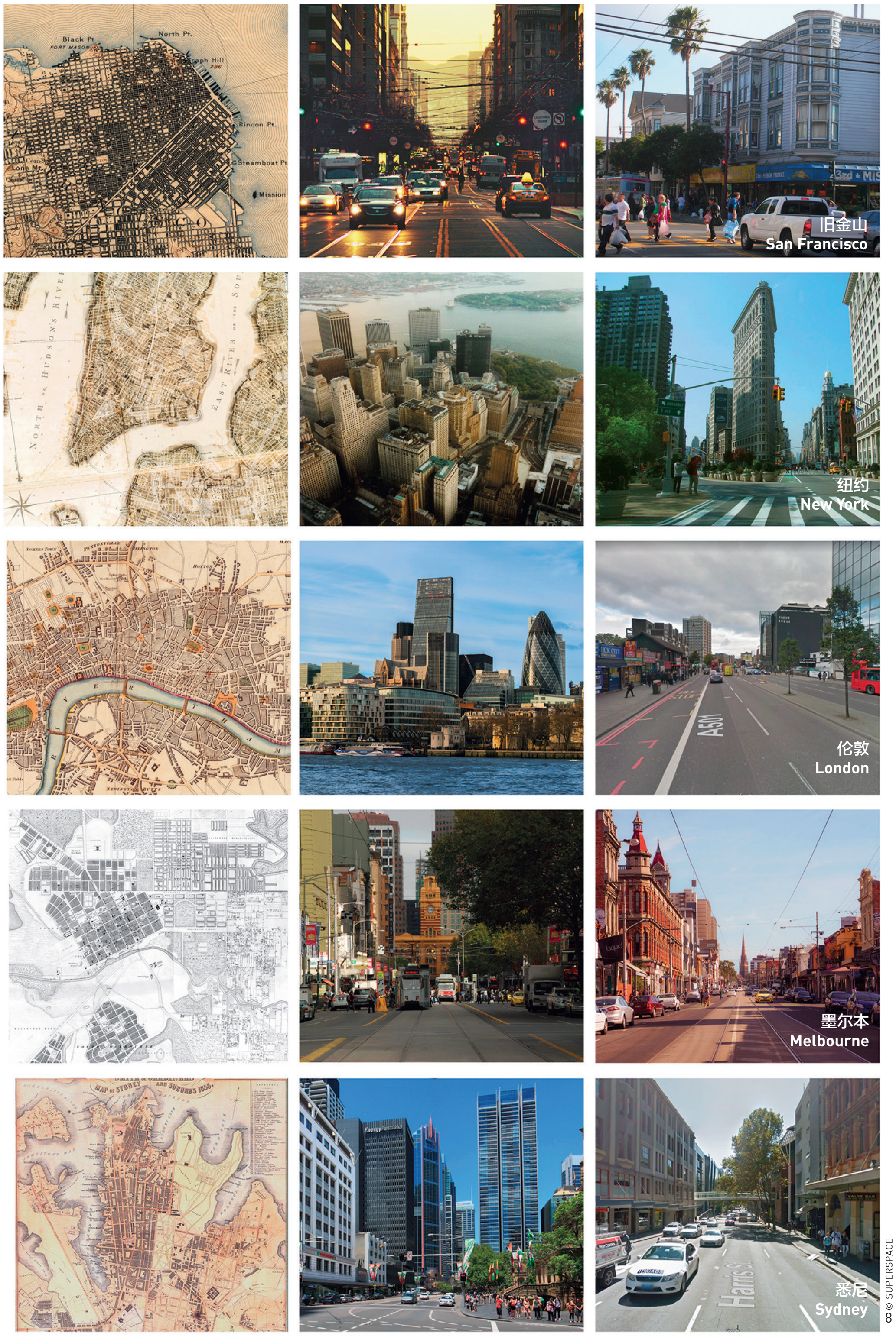
尽管SUPERSPACE所开发的产品多数基于数据处理与实证研究，但其始终聚焦于提供以用户体验为核心的设计方法——以本文所述案例为例，即利用基准数据和指标来衡量社区的宜居性。不管是针对研究项目，还是开展实际的总体规划，理解城市环境中不同的空间和社会特征及其相互间的关联始终是重中之重。通过了解全球不同城市中社区的异同，我们期望深入理解城市环境背后的社会空间结构，并将研究成果应用于改善设计过程。**LAF**

致谢

感谢陈磊、陈双霁、弗朗西斯·金、李德山、刘畅、舒童和亚历桑德拉·沃兰（按姓名首字母排序）对本文的贡献。

注释

更多有关伍兹贝格建筑设计事务所SUPERSPACE团队的信息，可访问www.superspace.woodsbagot.com。本文的英文内容由发表于《世界高层建筑与都市人居学会会刊》的版本（详见参考文献[7]）整理而成，其版权归属于世界高层建筑与都市人居学会。



1 Introduction

In 2008, SUPERSPACE (then Aedas R&D, an Australian architectural firm) developed a proof-of-concept model to simulate sustainable urban densification. The two cities of Dubai and London were used as cases to demonstrate the difference of densification when a new tall building is inserted into the urban fabric. Two dependencies formed the basis for the simulation: land-use provision for commercial buildings and accessibility to the predominant transport mode. The multi-layered feedback model clearly illustrated the levels of sprawl and densities seen in cities with either a (dense) public underground transport system like London or a car-dependent transport system like Dubai (Fig. 2).

The model was built with a scientific technique for self-organizing pattern reproduction called cellular automata used in academia to simulate urban growth since the 1970s. Academics such as Bill Hillier (and many others) identified then the core Key Performance Indicator (KPI) for sustainable cities to be based on levels of connectivity producing resilient configurations and in turn levels of density — built, land-use mix and inhabited[1]. Those metrics depending on movement structure became the key evaluation criteria for urban design guidelines such as Towards an Urban Renaissance by the Urban Task Force of Department for the Environment, Transport and the Regions (DETR)[2] and By Design by Commission for Architecture and the Built Environment (CABE)[3], tying Jane Jacobs' qualitative focus on street and community activation back to quantitative measures of spatial infrastructure.

For the 2007 ~ 2008 UK government funded research project "UrbanBUZZ — Building Sustainable Communities," SUPERSPACE built the first digital design chain for urban planning called Smart Solutions for Spatial Planning (SSSP)[4]. SSSP

① For more information about NYC Open Data database, please visit https://opendata.cityofnewyork.us.
② For more information about the London Datastore database, please visit https://data.london.gov.uk.

computed urban structures that complied with best practice for sustainability objectives of urban design and regeneration gleaned from guidelines such as workshops with urban design firms and London Borough planners. But it predated the availability of open-source urban data in large quantities as it has been emerging since about 2012. From 2014 onwards, the discourse about socio-spatial sustainability of cities has shifted from its design to its assessment, quantifying conditions and scrutinizing governance due to the analysis of big urban data.

From 2014 onwards, SUPERSPACE started to complement its computational urban design and planning framework (based on SSSP) by starting a big urban data analysis and visualization platform called CIVITAS[5]. The purpose behind the initiative is to attempt to quantify otherwise discursive concepts of "vitality" and "liveability" in order to assess and design urban interventions that blend into the city or enhance socio-spatial sustainability.

1.1 CIVITAS — An Urban Search Engine

CIVITAS aims to assess the nature and potential locations within a city. In order to generate a brief for a site and test the best symbiosis for development or use-case that benefits both the land-owner as well as the community, one has to reveal the dynamics that inform the profile of a location. While there are many qualitative dynamics that are difficult to quantify, one can compute a series of spatial performances that correlate to social sustainability such as those identified by urban planning guidelines of CABE's By Design or the UN Habitat. Dynamics are expressions of the urban systems that define cities, and hence the city has to be understood at a much larger organism than solely the site and its immediate context: "Places do not make cities. It is cities that make places."[1]

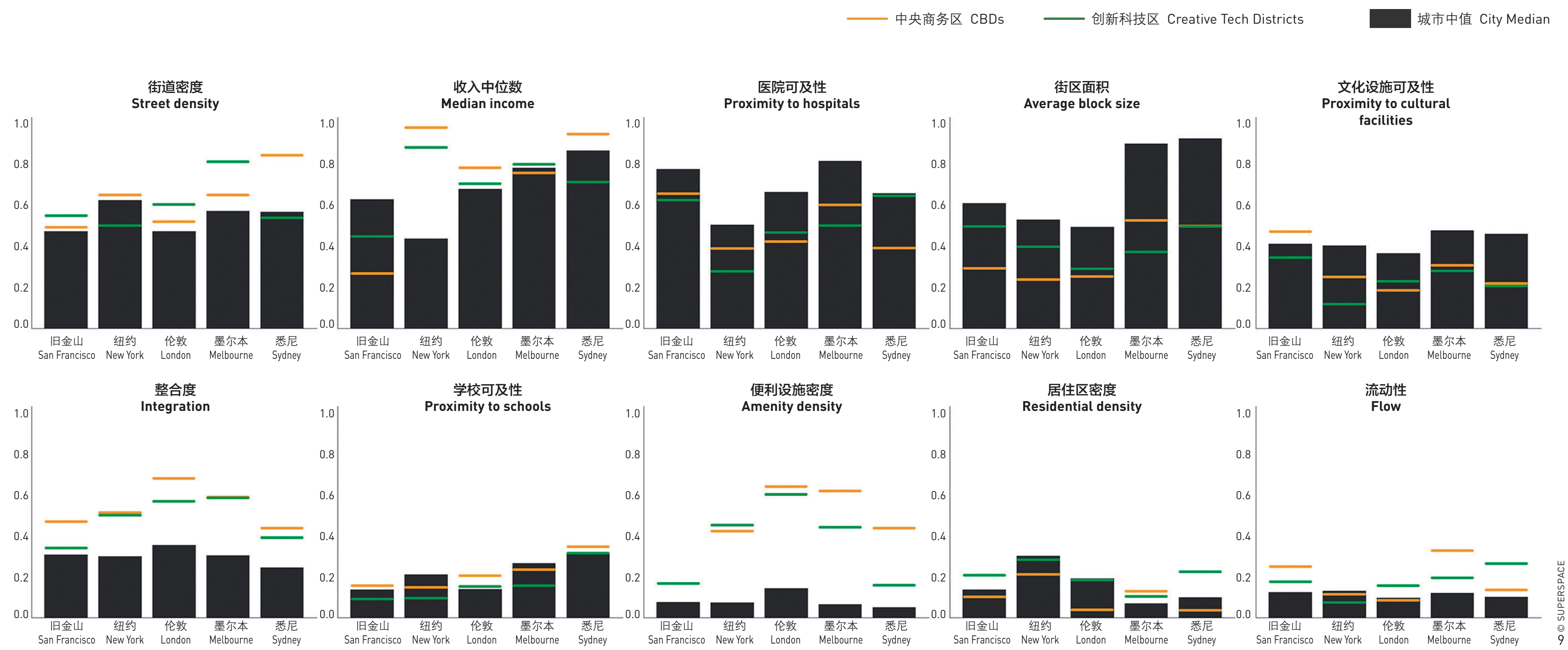
The platform is therefore composed of three scales where data from larger scales is passed to lower scales for integration: metropolitan region, neighborhoods and blocks (down to buildings and floors where feasible). This allows for persistent investigation and a test-fitting of KPIs across scales that are not limited to zoned planning legislation. The composition of publicly available to proprietary data shifts with each scale towards more self-computed metrics. In contradiction to the general perception of big data being ubiquitous, only 20% ~ 30% of data used in CIVITAS stems from public sources or client sources, and most requires computation by SUPERSPACE.

1.1.1 Metropolitan Scale

Most open source data is found at the city-wide scale for which city governments have started to provide curated databases such as NYC Open Data① or the London Datastore②. Three core categories of data at this scale include Urban Structure, Land-Use Density and Accessibility to Amenities. For each category there are some basic metrics and site-specific metrics. A set of metrics are selected that represent the objectives of project briefs or client requirements and are made available in the Graphical User

8. 从左至右分别为每个城市的城市老城区历史规划图、中央商务区和从各个城市中选取的创新科技社区的街景图。
9. 涉及城市形态、人口统计和管理方式等方面的10项指标在不同城市中所呈现的差异。

8. From left to right are historical plans of the historic centers, pictures of each city's CBD, and street view of the selected creative tech neighbourhoods.
9. Differences assessment across cities based on 10 metrics, relating to morphological, demographical and governance features.



Interface (GUI) of the online urban search engine, linked to our urban database called Urban Archive. The metrics within each category can now be weighted in accordance with the objectives and an urban map visualizes the locations that comply with the weighting in real-time. The model can also reverse engineer location weightings for strategic planning and project briefing and also allows the user to predict locations for future end-user allocation (Fig. 3).

1.1.2 Neighborhood Scale

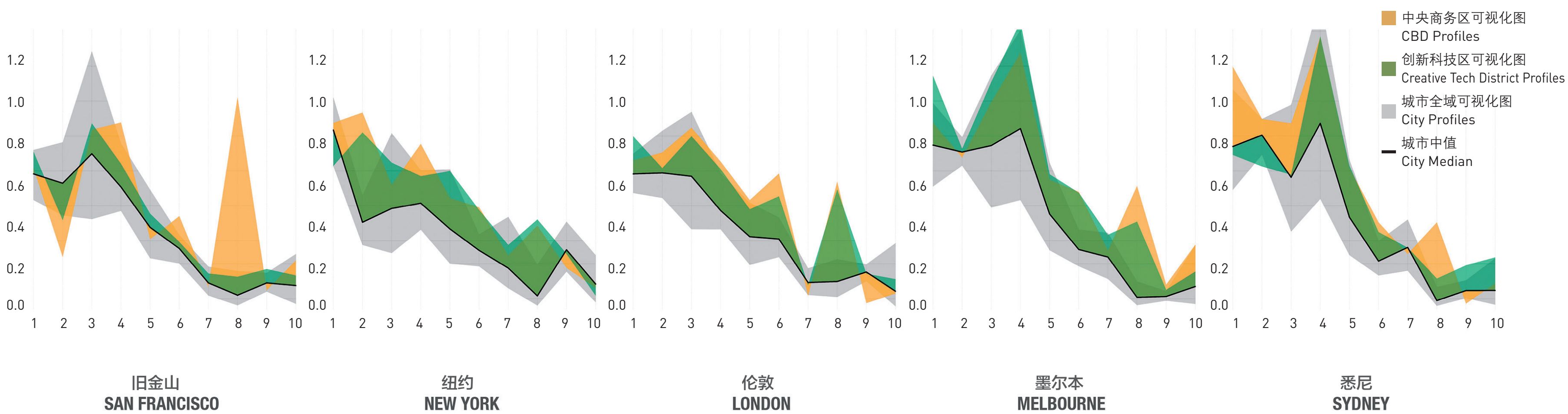
The metropolitan scale model classifies sites and neighborhoods based on relationships of metrics. When neighborhoods have been identified, a series of spatial analytics at street scale generate another set of attributes per street that profile the neighborhoods in more detail. Cognitive qualities such as way-finding and enclosures as well as many spatial metrics such as land-use mix, amenity provision, building aspects and footfall are generated that produce "place profiles" in 2D and 3D. The mapped profiles of this scale are stored in a database as encoded urban qualities and visualizations for further processing at the next scale, or used for masterplanning and place making (Fig. 4).

1.1.3 Building Scale

Value levels for metrics from the metropolitan (mapped at block level) and neighborhood scale (mapped at street level) are loaded into the building scale model. Additionally, all buildings with a chosen range — usually the identified neighborhoods and development zones — are dissected and quantified for spatial, environmental and economic metrics. Again, depending on project or client requirements, a series of KPIs and sites are selected and loaded into GUIs where the user can explore which building and even floor within a neighborhood complies with desired objectives. At this scale, buildings and floors are trading off between neighborhood profiles such as amenity provision or accessibility, building performances, and organizational requirements such as utilization. A rankable shortlist is created whose profiles' values are stored for benchmarking against further criteria (Fig. 5).

10. 尽管不同城市的可视化图存在一定的差异，但每个城市全域值之间，以及各个社区之间的分析结果却是相似的。此外，创新科技区和中央商务区的相似性也较大。
11. 5座城市中的街区和开源街景图所呈现的便利设施密度（上图），下图中黄色部分为中央商务区，绿色部分为创新科技区。

10. Although profiles across cities may diverge, the relationship between the city's global values and each of the analysed neighbourhoods tend to be similar. Moreover, the creative tech districts and CBD profiles seem to largely mirror each other.
11. Block area and Open Street Map amenities' density for the 5 cities (upper images), with images below indicating CBDs in yellow and creative tech districts in green.



指标 Metrics

1 街道密度（km / km²）
Street density (km / km²)
2 收入中位数（当地货币）
Median income (local currency)
3 医院可及性（m）*
Proximity to hospitals (m)
4 街区面积（km²）*
Average block size (km²)
5 文化设施可及性（m）*
Proximity to cultural facilities (m)
6 整合度（以200m为一个单位加权计算得出接近中心性的程度）
Integration (closeness metric 200 m weighted)
7 学校可及性（m）*
Proximity to schools (m)
8 便利设施密度（开放街道地图中兴趣点的个数/km²）
Amenity density (OSM points of interest / km²)
9 居住区密度（居民人数/km²）
Residential density (residents / km²)
10 流动性（以800m为一个单位加权计算得出两地间的通勤程度）
Flow (Betweenness angular 800 m weighted)

注：*表示该数值镜像于城市中值。
Note: * indicates that this metric is mirrored from city median.

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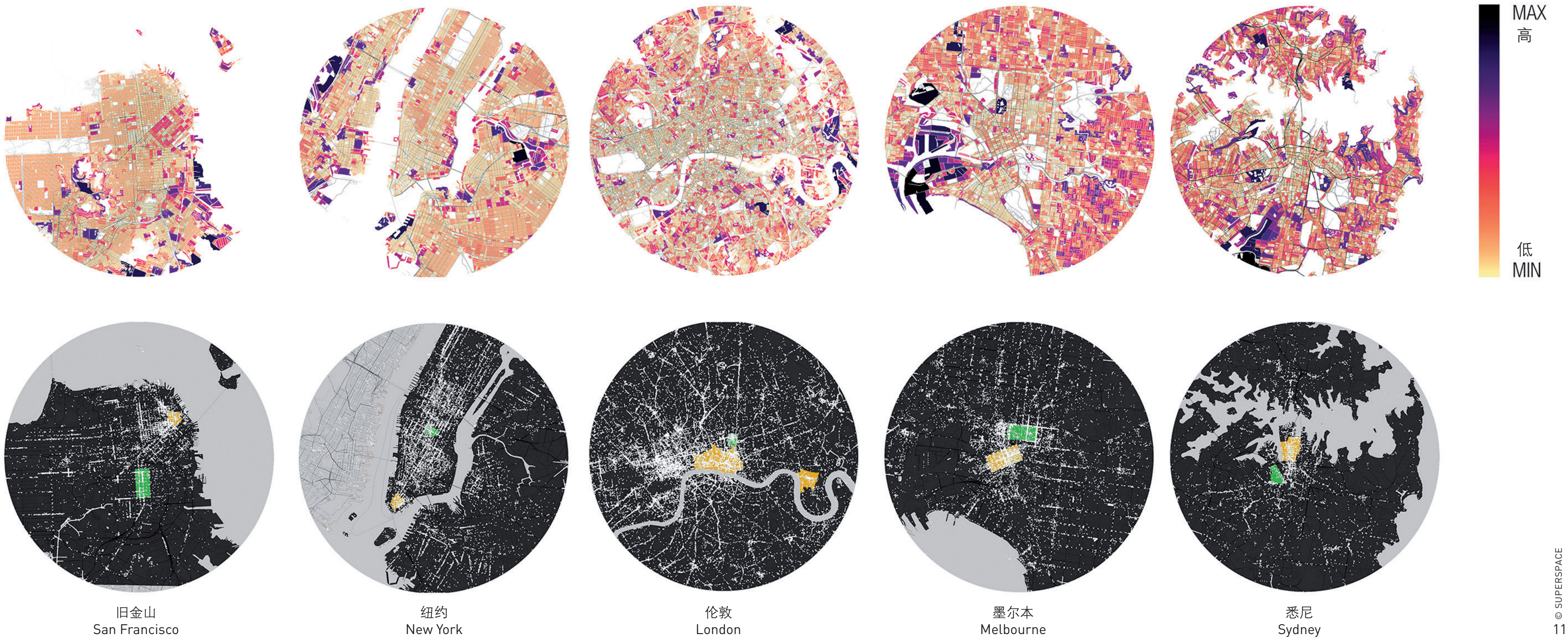

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1.2 Urban Archive

All metropolitan scale data is produced from another bespoke platform created by SUPERSPACE as a queriable database called Urban Archive, from which to export datasets and visualizations. Urban Archive consists of a web-based GUI that allows the user to operate a private Application Program Interface (API) to activate a series of spatial analysis models. Eight basic metrics are generated for each major city that Woods Bagot and its clients are operating in and the database equally stores the data from the CIVITAS neighborhood and building models, so that the metrics can be cross-referenced. Currently, Urban Archive comprises 10 cities with new samples being added continuously. (Fig. 1)

1.2.1 Strategy to Place

The three platforms as a digital framework — Digital Masterplanning, CIVITAS, and the Urban Archive — are applied to a variety of projects within Woods Bagot and as direct consultancy to clients. Applications range from site investment searches to strategic planning, feasibility studies, masterplanning and place making. The strength of this digital framework lies in the ability of weaving simulations of urban planning and design procedures with robust data analysis across all scales. This enables us to 1) produce more rigorous and complex scenarios, 2) integrate sensitivity analysis for community and urban resilience into the design process, 3) de-risk planning responses, and 4) combine currently disjointed insights and data from a variety of consultants into an integrated scenario planning procedure (Fig. 6).

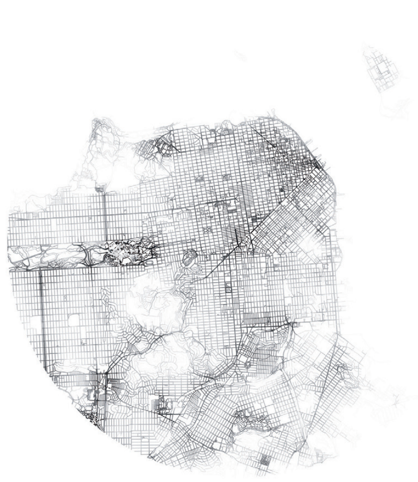
2 Comparing Cities and Neighborhoods

CIVITAS is applied to research and consultancy questions at city and neighborhood scale and, as an example, here we describe some work which highlights the advantages of global cross-city comparable metrics: comparing neighborhoods attractive to the creative tech industry (and later also the financial industry).

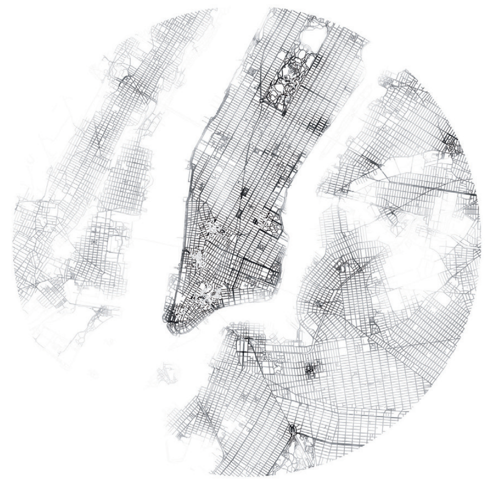
Based on the three cities of London, New York, and Sydney and the spatial analysis of three creative tech neighborhoods within those cities — Shoreditch, Flatiron, and Ultimo — it appeared as if the data for proximity to amenities was suggesting that those neighborhoods enjoyed similar profiles despite being situated in three different global cities, which displayed disparate profiles for those amenity profiles. It seemed as if the creative technology industry chose locations within global cities with similar utilization patterns. This suspicion was supported by research about creative tech companies suggesting that one of the key objectives for office locations is a high mix of and good accessibility to amenities and specific land-uses such as cafes and educational facilities for talent pools[6]. In other words, employees of creative tech companies prefer working in "liveable"

12. 上图为不同城市的街道连通性与城市肌理。下方图表中横向坐标轴为城市、中央商务区和创新科技区的临近中心性，即不同街道区段之间的连通性；纵向坐标轴为街道的数量（单位为标准化密度）。
13. 伦敦不同类型区域主要地铁站点的人行活动。图表显示了站点出口（上半部分）和入口（下半部分）的日人流量（从左至右对应从早至晚）。其中灰色为工作日，彩色为周末。

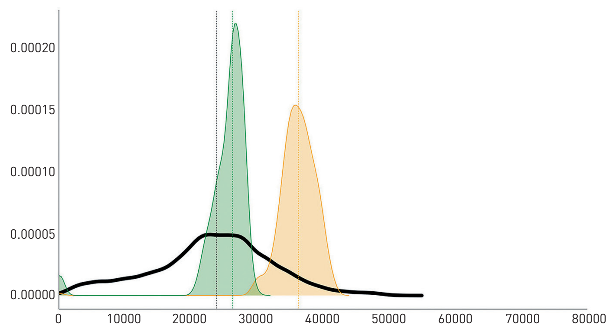
12. The upper images indicate the connectivity and indication of grain across cities. The graphs below show distributions of closeness centrality (x-axis) for the city, CBD, and creative tech districts to indicate the connectivity between street segments; and number of streets (y-axis — units expressed as normalized density).
13. Pedestrian activity at several key London Underground stations in different types of districts. The graphs show total number of exits (upper part) and entries (lower part) throughout the day (morning to the left, night to the right). Grey parts indicate working days and colored parts indicate weekend.

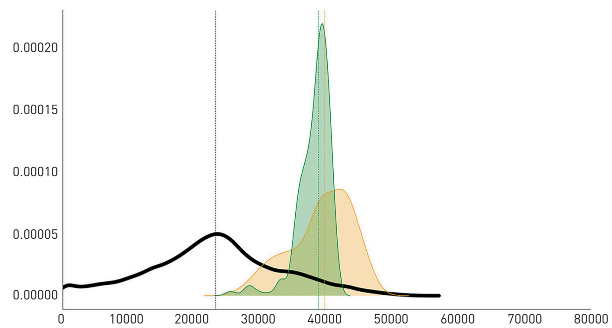


旧金山
San Francisco



纽约
New York





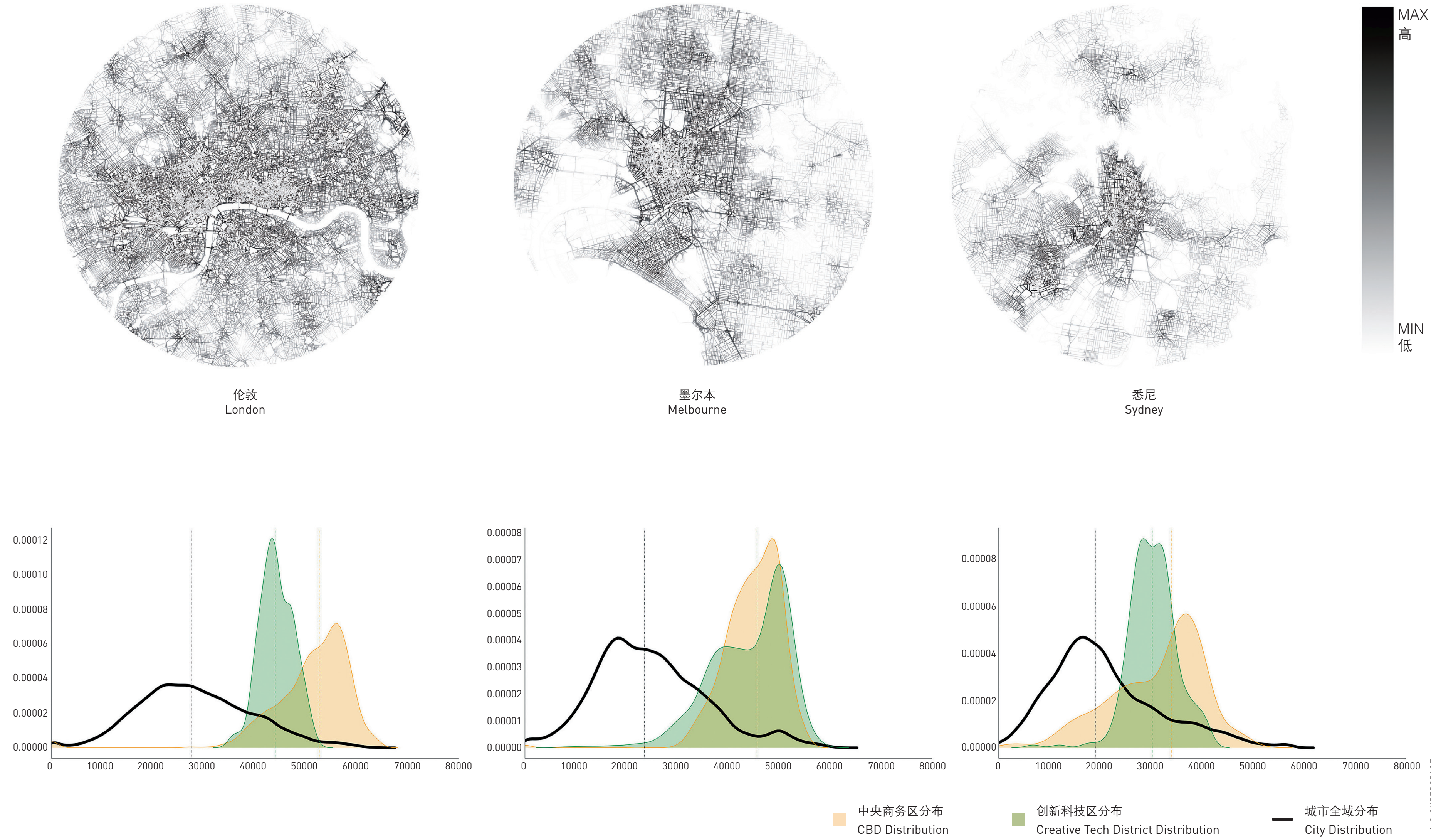
communities where this mix often occurs.

Five key amenities were used to represent both the requirements by creative tech companies and indicate community facilities: stations, educational facilities, cafes, libraries, and other cultural offerings. It was found that average distances to the amenities within those neighborhoods were very similar (about 500 meters for stations, 300 for educational facilities, 100 for cafes, 250 for libraries, and 300 for other cultural offerings). Average distances to those amenities vary much more between those cities and could not be aligned, pointing to potential differences in urban structure, topography or governance (Fig. 7).

Then, it was decided to expand the metric categories for this specific comparison beyond access to amenities to include aspects of urban structure and demographics and to establish whether correlations at neighborhood scale keep holding across cities while the whole cities' profiles vary. Also the number of cities was increased to five: San Francisco, New York, London, Melbourne and Sydney, with two types of neighborhoods to compare: central business district (CBD) and creative tech. For London only, the City of London was considered as a CBD. CBDs established around the mid-20th century are all located in the historic centers of those cities and as such represent a different age of urban structure. Apart from the comparison between them, it felt relevant to establish how those historic centers compared to their host cities and creative tech neighborhoods (Fig. 8).

2.1 Metrics for Comparison

To assess differences across cities and neighborhoods, each city was assigned a profile based on 10 metrics, relating to morphological, demographical and governance features: 1) street density; 2) median income; 3) proximity to hospitals; 4) block size; 5) proximity to culture; 6)


MAX
高
MIN
低
伦敦
London
墨尔本
Melbourne
悉尼
Sydney
中央商务区分布
CBD Distribution
创新科技区分布
Creative Tech District Distribution
城市全域分布
City Distribution
© SUPERSPACE

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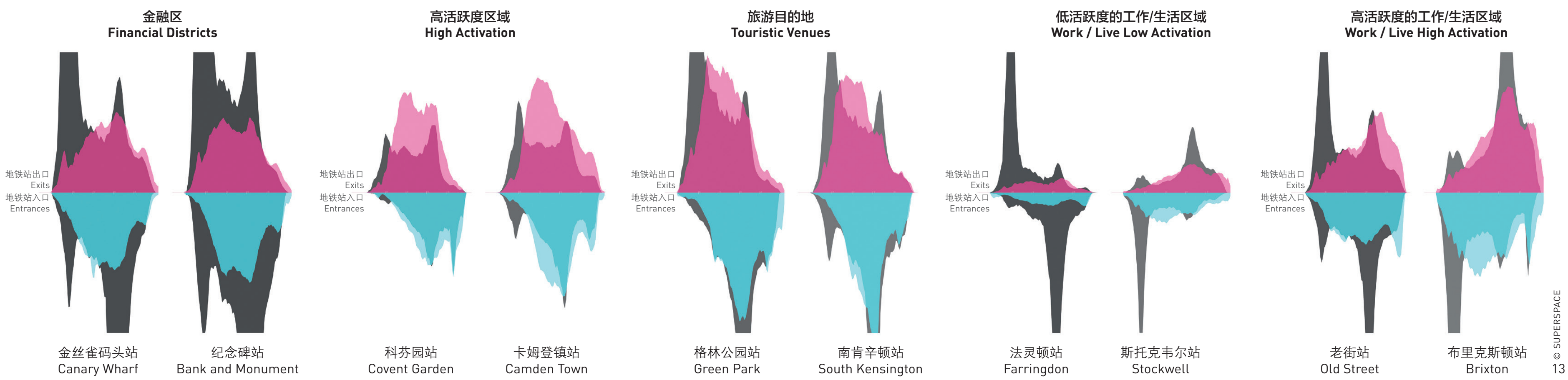
金融区
Financial Districts
高活跃度区域
High Activation
旅游目的地
Touristic Venues
低活跃度的工作/生活区域
Work / Live Low Activation
高活跃度的工作/生活区域
Work / Live High Activation
地铁站出口
Exits
地铁站入口
Entrances
金丝雀码头站
Canary Wharf
纪念碑站
Bank and Monument
科芬园站
Covent Garden
卡姆登镇站
Camden Town
格林公园站
Green Park
南肯辛顿站
South Kensington
法灵顿站
Farringdon
斯托克韦尔站
Stockwell
老街站
Old Street
布里克斯顿站
Brixton
© SUPERSPACE

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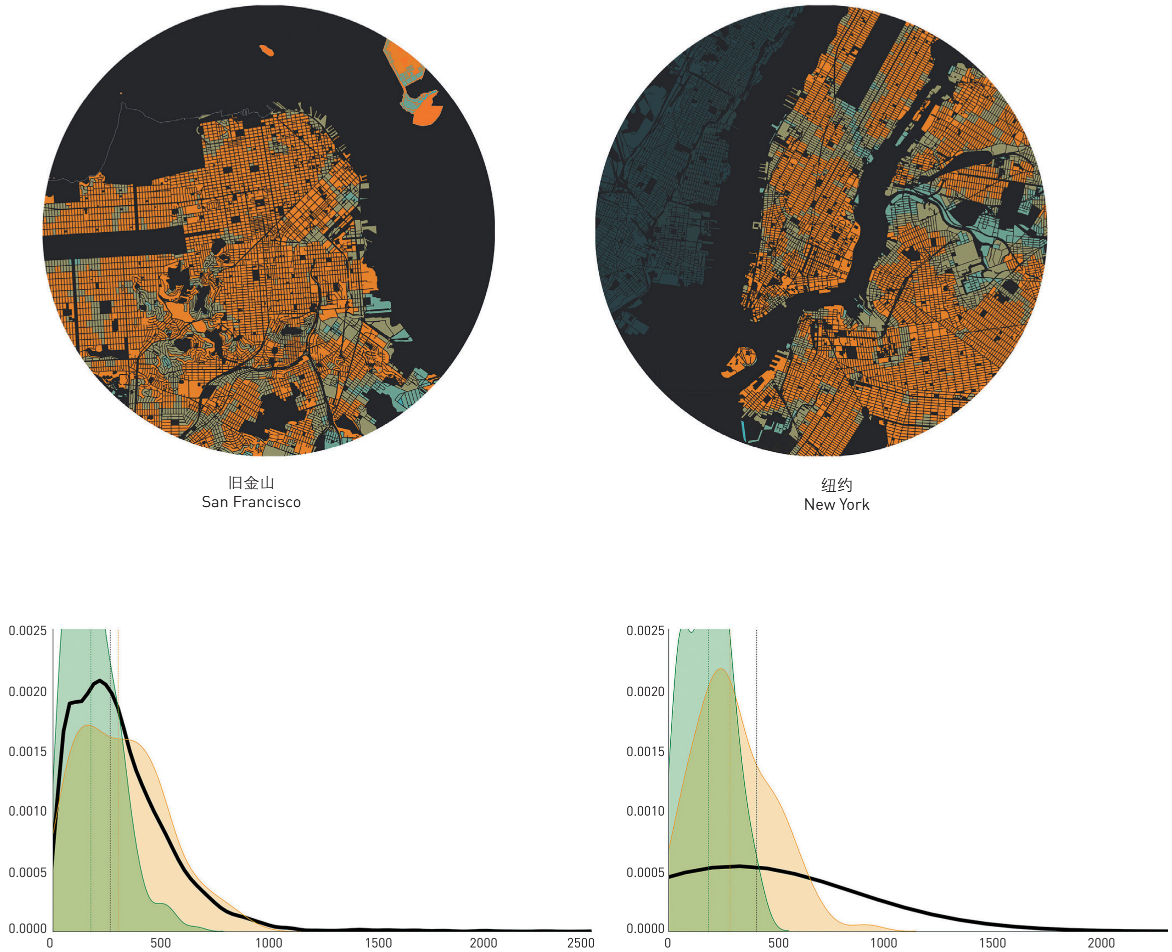


14. 上图为不同城市的学校可及性。下方图表中横向坐标轴为城市、中央商务区和创新科技区与学校的距离（m）；纵向坐标轴为街区的数量（单位为标准化密度）。

14. The upper images show proximity to schools across cities. The graphs below indicate distributions of proximities in meters (x-axis) for the city, CBD and creative tech district; and number of blocks (y-axis — units expressed as normalized density).

integration; 7) proximity to schools; 8) density of amenities; 9) resident density; 10) flow. Two types of aggregated profiles were produced for comparison in order to compare metric similarities and city differences.

2.1.1 Metrics' Profiles

Some similarities arise when comparing metrics across cities: although their individual numeric values might differ significantly, the variance between the neighborhood medians (color lines) and the medians of the city (black bar) seem to be similar. This holds true for the majority of the metrics, even when one city might in some cases be an outlier (Fig. 9).

2.1.2 City Profiles

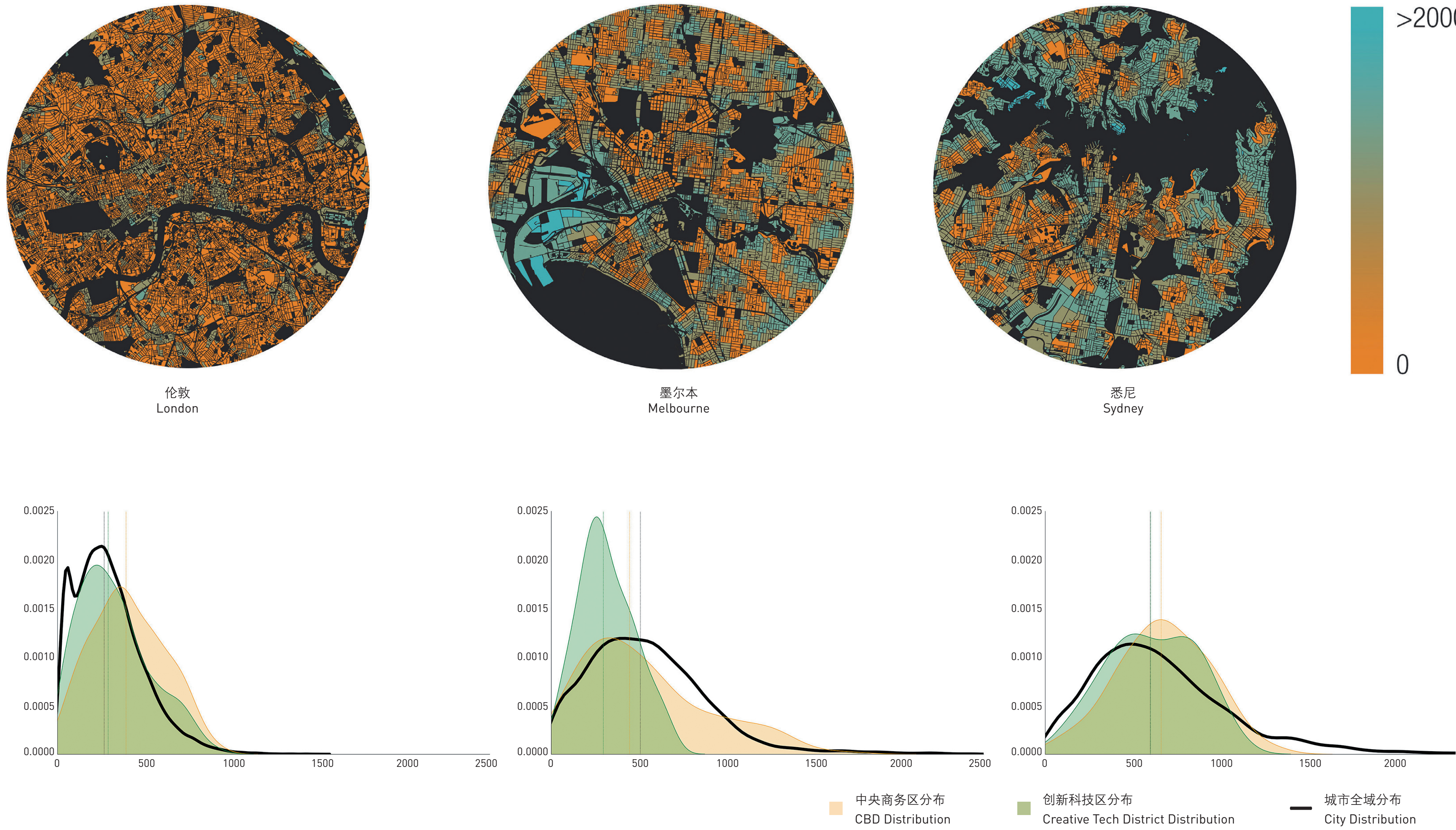
The profile of the city (grey) is plotted against the profiles of its CBD (green) and creative tech (orange) neighborhoods, and again the difference in the medians is assessed. The median values in CBD and creative tech largely occur higher on the scale as compared to the median values for the whole city. Additionally, the differences between the CBD and creative tech neighborhood profiles appear very small for most metrics within each city. The city profiles are visualized in such a way that the deviation above the city median line represents positive differences and the deviation below the city median line represents negative differences. However, some values are "mirrored" across the city median line because their "smaller values" are considered "good": all proximity values and block size (Fig. 10).

2.2 Insights

There are some high-level insights that can be read directly from the visualized data.

2.2.1 Grain versus Amenities' Density

As can be seen in the CBD charts, smaller block sizes normally exhibit a higher amenity density, several times higher than the city median. This also holds true for the tech neighborhoods: amenities are reflected by points of interest crowdsourced in Open Street Maps, so this metric is subject to active mappers who report those points (Fig. 11).



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2.2.2 Enhanced Connectivity

The assumption that the CBDs enjoy a preferential position within the urban street network is verified across the five cities: the integration values (closeness centrality) are clearly higher than the city medians. As seen in Figure 12, only the creative tech neighborhood in San Francisco does not have a significantly higher street connectivity than the city. Integration of streets based on their connectivity also correlates to smaller block sizes and therefore amenity densities, showing that historic urban centers before the automobile share similar morphological features that are aligned to sustainable city planning criteria. In other words, these urban structures are inherently "walkable." This supports our earlier research into objectives for locations by creative tech companies as stated by Gregory Spencer[6].

2.2.3 Utilization

The above values however do not represent actual utilization: higher density of points of interest or amenities do not necessarily imply diverse or persistent activation in time, i.e. it does not suggest liveability.

An earlier study regarding the flows of transport across London was used to assess the difference between neighborhoods that were believed to have highly mixed land-uses and homogenous land-use concentrations such as financial districts that tend to be active only during the week. Ten station profiles were compared by entry and exit counts across each day and hour across five types of neighborhoods in London. It was found that stations placed within the traditional financial district (City of London) showed high volumes during the week, with almost no visits in the weekend or at late hours. The only exceptions are areas that have tourist attractions like St. Paul's. Stations placed within the identified creative tech districts show higher levels of activation at later hours in the day as compared to CBDs. They also appear to be well activated during weekends. This points towards creative tech neighborhoods being more "liveable" and might also significantly vary in demographics (Fig. 13).

2.2.4 Demographics

Despite having Floor Area Ratios (FAR) values multiple times higher than the city median, CBDs' residential densities prove to be quite low (except for Melbourne). Drawing on previous research, new metrics associated with residential character were studied, such as proximity to schools. CBDs score similarly to the city medians, despite their central position in the urban fabric and their high connectivity. In all cases, creative tech neighborhood values are lower meaning that they have better access to schools as compared to CBDs (Fig. 14).

When looking at residential ownership as another factor associated with demographics, very low ownership ratios were found in the creative tech neighborhoods, with CBDs scoring differently (high for London and New York, low for the other three cities, Fig. 15-1). Creative tech neighborhoods show well-above the cities' medians in terms of percentage of rented properties. On top of that, density in terms of height and FAR is far higher in CBDs than creative tech neighborhoods, yet with lower dwelling densities, hinting at much lower occupancy and activation in CBDs by local residents (Fig. 15-2). Creative tech neighborhoods seem therefore more vibrant due to more residential activation and a higher land-use mix.

2.3 Conclusions of the Neighborhood Research Piece

Based on an initial 2016 comparison of data on proximity to amenities in three cities and three of their creative tech neighborhoods (London / Shoreditch, New York / Flatiron and Sydney / Ultimo), it appeared that the neighborhoods had more in common than their host cities. After expanding the research to compare more cities and neighborhoods with an increase in diverse metrics, the pattern weakened but new findings emerged.

CBDs and creative tech neighborhoods within each city score similarly for metrics in regards to urban structure but not for amenity provision and demographics. Similar grain seems to stem from historic structures such as street connectivity and block sizes, while differences in amenity and demographics hint at fundamental differences in activation and liveability. CBDs are clearly less "liveable" than creative tech neighborhoods, where creative technology and other service-based companies like to locate due to their employees' preference for vibrant community environments.

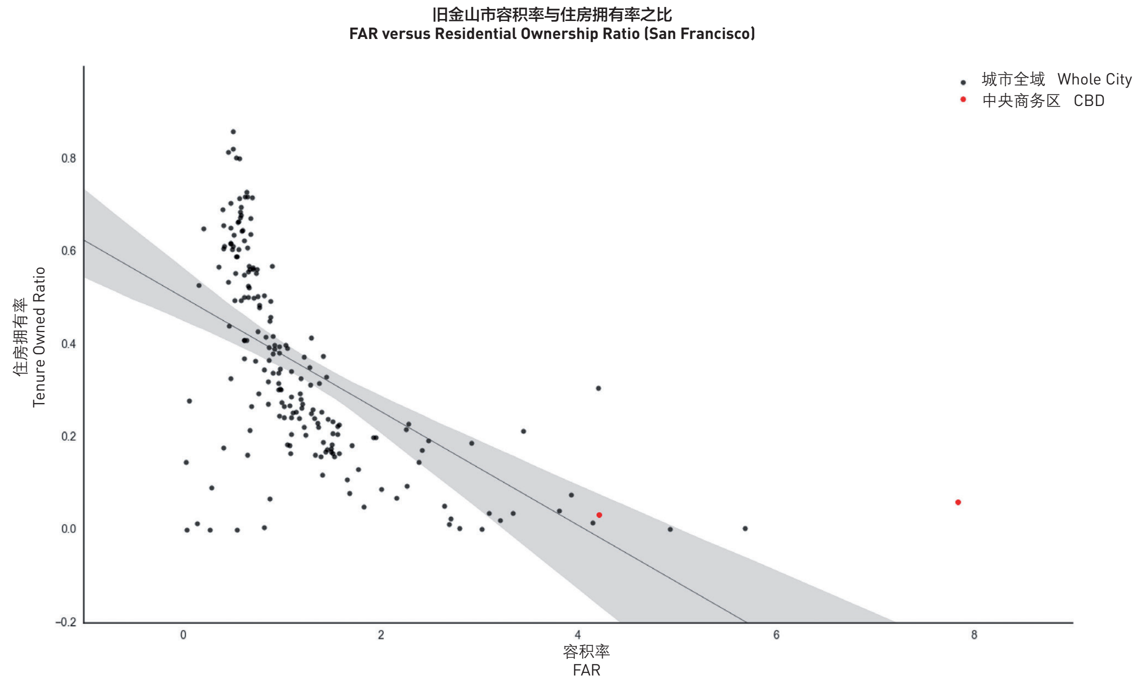
Across the individual metrics, both CBDs and creative tech neighborhoods appear less aligned than initially thought when comparing them across global cities. Yet, the deviation from their host cities is similar, showing that while slightly differently composed to their host cities, the neighborhoods are similarly experienced in relation to their host cities.

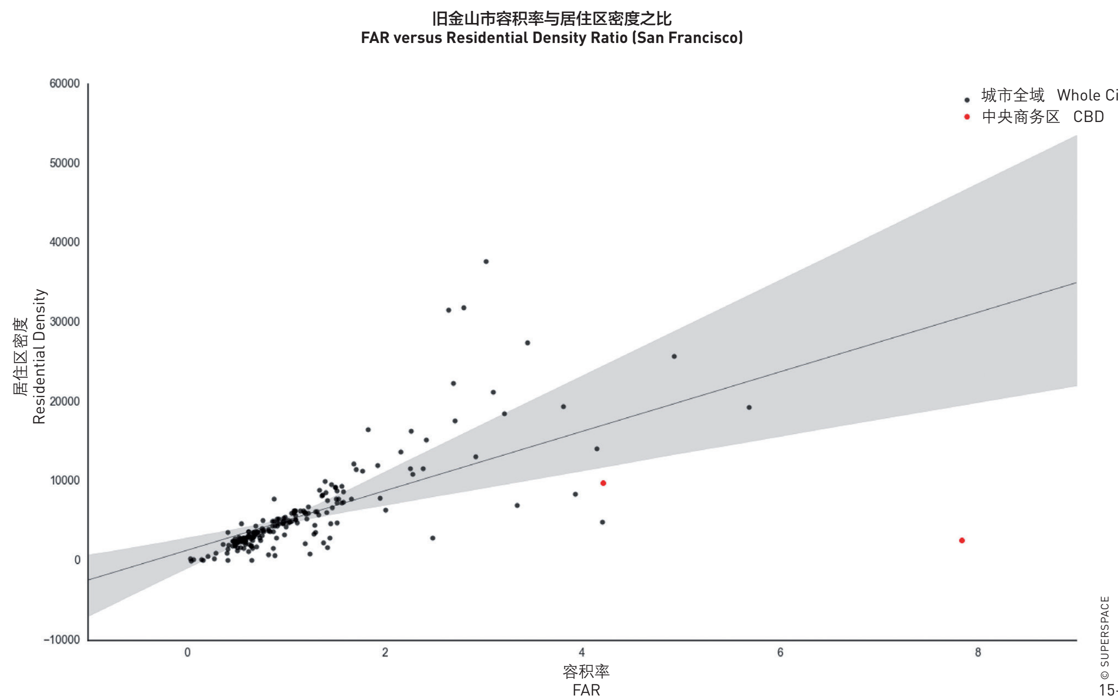
It is well known that gentrification might push smaller creative tech and generally creative and service companies out of the types of creative tech neighborhoods here analysed, where generally good liveability conditions still occur compared to CBDs. With global intentions to create "innovation" districts with very similar spatial recipes, there is a danger that those conditions disappear fast and homogenization increases despite the intention to be "unique." As espoused by planning guidelines and shown in the findings, a key appears to be high land-use mix for diversified demographics that generate higher activation.

3 Conclusions

As discussed, CIVITAS provides Woods Bagot with a unique platform for urban data analysis that can be applied equally effectively to research questions, consultancy studies and live masterplanning projects. When applied to comparisons of different areas in cities, such as CBDs and creative tech neighborhoods, CIVITAS enables in-depth research questions to be explored via its unique metrics and methodologies.

15-1





15-2

15-1. 不同城市中住房拥有率比例
15-2. 图表中上图为旧金山的容积率与住房拥有率之比，下图为旧金山的容积率与住宅密度之比（中央商务区标记为红色圆点）。

15-1. Ownership ratio across cities
15-2. Graphs are San Francisco's FAR versus ownership ratio (up) and San Francisco's FAR versus dwelling density ratio (down), with the CBD marked in red.

SUPERSPACE methodology itself, although data-driven and evidence-based, ultimately focuses on providing a human-centric design approach — in this instance creating profiles of the liveability of a neighborhood using benchmarks and metrics. Whether a research piece or a masterplanning project, a common thread is the importance of understanding the layered and correlated spatial and social parameters of an urban environment. Through understanding similarities and differences across neighborhoods in global cities, we hope to gain valuable insights into the socio-spatial structure of the urban environment, and to apply this knowledge to improving the design process. **LAF**

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NOTES

For more information about SUPERSPACE of Woods Bagot, please visit www.superspace.woodsbagot.com. An earlier version of the English manuscript was published in the *CTBUH (Council on Tall Buildings and Urban Habitat) Journal* (see Ref. [7]) and remains copyright of *CTBUH*.

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