



嘉 宾： Alan Penn，伦敦大学学院巴特雷特建成环境学院院长，空间句法实验室建筑与城市计算讲席教授，英格兰高等教育研究基金委员会委员，伦敦空间句法公司创始人

采 访： 沈尧，伦敦大学学院巴特雷特建筑系空间句法实验室博士生

协助整理： 孙唯、姚妍华，伦敦大学学院巴特雷特建筑系空间句法实验室硕士生

# URBAN DESIGN IN THE NEW DATA ENVIRONMENT:

## Dialogue with Professor Alan Penn

### 新数据环境下的城市设计 ——Alan Penn教授访谈

#### INTRODUCTION

The existing urban design seems to be increasingly challenged by the newly-emerging theoretical compositions, data resources, scale resolution and analytical methods in the new data environment with the so-called 'big data'. Although there is a strong sense of technological optimism, it is currently debatable that the paradigm of urban design will be changed by the urban big data. This interview, therefore, aims to explore the possible theoretical and practical implications of the application of urban big data for urban design.

#### 引言

如今，城市设计日益受到来自数据环境变化引起的挑战。这些变化主要体现在有关城市“大数据”的理论、城市数据资源、分析尺度、精度及方法的演变。虽然技术乐观主义正在获得广泛的认同，但是关于城市设计范式在新数据环境下可能的变化的讨论方兴未艾。本文通过与伦敦大学学院院长Alan Penn教授（建筑计算方向教授）的对谈，探讨在城市设计过程中应用城市“大数据”的理论与实践意义及其他相关的议题。

## 01 A new 'quantitative revolution' ? 一次新的“计量革命”？

YS=沈尧

AP=Alan Penn

YS: What are commons and the differences between the first quantitative revolution (the climax of quantitative

AP: When we went through the first quantitative revolution, there was a very famous critic published (Sayer 1976, 1979a, 1979b). It is a very nice short essay. It came up with 10 or 11 things that we were wrong with the quantitative revolution, and these were the direct criticism of Large Scale Urban Modelling. Professor Mike Batty has written a more recent response to that (Batty

studies happened in the 1960s) and the second quantitative revolution (occurring rise of the quantitative urban studies with urban big data)? How do these differences embody differently in the Chinese context and the Western context against the general background?

有人认为，目前的数据环境提供了所谓的第二次定量革命的契机。假设我们接受这一论调，那么在您看来，它与上世纪六十年代发生的第一次定量革命有什么异同？这样的异同东西方不同的背景下又会呈现出哪些特点？

2013). Early criticisms equated quantitative revolution with positivism, and argued that the positivist analysis is for hypothesis-testing, that observation cannot be simply reduced to the general recursive casual system, that data is not theory-laden, and that predictive models can only be treated as explanatory models (Sheppard 2001).

当我们在经历第一次定量革命的时候，有一些批评观点不容忽视。其中有一篇非常精湛的批评文章，作者列举了一系列在变革中所产生的认知偏差，并直接批评了当时流行的大尺度城市建模 (Sayer 1976, 1979a, 1979b)。而Mike Batty教授在他最近的论著中回应了当时的批评 (Batty 2013)。早期关于第一次定量革命的批评通常集中在它的实证特性，并声称实证分析应是为了假设的验证。因而，观测的现象不应该被简化成为一种普适的递归的因果系统。同时，数据也不应该被认为能够替代理论的重要性。此外，预测模型只能作为某种探索性的分析 (Sheppard 2001)。

One of the criticisms was we did not have the data that these models can rely on. We did not have access to the data. Another question was that we did not have the computational capacity to run computations of that complexity at that moment; meanwhile, we did not have the computer power that was needed to handle the number of variables, and the size of these variables and the whole system. There were other things with getting more complicated social issues that were ignored by those rational models. I think that the data and the computational power now exist. Professor Mike Batty is optimistic because today we can do what we could not do in the 1960s.

也有批评认为我们的模型没有可供支撑的数据与计算机能力。当时我们没有手段获取全面的数据，同时电脑没有足够的运算能力来处理多因子、大样本及全系统的推演。此外，许多复杂的社会因素也时常被主要的理论模型所忽视。这些问题在之后的几十年里逐步得以解决，这也是Mike Batty教授对计量手段的未来充满信心的主要原因。

There are other people who were also involved in the 1960s revolution, the first quantitative revolution, like Christopher Alexander. He tried to design a system to design Indian villages, one of his first computational projects (Alexander, 1964). He is a mathematician and a computation scientist. There was an interview some years later in which he said that he was completely mistaken. It was almost impossible to estimate a complex settlement. And this converted him into a complete sceptic about quantitative methods. His next set of works was about the passive languages of human understanding. He moved on to explore an entirely different philosophy of life about 'the natural order', the individual psychology and the related factors that people felt comfortable within the world (Alexander 2002). In some ways, this may be closer to Feng Shui. Many of the issues capture things which are about one's relationship with the cosmos of the world. We might see his pattern language as a 'Feng Shui' from the west coast of America. Meanwhile in China, Feng Shui is out of fashion. You still have some people with a good understanding of Feng Shui, but if you are a serious urbanist in China, you will be more interested in the rational models of the 1960s. That may be why people in China feel that Space Syntax is interesting.

其他的批评观点来自于一些直接参与了第一次定量革命的人，如Christopher Alexander。他是一个数学和计算机方面的专家，曾试图设计一个整合系统来设计印度的村庄 (Alexander, 1964)。在这个项目结束几年之后，他曾在一次采访中承认他之前的想法是完全错误的，并表示估量一个复杂的人居聚落是不现实的，这也使他加深了对定量方法的怀疑。此后，他试图探索一种相对不太激进的语汇，来解释人们对事物的广义理解。后来他开始提倡一种完全不同的生命哲学来解释“自然秩序”——其包括了一种基于对自然的认知与感受的个体心理学及相关的因子 (Alexander 2002)。在某些方面，这种理念类似于中国的风水，捕捉自然状态，阐释个人与世界及宇宙的关系。我们也许可以将他的模式语言理解为来自美国西岸的一种“风水”学说。而在当今的中国，风水似乎已经过时了。虽然现在仍有一些人精通风水，但如果你是一位当今中国的主流城市学家，你或许会对上世纪六十年代的诸多理性的模型更感兴趣。这也许是中国国内对空间句法感兴趣的原因。

I think there is a very interesting context in China. On the one side, the country has an opportunity to redo the aspiration in the 1960s with the criticism and learning from the sceptics in geography, architecture and other fields, and the responses to these objections. The optimists say that we

now have the technology to do quantitative methods properly. However, Christopher Alexander's criticism is also essential on the other side of the argument. Quantitative development of these rational approaches risk losing the human spirit and the soul. I think this is a critical aspect. We need to understand that humanity and bring it back within our methodology.

我认为中国正处于一个非常有趣的时期。一方面，人们有机会重新认识、梳理并实践西方国家上世纪六十年代在地理、建筑等领域发生的定量革命的经验教训。乐观者也许会认为更为先进的当代技术可以弥补之前的偏差。另一方面，Christopher Alexander的批判仍旧值得重视。在设计过程中，对于定量的过度强调，以及过度刚性的手段的介入也会使得设计失去其精神和灵魂，进而缺少应有的人文色彩。我认为这是一个非常重要的观点。认识到人性的重要性是必要的，我们必须在我们的方法论中予以重视。

There was a political criticism that came from people like David Harvey, who was also originally a quantitative geographer. His criticism focuses on political values. It was essentially a criticism of the production processes and of capitalism. It is incredibly important as well because it is a real issue. Apparently, modern China needs to think back very carefully about what has been happening as the society has converted from the previous political structure to a more capitalist form. There are real risks for China. It would be unwise to ignore them simply and just run ahead. The related issues need to be considered consciously if you are going to invent a political system in which the problems of markets are controlled by regulations.

还有一些学者从政治角度来提出批评意见，如David Harvey。他也曾是一名定量地理学家。他对于定量革命的批评集中在对其政治价值的重新审视，他关注生产及资本。这确实是一个需要重视的现实问题，对于当今的中国也十分关键。中国社会正处在从过往的集体式政治经济结构向市场经济形态转型阶段。这一过程存在很大的风险，涉及大量的资本制度问题。简单地忽略这些问题显然是不可取的。思考相关的制度建设有助于在定量背景下建立一个较好的市场管理机制。

During the period when the first quantitative revolution was taking place in the West, China was going through the Cultural Revolution. The Cultural Revolution, as I understand, interrupted a lot of academic investigations. People who worked in the academic fields had to move to other places and be redeveloped. When people returned after the Culture Revolution, the universities restarted innovation, but they brought back the 1950s' understanding of architecture and urban planning. So, there is something very interesting in the nature of architectural and urban design education in China, which is the result of the Culture Revolution. It means that China has missed the first quantitative revolution and returned to the previous 'beaux arts' methods of training an architect. Students were taught to draw the plans, elevations, and the three-dimensional representations of the simple buildings and then the more complicated buildings.

当西方发生第一次定量革命时，中国正在经历文化大革命。文化大革命打断了当时中国学术的诸多探索。科学研究被迫暂停，学者们则被要求改造自己。在文化大革命之后，大学重新发展的教育体系仍旧聚焦在西方五十年代的建筑及城市规划学。因此，在中国，建筑及城市规划学科错过了西方的第一次定量革命，当然也错失了充分吸收相关成果的机会。这使得中国建筑教育趋向于以传统学院派模式培养新人。学生们学习绘画平面图、立面图和三维几何形态来塑造建筑及城市空间。

So you need political, economic and social perspectives, as well as a series of rational approaches with urban computation. I think all of those are possible, but it requires a whole new solution. It is unnecessary to duplicate what the West did in the 1960s. There should be a new generation, especially for China. If China does it, it will be a Chinese development, but it should be very careful about just trying to copy the models from the past or from the West.

因此，中国现在需要从政治、经济及社会角度来看待城市计算，并注重提倡与之相关的理性方法。我认为这些是可行的，但需要一个全新的解决方案，而不是复制西方在六十年代所采取的措施。中国应该充分把握当今的新机遇，探索自己发展的新模式，并在借鉴既往模式或西方模式时保持谨慎的态度。

## 02 A new turn? 一次新的转型?

YS: The so-called quantitative revolution in the 1960s turned out to be less popular in the 1970s, and the social transition of urban planning/design occurred. Then, the social values in urban design became the new focus. If using urban big data will be the new normal, what kind of transition will happen? Is it still social? Or will it be inspired by other disciplines, say, data science or the artificial intelligence?

西方国家上世纪六十年代对于第一次定量革命的热衷，在十年之后有所平息，取而代之的是在城市规划与设计领域发生的社会学转向。而后，城市规划设计中的社会价值获得长期关注。假设应用城市大数据将成为未来的常态，那么是否也可能在城市规划设计中带来“转向”？如果有，这种“转向”是否仍旧会来自于社会学，或者其他学科，比如数据科学及人工智能？

AP: There are many turns in the history of social science, and the historical reason for this is that social science is only just maturing as a science. And what they (socialists) tend to do is borrowing ideas from other fields, applying them and finally making they get fit. In fact, lots of sciences progress by copying previous sciences. For example, many models in the 1960s were based on a 'Newtonian' gravity theory from physics. Theorists tried to apply the gravity theory to urban systems. However, the fact is that they have not found a gravitational constant for a human system. Society does not function in the same way as matter.

在社会学的发展历程中存在多次转向，社会学也因此逐步成熟为一种科学。在这个进程中，社会科学家往往借鉴其他领域的成果，加以应用并最终找到契合点。实际上，许多科学的进步都基于以前的科学。例如，上世纪六十年代的许多社会学模型都是基于万有引力定律。理论家们试图将引力理论应用于城市系统。然而，他们在对人类社会的研究中没有找到一个稳定的引力常数。这也意味着，社会发展并不遵循一种单一的模式。

In the urban systems, I am afraid, the people who try the Newtonian gravity modelling, have to take the data around the function of the system, feed it into model calibration, set the parameters, and organise the parameters into the constants. But the constant is different for every city that you look at. It is always different. It is not same gravity where the constant is universal. Sometimes it is negative, while sometimes it is positive. There is no stability at all.

在对城市系统的研究中，试图运用牛顿万有引力模型的人，必须利用数据来校准模型，设定并求解参数。然而，所求得参数在不同城市间并不统一。因此，城市模型无法像牛顿的万有引力模型一样拥有一个绝对且稳定的参数。事实上，这些城市模型中的参数时而为正时而为负，时而大时而小，很难找到稳定性或普适性。

That is my view. People who are in this mind apply Newton's physics that they think is wonderful to social systems, but they just make themselves narrow-minded. They are stuck in one paradigm, cannot see the sciences, rationality and other forms. This situation will change, but it will only change when the 'Newton' comes along who manages to explain social systems in a new way which will be very elegant to account all of them. It will happen, but it would take a Newton or a Darwin or an Einstein to come along and explain everything in a simple way that comes through all of these phenomena. So the reason why we have 'turns' in social sciences is that somebody is saying, we have missed this, and let us put it in.

在我看来，借鉴牛顿物理学并认为其将完美符合社会系统的人，他们只是在证明自己思想的狭隘。他们陷在一种范式中，进而无法遇见真的科学与理性。也许当新的“牛顿”用更精巧的方式来阐述城市发展的基本状态时，这一情况会有改变。但这需要下一个牛顿、爱因斯坦或达尔文用简单的语言解释所有这些现象。不可否认的是，向社会科学的转向实际也许和巨匠的出现，以及他们想开创性地引入某些观点有关。

There was a spatial turn in social sciences. Bill Hillier is part of it. There are others who also said, space is important. I think that is a key step to this progress, but it is not the destination where we can have a complete theory that covers all the phenomena that we see. One of the difficulties is that, what is injected into the world at the moment is technological change. In the 1970s and 1980s when Bill Hillier was writing *The Social Logic of Space* (Hillier and Hanson 1984), the internet had just been created. I can still remember the first time when Bill got an email address; nobody knew what to do with it because nobody had anybody else's email address. Shortly afterwards, we started using computers. Then the email came along, and very rapidly, you had an email address, and people started getting email addresses, which was the reason to send emails. But it took a few years before the email became something that is socially meaningful. Now everything is done through email all over the world.

在社会科学的发展历程中，空间转向也很重要。许多学者都曾强调空间对于理解社会的重要性，Bill Hillier教授便是其中一个重要的学者。他的理论是社会科学空间转向中重要的一步。虽然并未形成一个完整的理论来涵盖当今我们所见的社会现象。其中一个难点是理论发展似乎总是慢于技术变革。上世纪七八十年代，Bill在写《空间社会学》时，互联网才刚刚兴起。我记得Bill第一次拥有电子邮箱时，没有人知道该如何使用，因为没人拥有别人的电子邮箱。而现在整个世界的沟通都可以通过电子邮件来完成。

Technological changes are something that is not in *The Social Logic of Space*. The connectivity through the internet and communications by mobile telephones did not exist when *The Social Logic of Space* was written. Afterwards, we have computers, social networks, Facetime, and social media. These things are absent from Bill Hillier's social theory, though their elements might be contained. The idea of society coheres through a transpatial mechanism, as well as a spatial mechanism. I think mobile phones and email are a transpatial mechanism. But the impacts of them on the way we design cities, the way we design buildings, the way organisations function and the way politics happens, have not been theorised fully yet. That theory will come, but the problem is that technology and its social consequences are evolving more rapidly than theory.

技术变革对社会的影响在《空间社会学》中并没有论及。当今社会无处不在的互联网、社交媒体及智能手机在《空间社会学》出版时还未出现。这当然不是Bill的社会学理论可以预见的，即使他的论述包含了一些与之相关的元素。社会的连接机制可以是空间的，也可以是超空间的。我认为手机与邮件便是超空间的连接机制。但这种机制是如何影响我们设计建筑、规划城市、协调功能及制定政策，还未被充分地理论化。相关的理论一定会涌现，但是问题是技术更迭总是快于理论发展。

We now have rapid trains and aircraft. We can move around the world, and the whole world is a single object now. We need to analyse the structure of the whole world. It is now about the scale of analysis. We need to account for how these interactions take place and think about the whole world. It is a scale-related problem. And the interaction pattern is continuously moving and changing almost month by month. So there is a real challenge. The next generation of urban designers, if we call them that, have to bring in digital communications, and have to think about the social logic of the digital spaces as well as the real space. In fact, I think it is a very interesting opportunity and challenge because the smart city is actually the city that is enabled with digital. There is no theory of this, no proper social theory of this. But there are elements of it, and you can recognise them in various social scientists' thinking.

如今，由于交通工具的发展，我们获得了空前的移动力。我们可以在世界范围内任意移动，而整个世界也更加趋向于一体化。因此，我们不得不开始分析整个世界的结构。这就涉及研究的尺度与规模的问题。在当今的数据条件下，我们需要解释互动是如何在全球发生的。由此，这变成了一个尺度问题。同时相关的互动形态持续动态地在演变，这也给相关问题的研究带来了挑战。新一代的城市设计师必须考虑数字通信的影响，还需思考数字空间的社会逻辑并将其与现实空间联系起来。我认为这是一个非常有趣的机会和挑战，因为智慧城市实际上是一座数字化的城市。目前还没有相关的理论，也没有合适的社会学理论。但已经有一些思想因子存在于许多社会学家的思想体系里。

### 03 A new paradigm? 一种新的范式?

YS: Will the paradigm of urban design be changed? Do you think that the golden age of the data science will be the golden age for the urban design?

AP: That is a good question. I am not sure about 'golden ages'. I think it is very hard to identify a particular golden age. We can explain things retrospectively by looking back and say that it was a golden age, but I don't think you can say this will become a golden age.

这是一个很好的问题。我并不确定黄金时代的说法。我认为很难确切地区分具体的黄金时代。我们可以通过回溯来界定一个黄金时代，但我认为现在说这将会是一个黄金时代还为时尚早。

在新的数据环境下城市设计的范式是否会被改变? 数据科学的“黄金时代”是否也会是城市设计的黄金时代呢?

I think that big data and data science will make a big difference, and there are several reasons for this. They are parts of the whole digital revolution and the computational revolution. There will come a time when human creativity will be enabled and supported by things such as machine learning. They have abilities to look and find patterns in vast volumes of data. However, I think it is very hard to predict what that actually means. People who may predict are the writers of science fiction.

我认为大数据、数据科学会改变很多东西，这是整个数字革命的一部分。人类的创造力将由数据及其衍生手段所支持。通过机器学习，我们有能力在海量数据中寻找、预判某些规律，并加以利用。但是很难猜测这到底意味着什么。我想最能预测未来的人应该是科幻小说作家。

So I think that there will be a revolution coming from big data, from data science, and from machine learning and computer creativity. It is what some people keep talking about that artificial intelligence is part of the same picture. Computers now are able to do things that are many steps beyond what they were able to do 10 years ago. The processes that have just been used to play Go and beat the grand master of Go. That is a machine learning approach to doing the pattern-spotting. Now, the next application might be architectural design and urban design.

我认为有一场大的变革将会发生，涉及大数据、数据科学、机器学习及计算机的创造性等多个方面。这与目前许多从事人工智能的人一直畅想的愿景有相似之处。如今，计算机的运算能力已经远超十年前。就像最近发生的围棋人机大战所展示的一样，机器学习代表了一种图形认知与测定方法。下一步的应用将与建筑设计和城市设计有关。

I think that the paradigms of urban design would change. I have got two feelings about it. One is relates to people and the way in which their psychology operates. It has been around for a very long time, millions of years, and we are not very different in genetics term, from the way we were 100,000 years ago. The genes have not changed our cognitive capacity. If you take somebody from 100,000 years ago and put them in a modern building, they would come out, very much like we are today.

我想城市设计的范式将会改变。对此，我有两个层面的理解。首先是关于人及其心理运行模式。事实上，自远古以来，我们的生理结构并没有什么显著的改变，我们对空间的认知能力也没有显著的不同。如果将某个远古人类带到一幢现代建筑空间，他/她会凭借自身的认知能力找到出路，这与身处现代的我们无异。

The things that have changed over the period from about 10,000 years ago until now are social and cultural structures. And an interesting component of this is the time when urbanisation took place. The earliest settlement was established about 10,000 years ago. The fact is that the cities having millions of people now might be the cities where hundreds of people lived 10,000 years ago. As the scale changed, the required political structures, government democracy, and the whole series of different cultural and social structures were created and invented, and these changes happened almost in no time at all. So the transitions took place in the human capacity lead to radical fast changing social forms and social structures, which are our innovation. Settlement form seems to be associated with this. And then, money and writing are created. As soon as you have money, you have transactions that are not about my needs and your needs, but come together to exchange for the money. As soon as you have writing, then you have the history and memory that last longer than the individual life. As soon as you have money, you have the ability to create credit so you can ask somebody who is able to invest for the future value and then you have development. This is capitalism. Capitalism is about creating credit. It allows someone to invest in a development which is not yet there, so you can pay for something to be made as a future vision. And this is what the architects work for. They sell a vision of the future to capitalists who pay for the developments of the buildings and then create the real future vision. If they fail to create that vision, you will end up with a wasted investment. If they create that vision, it will be a successful investment.

另一个层面是社会经济结构。千万年来，社会及文化结构发生了很大的变化。最初的聚落可以追溯到万年以前。当今拥有百万人口的城市在那时候也许只是一个拥有百余人的小聚落。因此，当城市

规模改变时，所需要的政治结构、治理结构及民主程度也会随之变化，与此同时，社会、文化结构也会发生相应的再造或变迁。人类能力的变化引起社会结构与形态快速彻底地发生改变，而这才是人类真正的进化。聚落形态则与这个过程密切相关。随后，货币与文字出现。有了货币，人们就能够进行交易，不再局限于自身温饱的满足，进而关注财富的积累与创造。有了文字，就有了长于个体寿命的历史和记忆。当财富积累到一定程度时，城市便能够创造信用，吸引潜在投资者，进而获得发展机遇。这便形成了市场经济，而市场经济依赖于资本创造信用。信用使得投资人愿意投入暂时还不存在但前景光明的发展项目。这其实就是建筑师的工作。他们向资本所有者兜售未来的愿景，使得他们为此投资并将其变为现实。如果建筑师没能创造出一个好的愿景，那么投资很可能会失败。相反，投资成功率会大大提高。

Urban big data is a type of credit. By reducing the risk of failure, by understanding when things fail, when they succeed and what that stands for, it helps credit and capital to invest in things that are more likely to succeed than to fail. It will also create political and social structures. For a city to thrive, it has to have a rule of law. Simultaneously, you need rules of laws because in a city without laws, nobody will invest in them. If you look at where money is flowing around the planet at the moment, you will discover that investing in real estate is about flowing money into the cities like London because London is a relatively stable political system with a clear rule of law. If you invest your money, you are not going to have it stolen from you by a local power or a powerful figure. If you do this in less well developed state, you might be worried.

城市大数据是一种新的城市信用。通过减少失败风险，吸取具体成败的经验，可帮助提升城市开发信用，进而会提高相关投资的成功率。这将塑造新的政治及社会结构。为了一座城市的长久繁荣，必须有与之配套的法律制度。法律也是一种信用，一座没有法律保障的城市是无法吸引潜在投资者的。看看当今世界的资本流向，不难发现，大量资金流入像伦敦这样的城市的房地产，恰恰是因为该城市有相对稳定的法治政治环境。资金能够通过信用得到保障，而不会被地方势力巧取豪夺。但如果要在一些欠发达地区进行投资，也许就会令人担心。

The rule of law, good government, credit, these are required. There is another question here about democracy - Do people need autonomy? The rule of law and good government may get abused if people do not have any autonomy. However, this is not to say that democracy by itself can guarantee the rule of law or a good government. The problems of America at the moment are issues regarding the balance between the Senate and the Congress, which stops them from making effective decisions (for example revising their gun laws). They are democratic, but they are not progressing.

法治、良好的政府、信用，这些都是必要条件。此外，必要的民主制度也很重要。当人们没有民主权利时，法律及政府职能有可能被滥用。但是民主本身并不能保证法治和好的政府。美国当今有个问题就是如何平衡议会与国会之间的关系。它们之间的复杂关系已经使得决策趋于低效（比如枪支管理法案的修改）。从这一点看，美国的制度虽然民主，但有时候可能妨碍决策。

Regarding with the way of making a design, I will describe something interesting to you. We did some research a few years ago by using augmented reality. We could manipulate the model on the table just by moving tangible placeholders because cameras in our headset can recognise the things that you touch, move and scale. We observed how two people across the table worked on the same model. The first task we set to them was to design something like an ordinary urban area collaboratively. We gave them some digital building blocks, so they could arrange them together to shape the squares, streets, etc. Their descriptions often ended with the geometric ideas. Then, we placed software 'agents with vision' in the model. These pedestrian agents started walking around the table. When a building blocked the agents, they would walk around it. As the designers moved the blocks, the movement pattern of the agents changed accordingly. In this sense, the nature of the collaboration between designers has been changed.

至于如何在新的数据环境下进行具体的设计，我可以向你讲一件很有意思的事情。几年前，我们运用增强现实做了一项研究。通过镜头识别被触摸的物体，我们可以通过操控桌面上的实物模型来调整设

计的形态及体量。我们组织两人为实验对象，基于同一模型进行实物干预的设计操作。我们分配的第一个任务是设计一个城市街区。我们给他们一些建筑体量、街块，他们可以一起对其进行操作，进而形成广场、街道等城市基本要素。在试验中，我们发现他们对于设计构想的形容总是与几何形态有关。在他们大致确定了形体要素后，我们通过软件对这一新设计环境加入带有视野的步行主体。这些行人开始从四面八方游历所设计的环境。如果有一幢建筑阻碍了行人，使得他们不得不绕行，设计师会移动建筑改变其布局。在这一试验中，设计师之间的协作模式被改变了。

As soon as you inject people (agents), what was going on was that designers stopped making a square and started to make an open circle. After that, they began talking about how people were walking around. What came out of this process was not the regular grids, squares, streets or any other naive geometric descriptions. The final results were very organic because the moving flows were informing the designers, and the design was informing the flows simultaneously. Therefore, the feedback loop between the simulation and the design was formed. The layout was justified by the designers in response to the walking agents with vision on the ground. It finally came up with a result that is much closer to the organic urban flows. This suggests the novelty of the real-time modelling, in this case, that is the agent-based simulation and the significance of using it to inform urban design. Then we can get away from the Chinese gridded cities and the American super-block-based city, but still, have urban networks with much more contextual sensitivity.

当我们加入了步行主体的模拟后，设计师不再设计广场，转而设计环形贯通的开放空间。而后，设计师开始谈论人们可能的步行行为模式。最终的设计形态摆脱了规则的空间设计，趋向于有机的、不规则的形态，这与自然发展起来的的城市空间非常相似。在这个实验里，通过模拟的介入，人的动线启发了设计师，而设计又同时影响了人的动线。最终，一个介于设计与模拟之间的积极反馈机制得以建立，并通过步行人流模拟结果反复校核，使得最终的形态具有某种有机性。这个例子揭示了城市建模对于城市设计的独特意义。通过这样的模式，我们也许能够摆脱近现代中国的网格城市或者是美国的超大格网街区，而使得城市形态设计对于文脉具有更高的敏感性。

I think there may be a big revolution which will come through the real-time simulation in design, which should be considered in the urban design education. That will be the thing that shifts city form. It is about being smarter in the production of the city, rather the city itself being particularly smart.

我认为实时模拟技术的变革将对城市设计范式带来大变革，因此未来的城市设计教学中需要辅以妥善考量。实时模拟技术也许还会带来城市结构形态的改变。城市大数据应该更加广泛地让城市的生产变得智能，而不是一味地追求城市的某种智能性的提高。

## 04 A dynamic urban design? 一种动态的城市设计？

YS: Urban big data helps us to understand the human behaviours in the built environment. It improves not only the spatial resolution as well as the time resolution for spatial analysis. In the conventional urban design process, we got used to describing the final vision but did not consider the temporary solutions for the dynamic questions. Recently, the immediacy and dynamics

AP: Analogies in science are often considered to be a bad thing. However, they are useful tools for thinking. I think that the analogy might be relevant in the shift from Newtonian physics to quantum physics. In quantum physics, you have to think about things in terms of probabilities rather than in terms of the particle in a certain location or momentum. The reason for this is that in quantum physics, the effect of the measurement disturbs what is actually happening. So if you observe with a photon, you will find the trajectories of other photons. There is a different reason in urban systems, as you come down to the scale of individuals moving in real-time, minute by minute, second by second. You come with various granularities that there is so much information; therefore, you need some way of bringing it together to arrive at any stable phenomena. So what we tend to do is observations of people. We repeatedly observe to get an average, and count the people who are walking down the street. We do it over a time period and take the average. We have done research that looked up the minute by minute counts of people, not the average over time. You find that you can detect things like the trains coming into Kings Cross from the flows of individuals through the street system in the area, you can tell through the pulses in passing numbers of people by recording

of the urban big data increase the emphasis on the accuracy of the short-term decisions. However, it seems that we do not have the theory or experience to do the urban design that is just for that short period. How can we use urban design to achieve the dynamic aims?

城市大数据帮助我们理解建成环境中人们的行为，不仅提高了空间解析精度，更提高了时间精度。而在传统的城市设计中，我们习惯于只考虑规划设计的终极愿景，而往往较少考虑动态的即时问题。近年来，城市开放数据的即时性被认为可以帮助提高城市短期决策的精确性。但当前的规划设计理论或实践似乎都还不能做到这一点。在您看来，城市设计如何能够实现动态的即时目标？

within three changes of directions in Kings Cross station, and you can detect structure in the time series of spontaneous counts. A train with a thousand people comes into the station. People get out from the platforms at the same time. They walk at different speeds and move through the city. We have not yet got any proper analysis of how those fine-scale data with time periods can work properly. So we are always thinking about things of a much longer period because as urban designers, we are not designing for that train coming in. We are designing for the station or the area to work over the next 20 years or the next 100 years. We do not know how it will be. We do not know if there will be trains. So you are designing for a long future which does not work at the scale of minute by minute.

类比在科学界不被视为一个好的方式，但却是极有用的思考工具。对于你的问题，我认为可以用牛顿物理学向量子物理学的演进来做类比。在量子物理学中，你要从概率的角度去思考问题，而不是依据一个特定的位置或动量。之所以这样，是因为在量子物理学中，观测对象与方法不同，得到的答案也会不同。比如你去观察某一个光子，你会观察到它的行动轨迹及周边的其他光子。在城市系统中则有不同的理解方式，当聚焦在个体的尺度观察实时移动，常常是以分秒为单位的。当你用不同时间间隔来观察人们的行动时，由于信息的冗余，就需要一些方法来获得较为稳定的现象描述。我们常常将人作为一个整体的观察对象，反复观察他们在街道上的轨迹，选定一定的观察时间间隔，从而得到一个均值。我们也曾尝试以一分钟的时间间隔来观测人流。在这个时间间隔中，我们发现通过观察国王十字车站周围以三个拓扑距离为半径的缓冲区内的人流动向的变化，可以清晰地发现某辆火车刚刚进站，还可以通过人流数据得到对城市结构的描述。一辆火车一下子带来上千人，这些人即刻离开站台，以不同速度穿过城市，去向各自的目的地。目前我们还没有合适的方法来分析如此短的时间间隔里城市是如何运转的。作为设计师，我们通常是以一个较长的时间维度在思考。我们不只是为了某一列火车进站而设计，我们还要为车站或者相邻区域的未来二十年甚至一百年而设计。我们无法准确预知未来将会如何，不知道是否还会有火车站。所以，城市设计是为一个长期的未来而设计，而不是为了分秒之间而设计。

When we are designing mobile phone apps, it would be a different design. The way that we interact with the device is actually about what it feels like in the interaction, in real-time, second by second. If there is a delay when you are dragging on a computer surface, you will notice it even though it is even only a microsecond, and you can make it usable or unusable just according to the length of delay. I tried playing with the Kindle surface. It is not as good as an iPad in terms of the smoothness. When you track smoothly, the Kindle jumps. And it is not smooth enough, and its microsecond delay makes it much less usable. This is very interesting because that is a scale that technology will require us to understand. Therefore, different designs fit for different time scales.

设计手机应用APP是另一回事。我们与设备的互动方式实际上与我们的操控体验有交互影响，它存在于真实的每分每秒中。当你拖动屏幕上的软件时，哪怕只有些许延迟，你便会敏锐地注意到。事实上，你可以根据延迟的长度来判断好用与否。我试着玩Kindle时，会感受到它不如iPad那样灵敏。一旦你动作太快，它便会闪跳。这只是因为它的表面不够光滑并且有微秒的延迟，便让人们感觉它没有那么便于使用。这便是手机技术需要关注的时间尺度——就在毫秒之间。因此，不同的设计适用于不同类型的时间精度。

## 05 A new design philosophy? 一种新的设计哲学?

YS: Do you think that recognising the fundamental properties of urban big data can bring the new design philosophy? For instance, the scaling laws or fractal dimensions.

AP: I think that the human mind is very good at spotting patterns. And one way of thinking about the human brain and what it must have evolved to do is to be a pattern recognising machine. So I believe that we can get satisfaction when we see the patterns. And there must be something in the aesthetic judgment of beauty which is satisfying; that is "I have spotted a pattern and therefore I am satisfied". I can imagine a scaling law as being a pattern, which may be perceived thereby making people satisfied. I can think of other laws that maybe similar. For example, there is the law of the golden section. It is a pattern law like a scaling law to some extent. When this ratio is the same as that ratio, and that ratio is the same as that ratio, you might perceive something and say that could also be satisfying. So I suggest the aesthetic could be considered as satisfying a desire for pattern

您认为城市大数据中蕴含的基本属性是否会带来新的城市规划设计哲学？比如幂率分布及分形特征。

spotting. Spotting inherent pattern properties could be a useful thing to have in the evolving brain since it will help make good predictions about the world.

我认为人类非常擅长图形发现与认知。一种认知人类大脑及探索它如何运作的方式便是将它理解为一种图形识别机器。我们看到易于认知的图形时会感觉到某种满足。与此同时，当人们作出美学判断时也有相应的满足感。我可以理解幂率分布本身作为一种图形的属性是可以被人们识别，并带来愉悦感的。同时我们也会发现有許多其他相似的规律，比如黄金分割，也是一种图形规则。我认为黄金分割作为一种比率，与幂率分布有某种相似性。当这种比例在不同场景中反复出现，人们便能感知到并意识到它能够带来审美的满足感。因此，当我们把美学理解为一种对于图形的识别而带来满足感的追求，这个图形内在的属性便可能帮助发展大脑并改善人类对世界的认知与预测。

I have to say something about the field of physics. Physicists, in general, try to find a single number which they can put their name on, which would be the best thing you can have as a physicist. Newtonian Constant and they have got his name on it. The problem with this is that they keep looking at cities and say, is there a constant? And that is a scaling constant. The related attempts were trying to reduce all complex phenomena of the city to one number. This issue is that what they are searching for comes from a physics tradition that says this is what it should look like.

接下来我不得不提到一些关于物理研究的事情。如我们之前谈到的，物理学家总是试图找到一个常数，并附以自己的名字。对于物理学家来说，这可能是最大的成就。牛顿常数就是以牛顿的名字命名的。问题是，当他们看待城市时也总是自然地会问：城市是否也存在一个常数？幂率常数便是其中一个。许多研究都试图将复杂的城市现象简化为这样一个常数。当他们按照物理学家的传统来思考时，便会觉得这是理所当然的。

Then, I would contrast that with the constant from Newton. Newton was the first person who discovered the constant basically, and his constant is remarkably robust and has lasted for 200 years before Einstein came along to change it. The thing I would contrast with the Newton's constant is Darwin's theory of evolution which does not have any constant. But it is a theory. He successfully explained something about the world. In the biological world, it was the thing that accounts for the diversity of the species and how they behave and fit well into their ecological niches, symbiosis, inter-species similarity and other amazing phenomena that you see in the world. All of these sorts of things can be accounted for his amazing and simple theory of the natural selection and random mutation.

我想用牛顿常数与其他类型的理论作一个对比。牛顿基本上是科学界发现普适常数的第一人，并且这个常数在不同模型中非常稳健，直到二百年后被爱因斯坦改变。如果将达尔文的进化论与牛顿常数作对比，达尔文的学说不存在任何常数，但它也是一个相对完备的理论，解释了一些关于世界的普适现象，比如生物多样性、生物行为及其进化过程、生态位、生态共生现象，以及种间相似性的原因等。所有这些现象都能被简单的规律——自然选择及随机突变，所解释。

I think that in the urban world, we will have a theory, but it will not be a single constant. It will not be written in an equation in physics or a mathematical equation. It will be a bit more like a Darwinian survival of the fittest. It will be something that accounts for cities, buildings, people, organisations and mobile phones. It will be a paradigm-shifting way of looking at things in which all the sudden will explain a lot of the phenomena that we see frequently. That is what will come, and then social science will become a real science. I think it will happen in a short period, and maybe it has happened already. Maybe *The Social Logic of Space* is such a theory, or possibly it is the first stage of that. There are many more things to do to make that happen.

我认为城市研究领域将会有有一个理论，但它应该不会是一个简单的常数，也不会是一个物理学或数学方程式，更可能是一个类似于达尔文的适者生存理论。这个理论会囊括城市、建筑、人、组织和移动网络。或许它也会是一种思考范式的转变，让我们开始通过分析一些特例来解释司空见惯的现象。当这个理论出现时，社会科学才能成为真正的科学。我认为短期内就会发生，很可能已经发生了。也许《空间社会学》会是这个理论的第一阶段，但仍需更多的努力。

## 06 Be enhanced or limited? 被加强抑或被限制?

YS: The role of so-called PSS/DSS (Planning Support System/Design Support System) is not sufficiently recognised by the urban designers in history, mainly because the urban models were considered as the chains rather than the ladders for the designers. Conventional models focused on the system dynamics without the proper reaction to the design aims. How can the urban design process be enhanced by the application of newly emerging urban big data instead of being limited?

历史上, 所谓的规划支持系统/设计支持系统的作用, 并未被城市设计师充分地意识到, 主要是因为城市模型被设计师视为对他们的限制而不是支持。传统的支持系统基于系统动力学观点, 而缺乏对设计目标的适当反映。我在此的问题是, 如何能使应用新的城市大数据以增强城市设计流程, 而不是被限制?

AP: I think we have to think about urban design in general terms. They are social phenomena, and therefore design is socially constructed. It has never been devoid of a context in an existing situation and an existing culture of design. And we design with that in the back of our head; with a long history of design that is already there. It is highly complex. There are many different levels in design, in society, and in the individual, that interact. Humans are very good at thinking through complex design processes and handling the complexity of design situations. So the design support system needs to support the human designers who are the whole team of people doing all sorts of different things around what they plan to do. Take it very simply, there will be engineers who consider the structure and the transport system, respectively, and the environmental engineers who think about the way in which the wind blows. There will also be the architects who think the social and aesthetic issues and the landscape designers who think about trees, plants as well as the aesthetic issues. All of these are parts of a team; thus, a design support system or an urban planning support system should support the social team by adding data, analysis and simulations. The team will think either divergently or convergently based on the nature of the team. In the field of design, there is relatively little that is truly innovative. Most often, people just take what they did previously, and think about what they can revise and improve, and so on and so forth.

我想我们首先需要从整体上来理解城市设计。城市设计实际也是一个社会现象, 因此任何设计都是通过社会化来组织的。所有设计都有其赖以存在的文脉环境, 且和既有的设计传统相关联。城市设计因此十分复杂, 在设计、社会及个人的互动方面存在许多不同的层面。人类很擅长搞明白高复杂度的设计过程及管理复杂的设计环境。因此, 设计支持系统需要支持设计师们及他们所在的团队计划要做的不同类型的工作。简单地说, 一个设计团队中会有结构工程师、交通工程师、环境工程师、景观设计师等等。设计支持系统或规划支持系统需要支持的是整个团队的社会化互动。通过将数据、分析及模拟引入沟通与决策过程, 使得整个团队根据其特色或发散或收敛地思考。在设计过程中, 其实只有相当少的部分是完全原创的, 更普遍的情况是, 人们不断从此前的设计中吸取经验并不断调整、修改与优化。

Where I think planning support systems will really work is to bring a range of cases to increase people's awareness of what may be relevant, but that they did not necessary know about before. So I think there will be some interesting things coming from big data. That will be the scene where the computer is saying, I see what you are designing, have you noticed these schemes over here in Brazil? Do you know that project failed because of this? So post occupancy evaluation of schemes with big data could represent the reasons why a project failed or succeeded. If we can bring those data to the table of the designers at the time when they are just thinking, it will be very useful. I think that it is about supporting planners in their social decision-making process with their creativity, rather than telling them what to do.

规划支持系统的一个好处是能够带来一系列与设计相关但是并未被设计团队充分认知的案例。因此, 我认为新的数据环境将来带新的契机, 海量的数据将通过识别设计内容来提示不同的案例, 并通过定量评价来理解这些案例成功或失败的可能原因。当这些数据在方案制定阶段提供给设计师, 将会别有益处。我想, 在设计师及规划师的社会决策过程中提供创意支持胜于告诉他们要做什么。

I am thinking that from a design team's point of view, who want to change something. What the models can do is help you to think new thoughts. So, for me a model helps one see new possibilities. Big data has a different role, I think. It informs you about past history, and distinguishes the things that are worth doing from those that have less potential.

我这么说因为我是站在设计团队的角度想问题, 我们一直想有所改变。城市模型有助于启发新的想法。因此, 于我而言, 一个模型应该帮助设计师使其意识到新的可能性。而城市大数据还有另一个角色, 就是提示你已有的经验, 并帮助厘清什么措施是得当的, 而什么措施则收效甚微。

## 07 The death of the theory? 理论的终结?

YS: We heard that 'big data' brings 'the death of the theories.' Methodologically, we observed that machine learning is increasingly challenging some conventional views. Do you think the urban design theories will 'die' in the new data environment?

我们时常听说大数据将带来理论的终结。从方法论的角度看，我们发现许多数据分析技术，如机器学习，正在逐步挑战传统观点。您认为城市设计的相关理论是否会在新的城市数据环境中面临终结？

YS: Many theories in the past were proven to be powerful when the data are not accessible, e.g., space syntax. How can these models find the new possibilities of developing themselves in the new data environment?

AP: There is absolutely an issue around this, which is very true. But I am not 100% sure if machine learning is able to find and generate creative paradigms for breaking possibilities, or whether it can only find things that have already existed in an existing data world. So, one thing that designers always do is that they look for a way of doing things that has never been done before. Would it be possible for machine learning algorithm to predict what has never been done before? I just do not know.

这确实是一个问题。但是我并不完全确定机器学习是否能够帮助找到创造性的范式，进而带来新的可能性，还是它只能用于在已知现实数据中寻找答案。设计师一直以来都试图寻找创新的可能。机器学习是否能够帮助预测之前没有尝试过的事情？对此我并不知道。

Otherwise, machine learning will be only very good at telling you how to do the things that come from what is already known in the existing world. And it may be able to optimise the existing things and redo the really good things that exist. But it may not be able to turn the problem on its head and think of something completely different to the current way of doing things; it may not be able to do that. And it may not help people to do that.

或者说，机器学习只擅长于顺藤摸瓜地揭示现实世界已经发生的事情。它能通过学习现实世界中存在的好的事情，从而帮助优化那些目前并不好的。但似乎没办法举一反三，并基于经验，思考出完全不同的行事方法。至少目前来看，还无法做到这一点。

Now, people are tremendously resourceful, so as soon as you come up with the machine learning in an urban design program that designs things incredibly well and makes them wonderful, you will find that some architects and designers will come in and subvert it. When they try to do an art project, they will make use of machine learning to do something that is completely different. Because designers are always thinking through the new ways of doing things. Artificial intelligence will not be a really intelligent until it is able to do that. It is a bit like a version of Gödel's incompleteness theorem. He proved that there is no language in which all arithmetic maths can be stated. He did this by iterating through, and showing that is always able to add one more language. Therefore, he showed that there is always one more set of axioms that you can construct differently. I suspect there may be a kind of 'completeness theorem' to be constructed around these issues of big data and what is possible to predict.

现今，人们足智多谋。一旦你在城市设计方案中掌握了机器学习，就能做出不错的设计成果，而你会突然发现，一些建筑师和设计师已经开始了新的颠覆。当他们着眼于一个艺术项目时，他们会通过机器学习做出大相径庭的东西。人工智能只有在能够完成某种“颠覆”时才能被真正地称作一种智能。这类似于Gödel提出的不完备定理。他已经证明世界上没有一种语言可以阐明数学。这意味着一种开放性：即使充分迭代后仍旧可以不断地增加新的语言。Gödel告诉我们，你总还可以建构别种公式。我怀疑对于大数据的诸多议题及它的预测性也存在这种不完备的特性。

AP: It is a real issue for some successful models. I mean to describe it in a slightly different way.

新的海量数据可以表征许多城市信息，这确实对于一些已经成功的模型来说存在某种挑战。但是我想先从一个不同的角度来谈这个问题。

We did a project a few years ago when we used Bluetooth sensors to log the presence of people through their cell phones, as they walked around the city of Bath in the UK. And we had several of these sensors that logged the identifier addresses or MAC addresses of the devices that people

许多在有限数据条件下被证明很有效的简明模型，比如空间句法，如何在海量数据涌现的新数据环境下寻找自身理论发展的可能性？

carried past them on the street. This gave data with a very fine time and space resolution. You could detect people who were standing next to the sensors and people who were moving through, and then you could actually tell people whether they were driving or running through because some of them would move much quicker. You can see who are in the same space at the same time because we had several of these maps in different parts of the city. You could see these two people at the same space at the same time; and half an hour later, the sensor is still paired with these devices, which suggests that the same people are present at the same space at the same time. This indicates that they are probably a couple who come and go around the city together. We mapped the patterns for 18 months. During this period, you could see how people came and went. Some people who only have been there for one day only were probably the tourists. Some of them were further identified as Japanese or American because their mac-addresses come from those countries. The MAC addresses have identified some of them by knowing where they were regionally located around the world.

几年前，我们曾做过一个项目，借助蓝牙感知设备探测手机来记录巴斯城个体分布及其步行行为。我们几个主要的感知设备能够识别路过的通信设备的MAC地址。通过这种方式采集的数据具有很好的时空精度。我们可以通过感知器判别谁靠近感知器，谁正好经过，并通过他们的移动速度来判断他们是驾车还是跑步。我们也可以知道哪些人同时同地出现。我们还可以通过记录连续的蓝牙配对情况来判别同行的人，总是在城市中同来同往的人就有可能是夫妻。我们记录了18个月的相关数据。在这一段时间里，你可以看到人们来来往往，有些人只停驻一天，他们有可能是游客。而且他们的MAC地址显示他们来自日本或美国。电子设备的MAC地址会显示他们来自不同的地区。

So we had lots of data, a big data network, and then we constructed the time-based graph between all the devices that had been detected with directions and arrows of time from day 1 to day 500. Then, we tried a 'virus transmission' experiment on this network. There was a probability that computer virus might transmit from one mobile phone to another when they are co-present. The time needed for this transmission can vary. It might happen in just one second, or it may require for a minute or half an hour. So you can have a transmissibility. Now, this is the same as the epidemic model which can be written as a diffusion equation.

这样我们有了许多数据来构建大数据的网络，接着我们构建了500天的支持蓝牙的电子设备之间的有向网络图。在该网络上，我们模拟了一种“病毒传播”的情景，即当两个通信设备用户同时出现在一个空间时，他们便有一定的概率相互传播手机病毒。传播的时长会有一些的不同，从一秒到几分钟，甚至半个小时不等。因此所有的网络节点都将根据自身情况获得一定的传播性。这很接近于现在的流行病学研究领域的模型，即一种扩散模型。

In the epidemic research, the epidemic model focuses on the human flu, SARS, or those type of diseases. You can get the effect at the place where the epidemic picks up and drops off, and then returns again after some time. We found a similar thing for the information transmission from one Bluetooth device to another through the network. But this is not a simulation but an emulation. In fact, we emulated it and made it happen based on the real network of co-presence data that was derived from the big data of how people were actually connected together in space. That is a very different and interesting thing. It derived the things illustrating what the whole network holds the most strongly at a certain distance. So, even though some people stay in a space for a very short time, it could influence the whole system. It is very fundamental.

流行病学的模型通常关注的是流感、非典型肺炎等传播疾病。根据联系的网络中的位置与时间的不同，人们在不同地区、不同时间有着不同的被感染概率。我们在根据蓝牙设备的联系关系所构建的网络中也发现了类似的现象。但是我们尝试的不是模拟，而是仿真。我们模仿了流行病的传染机制，它是基于大数据感知手段获得人们在空间中的共现关系来测度的。这与流行病的传染是截然不同的，但也十分有趣。我们发现整个网络在某些地区联系度非常高，因此哪怕有些人在那个空间只待很短的时间，对整个系统影响也会非常大。

What we have not explored yet is how the spatial structure of the city of Bath affects the pattern

of the network where who are co-present and who are not co-present at a time. I can imagine that this will be possible. I can imagine that in the city of Bath you might get one thing, but at the city of New York or Beijing or Shanghai, you may get different statistics in this network of possibilities. That is a marriage between the big data from Bluetooth with the measurements in spatial syntax, but it is also moving towards the question that you asked about time resolution. It could help analyse the next epidemic. But that is not the only question. You could start to ask: "if I want to design a city to reduce the chance of epidemics, what are the other things I can do for the spatial design that will change the propagation?" But this is very likely to have a direct impact on productive conversation between people because there is real information transmitted between people. So you could have a city that is designed to restrict the bird flu transmission which will restrict the economy of new ideas. It could demonstrate that you cannot win. So I see that the new data environment and related approaches will not kill or threaten the existing models, but allow these theories to be expanded to do completely new things. So, I am very positive, and there is no such thing as a bad piece of evidence. It can only help change a theory. Existing theories will change, and it is not the end of these theories, but the beginning of the next phase.

我们当时并没有探索巴斯城的空间结构如何影响不同时间的人们的联系网络。我可以想象在巴斯可能是一种情况，在纽约、北京和上海也许又是其他情况。我们可以将基于蓝牙大数据的分析与空间句法分析结合起来，但是也许也会涉及你之前提到的时间精度的问题。理解空间对传播的影响应该会帮助进一步的流行病学分析。但这不仅仅是问题，也是一种解决方案，即回应城市空间设计将如何帮助减少传染病的相关疫情，以及改变它的影响范围。但是这也意味着人们之间建设性的互动可能因此而受到影响。因为在流行病传播的同时人们也在交换着真实有用的信息。因此，一个空间设计有可能阻止或减缓禽流感的传播，但同时也限制了有关经济的新思想。这说明，要让一个空间设计得成功绝非易事，也并不是有了数据就能轻易办到的。所以，我认为新的数据环境和方法并不会危及现有的理论、方法及模型，反而会提供更多可能性去扩展并形成新的理论。对此我是很乐观的，现有理论会因为新的数据环境及研究方法等而演变，从而找到下一阶段发展的新起点。

## 08 The social meanings of the bias 数据偏差对于社会的意义

YS: It is recognised that over-emphasis on some groups of people in current urban big data, might lead to the segregation in modern society. Do you think this would be a problem for the so-called quantitative urban design?

城市大数据被认为过度强调某些特定人群，盲目地使用这种数据有可能导致当代社会的隔离被加剧。您认为这会对所谓的定量城市设计带来影响吗？

AP: I think this will change in ten years. My perception is that it is an age generation thing, and it is not the natural disadvantage of urban big data. And I think there is the huge significance of using urban big data for understanding the inherent social segregation of the society. This should not be a problem, but an opportunity for urban design.

我认为城市大数据有偏差的特性在未来十年内应该会得到改善。我认为这与年龄层有关，实际上并非城市大数据所固有的缺陷。同时我认为当前通过研究数据的偏差来理解城市的隔离有重大意义。这对城市设计来说并不构成问题，反而是个机会。

I have tried to predict the nature of migration which is about how new migrants move from their region to a city. Their social support network will be from their original areas. After the first villager finds somewhere to live in the city, the next villagers will contact this person who will help them to find places to live and work. There is related to the question that how those networks are developed and whether they can continuously stay inwards. So the core question here focuses on how people who come from one region to another and how they expand their local network in their new home. This process will depend on the nature of employment and economy that embeds them in society. If their jobs are in a big factory, that is one situation. There will be a different effect if a person becomes a street trader. If many people become street traders, I would expect that their embedding in local society will be much more diverse than the local society that they can have in a factory. This is an interesting phenomenon.

我曾试图预测移民的自然规律，特别是关于新移民是如何从故乡进入一个城市。他们的社会网络与他们的故乡息息相关。当第一个村民进入城市并且生存居住下来，接下来老乡便可能联系这个人，

并从其处获得帮助，找到居住和工作的地方。那么有个问题便应运而生：他们原来的社会网络在新的城市是如何发展演变并最终在新的城市保存下来的？这关乎这些来自于同一个地区的新移民是如何在新的城市环境中扩展他们的局部社会网络。这个过程与就业发展的情况及社会经济的运行情况有关。一个在工厂内就业的新移民和一个在街上当商贩的新移民的社会网络将大有不同，后者应该拥有更广泛和多样的社会网络构成。

Something that is also interesting is the issue of the digital device. The mobile phone has been a very important innovation. And mobile phone is more important for poor people than for the rich people. The poor people need the mobile phones to give them accesses to the information and the networks that they have never obtained before. So the mobile phone transforms them. I expect that the helpfulness of digital devices could be found in the analysis of urban big data.

另一个相关的事情是关于电子通讯设备的。手机是一项重要的科技创新。它对于穷人而言也许更加重要。穷人需要通过手机获得更多资讯及接入更广泛的社会网络，而这是他们在手机出现之前很难获得的。因此，手机正在改变他们。我期待电子通讯设备的意义可以在城市大数据分析中有更多体现。

I strongly believe that all the implications of digital devices have not actually yet taken place. There was a theory that suggested that only the rich want to have them. In fact, if we look this country, the poor invest in mobile phones, even the poor kids living on the street own one. So I think it is an integrating process. What urban big data illustrates is how digital sensors will work in people's hands, but the key part is that they can give you global access to information. The access to information is something which previously the poorer people are always segregated from spatially, and only the rich could afford the cost of the city centre location having the global access. Therefore, I think, the digitalisation of modern society is an interesting angle to rethink urban design about how it can be appropriately applied to reduce the pressure of social segregation. That is to say, the bias of urban big data is not an actual problem, but an opportunity for designers and planners to uncover the impact of mobile technology on social patterns and social integration.

我坚定地相信电子通讯设备的潜在影响还未发生。曾有一个理论认为只有富人才会想要拥有手机。事实上，在英国，穷人几乎都会投资手机，即便是街头的穷孩子也几乎人手一台。因此，我觉得这是一个联系与整合的过程。城市大数据可以描绘人们手中电子感知器如何工作，但更为重要的是，他们由此有了全面获取信息的机会。而在通讯技术发展之前，穷人总是被空间性地隔离，但只有富人才买得起最好的区位而获得最好的空间和信息可达性。所以说，当代社会的数字化是一个重申城市设计的有趣视角，需要思考如何发展数字社会来降低社会隔离。也就是说，城市大数据的偏差实际上并不是一个问题，对于设计师和规划者而言，这也许是一个契机来理解当代通信技术对于社会形态及社会整合的影响。

## 09 Education for the new generation of urban designers 如何教育下一代城市设计师？

YS: You have organised many events to reclaim the importance of data in design practice and the architectural education. Based on your experience about researching and teaching, to what extent will the quantitative logics and methods, or let us say, the skills of quantitative reasoning and data literacy be the critical

AP: I think the Masters of Architecture (MArch) is an interesting object in Bartlett School of Architecture (BSA), I will use it as an initial example. Students gain their professional qualification after obtaining their degree. However, the MArch is not constrained by a professional body. This is good, because it allows people to think very new thoughts about design. They do a lot of work at the moment on the fabrication of material form by using robots. Using robots allows them to program a robotic arm to go to any points in a 3D model in a given sequence. They will learn to write the scripts to use an Arduino board to control the heating and shaping of the plastic. And then, they also learn the electronic and mechanical engineering, the programming of the Arduino board and the manoeuvring of the robots. Besides this, they start to understand some material science of the way in which the plastic melts, extrudes and sticks together. Then, they will apply all of these to design something. So what we are doing now is educating designers in material

parts in the education for the urban designers in the next generation?

您曾牵头举办过多次与城市大数据相关的学术活动，并强调数据在城市设计教育与实践过程中十分重要。基于您在相关领域的研究与教学经验，您认为定量分析的相关能力是否是下一代城市设计师的教育重点？

science, mechanical engineering, electronic engineering, robotic programming and algorithms. Drawing is also very important. We use drawing in architecture to help the mind to think. The purpose of the sketch is for externalising an idea in your head into a form that you can criticise. You draw again if you think something is not quite right. As you sketch, you change the way you think as an externalisation process. So the hand co-ordination in the drawing is a very important technique in architectural design for thinking creatively. But now we add algorithms, material science, and electronic engineering into it. It does not mean that the people we generate here will go off and work in the architectural factories with robots. They will design buildings that exploit the possibilities produced by new materials, electronics, mechanical engineering and the robotic techniques.

巴特雷特建筑的硕士课程有一个有趣的设置，我先用它作一个例子。学生在课程结束后，可以免试获得RIBA颁发的专业资格，因此不再受到执照相关教学的影响，能够专注于探索设计中的新想法。他们最近做了大量工作，尝试运用机器人来探索新的材料形式。使用机器人，就得学习如何通过程序控制机器人摇臂来精准地制作3D模型，还需要学习用Arduino面板写脚本来控制工程塑料的加热及塑形。此外，他们还需要理解材料科学，以方便理解塑料的溶解、挤压及粘合过程。这些技巧最终被集中运用在设计过程里。因此，我们实际上从材料科学、机械工程、电子工程、机器人编程及算法层面培养设计师。当然，绘图也一样重要。绘图是一种将想法外化的过程，同时也提供了一种便于批评沟通的形式。一旦发现不对便可以马上更改。在绘图过程中的手脑合一一是建筑设计中创新的重要技巧。不过我们现在又加入了算法、材料科学、电子工程等知识。这并不意味着巴特雷特的学生将去建筑工厂工作，我们是在培养他们通过材料、电子机械及机器人技术来进一步探索建筑设计新的可能性。

Though this is an architectural program, I believe there will be a similar issues come through in our urban design programs which are about designing on scales that are obviously much larger than the building level. These are a different thing. They require quantitative approaches, e.g., big data, smart city, space syntax, social media data and these sorts of things. And what we are doing is generating new ways of thinking about these data with the aim of creating new cities, urban forms, new forms of society and economy. Now the people who in the units like Claudia Pasquero (Claudia Pasquero is the teaching fellow and the director of Urban Morphogenesis Lab in BSA), she is running her unit in an urban design program in which urban form is considered through various computational approaches. This is very cutting edge. But it is not easy, and it does not always produce things that are recognisable enough as the observed urban forms yet. It is a new program in BSA, and they are finding the routes to education. They educate the students who have the ability to work with the quantitative data, urban big data in particular, and maintain the skills to do programming and scripting aiming to explore the related design issues. The methods of quantitative thinking might also be able to be translated into design in this course. This is one direction.

虽然这是一个建筑设计硕士课程，但是我想城市设计课程也具有共同之处，虽然它们在尺度上有些区别，但是涉及的培养议题却是类似的。城市设计课程需要定量方法、大数据、智慧城市、空间句法、社交媒体分析等等。我们正在尝试利用这些新的数据来启发新的想法来设计新的城市、新的空间形式，以及新的社会经济结构。在城市形态实验室，我们正在尝试设立新的城市设计硕士课程，以探索使用多种定量算法来理解城市形态。这是非常前沿的，但是这样的探索并不容易，因为并没有生成传统意义上直接可理解的城市形态。这是我们的新课程，他们正在探索最合适的教育方法。他们将招收一些具有定量分析背景，以及具备编程能力来探索设计议题的学生。这样，定量思维便能转化成设计成果。这也是一个方向。

I have another direction to travel, which is about the collective intelligence in a design process. Architects at the moment are trained as individual artists. There was a famous film called *The Fountainhead* in which the great inspiration of an individual was appreciated. Buildings, however, are designed by a team of people. We do not educate the architects to work in teams, so one thing that I am particularly interested in is team creativity. We just started some new programs in which we organise the students to work collaboratively and creatively in a team. The thing that attracts my attention here is making students learn from other creative fields, which are highly collaborative,

such as modern dance or jazz music performance in which people improvise dramatically. This is what we can inject into the way in which we educate architects as ‘performers’ so that they can collaborate together in real-time. I think urban big data can make this more possible than before. Related approaches could include the real-time simulation as well as creative collaboration. Current urban systems with data support have various subsystems representing transport, water, lighting, etc., and all these different specialisms should be incorporated to create the form.

我还有另一个正在探索的方向，它与设计中的集体智慧有关。一直以来，建筑师被按照独立的艺术家在培养。曾有一部著名的电影叫作《源泉》，歌颂那些巨匠所带来的启发。但是事实上，建筑是由一群人设计的。虽然认识到了这一点，我们却没有真正地培养这些未来的建筑师在团队里工作。因此，我现在对团队的创造性特别感兴趣。我们刚刚开设了一个新的硕士课程，课上我们组织大家在一个团队中有创造性地通力合作。我注意到，这门课很重视让学生向许多其他极具合作性的创意领域学习，比如现代舞或爵士乐表演，都长于即兴表演。这是我们正在探索的如何像培养“表演者”那样培养建筑师，并使得他们可以实时合作。我想城市大数据正在让这个构想更加可行。我们所谈到的实时模拟、算法等等都可以帮助建立这种合作模式。不同城市子系统的数据支持，如交通、水、照明等都将统合起来进而影响形式的创造。

## 10 Current Chinese urbanisation 当今中国的城市化

YS: The Chinese government has an ambitious plan called ‘the new urbanisation’. To what extent, do you think, using urban big data could help to secure the success of this plan?

中国政府制定了雄心勃勃的《国家新型城镇化规划》。在您看来，城市大数据在多大程度上能够帮助协助巩固这一计划的顺利实施？

AP: For me, the really important thing is what this plan will mean to the urban economy and employment. I heard that there were stories of the new towns built without residents in China. I understand that they are not inhabited because there are many residential blocks without the employment supply. Urban big data can be helpful to address this issue.

从我个人的角度来看，首要的是这一计划对于中国的城市经济及就业到底意味着什么。我曾听闻中国有许多新城建成后并没有居民而沦为“鬼城”。我认为之所以没人去住，是因为这些居住区没有相应的就业岗位供给。城市大数据在这一议题上可以发挥作用。

China is considered to be very good at allocating people because you can set up your factories here and there. By using the top-down planning, the Chinese system is also top-down. And then you can organise the employment to go where the people will be. From that point of view, the related urban big data should be very important, because knowing where the people are is part of the mechanism to regulate and have the feedback.

中国一直被认为很擅长于人口统筹。早年你们可以在不同的地方规划工厂并安排人口。通过自上而下的规划及自上而下的管治体系，你们可以使就业和居住相结合。从这点上看，相关的城市大数据分析变得尤为重要，因为提前了解人们的分布情况应该是规划机制的一部分，能够帮助建立起规划的调节和反馈机制。

There is always a risk for making such a big plan. Robbie Burns, a Scottish poet said, “*The best laid schemes o’ mice an’ men / Gang aft a-gley*”. It means that even the best laid plans often go wrong. So you have to be careful and practical, and to recognise the extent to which your plan would be likely to go wrong. This is why you actually need the theories rather than the big data. What you really need is a theoretical understanding of the nature of migration and how it drives the urban economy in order to make it happen. So you cannot just say that it will happen, because the plan should be made with the consideration of human psychology and economics, and the market will be outside your control. Making sure that the theory works is the precondition of making urban data work in this big plan.

制定这样的大规划是有一定风险的。苏格兰诗人Robbie Burns在其著名的诗作《致老鼠》中曾说：“即时最如意的安排设计，结局也往往会出其不意”。这说明再好的规划也可能潜藏着失败的

风险。因此，你们应该更加谨慎及务实地发现这样的规划可能出现错误。从这个角度看，我认为这也是为什么你们实际上更需要理论，而不只是大数据。中国真正需要的，在我看来，是对于人口流动自然规律的理论化总结，以及认识人口流动对规划的影响，以便提高规划效应。在表明规划目标能够实现之前，应该从考虑人们的心理因素及经济发展规律入手，并充分释放市场的调节机制。确保理论的可行性是让数据在这样的大规划中真正发挥其作用的前提。✍

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