Beijing City Lab

Liu L, Long Y, 2013, The interview with Michael Batty on applied urban modeling. Beijing City Lab. Working paper # 22

I=Interviewer
B=Mike Batty

I: Your new book is titled as the "new" science of cities. Which "old" science is it compared with? Can we put it this way, that the academia has made a substantial amount of achievements in urban complexity and network research to give impetus to a "new science"?
您的新书题为"城市'新'科学"，这个"新"科学是与什么"旧"科学相对应的？我们是否可以这样认为，学术界在城市复杂性研究方面已经取得了相当多的成果，以催生一门"新"的科学？

B: It's a good question. One thing which I say in the book is that there is not just one new science. There are many new sciences of the city. And the reason why I call it "the new science" is because many of the techniques and tools are relatively new, compared to the older science. The older science was related to urban economics, social physics, central place theory, transportation-type theory, etc. In other words, the old science was what was loosely called "regional science". And it was based on much more static and cross-sectional view of cities, which takes city as a system; while the newer science is based on the idea of evolving cities and complexity theory. To some extent, a way of talking about the new science is to say all of the new tools and techniques, which have come over the last twenty to twenty-five years, are related to complexity theory. So there are many different dimensions in which we can characterize the new science, such as disaggregation, bottom-up thinking, and evolution and so on.
这是一个好问题。我在书中也提到，并非只存在一门关于城市的新科学，而是存在多门这样的科学。我称其为"新科学"的原因在于，这门科学所使用的技术和工具是相对较新的。"老"的城市科学是指城市经济学、社会物理学、中心地理论，以及与交通相关的理论等。换句话说，"老"的城市科学可被粗略的称为"区域科学"，它更多的是基于静态的、截面的、系统论的视角。而新科学则是基于演进的、复杂科学的视角。从某种意义上说，我们可以这样描述这门新科学——利用了过去 20 至 25 年内发展出来的新技术和新工具，基于复杂性理论的城市科学。其实，我们可以从许多不同角度来定义"新科学"，比如离散性、"自下而上"的思想、演进的视角等。

The answer to the second question is "yes". The urban complexity theory, network science are two main areas that have pushed into the new ways of looking at the city. I think one of the key things is the idea of networks and flows. It is really changing the emphasis on location. It is not that location is not important, of course it is important, but networks and flows are particularly important in this particular new science, and also the dynamics of change.
第二个问题的答案是肯定的。城市复杂性理论和网络科学是主要两个研究城市的新视角。特别是"网络"和"流动"的思想尤为关键，这一思想正在改变城市科学对于"区位"的强调。"区位"并非不重要，它的确很重要，但在这门新科学中"网络"、"流动"以及"动态变化"更为重要。

I: You highlighted flows, interaction and network. Generally what CASA has done and meanwhile is expecting to do in this new science highlighted field?
您在新书中强调了"流动"、"互动"、"网络"这几个概念，您能否介绍一下您所领导的 UCL 大学高级空间分析中心（CASA）在这一"新科学"的重点领域做了哪些工作，并将展开哪些研究？

B: We group in CASA are exploring a lot of interesting ideas and methods which relate to, on the one hand, the morphology of cities, the shape and size of cities, and also the idea of connectivity in cities, the network. Those two things are important to us. We are also quite interested in scaling in city size. Another part of CASA, which I have less to do with but is consistent with our general approach, is what Alan Wilson is doing with dynamics, sort of short-term dynamics where you have bifurcations and perturbations. So you have static models of the city, which could be put into a dynamic framework and then generate rapid change, such as emergent things like shopping centers. These models represent more of the old science, but the dynamics of them represent more of the new science.

CASA 中我所带领的研究组在城市形态和城市网络方面提出了很多有趣的想法和研究方法，比如城市规模的测度。由 Alan Wilson 教授领导的另一个研究组开展了许多城市动态演变方面的研究，比如受到扰动后的短期动态变化。因此，CASA 既研究城市静态模型，也可将这些模型置于城市动态演变的研究框架内模拟城市短期变迁，比如购物中心的出现等。这些模型是分散的、片段式的。它们更偏向于“老”的城市科学，但它们的动态性使它们具备了一定的“新科学”色彩。

I: From AUM (Applied Urban Modelling) conferences held in the previous several years, there were two model groups, one the top-down macro models like MEPLAN and the other bottom-up micro models like UrbanSim. Would it be more appropriate to combine the both types in one integration? Say, the macro model is responsible for estimating zonal scale simulation results, which are further used by micro model to “allocate” them in a bottom-up means.

从过去几年中召开的“应用型城市模型会议”中可以看到，目前存在两大类城市模型，一类是 MEPLAN 等“自上而下”的宏观模型，一类是 UrbanSim 等“自下而上”的微观模型，我们是否有可能在建模中将这二者相结合呢？比如，将宏观模型用于生成区块尺度的模拟结果，将微观模型用于“分配”上述结果。

B: In some senses, most of the models in the applied models conference come from the “top-down”, even UrbanSim. But as these models got more detailed, they moved into disaggregation. So you can see in the development of urban modelling that people began fifty years ago with aggregate models, and then began to disaggregate populations and introduce a little bit of dynamics into these static models. And then in parallel with these models, there is a new view of transportation behavior which is reflected in economics in discrete choice models, or so-called disaggregate demand models. And from those comes the idea of highly-disaggregate agent-based models of the transportation systems, where individual travelers are modeled individually in this sense. So the trend is the breaking-down of populations which perhaps in some of the regional models like MEPLAN have been in zones of 3000-4000 households. So there is a consistent line of development from top-down to bottom-up. For example, the UrbanSim models were a little bit more aggregate twenty years ago when Paul Waddell began those models. In the transportation domain you get this disaggregation of models from aggregate trip distribution into travel demand models and then into household activity models, where individual activity patterns are modelled. For example, the TRANSIMS and MATSim models are transport models that model individual’s trip-making decisions during the day. And those models

are truly agent-based and bottom-up. Now most of models in the applied models' field tend to interface with the transport models. In other words, the transport models used to be built inside of the aggregate models, but no longer are they built so. For example, the UrbanSim model interfaces with a transport model. It could be any kind of transport model as long as it generates trips. And the Marcial Echenique models, the original MEPLAN models, did the same except that the transport models were built by MEPLAN as well, but the travel demand has been separated out to some extent in these models.
从某种意义上讲，绝大多数应用型城市模型都是"自上而下"的，UrbanSim 模型也是如此。但是，随着这些模型的细化，它们开始逐渐解体。从城市模型的发展历程中也可以看到，50 年前，人们最早构建的城市模型是集聚模型（aggregate model），此后，人们开始将模型中的人口进行细分，并在静态模型中引入动态成分。与此同时，交通行为研究也从经济学中引入了离散选择模型（discrete choice model），或称为分解需求模型（disaggregate demand model），从中又产生了高度分解的多主体模型（agent-based model），在这类模型中每个出行者都被单独模拟，而 MEPLAN 模型等区域模型则可能是将 3000 至 4000 个家庭作为一个整体进行模拟。所以说，城市模型的发展趋势在于不断细分人口，由"自上而下"向"自下而上"发展，比如，20 年前当 Paul Waddell 创建 UrbanSim 系列模型时，它们比现在要更加"集聚"。交通模型的发展历程也呈现出相似的分解趋势——从总体出行分布（aggregate trip distribution）到出行需求模型（travel demand model）再到如今的家庭活动模型（household activity model），后者是对每个个体的活动模式进行模拟。例如，TRANSIMS 模型、MATSim 模型都是对个体在一天中的出行决策进行模拟，属于"自下而上"的多主体模型。

Now there is another cluster of models, which emerged not from this particular tradition, but from GIS. They are land development models, for example SLEUTH model, which are more micro. These models are again quite different in some senses that they don't deal with transportation behavior and they mainly deal with land development. They are not as widely applied in practice. There are some of them like Metronamica, the Dutch one, which do interface with travel demand models, etc. And there is the general cluster of agent-based models, of which there are not many that have been developed specifically for urban systems.
现今还存在一类模型，它们并非以上述方式演化而来，而是起源于地理信息系统（GIS）。它们是基于微观的土地发展模型（land development model），比如 SLEUTH 模型。这类模型与上述模型有很大不同，它们并不模拟交通行为，而是主要针对于土地发展，其中也有部分模型如荷兰的 Metronamica 模型是与交通需求模型等交通模型相交互。但这类模型的实际应用并不广泛。此外，还存在一类广义的多主体模型，但其中专门为城市系统开发的模型尚不多。

There are one or two which don't really take the applied urban modelling view point. They don't really rely on that. They are built quite separately from the bottom-up perspective, although they do tend to have aspects in them that are similar in part to the various aggregate and disaggregate models like MEPLAN. Examples of these models are not easy to specify. There are some examples in Tokyo. They tend not to have recognizable names or acronyms like MEPLAN or SLEUTH. They are just one-off. Models like MEPLAN, SLEUTH, Metronamica, or UrbanSim have probably been applied in several places. These are based on more widely used model software packages, but there are quite a lot of models out there which are just one-off. So they are more difficult to characterize, to classify. You can see that they have got bits of different models in them. There are quite a lot of those models around.

还有少数模型并不能被完全归类于应用型城市模型。虽然它们与各种集聚模型和分解模型在某些方面也具有一定相似之处，但它们的建模方式是相对独立的，包含对多种模型的不同部分的融合。这类模型并不容易举例，在东京有一些这样的模型。这类模型一般没有 MEPLAN、SLEUTH 这样具体明确的名称，且往往是一次性的，而不像 MEPLAN、SLEUTH、Metronamica、UrbanSim 等“软件包”式的模型在多个地区都有应用，因此它们更难于描述与分类。

I: Is the relationship between macro and micro models an evolution of model types, or they will be integrated in the future?
那么，宏观模型与微观模型之间是一种演进关系，还是在将来可能被结合？

B: I think we are in a situation that it is quite possible to build integrated models as you suggest which have aggregate and disaggregate, or macro and micro features in them. Increasingly I think that model building has moved to a situation where you can develop particular aspects of models for particular problems. So we are moving to a situation where you can take little bits of models. My book represents a series of tools that you can use in relation to building a model. There are different things in these models that can be packaged in different ways for different sorts of problems. So rather than integrate macro and micro, the best features of each can be taken out and applied to specific problems. Many models are general models that are applied to a variety of different situations. But increasingly I think models are being adapted to particular situations.
我认为目前我们很有可能构建出如你所建议的兼具集聚与分解、宏观与微观特征的模型。同时，我愈加认为城市建模发展到了一个为特定问题建立专用模型的阶段，专用模型可以从多个模型中截取片段并加以组合。我的新书中展示了一系列可以用于建模的工具，这些模型工具的不同部分可以用不同方式加以“打包”，以应对不同问题。所以说，不仅是要将宏观与微观相结合，还应将不同模型中对特定问题最有用的部分相结合。

I: So, more problem-oriented?
所以说，城市模型应当更加以问题为导向？

B: Absolutely. Japan is just one instance. There are models also in Europe and North America which don’t quite fit the category of aggregate or disaggregate like MEPLAN, TRANUS, DELTA, and the Alex Anas) models. And there are those that don’t fit the UrbanSim and system dynamics model after Forester, such as MARS developed in Austria. They develop their own software and they pull bits out of each.
完全正确。除了日本，欧洲和北美也有一些模型并不属于任何一类模型——既不属于 MEPLAN、TRANUS 等集聚模型或分解模型，也不属于 UrbanSim 系列模型，以及 MARS 等系统动力学模型。它们有自己的软件，同时是不同模型要素的结合。

I: Do you think we are still going to produce those comprehensive and transferable models, or we will do more problem-oriented jobs?
那您认为我们将继续构建综合性的、普适的模型，还是将工作重心置于“问题导向型”模型？

B: We will do both I think. The field is still expanding a bit. There was a slow expansion from quite a lot of modeling in the 1960s and 1970s, and then a more low level involvement for a number of years, and then a pick-up again in the 1990s. I think there is more expansion on all fronts going

on. These things are not massively dramatic, but are gradually being extended. So I think we will see both a continuation of the reasonably big comprehensive models and new individual models which are problem-oriented. And you will see some of the aggregate models are tuned to be problem-oriented as well.
我认为二者不可偏废，城市模拟的研究领域仍在扩展。在 20 世纪 60 至 70 年代，大量的城市模拟研究促进了领域的扩展，此后沉寂了若干年，在 90 年代又再次回升。如今，相关研究在各条“战线”都在扩展。这种扩展并不是急剧，而是渐进的。因此，我认为我们既可以看到大型综合性模型开发的延续，也将看到更多“问题导向型”模型，同时，一些集聚模型也将向更加“问题导向”的方向发展。

I: The golden age for quantitatively understanding cities in 1960 to 1970 was then damped by social theory and Marxist approaches. A main reason for this is not well addressing planning problems and lack of practical applications. Now we seem to have entered another golden age, what could we do to avoid the previous problem and do better this time around?
上世纪 60 年代到 70 年代是城市定量研究的黄金时期，但不幸被社会学理论和新马克思主义城市理论所打击。发生这一现象的主要原因在于当时的研究没有很好的与规划问题相结合且缺少实际应用。在当前这一新的黄金时期，我们应如何避免类似的问题并做得更好？

B: There is no question that there is a new interest in these things, which is also coinciding with the interest in the smart cities, big data and all these kinds of stuff, which are not quite the same as modeling. In some senses, the difference this time is that in the 1960s, particularly in the US, a lot of ideas were transplanted really from system analysis and system development, which were being developed in the military and defense related aspects, to municipality governments. It wasn't easy to get the transition right. Often the techniques and the tools were not well adapted. There were problems of data, problems of computation, and problems of financing and funding, etc. And also the cultural difficulties were not making these models work and they were not well used by planners and policy makers, who didn't have any real sort of feel for these approaches. So, to some extent, there was reaction against this style of modeling by, as you say, social theory, political economy, Marxism, and so on. The interest moved away from urban and regional modeling and system approaches to planning in the late 1970s. And it was often said that "the models are part of the problem, not part of the solution". In some senses, the issue was that the models themselves contained within them various things that planners and policy makers wanted to change. It was the structure of things.
毋庸置疑，人们对城市定量研究正在产生新的兴趣，同时被人们所关注的课题还有智慧城市、大数据等——它们与城市模拟并不尽相同。从某种意义上说，本次城市定量研究的热潮与上次的不同之处在于，在上世纪 60 年代，特别是在美国，许多系统分析与系统发展的思想是从军事领域移植而来。在不同领域间进行这种移植并非易事，相关的技术和工具通常并不能被很好的转换以适应新的需要，出现的问题包括数据问题、运算问题、财务和资金问题，等等。“文化”问题也阻碍了这些模型在规划师和决策者中的应用——他们对这类方法无动于衷。所以，从某种意义上讲，当时人们借助社会学理论、政治经济学理论、新马克思主义城市理论等反对城市模拟。于是，到上世纪 70 年代末，对城市和区域模拟以及系统性规划的兴趣便消失了，甚至有人称“城市模型本身就是问题，而非解决方法”。从某种意义上讲，出现这种说法的原因在于，城市模型中存在一些规划师和决策者希望改变的东西，这是一个结构性问题。

But at the same time in parallel what began to grow was GIS, sort of because computers were being down-sized, miniaturized, and made much more available. And it was only in the 1990s, perhaps even more recent than that in the 2000s, that we got in a situation where data was much less of a problem, computational power was no longer a major issue in term of these models. You can say that all of these things are coming together, are giving a new impetus to modeling. And at the same time, there is the idea of putting computers into cities in different ways and generating new data from the methods. So this is also coinciding with this renewed interest in modeling.
但与此同时，随着计算机的小型化与普及，GIS 也在不断发展。到上世纪 90 年代，也许是更晚至 21 世纪初，我们真正进入了一个数据可获得性与计算机计算能力不再是主要问题的时期。在上述因素的共同作用下，城市模拟获得了新的发展动力。同时，大数据思想（将计算机以各种方式整合入城市生活并从中产生新数据）的出现也与人们对城市模拟的新一轮兴趣不谋而合。

The smart-city movement is running in parallel to this interest in modeling. Smart cities and urban and regional modeling are really quite different in many ways. Urban and regional modeling is just a set of tools and techniques that are used to think about the cities. Maybe there are some aspects of the smart city such as very fine-scale problems of movement and transport, emergency vehicles, police vehicles, very detailed transport system disruptions, and so on. All of these things are what the smart city technologies are designed to improve. So as part of that, some styles of operation and research modeling are being developed in the smart city movement by IBM, CISCO, etc. The urban and regional function within our long standing models is much more related to bigger questions of housing policy, transportation policy, policy which is thinking about what is happening over a longer time span basically. Smart cities are dealing with short time spans, the day basically, or the peak hours, or what is happening over a couple of days or weeks. Whereas urban and regional modeling is about the dynamics over a much larger time span, say six months, five years, or longer.
智慧城市运动也在与城市模拟的新热潮并驾齐驱。但它们在很多方面截然不同，城市和区域模拟只是用于理解城市的一系列方法和工具，这与智慧城市的某些方面有所交叉，比如非常精细尺度的交通与人流移动问题、紧急车辆调度问题、非常具体的交通系统故障问题等——所有这些问题都是智慧城市技术所要改善的。因此，IBM、思科等公司在其智慧城市项目中开发了一些操作性与研究性城市模型。但智慧城市更加关注短期变化，诸如早晚高峰、一天、一周的变化，而城市与区域模拟则关注更长的时间跨度，比如六个月、五年内的住房政策、交通政策等。

What could be done to avoid the previous problems is a big issue. Because in some instances, this is not a precise science in any sense. It is extremely fuzzy around the edges. And there is a lot of ambiguity. So I think we need to continue learning from the past experience. I hope so we will do better this time around. But you never know.
怎样才能避免此前出现的问题？这是一个重大课题。因为，从某种程度上讲，城市定量研究并非一门准确的科学，它包含大量的模糊性，所以我认为我们应当不断吸取过去的经验教训。希望我们这次将做得更好，但谁也不能保证。

I: Could you explain a bit more about what the "structural problem" of models were in the 1960s to 1970s?
您能否进一步解释一下上世纪 60 至 70 年代城市模型的"结构性问题"？

B: The main issue I think was that the models were predicting the wrong sorts of things such as long term structural change. That was not really what planners and policy makers were interested in. They were particular interested in community renewal and regeneration, housing problems. In that particular context, the models were not very good simulations. The aspects of the city that were most important to policy during those times were not easy to articulate. The housing market is an extremely difficult market to predict. It is much easier to make predictions about the retail market, in terms of the impact of shopping and so on. Perhaps it is easier to make predictions within the commercial context. But the housing market is completely a mixed market of private and public. And the people producing the supply are very different in scale and size from the people who generate the demand, which are individuals. So you have a lot of distortions in those markets, such as the mortgage market. The ability to actually even build in a timely way on the part of the construction industry and the developers is a problem. Those issues I think were thought about in the early models. But the models that were built were not very good at getting to grips with the underlying logic of how those markets work. So that was one of the main issues.
我认为主要问题在于模型是用来"预测"的，这并不是规划师和决策者们所真正感兴趣的，他们所感兴趣的是社区更新、住房问题等。在当时的特定背景下，城市模型所给出的模拟结果并不理想，原因在于城市发展中对政策制定最为关键的领域并不容易建模。比如住房市场就极难预测，与之相比，零售市场则容易预测的多。也就是说，对纯市场环境的预测要更为容易。而住房市场既受到私人部门也受到公共部门的影响，且市场中的供给者和需求者在规模上极不对等，因此在住房市场、抵押贷款市场等此类市场中存在大量扭曲。此外，开发商能否及时调整建设供应本身也是一个问题。我认为城市模型在构建之初是对上述问题有所考虑的，但它们未能很好的把握上述市场的内在逻辑，这是一个主要问题。

Good theory of the city was lacking too. We didn't have a good theoretical basis for building the models. So they didn't perform well. They gave poor results. This was very true in rather narrow areas of application, such as allocation models of urban services. In New York, for example, in the 1970s, there were a variety of models built to look at emergency services, fire police, ambulance, etc. They were predicting how these things would respond. And the predictions they made were essentially wrong and they added to the problems. In other words, you are predicting where these crises, fire and crimes, might break out, so you deploy your fire engines, police etc. to these points. And then when fires do break out or crimes are committed or whatever, they are in the wrong places. Because the models were basically too simplistic.
所以说，其实是城市理论不足以为模型提供坚实的基础，才导致了不佳的模拟结果，在相对狭窄的应用领域尤其如此，比如城市服务设施的分布问题。例如，上世纪 70 年代，纽约构建了一系列针对火警、紧急救护等紧急服务的城市模型，这些模型被用于预测应如何应对突发情况，但它们的预测结果基本上是错误的，反而增加了问题。比如，你通过模型预测了哪里将发生火灾并将消防车部署于此，但实际上火灾并未发生在这些地点而发生在了别处。

The models were not wrong fundamentally, but the problems were too complicated to predict. The process of the actual way the firefighters and the police responded to things was not built into the models. So consequently, it didn't take account of the fact that you had all these changes going on at the local level. There would be local changes which the models couldn't take account of, e.g. fire fighters may not turn up to work. You know that happens in a lot of services in the cities. Trains get cancelled, more because people don't turn up to work rather than there being some problems on the track. My train today got cancelled in King's Cross. A lot of that happens in Britain and in lots of places. To some extent, people would react if they feel that the system was too organized for them. And the models didn't get to the basis of the patterns of crime, fire and emergency services in this particular instance. The actual patterns were very difficult to predict. You didn't quite know where fires were breaking out in certain places. And it wasn't just to do with the fact of buildings, such as that old buildings are very fire-risky and so on, but also behavioral factors, related to gangs, social mix. That is one of the basic things why models are often too simple. These models could be fairly complicated, but they were still too simple for the problems at hand.

其实，模型并没有错，只是面对的问题本身太过复杂。例如，消防员和警察在突发情况下的行为并没有被纳入模型，因此，模型未能考虑很多微观层面的可能性，比如消防员可能会缺勤——很多城市服务都存在这种情况，当人们感到规章制度太过束缚时就会做出自我调整。当然，这种情况在中国可能会少一些。同时，在这个例子中，模型也未能深入犯罪、火灾等突发情况的产生机制，它并不仅与建筑房龄等客观条件相关，还与犯罪行为、社会结构等行为因素相关。这就是为什么说城市模型太过简单的原因之一——这些模型本身可能已相当复杂，但与其面临的问题相比仍然简单。

I: So we can put these problems as uncertainty problems?

我们是否可以说这是不确定性问题？

B: Absolutely. Uncertainty, and the lack of information about what the underlying behavioral patterns are for the agents who we are trying to model. Because often the agents might appear to act rationally. But in fact they are probably acting rationally in a much more complex framework that we weren't able to take account for in the model.

完全正确，同时我们也缺乏模型"主体"行为模式的相关信息。模型"主体"可能看起来是理性的，但实际上他们的理性行为可能依循比模型更为复杂的逻辑框架。

I: Are we going to be able to take account of uncertainty in the future?

那么，将来我们会否有能力在城市模型中纳入不确定性？

B: It is extremely difficult. It is a good question. We need to think about how we enable our models to deal with this uncertainty in some way. And probably this means we need to carry out things that we know about. We have not carried out much sensitivity testing of these models, and there is also the possibility to build different models on the same problem instead of just one model. That is to apply several models from slightly different perspectives and to look at the range of results. So we just need a bigger arsenal of tools being employed from different perspectives on these things. That sounds very expensive, although as these models get easier to build and they would get better. And it is possible we might be able to do more along those lines.

There are quite a lot of suggestions in the literatures over the years that we need to build more than one model. That happens for the national economy. The economic structure of a country is modelled using several different econometric models. And they have a kind of basket of results, which they discuss. And I think that certainly in the US and here, and I guess even presumably in China too, there are several different econometric models that are used to look at big economic issues on a month by month basis. And they are all producing slightly different results. So the people that are making policies have a view about the differences between the results in some sense. But that has never been carried out at all in cities.
这是一个好问题。这非常困难。我们需要考虑可以通过何种方式处理不确定性，这很可能是某种已知的方法。我们还没有开展很多模型敏感性测试，这是指针对同一问题从不同角度构建多个模型并观察其模拟结果，近些年有很多文章都提出了这一建议。因此，我们需要一个更大的“工具库”，使我们可以在分析问题使采用多重视角。虽然建模难度在降低，模型模拟能力也在提高，但这样做仍将花费不菲。这一思路来自于宏观经济领域——经济学家采用多个不同的计量模型来模拟一个国家的经济体系，然后对生成的不同结果进行选择与讨论，因此决策者也可以了解到模拟结果之间的差异。这种工作还未在城市研究中开展。

I: As you mentioned in our previous seminar, cities are becoming more complex so fast that it poses a major challenge for urban simulation. How do you think can we tackle with this challenge? To develop models in small pieces, and on different levels of sophistication, or other approaches?
您在此前的研讨会上曾经提到，城市模拟面临的一项主要挑战是城市的复杂性正在快速提高，您认为我们应如何应对这项挑战？是构建针对特定问题或领域的“小”模型，还是构建一系列不同复杂度的模型，还是其他途径？

B: That is a very good question. The cities are becoming more complex, faster than our ability to keep up with them. I think we can tackle this certainly, and we are tackling it. And there is the move to get better and better data, the move to actually develop different sorts of models of the system. Models by their very nature are simple and they have to be. That is the definition of a model. They have to be relatively simple and pick out certain aspects, which are important to the complexity. So if things are getting more complex, there might be more aspects to pick out, to embody in one or more models. So that is clearly an issue.
这是个很好的问题。我认为我们可以解决这个问题，而且我们已经正在解决，我们正在通过各种方式提高数据质量，也正在扩展模型的种类。模型的本质是追求简单的，它们必须如此，因为这正是模型的定义。所以，如果模拟对象变得更加复杂，模型可能就需要将模拟对象划分为更多方面。

Developing models in small pieces, yes. I think that is a reasonably good strategy. That is in line with what I was saying earlier in that some of the newer models are from a problem perspective and are picking the best and the most appropriate from these other main-style models. And building them at different levels of sophistication, yes. I think all of those things are things that need to be done in terms of dealing with complexity.
开发“小”模型和不同复杂度的模型是相当好的策略。我认为这些都是应对日益提高的复杂性所需的工作。

The other issue, of course, is that our ability to predict is under extreme scrutiny. It is under a lot of attention. It is quite clear we sort of know that we can't predict the future, but we are trying to predict conditionally. And this I think is something that we've yet to get to grips with what prediction means in social systems. We are learning a lot at the present time about predictability. And I think there are some other things happening too. We are getting more opportunities to experiment in cities, in limited kinds of ways, because things can be done in a very short term and make an impact and can see how population respond. So I think there are some new opportunities being posed by information technology in this, through the idea that we have access to various kinds of information and information devices that enable us to respond quickly to different stimulus. And from this we should be able to learn quickly. In other words, we could figure out if something is trending, and figure out what impact this might be having on the population. That is just one simple example. I think there would be many other sorts of examples where limited experimentation can be developed without intruding on the population in any way. And we can try to tie up causes with effects. So I think that is quite an important issue too. Also there is the idea of crowd-sourcing, the idea of producing a new dataset which we did not have before by asking people. I think it is a very important issue. So that is the whole variety of things that can be done to deal with the increasing complexity.

与此相关的另一个问题是，我们在认真审视我们的预测能力——我们很清楚我们并不能预测未来，但我们在尝试进行有条件的预测，我认为这也意味着我们理解了什么是社会系统的预测。此外，我还有了更多在城市中做"实验"的机会，也就是在短时间内、小范围内进行某种改变并观察人群的反应。比如，信息技术就提供了新的机会，人们可以通过各种信息设备获取信息以对外界"刺激"迅速做出反应，由此我们能够快速的"学习"，也就是及时发现新趋势以及新趋势的影响。除此之外，还有很多其他"小范围实验"的例子，这些实验并不会干扰人们的生活。"群众外包"（crowd-sourcing）也是一项重要的新课题，它可以提供传统调研所不能获取的新数据。这都是我们为应对复杂性而应做的工作。

I: Though the academia has made a lot of progress in urban simulation in the past decades and there's a growing number of "clients", like governments, funding bodies, becoming interested in simulation, it has not yet been applied vastly in planning practice. According to our experience in China, it is a complicated process to persuade planners of the relevance and accuracy of the simulated results. There are always a portion of them doubting urban models. Could you comment on the application performance of urban models up to now?

虽然学术界在过去的几十年中在城市模拟领域取得了大量进展，并且有越来越多的地方政府、学术资助机构等"客户"正在对城市模拟产生兴趣，但此类方法仍然还未被大规模应用于规划实践。根据我们在中国的经验，扭转规划师对城市模型的怀疑态度并说服他们接受模拟结果并非易事。您能否评价一下到目前为止城市模型的实际应用情况？

B: Different cultures develop different styles of thinking about these models. So, for example, in the US, there is a much stronger sense of what we call technological optimism. They are more optimistic about technology than there is in, say, Britain. Although that is changing a little bit because of the impact of new technology. So I think that in different places you have different sorts of reactions. In the 1960s and 1970s in the US, there was very strong optimism on the part of policy makers and planners that these tools would be useful in some way. Of course they were found out not to be as useful as people suggested even there. But here, for example, there was

much less optimism that these tools would be useful anyway. So there are many less applications of urban models in Britain than you find in the US. There are probably some that the David Simmonds Consultancy does, some for London, and southeast England; one or two transport consultancies have done some; MEPLAN did do some, and they had a big model of southeast England, which to some extent the DELTA model has taken over from. The company that owns MEPLAN now I think is still working with models, but much less so. Whereas in the US you will find that most big cities would have models of various sorts.
不同文化对待城市模型的态度不同，比如，美国有较为强烈的所谓“技术乐观主义”，他们比英国人对技术的态度更为积极。当然，由于计算机等新技术的影响力持久不衰，英国的情况也有所转变。因此，我认为在不同地区存在着对城市模型的不同反应。上世纪 60 年代到 70 年代，美国的规划师和决策者对这类工具持有非常乐观的期望，认为它们一定在某些方面有所裨益，当然，后来人们发现它们并非如此有用。但是，在英国，人们则不那么乐观，因此城市模型在英国的应用案例显著少于美国。英国的应用案例包括：David Simmonds 咨询公司在伦敦和英国东南部的模型应用，一两家交通咨询公司的模型应用，MEPLAN 模型的应用（现已结束）。相比之下，大多数美国大城市都有其自身的城市发展模型。

I: But UK is the hometown of urban models?
但英国不是城市模型的“故乡”吗？

B: Probably more the US. I think the real home was the University of Pennsylvania (U Penn), which was probably the main one in the 1950s, 1960s and 1970s.
应该说是美国。我认为真正的“故乡”是宾夕法尼亚大学，那里是上世纪 50 至 70 年代城市模型的主要开发地。

I: Not California Urban Future model?

B: Well, that was one. But there was Penn-Jersey transportation study or Penn-Jersey model with Britton Harris. And also Alonso was a PhD student at U Penn. So there was a lot of emphasis in U Penn. And U Penn was called the home of regional science. So in many senses, U Penn and possibly Berkeley to a limited extent. And then to some extent the UK. The UK started a bit later and there were really three or four groups in the UK. We had a group at the University of Reading in the early 1970s. And then by the end of 1970s the biggest groups were here in Cambridge and at Leeds. Leeds and Cambridge were by far the biggest groups. And the Leeds group is still there, but they are much more involved in spatial analysis now, largely because Alan Wilson who was at Leeds moved sideways to other things. The Cambridge group is always quite strong through MEPLAN. And also the David Simmonds Consultancy here and the spin-off TRANUS as well. And there were one or two other places. Liverpool had some emphasis in the work of Ian Masser and Peter batey in the 1960s and 1970s. And that was about it. So there were four or five centers back then. And then it got down to two centers by the 1980s. Then I think the Leeds center changed a little bit. It is still quite quantitative and transport is important at Leeds too. At UCL, there was never a strong quantitative modeling group until we started CASA about nearly twenty years ago. But there were small individuals doing certain things all around the country. There were various people at UCL planning. Allen Scott, for example, was in location allocation modeling within the late 1960s and 1970s. Wilson was involved when he was in CES (Center for

Environmental Studies). So, bits and pieces. And then outside the UK and US, there was CSIRO in Australia. But that disappeared about twenty years ago, but now it is slowly coming back a bit.
宾大的 Britton Harris 曾开发 Penn-Jersey 交通模型。阿隆索也是在宾大取得博士学位。所以当时宾大开展了很多研究，被称为“区域科学的故乡”。英国在城市模拟领域起步略晚，前后主要出现过四五组从事相关研究的人马。70 年代初，雷丁大学曾出现相关研究，到 70 年代末，剑桥大学和利兹大学则成为了研究的主力，至今仍是如此。目前利兹大学的研究组更多侧重于与空间分析相关的工作，主要因为 Alan Wilson 在利兹大学期间转向了这些方向。而剑桥大学的研究组则一直非常擅长 MEPLAN 模型的开发。David Simmonds 咨询公司和利物浦大学也分别发展了 TRANUS 模型和 MUSSA 模型。而到 80 年代，就只有剑桥大学和利兹大学还在从事相关研究了。在 CASA（高级空间分析中心）成立之前，也就是大约 20 年前，在 UCL 并不存在强大的定量分析和城市模型研究团队，但现在 CASA 已经比较壮大。此外，在英国乃至世界各地还有一些学者和组织在做类似工作，比如澳大利亚的 CSR。这些研究在 20 年前曾一度消失，但如今又有所恢复。

And back to the question. You have a strong physical planning orientation in China, which is architecture and urban design orientated. And in this country, and certainly in the US, there was always a much stronger transportation lobby, a transportation planning, engineering kind of emphasis. And that made a big difference in the US and to some extent a big difference here. So there are some quite big transportation groups. We have not really talked about that. But the transportation group at Berkeley in the 1960s was very strong. That led to various models that were built in Berkeley of the San Francisco Bay Area. There were various Lowry-style models and other kinds of econometric models built, but linked to transport. And that continued because the CUF models were developed by John Landis, late in the 1980s or 1990s. And of course Waddell with UrbanSim is now in Berkeley. So that was the timeline of all of this. There is a strong link to transportation here. Big transportation centers such as Imperial College are very strong and there are probably five or six transportation centers. Transportation modeling is stronger than land use modeling in the UK. And I think there is also a lot of strength in Europe as well now, like ETH.
回到你的问题，中国的城市规划有强烈的物质规划倾向，侧重建筑设计与城市设计。而英美两国的情况是，它们拥有强大的交通部门，侧重交通规划和相关的工程设计，这使两国都出现了较大交通研究机构，比如上世纪 60 年代伯克利大学的交通研究组（基于劳利模型和计量模型针对旧金山湾区开发了多个交通模型，80 年代末 John Landis 开发了 CUF 模型）以及帝国理工大学的交通研究中心。在英国，交通模拟较土地利用模拟具有更强的传统，在欧洲大陆也是如此。

Now in terms of the question you asked about applications in planning in Britain there was sort of gradual change from an architectural approach to planning towards more of a social science approach of planning in the 1970s. So most planning schools here don’t do this sort of stuff either, but they don’t do urban design either. They do a lot to do with economic development in cities, such as the development process, the social structures of cities, social welfare. So a lot of planning schools now in Britain are really non-design and non-technical. And that is different again from what is in China. So you get the same sorts of reaction in different countries as in Britain. A lot of planners would not be very comfortable with this sort of models because they really don’t consider that you can actually make predictions of the near future with respect to the issues they consider important. And they think that the world is too complicated, too complex. In

terms of China, I don't know, I imagine that a lot of people who are interested in design and prescription would not be very comfortable with prediction. Because I assume that the design process is informed by these tools. The planning support systems that have emerged here and in the US are such that you have the iteration between some kind of proposal and some kind of prediction of its impact, etc. And that might be a problem. Also there is a basic lack of training, and a lack of exposure to these ideas.
在上世纪 70 年代，英国的城市规划逐渐由偏向建筑学转向偏向社会科学，所以英国的大多数规划院校也并不从事与城市模拟相关的工作，但它们也不做城市设计，而是较多的研究城市的经济和发展问题，比如城市的发展历程、社会结构、社会福利等。因此，当前许多英国规划院校既非“设计”也非“技术”，这与中国的情况有所不同。但你在英国可以发现人们对城市模拟存在着与中国类似的反应——许多规划师并不习惯于使用这些模型，他们认为现实世界过于复杂，并非借助模型即可对未来进行预测。我不了解中国的具体情况，但我猜测很多来自设计背景的规划人员也并不习惯于模型“预测”，因为设计过程将会被这些模型工具所左右——规划支持系统就是一个不断调整方案并预测方案影响的过程。此外，规划人员对城市模拟相关思想了解较少并缺乏相应的训练也是造成这一问题的一项原因。

The only way around this is that the education system should be adapted in some sense. That can take a long time to change. It is very difficult to say that you can do one thing if several things need to happen. And there are certainly some good things in terms of the way planners actually do planning in China compared to here. So the design side is not all bad. It could be useful in some sense. We can probably do it with more design here. So there really is no magic formula for knowing how to deal with this problem.
唯一的解决方式是调整规划教育体系，这需要较长的时间，同时还需要许多其他转变同时发生。我们也不能断然否定中国规划师偏重设计的工作方式，在某些方面它可能好于英国，英国的城市规划也可能需要更多的设计成分。所以说并不存在解决上述问题的灵丹妙药。

I: So the major obstacle lies in education?
所以说，城市模型应用的主要障碍在于规划教育？

B: Education is one thing. But it is also the ability to know how to deal with scientific tools. A lot of scientists and non-scientists believe that science can produce magical answers. And the big difficulty is that the magical answers are unknown. In planning it is particularly acute because the whole notion of planning is to make up the answers. So, to some extent, it is this tension between what we can model in terms of actual behavior, and what we want to change, which is also related to behavior. That's a big tension that education in the broader sense can help with. In the broader sense I think that needs to be thought through by a lot of different people that are involved in planning and prediction. So, education yes, to some extent, but also this is a reflection on what is being done in cities. So it is the wider context. It is about the policy makers as well. Policy makers are probably not very happy about models. It may be because what we need to do is to let cities develop more spontaneously and that conflicts with the role of policy makers. Policy makers are in the business of making policy. They see their rationale for making decisions about the future, to optimize in some sense. I am not saying that one should not optimize, but lots of predictions might tell you what you should not optimize as well as what you should optimize. And that is a difficulty for many policy makers who should do nothing really, rather than

to do something. They ought to do a lot less of something than what they might want to do.
教育是一方面，使用科学工具的能力也是一个重要方面。许多科学家以及非科学家都相信科学可以帮助人们得出奇妙的答案，但困难之处在于，这些答案是未知。而规划更是如此，它的总体理念即是“编”出答案。所以从某种意义上讲，在“我们能模拟什么”和“我们想改变什么”之间存在着一种拉锯，这二者都与人的行为有关。这种拉锯关系可以通过更广义的教育获得改变，但并非仅能如此。我认为很多参与规划和模拟预测工作的不同专业人士都应深入思考这一问题，思考在城市中究竟发生了什么，这是这个问题所处的更广阔的背景。决策者也可能不倾向于使用城市模型，这可能是由于我们的工作在于使城市发展更具自发性，而决策者的工作在于为未来发展做出决定以起到“优化”作用。这并不意味着我们不应去“优化”，但许多模型预测结果可能既告诉人们应该“优化”什么，也告诉人们不应“优化”什么。然而，说服决策者“不去做什么”有时更难于说服他们“去做什么”——他们想做的事情中很多都是不应当做的。

I: But according to my experience, policy makers in China tend to be friendlier with models than planners… Is UCL combining quantitative education in its planning education system, or you are going to do so?
UCL 在规划教育体系中是否纳入了定量分析相关的内容？或者 UCL 计划开展相关工作？

B: The issue is in UCL we have several different groups of people involved in cities, like here in Cambridge. In Bartlett School of Planning we teach them a course in GIS, but that is it. There is no teaching in anything quantitative, or even theoretical in terms of urban theory. So they don't learn about urban economics or anything like that. But in the Bartlett we have a Masters degree, which we have just started and is very orientated towards what we do. We teach modeling in that degree. We are just starting a new Masters next year in smart cities and urban analytics which will have a lot of this sort of stuff in. It will be built on existing Masters degree, which is quite a small course. It is more a kind of feeder course for the PhD, a Masters by Research. So we teach modeling as part of that. Alan Wilson teaches a spatial interaction models and I teach cellular automata and agent-based modeling. So that gives a broad view. Students also have courses in computer visualization, programming, GIS, smart cities, urban theory, etc. So, that would be the nature of the Masters in Smart Cities that we are starting
目前在巴特莱特规划学院我们开设了一门 GIS 课程，是唯一一门“定量”课程。但我们明年即将开设一个新的硕士项目，这个项目的侧重点与我们的研究方向非常接近，将围绕智慧城市与城市分析开设课程，更接近于一个博士预备项目。我们将教授城市模拟（包括元胞自动机模型与多主体模型等）、计算机可视化、编程、GIS、智慧城市、城市理论等内容。

I: How long do you think it will take before quantitative becomes an essential part of planning education?
您认为使定量分析成为规划教育的一项基本组成还需多久？

B: That's very difficult. It is going to take a few years. It is like you have the same question in a British context, which is how long would it take for planners to be much more exposed to urban design. To some extent, there needs to be a change in the faculty, in terms of having more expertise in these areas. Then secondly, this is changing slowly as more people get skilled in these things. But the most important thing I think is that it is not so much that planning students would

do this, but that people in planning are coming from many different backgrounds. That probably is the main thing. And some of these different backgrounds would be scientifically orientated. So consequently, I think the change will come more from the prior education of people coming into planning. Because it is a much more fluid set of ideas and disciplines now in planning. So there are lots of different backgrounds, some of which will be more scientifically-literate than others. And probably the changes in practice will come more from that. The change will also come from different agencies dealing with planning. A lot of big firms, big agencies, and government agencies now deal with sort of planning. And they are all doing it from different perspectives. The IBMs of this world have planning divisions. Big engineering companies like ARUP have a lot of quantitative planners within them. So the big consultancies, the big agencies, the big computer firms, any big multi-national firm with a lot of operations would have planning staff who would not necessarily be professional planners in the traditional sense of the word. In fact, a lot of our professional planners go into the development control system instead of strategic planning. Strategic planning takes place in different agencies now.

这是非常困难的，可能需要若干年，这就像问“还需多久英国规划师才会做更多的城市设计”一样。从某种意义上讲，这需要规划院校教师人才结构的转变，引进更多具有这方面知识的人员。事实上，有越来越多的人正在开始具备这方面的技能，所以情况正在逐渐改变。但我认为最重要的一点是，定量化的城市研究并非一定由规划学生来完成，相反，规划行业中有来自不同学科背景的专业人员，其中一些具备较强的“科学导向”，因此，改变可能来自于这些人。此外，改变还可能来自不同和规划相关机构，比如与规划相关的大公司、政府部门等，它们各自在从不同角度开展规划工作。IBM 等大型 IT 公司都建立了规划部门，ARUP 等大型工程公司则拥有许多从事定量分析的规划人员，可以说，大型咨询公司、大型 IT 公司、大型跨国企业都可能雇佣了规划人员，而他们并不一定是传统意义上的规划师。实际上，当前很多规划师进入了发展控制部门而非战略规划部门，而战略规划则由不同机构完成。

I: It is a big data / open data era. Will it be another requiem after Lee's in 1973 for large-scale urban models since some researchers advocate that "data itself is model"? In other words, what is the promising urban modeling diagram for such an era?

1973 年，Lee 发表了“大型城市模型的安魂曲”，在如今的大数据时代，一些学者提出“数据即是模型”，您认为大数据是否会成为城市模型的又一次“安魂曲”？

B: There is a shift towards more data intensive modeling. In other words, modeling is much closer to data. To some extent, you can see that in the development of GIS. GIS is basically just putting data into a spatial information system. And a lot of GISs are simply displaying the data in different ways. A lot of GISs are very close to the data. And some other tools and techniques that are used to display the data and build analysis from it are very close to the data. So they would be data modeling, which means data itself is the model. Of course that is happening slowly. Although one of the key things with respect to the big data movement is that a lot of the big data movement says that you don't really need theory anymore and data is enough. And I think that is a mistake. My own view is that you will always need theory. We desperately need theory in big data to be able to tell you what the data is basically. A lot of big data is highly unstructured. It just spurts out of the fire hoses. We need to impose structure on it. So just by searching it, we could search forever and not find the pattern in big data. We need some kind of theoretical focus that needs to be brought in. But there is a paradigm shift going on that when we build new models we

should be a bit closer to the data.
模型与数据的关系将更为密切。你可以从 GIS 的发展中看到这一点，GIS 的本质就是将数据输入一个空间信息系统，在很多情况下，GIS 仅是以不同方式呈现数据，GIS 以及其他一些基于 GIS 的工具都与数据有非常密切关系。它们可以被称为“数据模型”（data modeling），也就是说，数据即是模型。当然，这一趋势是渐进的，但城市模型研究的确存在这种范式转变，新模型与数据的关系将会更加紧密。一些大数据的支持者声称，海量数据可以让人们不再需要理论，我认为这是错误的，理论永远是必要的。特别是在井喷式的大数据面前，我们更加需要借助理论来识别数据。

Will there be another requiem after Lee's? Lee looked at the modeling movement and made the point that those models didn't work basically in terms of their goals, etc., or for what they were supposed to do. It is too premature for another look back. There needs to be another wave of applications, which may be beginning. It is hard to tell. It is more likely that there would be a requiem in terms of the smart city movement, which depends on what happens to the smart city stuff. If a lot of that is hype, then somebody will write some requiem for the smart city movement. It will then be requiem for smart cities rather than requiem for large scale models. So there is always a danger with new innovations.
Lee 提出大型城市模型的“安魂曲”是因为当时的模型并未实现其预设目标，至于是否会出现第二次“安魂曲”，我认为现在下结论为时尚早。我们需要观察新一轮的模型应用，这才刚刚开始。但我认为，智慧城市运动更有可能迎来“安魂曲”，这取决于智慧城市是否被炒作过甚——创新总是面临这种危险。

I: You said in AUM this year that if big data is collected for long enough, like five or ten years, longer term will emerge from the short term, which is a paradigm shift. Could you give us a snapshot of potential research territories driven by long term big data? How could this unprecedented availability of data change our understanding of cities, or they just replace the data for calibrating existing models?
在今年的应用城市模型会议上您提到，未来如果收集到长期大数据（如 5-10 年），那么有可能可以从短期趋势中识别出长期趋势，这将是研究范式的转变。您是否可以为我们简要介绍一下长期大数据的研究前景？

B: If we ever take a dataset where you can identify routine behavior on a short term basis, for example journey to work, and you have unique identifiers of an individual, you can see whether that individual will shift the routine pattern. But you are not likely to be able to see that on mass until you accumulate enough observations over a period of some years. If you get routine behavior where you can look at an individual or a set of individuals using a system on a daily or hourly basis, then you can identify trends in the data. We could really only begin to identify trends when we get enough data. So that is when it is long enough. Of course once we get five to ten years' worth of data then we would be able to look at different sorts of trends that are taking place over a month, or a half year and so on. So with big data over a very long period of time, you can look at lots of different time-behavioral trends. For example, if I would use the same credit card to buy my goods and this data were recorded over twenty or thirty years' period, you will see changes in my pattern. Because as you get older, you consume less, you consume different things. In fact, you can see it now, such as say twenty years ago we would buy more in the

supermarket than we do now. So you could see how our lifestyle is embodied in our purchases. But only when we have enough data to do that.
如果你可以从短期数据中识别出通勤等规律性行为，那么你就可以识别出数据中的不同个体并观察他们的规律性行为是否有变化。但只有当我们获得了足够多、足够长期的数据，我们才能进行大规模的观察并识别出趋势，比如我们可以从跨度为 5 至 10 年的数据中识别出不同类型的趋势——一个月内的趋势，半年内的趋势，等等。例如，如果我的信用卡消费数据可以保存 20 到 30 年，你就可以从中观察到我的消费模式转变，随着年龄增长我的购物量减少了，购物种类也有不同，从中你可以看到我的生活方式的变化，只有足够量的数据才能实现这一点。

I: A broader question. You said it has taken more than 50 years for us to approach the goal of making planning rational and establishing a science of cities, and it will take another 50 years to make significant progress. In your mind, what's the destination of this long term mission? How would the discipline of planning and urban study differ from now when this goal is fulfilled?
您曾说过，我们用了 50 多年来使城市规划更加理性并建立一门城市科学，我们还将再用 50 年来取得重大进展。您认为这项长期任务的最终目标是什么？当这一目标实现后，城市规划学科将与现在有何不同？

B: The long term mission would be to be able to get a better understanding literally on a database basis of what is happening in the cities. Let me give you an example of what could happen. Say for example, we had very good remote sensing images on a daily basis. The interpretation is such that one is able to see how physical changes take place. Then over years, you can see buildings being constructed -- this kind of thing. You might be able to reconstruct your 3D model from this remotely sensed data each day. And there are a lot of changes, very micro-changes going on in the environment each day, such as say somebody puts up a little aerial or something like that. You could then begin to see how the city would be changing over periods of time, just as we have been talking about big data over long time periods. This is a kind of big data. And maybe one is building a model of traffic flow and there are changes each day in how people move, then potentially, the models can be run in on a daily or weekly basis. So in other words, the intelligence function of the city can be established in some detail. You can build an intelligence function that informs the planners and policy makers of what is going on. To some extent, bits and pieces of that exist already. You have traffic control centers in terms of aircraft, etc. And a lot of traffic moving around cities and above cities is captured on a daily basis and people deal with it in terms of keeping the system running. But it is more being extended to how land is developed, how people are making purchases of housing, etc., which together add up to a picture of what is happening. And to stand back, you need to have good tools to abstract from it, to make sense of what is happening. Of course all of those bits and pieces are kind of there, but we have never been able to join them up. Because it takes a lot of effort and a lot of funding. So this is broadly what I think a science would begin to do. It would make planning rational and more effective in some sense.
长期的任务是通过数据对城市发展历程获得更好的理解。比如，如果我们可以获取高质量的、每日更新的遥感图像，就可以观察到城市形态每天的变化，每天都存在微小的变化，如一根天线的出现等等，积累很多年后，我们就可以观察到城市的演进历程。这和我们之前谈到的

长期大数据很像，也是某种意义上的大数据。再比如，交通模型可以具体到以天或周为单位，模拟人们每天或每周的出行变化。换句话说，城市的模拟规则可以更加具体。从某种意义上讲，这种“以天/周为单位”的模型在某些领域已经存在。比如，飞机流量控制就需每天更新交通流量数据以维持系统运转。但我们更需要将这类工作扩展到土地利用领域，最终形成城市发展的整体图像。此外，我们还需要一些好的工具方法从中提取有用的信息。当然，这些要素大多都已经存在，但我们从未能将它们真正结合起来，这需要大量的人力与资金。以上是我认为一门城市科学应当做的工作，它将使规划更加理性与高效。

I don’t know how long it will take to make significant progress. In the long scheme of things, probably it will take fifty years or longer. But in that fifty years there will be also sorts of changes that could change completely what I am talking about here. In fifty years we don’t know how we are going to be living in any sense. For example, if you think of the last ten years, ten years of the smartphones, other mobile devices, open data, sensing and so on and how these are changing the city.

我也不确定产生重大进展需要多长时间，也许比 50 年更久。但我今天谈到的问题在 50 年内应当有所变化。

I: We have established Beijing City Lab for promoting quantitative urban studies in Chinese cities, in the context that design and qualitative studies dominates urban planning and studies in China, especially within the body of planning agencies and research institutes. What is your opinion and suggestions to our two months old Beijing City Lab and its future development?
设计工作和定性研究一直是中国城市规划和城市研究的主流，为此我们刚刚成立了北京城市实验室（Beijing City Lab）以推动中国城市定量研究，您对我们实验室的未来发展有何意见与建议？

B: It is good. It is kind of like open source lab. It is an open network. I think it is a very exciting development. I think one of big problems for westerners to get to know about China is that there are so many labs and universities. In a sense we only see the most important. So it is always very confusing. Tsinghua, Peking, I kind of only see that. But then, even in Beijing itself, there are several universities. Occasionally you see the forestry university, mining university and so on. And the other thing is the local municipalities have their own city planning diversions which are sometimes almost like research units. And then there is China Academy of Science. That’s complicated. That is almost like competing with universities in a way. They are doing Masters courses and PhDs. That’s quite complicated for westerners. Because we don't really have quite the same thing. Because we think the China Academy of Science is a bit like the Royal Society, which is more a learned society. So I think anything to clarify all this would be useful. So the BCL network I think is particularly good in that it will increase cooperation and communication as well as telling us what is going on in China in the field of urban modelling and related research.
建立开源实验室、开放网络是一项很好的工作，我认为它是一项振奋人心的工作。西方学者认识中国的一个障碍之一就是中国有很多大学与实验室，所以建立北京城市实验室这样的工作网络是非常有益的。