

中国古代空间文化溯源

(修订版)

The Cultural Gene of
Ancient Chinese Space (Revised Edition)

张杰 著

清华大学出版社

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修订版序

转眼《中国古代空间文化溯源》一书出版已三年多，其间很多对此书感兴趣的朋友常问我一个问题：书中有一些山川定位的案例涉及的空间范围很大，甚至跨越近两千公里的距离，而且案例出现的年代很早。古人是靠什么技术手段做到这一点的？其实在我写书的过程中，这一问题也一直困扰着我。当时由于研究还不够深入，我没能回答这一问题，这也成为该书初版的一个缺憾。

虽然裴秀的“制图六体”早在魏晋时就已出现，但采用这种方法测绘的大比例尺地图误差较大，且要耗费巨大的人力、物力，似乎难以满足精度要求相对较高、范围大的空间定位的需求。不过理性告诉我，如果中国古代有那么多案例都涉及超大距离的空间定位，而且它们又多与一些重要的山川要素相关，这绝非偶然，应该是一种文化现象。既然如此，中国古代就应该有相应可行的技术手段，以满足超大范围内空间定位的诉求。当时我从《易经》等典籍的字里行间隐约感觉到，古人以天体为参照物进行方位判断的可能性最大。

书初版后，我继续在《四库全书》和其他资料中寻找可能的线索。又花了一年多的时间，我发现清代典籍有利用时差推算东西距离的记载。乾隆年间，清廷曾通过观测不同地方的中星偏度和去极高度，在新疆地区进行大范围的测量工作。这对我的研究是一个极为重要的启发，但答案并不因此而全然明了。清初西方的机械钟（即轮钟）已传入中国，人们可以凭借轮钟将京师的标准时间带到任何一个地方，从而很容易知道不同地方的时差，并以此推出任何两地的东西经度差；

而任何一个地方的纬度则可以凭借观测北极高度角得到。另外，明末清初地球说已被朝廷所接受，人们已经知道，地球每一经度或纬度的距离约为二百里。这样，人们可以先测得两地的中星相对京师的偏度差（时差）和去极高度差（纬度差），然后通过勾股定理或作图推算出两地的直线距离，最后形成大范围的地图。清代的《钦定河源纪略》就列出了新疆主要城镇的中星偏度和去极高度数值，以此确定这些地方的定位坐标。有了这样的数据，任何两地的方位也就很容易确定。同样，有了这样的坐标体系就可以把按照裴秀“制图六体”原则绘制的相对较小范围的测绘成果联系起来，形成全国地图。这些内容都是目前中国古代测绘技术发展史研究所未涉及的。

中国古代对地球子午线的测量在唐以前和唐代都做过较系统的测量，不过精度不是很高。另外，虽然在汉代就有较高精度的漏刻装置，但很难携带，所以不能仅凭漏刻来比较不同地区的时差。再者汉代以前的漏刻精度较低，更无法满足精度较高的定位对时差观测精度的要求。那么，小型的机械钟在中国出现之前，我们的先人是如何判断时差的呢？我继续在古代文献中寻找可能的答案。大概又用了一年多的时间，我翻阅了大量的古今资料，终于弄清楚，中国古代是通过比较同一月食现象在不同地方出现时间的早晚，断定东西时差，即古人所说的“里差”，而且这种方法应该在三代以前就被采用。这就为我探究中国古代在超大空间范围内进行定位的技术可能性打通了途径。

经过几个月的笔记梳理和写作，我终于完成了“中国古代超大距离方位测定技术”的研究论文，并希望能在本书再版时补充进去。恰巧清华大学出版社跟我联系，商议原书再版的事。承蒙出版社对该书的厚爱与支持，我得以及时将上面提到的研究成果增加到新版书的第四章中。此外，这次的修订版还对原版进行了勘误，完善了原书的一些内容，了了我三年来的一个心愿。

最后，我愿借此机会再次感谢清华大学出版社对本书的修订、出版所做的一切。

张 杰

2015年仲春，清华大学荷清苑

原版序

中国古代城市与建筑传统博大精深、源远流长，一直是很多西方和中国学者研究的课题。近年来，这方面的著述就包括了夏南悉（Nancy Steinhardt）的经典著作《中国都城规划》（*Chinese Imperial Planning*）以及傅熹年等编写的《中国建筑》（*Chinese Architecture*）。相对而言，朱剑飞所著的《中国空间策略：帝都北京 1420—1911》（*Chinese Spatial Strategies: Imperial Beijing 1420-1911*）一书，虽然概括的总体范围没有那么全面，但却细致探讨了北京的空间传统。学术刊物发表的关于中国传统聚落的建筑特色的案例研究更是异彩纷呈。事实上，当代的研究已取得卓越的成果，如鲍尔·惠特利（Paul Wheatley）的鸿篇巨制《四方之极——中国古代城市起源及特点初探》（*The Pivot of the Four Quarters: A Preliminary Enquiry into the Origin and Character of the Ancient Chinese City*）和丁山探讨天文考古、历史地理等内容的《古代神话与民族》等。但就建筑而言，中国营造学社于 20 世纪 30 年代的研究工作以及梁思成随后出版的《图说中国建筑史》（*A Pictorial History of Chinese Architecture*）从总体上对古代建筑进行了追古溯源。实际上，张杰的这本书可归为对中国远古建筑与城市形态的研究范畴，该书并不是对历史的叙述，而更多的是对形成中国古代建筑空间的文化源头、准则以及在逻辑的思考。所以，本书在研究视角和论证方法方面颇为新颖，其中提出了许多突破性的见解。

我初次注意到张杰对这一课题的兴趣是在 20 世纪 90 年代。一次我们一同外出北京，到清西陵去考察。在我的夫人——她也是建筑师，还是一位画家——和儿子的陪同下，我们兴致勃勃地沿陵区建筑群的轴线观察了建筑、构筑物、自然景色精确组合、对位并共同形成精彩景观的现象，而且随着人们走近建筑，这些又都会隐去。之后，张杰根据 30° 与 60° 视域角度的假设，在北京国子监建筑群为我们示范了同样的构图规律。如张杰本人在书的后记中提到的，他在《建筑学报》上发表了论述更完善、详细并配有精彩插图的关于中国古代建筑空间透视现象的论文。那篇论文在研究与表达等方面奠定了此书的取向，特别是其丰富与精确的插图和数据资料。

为了界定和描述他所说的“中国古代空间文化溯源”，张杰研究了很多文献及相关注释与观点。他的核心论点是：中国空间布局与晷影观测密切相关，晷影观测是“十二律”形成的基础，它影响了古代的历法和礼制系统。“十二平均律”源自音乐，是将一个八度分为十二个平均半音的一种律制，其中每两个相邻半音的频率之比都一样，前一个半音的频率是后一个半音的 1.059463094 倍。因此，所谓“音律” (tempering) 就是微调整音度之间的频率，使音度相协调。十二平均律和综合中全音律等调音系统在文艺复兴时期开始盛行。虽然十二平均律的历史似乎相当悠久，但其精确值的确定却要归功于 16 世纪末明朝大儒朱载堉。朱氏代表作之一《律历通融》 (*The Concordance Between the Ritual Tone System and the Calendar*) (1581) 中记载了中国传统天文历法与律吕学相合一的密切关系。大约半个世纪之后，估计是通过利玛窦 (Matteo Ricci) 的中西交流，比利时的西蒙·斯蒂文 (Simon Stevin) 以及法国的马莱恩·莫赛尼 (Marin Mersenne) 各发表了相似的平均律理论，其理论更因约翰·塞巴斯蒂安·巴赫的《十二平均律曲集》而日渐推广。除此之外，十二平均律与中国传统的三分损益法恰好和《礼记·月令》一年中四季各分孟仲季三个月份相吻合。

在本书的一部分中，张杰深入探究了风水哲理与实践知识，有条理地揭去了笼罩在风水术上的迷雾及其迷信的外衣。为此，张杰分析了《鲁班经》等古籍资料。

鲁班（前 507—前 440），依古籍记载其真实姓名有公输班、公输子等，据说出生于动乱的春秋时期的鲁国。鲁班是位著名的发明家、工匠和木匠，传说他发明了锯子、刨子、墨斗、曲尺等工具。鲁班被认为是中国建筑体系的鼻祖。张杰同时把有关风水学与其运用的广泛见识编入此书。他在探索中还巧妙地结合了对中国绘画的分析。在中国传统绘画中，画面所表现的景致在构图上要与更大范围的景观相适应，正如人们所期待的那样，这些原则与建筑结合环境景观的构图所遵循的原则是一致的。同时，他阐述了传统绘画中暗藏的控制线以及其他设计规范，从而进一步延伸了他在先前提出的论点，并将这一控制性的几何形态与他所提出的有关比例、角度与视觉系统的基本框架联系在一起。

虽说张杰的研究与思索是针对古代的空间文化，但他在这发现之旅中充分利用了当代的手段和资料，在广阔的空间范围求证古代的相关概念和过程，例如对谷歌地球和现代地理定位系统等的运用。此外，北京大学出版社整理出版的《十三经注疏》和 1999 年数字版的、最初由清人在 17 世纪编纂的《四库全书》等古籍，也为张杰提供了既方便又具权威性的研究参考。当然，此书的探索当归功于张杰个人的努力。

综上所述，这是一部扣人心弦、发人深思的书。书中琳琅满目的插图与文字相得益彰，犹如昔日的工程则例。无论是现在还是将来，《中国古代空间文化溯源》一书无疑都将成为研究中国城市与建筑空间传统不可或缺的学术作品。

彼德·罗

哈佛大学研究生设计学院雷蒙德·盖伯
建筑与城市设计教授，哈佛大学杰出贡献教授

2011 年 2 月

Preface

The rich and venerable urban and architectural tradition of China has been the subject of numerous texts from both Western and Chinese scholars. In relatively recent times there is Nancy Steinhardt's classic, *Chinese Imperial Planning*, as well as Fu Xi'nian's *Chinese Architecture*. Less comprehensive in overall coverage, although highly detailed in scope is Zhu Jianfei's *Chinese Spatial Strategies: Imperial Beijing 1420 – 1911*, taking up with aspects of Beijing's spatial tradition. Other case studies also abound as do well-focused journal articles on particular architectural features of China's settlement tradition. In fact, much has been accomplished in the contemporary period. Then too there are searches for the origins of this tradition, like Paul Wheatley's monumental *The Pivot of the Four Quarters*, as well as Ding Shan's portrayal of astronomical archaeology and cultural geography, *Ancient Mythology and the Nation*. More squarely in architecture the work of the Institute for Research in Chinese Architecture in the 1930s and Liang Sicheng's subsequent *Chinese Architecture, A Pictorial History* also touched on the question of origins in its more general treatment of antiquity. Indeed, this present account by Zhang Jie certainly fits under the broad rubric of examining China's more distant past in what we now call architecture and urban form, although it is less of a history and more of an intellectual inquiry into sources, principles and logics which can be seen to have both generated and shaped ancient constructed space in China. In this regard it is novel in orientation and, in its treatment, ground breaking in many of the insights it has to offer.

I first encountered Zhang Jie's interest in this material during a visit with him to the Western Tombs outside of Beijing in the middle 1990s. Accompanied by my wife—also an architect and an

artist – along with my son, we all gleefully joined in a speculative game of discovering instances in which precise compositions and alignments of buildings, artifact and natural scenery would come into view as we traversed axes within the site, before disappearing as we moved on. Later on during the same trip Jie showed me how the same principles, based on 30 and 60 degree cones of vision, or so we supposed at the time, also applied in the Imperial Library complex in central Beijing. As he mentions in the preface to this volume, he presented a more complete, well-illustrated and documented account of these perspectival phenomena in the *Chinese Journal of Architecture*. Moreover, it was an account that was characterized by a style of both research and expression that carries over into this present volume, distinguished in particular by its generosity and precision in graphic and numerical presentation.

In defining and describing “the cultural gene of ancient Chinese space”, as he puts it, Zhang Jie combines readings and interpretations from several sources. A crux of his argument is that the Chinese spatial topology can be obtained from sun shadow observations, which in turn can be linked to the “Equal Temperament” at play in both the Chinese calendar and the doctrine of *Li* dealing with rites and rituals. Equal Temperament, of course, emanates from music and defines a system of tuning in which every pair of adjacent notes has an identify frequency ratio, also described by an octave split into twelve exactly equal portions, with each note’s frequency 1.059463094 and so on, times the frequency of the note below. “Tempering” in turn is the process of slightly altering the tuning of notes to effect a better harmony between them and the practice of Equal Temperament is one of several, including Mean-Tone Temperaments that were popular in the Renaissance. Although the idea of Equal Temperament appears to be very old, its precise specification dates from the latter half of the sixteenth century at the hands of the Ming Prince Zhu Zaiyu, who also observed strong interrelationships among the ancient Chinese astrology, calenderical science and tonal systems in *The Concordance Between the Ritual Tone System and the Calendar* of 1581. More than half a century later Simon Stevin and Marin Mersenne published similar accounts of the musical Equal Temperament, with Matteo Ricci probably playing a role in making Zhu’s work known in the West and with Johann Sebastian Bach promoting it in *The Well-Tempered Clavier*. The twelve-part division, along with the traditional three pillars of the Equal Temperament, also coincides with the tripartite division of the months of spring, summer, autumn and winter, embraced in the *Li Ji* (Book of Rites) and the *Yue Ling* (Proceedings of the Government in Different Months).

Also at work in Zhang Jie’s excursus is a principled and knowledgeable plumbing of *fengshui* rules

and practices, often rescuing the art of the geomancer from the murkiness and potential disrepute of fantasy and superstition. In this Zhang Jie returns to the *Luban Jing* (The Book of the Master Carpenter Luban) among other sources. Lu Ban (507–440 BC) whose real name apparently was Gongshu Ban, also known as Gongshu Zi, was born in the state of Lu during the tumultuous Spring and Autumn period of ancient China. He was an inventor, engineer and carpenter who gave rise to the Chinese saw, plane, chalk line and ruler, as well as being generally regarded as the founder of building in China in any systematic manner. In his treatise he also incorporated extensive instructions covering *fengshui* and its applications. Zhang Jie also engages Chinese painting, particularly with regard to compositional principles of scenic presentation, which, as might be expected, are not inconsistent with building and scenic composition or fitting in with the larger landscape. The virtual presence of regulating lines and other forms of design controls are also taken up, both extending points Zhang Jie made in his earlier work on the subject, and relating this geometry to his fundamental framework with regard to ratios, angles and perceptual systems.

Although moving back in time in terms of its research and speculation, Zhang Jie's intellectual quest also makes good use of contemporary materials and resources. Google Earth and modern systems of geo-referencing, for instance, are pressed into service in applying and testing ancient perceptions and procedures that covered quite vast areas. Searches using the 1999 digital version of *The Complete Library and Four Branches of Literature*, for example, first compiled by the Qing in the seventeenth century, as well as reliable access to editions of basic reference works, like Peking University Press' *The Thirteen Classics* of 1999, also facilitated Zhang Jie's work. Nevertheless, the real enterprise here belongs entirely to him. It is an enthralling book and replete with numerous illustrations, fittingly like the construction manuals of old. It will become and remain a central text in any discussion of China's urban and architectural spatial tradition.

Peter G. Rowe,

Raymond Garbe Professor of Architecture and Urban Design and
University Distinguished Service Professor, Harvard University

February, 2011

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