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The technical development of architectural drawing in modern China



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Abstract

Western architectural drawing techniques were introduced to China in the 1870s, when their importance was increasingly recognized by the Chinese. The development of architectural drawing in the nation led to the dissemination of knowledge on engineering drawing and enhanced the integration of different theories of drawing from both China and the West. Based on the translation of two western classical texts—*Shi Xue (The See)* and *Qi Xiang Xian Zhen (The Engineer and Machinist's Drawing Book)*—this study examines the technical development of architectural drawing in modern China.

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1. Introduction

The contributions of China in the historical development of graphics around the world declined during the Ming and Qing dynasties. After this period, the nation completely lost its role in the field and withdrew from the historical stage. Around this time, China experienced a slow development in science and technology,

but despite such difficulties the scholars of graphics of the period made some advancement in sorting out and elucidating theories of graphics and techniques of drawing and painting. They also absorbed the theories and techniques of western graphics while studying and disseminating them, thus helping increase the knowledge and innovative achievements in graphics both at home and abroad. The emergence of *Shi Xue (Study of Vision)* and *Qi Xiang Xian Zhen (The Engineer and Machinist's Drawing Book)*, the two representative works on modern theories of western graphics introduced during the Qing dynasty, exemplifies the achievements in engineering graphics and techniques of architectural drawing in this period. These books concretely reflect the evolution of traditional graphics into modern and contemporary graphics.

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2. The introduction of perspective theory of modern graphics and *Shi Xue*

In ancient times, the Chinese produced work instruments based on their observations of the workings of nature. This process continues to develop until today. Nothing is exempted from the rule “construction in line with the drawings” from ancient times to the present, both at home and abroad. The archive of architectural drawings during the Qing dynasty is called the “Yang Shi Lei Tu Dang,” which refers to the drawing files named after the Lei family who was in charge of the bureau of design for many generations. Graphics flourished during this period and was a booming phenomenon crowned with great achievements. However, its theoretical basis, particularly that of the application of the method of projection, the definition of the proportion of patterns, grid drawing, and iron modeling, remained steeped in the theory of graphics and techniques of contracting inherited from the earlier Qin dynasty to the Sui, Tang, and Song dynasties. Many problems remained unresolved in the field of graphic theories. Valuable works on the method of projection and the innovation of drawing techniques were seldom produced. These issues were left by unresolved by the “Yang Shi Lei Tu Dang.” (Needham et al., 1971)

Only when the graphics of the Ming and Qing dynasties is considered from the perspective of the history of the field across the world can the development of graphics in the east and west during this period be understood in a holistic way. After the 16th century, when the architectural graphics of China was stagnating along the traditional route, modern science and technology were emerging and booming in the West. Such developments formed a great and influential force in the physical and spiritual life of man. Accordingly, as one of the important parameters of the development of science and technology, graphics increasingly advanced along with emerging theories and approaches. The introduction of a series of basic conceptions, such as the center of projection, picture plane, distance, center of vision, horizon, and far distant point, into the theories of engineering graphics by some western scholars catapulted the field into a new stage of development. The basic principle of the theory of perspective, which was at this time understood primarily by the general public, paved the way for the argumentation of perspective in mathematical terms.

2.1. Development of graphic drawing in the west

The basic conception of the system of focus perspective proposed by the Renaissance artists is the principle of projection and section view. In the 17th century, the French mathematician Girard Desargues (1591-1661) developed this basic principle and introduced projection and section view as a new proof for or method of examining several different types of conic curves, forming a new mathematical discipline called projective geometry.

The Italian scholar of graphics Andrea Pozzo (1642-1709) published *Perspectiva Pictorum et Architectorum* between 1693 and 1698, which argued for perspective drawings, that is, drawings whose perspective was based on the two orthogonal projections of an object. He also introduced

the drawing of buildings expressed by two orthogonal projections.

The British mathematician Brook Taylor (1685-1731) and the German geometrician Johann Heinrich Lambert (1728-1777) both made breakthroughs in the development of perspective drawing. Taylor examined the resolution of basic location issues and the approach to defining various properties of the original object according to perspective drawings. Lambert diagrammatized a few important issues of elementary geometry based on perspective principles and drew perspective with the center of projection at infinity according to the property of affinity correspondence (Booker, 1963).

2.2. Nian Xiyao and *Shi Xue*, the first treatise of graphics in China

During the late Ming and early Qing dynasties, various preachers came to China and introduced the western perspective. The painters among these preachers applied focus perspective in drawing by furthering the landscape and strong stereo feelings, which attracted the attention of the scholars of graphics of the Qing dynasty. Nian Xiyao (?-1738), whose official position was as high as that of the assistant minister of the Ministry of Works during Yongzheng's reign, met several times with Giuseppe Castiglione (1688-1766), an Italian Jesuit, also known in China as Lang Shining.¹ Nian later compiled and published his book *Shi Xue*, publicly introducing the principle and approach of perspective drawing. While Lang Shining greatly contributed to the dissemination of the principle of the western perspective, Nian's *Shi Xue* marks the crowning achievement of Chinese scholars of graphics who attempted to capture and integrate western scientific ideas.

As the earliest treatise that systematically elaborated the theory of graphics during the Qing dynasty, *Shi Xue* was also a milestone in many other respects. It was the first written work to discuss descriptive geometry and to elucidate the application of the “method of points of distance” in drawing parallel and angular perspectives. It was the first to discuss the application of two side views of a geometrical solid and the intercept of sight lines in the coordinate axes of drawing perspectives. It was also the first to elaborate the drawing method of the shadows of the light source at the center of an axonometric drawing. The book was an excellent work and the first of its kind in the history of graphics in China, with elaborate illustrations and substantial length. Unfortunately, it had only a limited print run and only a few copies of the book remain available (Figure 1).

¹In *Draft History of Qing Dynasty*, a biography of this preacher states that “Lang Shining is a Westerner. He took the official place at the Kangxi ruling period. The Qianlong Emperor appreciated his exotic artworks. No matter what the emperor asked him to paint, the precious horses or rare birds or beautiful flowers or unusual plants, there is no exception of liveliness. The colors are splendid. Such local painters as Bingzhen cannot compete.” This chapter contains only less than four dozens of words and no more. Such is the testament to Lang Shining, who was not only an outstanding painter, but also an excellent designer of buildings and master of crafts. His role in the exchange of graphics between the east and west is tremendous. See Chao et al., 1977.

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