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RESEARCH PAPER

# Building Guastavino dome in China: A historical survey of the dome of the Auditorium at Tsinghua University<sup>☆</sup>



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## Abstract

Established in 1909, Tsinghua College was built on the base of a royal garden, and developed into a modern university through campus designs produced by Henry Murphy. The Auditorium, one of the Four Grand Buildings during Tsinghua's formative times, was a significant part of early construction and has become a symbol of the school. However, no thorough measuring work has ever been done to it since its completion in 1921. This paper delves into archives with combination of field survey and measurement, aiming to better understand the historical background in which the construction of the Auditorium was embedded, and technological and structural features of the Auditorium. Though the Guastavino system was indicated in the original design drawn by Murphy, concrete shell was applied in the end. The first part combs up the intellectual origins and precedents of the campus planning by Henry Murphy. As the dome is a focal point of the study, a brief course on the history of dome construction in the West is needed. The third part, based upon field measurement in July 2013, compares the actual dome with its original design featured by the Guastavino method, deducing possible reasons that resulted in the differences, including architect's unfamiliarity with Guastavino Company and its parameters, considerations about cost, and local construction tradition.

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## 1. Introduction

The emergence and development of modern Chinese universities is an epitome of the top-down modernization in the first decade of the 20th century in China. Confronting the catastrophes caused by Boxer Uprising motivated by patriotic and anti-imperialistic sentiment in 1900, along with the Treaty of 1901 that fined China a large sum of money for war reparations, the Qing government started

stated-led modernizing projects under a New Policy (*xin zheng*). Learning from the West became an unanimous principle that featured the period of the New Policy (1901-1911), and a handful of schools and colleges were set up in line of Westernization, a synonym of modernization at that time. In addition to new curriculum and educational ideals, these newly built schools and colleges distinctly differed from traditional Chinese private schools in that Western influence is manifest in the physical construction and built environment of modern schools. For example, buildings of these modern colleges, such as the Beiyang Public School (present-day Tianjin University), considered the first modern college of China that was founded in 1895, two- and three-storied buildings made of brick and wood were fronted with Western facades and ornaments.

Tsinghua Preparatory School to America (*qinghua youmei yiye guan*), known as Tsinghua University later which was founded in 1909, was somehow different from other contemporaneous state-sponsored schools. It was an “indemnity school,” as indicated in American newspapers, because the funding used to establish this school came from remissions of excessive part of the indemnity as prescribed in the Treaty of 1901 by the American government. A training school to prepare her students for advanced education in the US, Tsinghua had close ties with America, and even the administration of Tsinghua was put under the Ministry of Foreign Affairs instead of that of Education.<sup>1</sup>

The selected site for Tsinghua was a former garden of a prince of the Qing, located in the North-western outskirts of Beijing. Up to 1911, two years after the decision of setting up such a school was made, Tsinghua was ready to recruit her first students, and the name was changed into “Tsing Hua College”. The special relationship between Tsinghua and the US government in that “its foreign faculties are all Americans, and its students are all trying for the honor of being sent to America, on the Boxer Indemnity Fund”<sup>2</sup> resulted in administrative independence from the Chinese government during the tumultuous period between the 1910s and 1928s,<sup>3</sup> in terms of curriculum, faculty, student communities, etc. Secured funding from abroad also allowed Tsinghua to expand her campus and added advanced facilities and equipments over years. Consequently, with rapid development of two decades, Tsinghua became a well-known higher educational institution.

It was a booming period of campus construction at Tsinghua in the 1910s and 1920s, and the campus planning and construction on campus during that period, such as the Southern Gate (also widely known as the Hall of Tsinghua

College, the Second Gate, *er xiaomen*), and Four Grand Buildings: the Auditorium, library, gymnasium, and Science Building, became a typical model of modern Chinese universities.<sup>4</sup> Nearly all famous buildings of Tsinghua that typified the built environment in her formative years were built up during that time. However, it remains very vague what examples the campus designs of Tsinghua referred, and for what reasons such patterns were adopted.

Toward the end of the 1920s, the main part of the campus of Tsinghua had already been put in order, and the Auditorium has been a landmark and symbol of Tsinghua University since its completion in April 1921. Interior renovations have been made to the Auditorium several times, but knowledge about its dome, which is the symbol of the symbols, is still a mystery to architects and scholars, partly because no change has ever been made to it. Hence, the author organized a full-scale measurement of the Auditorium in July 2013, with particular emphasis on its dome, to compare its structural form and technique construction with the original design found in Murphy Papers stored in the Sterling Memorial Library at Yale University.

The first part of this paper charts out the intellectual origins and precedents of the campus planning of Tsinghua College, and further elaborates the formal and structural characteristics of the Auditorium. Because the dome was the focal point of this paper, the second part gives a brief history of the construction of domes in the West up to the 1920s when the Auditorium was erected. The last part, based on recent data from field survey and measurement, compares the actual dome with its original design and deduces reasons for the differences.

## 2. Planning Tsinghua in the 1910s and the background of the construction of the Auditorium

The formulation and implementation of the early planning scheme for Tsinghua was closely intertwined with the social and historical background in which Tsinghua was embedded, her intimate connection with America, and the educational ideals and policies of her administrators.

### 2.1. Intellectual origins of the campus planning of Tsinghua

In the statement of design specifications, it makes clear that “[t]he University, for which Murphy & Dana are to prepare, immediately, a tentative block plan, will follow in general the plan of the American Universities, rather than the English plan of separate small Colleges.”<sup>5</sup> Obviously the

<sup>1</sup>Wei Songchuan. A Study of Campus Planning and Architecture of Tsinghua University. Master thesis of School of Architecture, Tsinghua University. 1995:10-11.

<sup>2</sup>Tsing Hua College. Memorandum Report of Interviews of June 13, 14, 15, 1914, at Tsing Hua, Peking, China, between President TSUR & H.K. Murphy. June 26, 1914. Murphy Papers.

<sup>3</sup>Since 1928 onwards, “the educational policies of Tsinghua embarked on a new era of creation from the imitation of its American model.” Qiu Chun. “Progress of Tsinghua’s Education”. *Qinghua Niankan* (Tsinghua Annals). 1927. Collected in Historical Research Section of Tsinghua University (ed.). Selected Historical Materials of Tsinghua University (Vol. 1). Beijing: Tsinghua University Press, 1991: 272.

<sup>4</sup>Tsinghua was one of the first four universities that were designated as the National Preserved Cultural Relics. The other three are National Wuhan University (present-day Wuhan University), Northeast University and Yenching University (present-day Peking University). In a Forbes-conducted global selection, Tsinghua was also nominated as one of the 100 most beautiful universities in the world.

<sup>5</sup>Tsing Hua College. Memorandum Report of Interviews of June 13, 14, 15, 1914, at Tsing Hua, Peking, China, between President TSUR & H.K. Murphy. June 26, 1914. Murphy Papers.

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