

Quintessentially Billington: The Evolution of Structural Art Teaching at Princeton

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Abstract

One of the most classic courses at Princeton University (*CEE262, Structures in the Urban Environment*) was founded by Professor David Billington (1927-2018) in 1974. The course, based on his scholarship, argues that the best designed structures (bridges, buildings, and shells) are a work of art – structural art. The course integrates humanities with engineering through studies of cultures, people, and art as reflected in works of engineering. Professor Billington used alliterations to reinforce learning: The measures of structural art are efficiency, economy, and elegance; and the structural artist's designs evolve from imitation, to innovation, to inspiration. The authors are Princeton University faculty in who have continued teaching Billington's classic courses (*imitation*), enhanced it with modern pedagogical approaches (*innovation*), and created new classes and scholarship inspired by it (*inspiration*). This presentation and paper, in essence, illustrates the many ways that David Billington's legacy and scholarship continue to thrive in creative approaches that one can say are quintessentially Billington.

CEE262 current innovations include modern 'active-learning' activities embedded in the lectures such as internet polling and short physical experiments conducted by the students during lectures. An inspirational derivative of this course is intended for more advanced students studying structural engineering: *CEE463 (A Social and Multi-dimensional exploration of Structures)*. *CEE463* has been taught biannually since 2010 and it develops the student's skills in drawing, model making, aesthetic considerations, and advanced engineering analysis. It also emphasizes the humanities aspect of our built environment through a study of the social and economic context of the built work. The theme of the course changes every time it is taught, where the themes have been Fazlur Khan, German Shells, Spanish Bridges, Cuban Shells, and Italian Vaults.

Other inspirational derivatives of Billington's teaching and scholarship are represented in three more courses that are more heavily invested in the humanities: *CEE538*, *CEE418*, and *STC209*. *CEE 538 (Holistic Analysis of Heritage Structures)* is held bi-annually and connects the Departments of Civil & Environmental Engineering (CEE) and Art & Archaeology (ART). The course enrolls students from CEE, ART, and the School of Architecture, and it introduces engineering students to the humanities aspects of structural reconstruction and the analysis of heritage structures, as well as introducing humanities students to the scientific and engineering rules to consider in artistic reconstruction. *CEE418 (Extraordinary Processes)* taught by CEE and Visual Arts Faculty, focuses on the structural and aesthetic potential of ash wood, currently a beetle-infested waste material in USA. Students investigate new and replacement applications for the material based on its sculptural properties, its flexibility and high strength to weight ratio. Faculty from various engineering and humanities departments have come together to teach *STC209 (Transformations in Engineering and the Arts)*. First taught in the Spring 2016, this course explores the parallels and intersections of design and composition in engineering and the arts, emphasizing a merging of artistry and systematic thinking.

David Billington's influence has extended beyond teaching; it has set the foundation for and stimulated an *Engineering and the Arts* initiative on Princeton's campus. This initiative has inspired a Symposium, internal funding from an alumnus, and gathered an enthusiastic group of faculty from various engineering departments and the arts/humanities who are finding innovations and inspirations in their research by collaborating at the intersection of engineering and art. It is concluded that Billington's legacy at Princeton is not only alive, it is thriving.