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Comparative Study of Geometric and Numerical Cognitions of Structures in the Architectural Design Process

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ABSTRACT: Structural design extends beyond merely creating forms to withstand forces; it incorporates various technical and non-technical elements within architectural design. The true value of structural knowledge emerges during the design process when these elements are thoroughly understood. Achieving this understanding necessitates the provision of diverse types of structural knowledge capable of informing design and analysis. Additionally, by exploring various structural design methodologies, two principal types of cognition — "geometric" and "numerical" — can significantly help designers navigate the complex requirements of structural design. This research aims to investigate the different forms of structured knowledge relevant to architectural design, ultimately addressing the central question of how geometric and numerical comprehension of structures contributes to the architectural design process. The research employs a descriptive-analytical method with a comparative study approach. It begins by defining and detailing the characteristics of geometric and numerical cognition within the design framework, subsequently elucidating their interrelationship in architectural design. Findings suggest that geometric and numerical cognitions of structures, articulated through distinct languages, correspond to various roles in designing mechanical and spatial aspects, as well as different levels of structural comprehension at various design stages. Geometric cognition, due to its linguistic proximity to the design step, has the capability to examine and apply structural knowledge from the initial stages of form design to its actual construction phase. On the other hand, numerical cognition primarily focuses on the detailed examination of the mechanical and load-bearing aspects of the structure in its analytical step.

Keywords: Design process, Structural knowledge, Geometric cognition, Numerical cognition, Comparative studies

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