Strategic use of representation in architectural massing

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Architectural massing is the primary sub-set of the early stages of built form creation. In this empirical study, we seek a better understanding of the specific cognitive processes contributing to massing. We found that these processes help the designer improve the management of the overall design process through strategies that facilitate a discourse between designer and her graphic representations. These strategies, which rely on the use of regulating elements, include management of part–whole relationships, design hierarchy, topology–geometry relationships, scaffolding the design process, structuring ill-structured problems, and the restructuring of problem parameters.
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Architectural massing is the act of composing and manipulating three-dimensional forms into a unified, coherent architectural configuration. During this process, the relations among massing elements are studied; this includes the relations of the building with its surrounding context and of the building with its sub-parts. Massing comprises all decisions affecting external architectural form. It is a crucial component of design because it is the phase where a designer defines her building's identity as well as the impact of her building upon its urban environment.

Le Corbusier defined architecture as "the masterly, correct, and magnificent play of masses brought together in light". In his statement, there is an emphasis on massing as if it were the very essence of architecture.[1]

Architectural massing is mostly described as a product in the architectural design literature, and has not been sufficiently analyzed as a process. Therefore, we set out to analyze the cognitive strategies that contribute to

1 **Le Corbusier** *Towards a new architecture* Preager Publishers Inc (1960)(p 31)

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architectural massing. Our primary motivation was the design of effective computational tools that would support massing. Although the study presented in this paper focuses on the cognitive aspects of massing, it is a part of a larger research effort dealing with the computational aspects required to support massing.

Our initial study consisted of observing six architects as they performed early design activities that led to three-dimensional massing models. We collected protocol data that revealed specific mechanisms that were repeatedly and consistently used as an integral part of several widely recognized cognitive strategies. These include management of part–whole relationships, design hierarchy, topology–geometry relationships, scaffolding the design process, structuring ill-structured problems, and the restructuring of problem parameters.

We begin our discussion with a description of our empirical study, followed by a review of regulating elements used as design strategies. We then discuss each strategy as described in the literature and manifested in our protocol episodes. We conclude by describing concepts for computational support for massing strategies and by discussing the implications of massing strategies for architectural education.

1 Empirical observation

Our initial investigation of the field revealed that the cognitive aspects of massing have not been adequately described in the architectural or design process literature. Consequently we set up an empirical study for the purpose of gaining a deeper understanding of the strategies that guide massing processes. Since massing does not occur in isolation, we designed a series of protocol sessions that capture massing as well as early design activities that, although peripheral, influence massing decisions; for instance, site design, layout planning, or elevation design.

1.1 Experimental set-up

Protocol analysis has been widely used for studying human cognitive behavior within problem-solving contexts.[2] Advantages and disadvantages of protocol analysis have been debated extensively[3] but are outside of the scope of this paper. We chose protocol analysis because it captures comprehensively and simultaneously the designer's graphical representation and her corresponding verbalization. These verbal expressions encapsulate the motivation and rationale that are not evident in graphical representations therefore, clarifying possible ambiguities that are often present in the latter.

Our protocol experiment consisted of observing six architects while they

2 Kirwan, B and Ainsworth, L *A guide to task analysis* Taylor and Francis, London (1993)
3 Ericsson, K and Simon, H *Protocol analysis: verbal reports as data* MIT Press, Cambridge, MA (1993)