

Complexity in Architecture and Design

Nikos A. Salingaros

University of Texas at San Antonio

Oz Journal, Volume 36, May 2014, pages 18-25 (only the first two pages are posted online)

Introduction

Architecture is successful by connecting visually, emotionally, and viscerally with the observer/user through its complexity. For this reason, complexity is a generative tool. All traditional societies developed an individual architectural form language, transitioning into the complex design language of artifacts and the arts. Internationalization in the early 20th Century erased all of those traditions, with a vast concomitant reduction in design complexity. How do we re-embody complexity into architectural form, space, and surface? Intelligent guidelines come from science. First, we can distinguish between different types of complexity, something that few people have been clear about. Second, we estimate the degree of complexity using a simple model. Organized complexity elicits a harmonious response; versus disorganized complexity that is perceived as randomness. Only the former produces an emotionally nourishing state in human beings, whereas randomness increases anxiety. An architect needs to understand complexity: its intentional generation, and how to manage emergent complexity as a design tool. It is essential to stop using complexity as a metaphor detached from reality, in a random process without any underlying reasoning, and adopt instead a practitioner's perspective.

Defining complexity

Complexity represents intricacy of structure, stored information on how the system actually works and about its own makeup. This internal complexity is independent of whether the system "looks" complex or not. Something empty, excessively plain, containing no structural information, is not complex. The system itself would not exist without a sufficient internal complexity to make it run, or to make it stand up structurally. Disguising complexity is not really being honest about the design, yet the visual surface information of some man-made architectural and design objects is kept low for stylistic reasons [1]. As architects place an inordinate emphasis on visual appearance, a confusion about superficial "look" versus substance permeates and disorients many discussions of complexity in architecture.

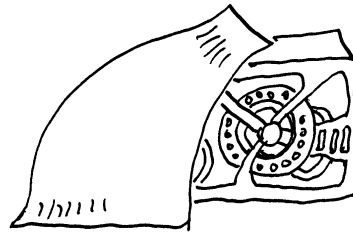


Figure 1. This system's organized complexity is hidden behind a misleadingly simplistic cover.

A useful but limited measure of complexity is the Kolmogorov-Chaitin complexity: how many words are needed for a fairly accurate description [2]. For example, on a blank or uniform computer screen, where all the pixels are exactly the same color, the complexity is zero, since the whole can be specified by a single word (the color of the screen). I have taught this model in Architecture Class, asking my students to catalogue the elements of a form language that was used to construct their favorite building [3]. Descriptions varied from one to four pages, since students chose very different buildings. The students then did a word count of their description. The raw word count measured the degree of complexity of their building. Clearly, minimalist buildings required only a very brief description, hence a low word count; whereas complex buildings needed more description, giving a higher word count.

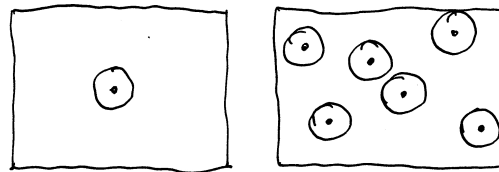


Figure 2. Verbal descriptions of complexity. LEFT: "Circle of radius 1 in center". RIGHT: "Circle of radius 1 centered at point a, circle of radius 1 centered at point b, circle of radius 1 centered at point c, ..."

Two types of complexity: disorganized versus organized

Having established the two opposites of LOW versus HIGH complexity according to the word count of their description, it's time to clarify a long-standing enigma of complexity theory. There exist two entirely distinct types of complexity: DISORGANIZED and ORGANIZED [4]. Both types require a high word count when describing examples, but have distinct internal mathematical structure. They represent departures from low-complexity minimalist structures, yet the way their respective complexity is generated is very different.