Chapter 2
Christopher Alexander's Nature of Order

Christopher Alexander is an oft-referenced icon for the concept of patterns in programming languages and design [1–3]. Alexander himself set forth his theory of good architectural design and its pursuit via architectural patterns in three books published in the latter half of the 1970s [4–6]. In a follow-up to his three-volume architectural exposition, he published a four-volume treatise on The Nature of Order that extensively examines his underlying theory and philosophy of *wholeness* and the properties of *life* in systems [7–10].[1]

This chapter examines Alexander's theory with the goal of correlating the principles and concepts of his treatise on *living structure* with the practice of modeling, analysis, and design of information systems. Although his central focus as an architect is on physical design as in building and construction, his theory goes to the heart of the process of creating systems that are effective and efficient.

Alexander's four book series, The Nature of Order, follows some 20 years after his earlier works on architectural patterns, A Pattern Language and The Timeless Way of Building. These two books are almost always cited as the genesis for the concept of patterns found in object-oriented systems engineering – most notably in Gamma [2] and Coplien [1]. In The Nature of Order, Alexander decomposes the conclusions and directives of those earlier works in a methodical explanation of their genesis in the principles of what he names the *living structure*. He accomplishes this by extensive excursions into contemporary theory and research reported in chemistry, physics, astronomy, biology, art, and engineering. Alexander's use of the term *life* is manifold drawing on its characteristics of evolution and growth, on its characteristics of nurture and interdependency, and on its fragility. In Book I and Book II, Alexander identifies "pattern" as a fundamentally informative characteristic of *life*. He draws out this theme as both a means of defining the existence of *life* in a structure and as a means (in patterned creations) of forming what he calls *living structures*. As he explains, "living structures are the result of a structure preserving process of becoming" [8, p. 4]. As these assertions are explored and explained,

[1] References noted as Book I, Book II, Book III, or Book IV refer to the four books in the series on *The Nature of Order.*

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Alexander defines *life* as it is manifest in physical architecture, its measurable characteristics, and the stepwise transformations that make up any process that is capable of producing a *living structure*.

The discussion that follows maps Alexander's theory and philosophy of building and architecture onto modeling and developing information systems and their architecture. It would be convenient to say that his thinking can be directly applied without any "interpretation"; however, his writings are rather clearly fixed on the physical architecture of rooms, buildings, towns, and cities. Although he cites work in information systems that have drawn on his vision of architecture, he is clearly preoccupied with a strong disaffection of what he calls a "mass psychosis, a half century of lifeless architectural design and construction" [7, p. 6]. His intention seems clearly focused on rehabilitating the practice of architecture in physical construction. Nonetheless, I shall show that the principles that Alexander develops to study *life* in buildings are entirely applicable to the modeling, design, and implementation of information systems.

2.1 Order, Complexity, and Human Perception

In Alexander's discussion of order, he settles on an understanding, based primarily on process, that the arrangement of things is based on their arrival at relative positions influenced by forces that guide their movement or evolution [7, p. 8]. The forces result from the relative location or context in which an element resides. Continuously influenced by these forces order emerges and is preserved over time, across space, or through change as elements systematically conform as constituent components of a whole. Arrangements that fail to achieve *wholeness* falling outside the equilibrium of these forces will not have sufficient stability to persist. In time, they must and will realign and in the meantime appear to exhibit disorder. In the millennia of human existence and evolution, the *wholeness* evidenced by the persistent arrangements has informed what humans have come to understand as "natural." In the world around us, we understand this as a result of the "laws of nature" and hence we perceive the world around us to be almost universally "natural" (with the probable exception of many human constructions).

A key concept in Alexander's theory is that order is a dynamic concept rather than a static one. Although humans often experience a large number of components or relationships as complexity, multiplicity does not automatically result in disorder. Neither does order naturally result from a small number of parts or relationships. It is not multiplicity that results in disorder but rather, an inability to comprehend an evolutionary, organizing, and explicative path of change from one arrangement to another and so forth and so on. As a result, human attempts to create and sustain orderly systems must rely on devising or (in Alexander's case) discovering rules for system construction that preserve the clearly visible, orderly composition and *unfolding* transformation of system and parts. Systems (natural

or human-made) that entail this concept of order are said to have *life* [7, p. 33]. And thus, Alexander argues that methods of constructing living systems will always be based on techniques that preserve the natural order of *living structure*.

Alexander's research over 30 years with observers of architecture reports a remarkable fact that is corroborated by researchers in related fields. Given any two systems presented as visual images to the same population of observers, the vast majority of those observers (in excess of 80%) will agree on which of the two systems exhibits a greater degree of *life* [7, p. 71]. Alexander concludes that within a certain sphere of culture, there are almost universally held conceptions of order, which are evidenced by the feelings of *life* experienced by observers viewing images, structures, rooms, buildings, roads, or landscapes. He further asserts that this concept extends to any space in which objects and their relationships may be observed.

Can Alexander's theories be translated for constructing models of information systems that exhibit *life*? It would appear so! If (1) Alexander's "any space" extends beyond building physical artifacts to "building" conceptual artifacts and (2) the same principles of order govern models of systems constructed in a conceptual space, then (3) models of information systems possess the same relative degrees of *life* attributable in physical buildings and architecture. The task of confirming the assertion that models of information systems have *life* begins by considering the underlying principles of Alexander's concept of order.

2.2 Wholeness and Centers

Alexander's explanation of *life* in structures would seem to most readers to be more of a poetic rather than a scientific argument. Alexander's concept of *life* asserts that reality lies not on either end of a philosophical continuum with poetry and science at either end, but with a realization that poetry and science are simply different views of the same reality. *Life* arises from a system of constituents that contribute to a shared identity and purpose, a concept Alexander names *wholeness* where each part's structure and function flows into a continuity of the whole [7, p. 80]. Each of these contributing parts Alexander calls a *center*, "a distinct set of points in space, which, because of its organization, because of its internal coherence and because of its relation to its context, exhibits centeredness, forms a local zone of relative centeredness with respect to the other parts of space" [7, p. 84]. The term *center* reflects a need for focus to identify a coherent concept: first, how that concept contributes by itself to the whole of a system of parts, and second, how that concept works together in concert with the *centers* around it to contribute to the whole. In a phenomenon Alexander calls "field effect" each *center* impacts the whole in a way similar to a gravitational field sending out waves of influence to all the *centers* within its range of influence, interacting with neighbors and the collection that composes the whole [7, p. 119].

2.3 Choices as Centers

Alexander's conception of *wholeness* and *centers* is grounded in the geometry of space and its physical attributes of position and distance. To apply Alexander's concepts of physical structure to information systems, they must first be translated from a language of physical space to a language of cognitive space where physical position and distance correspond to concepts and consonance in "fields" populated by abstractions rather than shapes. The term *choice* serves well for that translation of Alexander's term *center* into this cognitive space.

An information system is an organized and integrated collection of *choices*. Some of those *choices* designate the stakeholders' understanding as to the purpose of the system. These are sometimes called requirements. Some of those *choices* designate the operations that explain the behavior of the system. These are sometimes called functional requirements. Some of those *choices* designate information that records the history of system activities and accumulates information as it goes forward. These are sometimes called data requirements. Some of those *choices* designate points where the activities that go on outside the system come in contact with the system and are called interfaces. Some of those *choices* designate representations that will characterize elements in the implementation of the system. These are sometimes called design decisions. Traditionally, these *choices* are taken at different times and reflect a conviction toward organizing activities that eventually result in a working information system. A collection of the kinds of these *choices* and a particular sequence of activities that produces them is sometimes called a development methodology. In modeling and information systems, these *choices* are exactly Alexander's *centers*. And in Alexander's terms, the degree to which these *choices* contribute to the whole (system) determines to what degree the system has *life*.

Choices are the *centers* that lie at the root of *life* in information systems. *Choices* address different aspects of system abstraction at different points or stages in system development. A *choice* by nature admits to alternatives and the prospect of reconsideration when an *unfolding* context of experience and understanding merits it. Alexander uses this term, *unfolding*, repeatedly to explain the evolution of an architectural conception toward a useful intensification of *life*. In this sense, a living information system model *unfolds* revealing a continuity of structure and function and consonance with the context within which it is intended to serve.

2.4 Wholeness and Center Properties

Wholeness (as Alexander describes it) is a "field" of interrelationships among *centers* in a "space" where the interaction of the *centers* resonates with the "self" of the "observer." Alexander defines *wholeness* as follows:

> I propose a view of physical reality which is dominated by the existence of this one particular structure, W, the wholeness. In any given region of space, some sub-regions have higher

> intensity as ***centers***; others have less. Many sub-regions have weak intensity or none at all. The overall configurations of the nested centers, together with their relative intensities, comprise a single structure. I define this structure as "the" wholeness of that region. [7, p. 96]

Wholeness is palpable. In a system comprising strong *centers,* the *wholeness* "feels strong." To say that a system has "*life*" is to say that the system's *wholeness* resonates with the observer. The fact that a majority of observers consistently share the same relative feeling of *life* (as in the image experiments with Alexander's students) results from the observers' shared culture, a communal understanding about what order is in their world. The "feeling of *life*," the *wholeness* of systems, derives from identifiable (and in some cases quantifiable) properties that define each and every *center* and its relationships in the whole.

Alexander identifies 15 properties of *centers* that contribute to the degree of *life* experienced by an observer. In Alexander's list, the properties are expressed in terms of architectural visualization although he says that these properties are equally applicable to "actions:"

> Quantum mechanics asserts, via the mathematics, that particles are physically affected in their behavior by the wholeness of the space in which they move.... [Wholeness] is not restricted to buildings or works of art, but is valid and essential even in those parts of the world we have historically believed to be mechanical in nature. [7, p. 467]

Table 2.1 lists the 15 properties in Alexander's architectural vision of centers with the description of each [7, pp. 239–241].

Table 2.1 Alexander's properties of *Centers*

Property	Description
1. Levels of scale	The way that a strong center is made stronger partly by smaller strong centers contained in it and partly by its larger strong centers that contain it.
2. Strong centers	Defines the way that a strong center requires a special field-like effect, created by other centers, as a primary source of its strength.
3. Boundaries	The way that the field-like effect of a center is strengthened by the creation of a ring-like center, made of smaller centers that surround and intensify the former. The boundary also unites the center with the centers beyond it, thus strengthening it further.
4. Alternating repetition	The way in which centers are strengthened when they repeat, by the insertion of other centers between the repeating ones.
5. Positive space	The way that a given center must draw its strength, in part, from the strength of other centers immediately adjacent to it in space.
6. Good shape	The way that the strength of a given center depends on its actual shape and the way this effect requires that even the shape, its boundary, and the space around it are made up of strong centers.
7. Local symmetries	The way that the intensity of a given center is increased by the extent to which other smaller centers that it contains are themselves arranged in locally symmetrical groups.
8. Deep interlock and ambiguity	The way in which the intensity of a given center can be increased when it is attached to nearby strong centers, through a third set of strong centers that ambiguously belong to both.

(continued)

Table 2.1 (continued)

Property	Description
9. Contrast	The way that a center is strengthened by the sharpness of the distinction between its character and the character of surrounding centers.
10. Gradients	The way in which a center is strengthened by a graded series of different-sized centers that then "point" to the new center and intensify its field effect.
11. Roughness	The way that the field effect of a given center draws its strength, necessarily, from irregularities in the sizes, shapes, and arrangements of other nearby centers.
12. Echoes	The way that the strength of a given center depends on similarities of angle and orientation and systems of centers forming characteristic angles, thus forming larger centers, among the centers it contains.
13. The void	The way that the intensity of every center depends on the existence of a still place – an empty center – somewhere in its field.
14. Simplicity and inner calm	The way the strength of a center depends on its simplicity – on the process of reducing the number of different centers that exist in it, while increasing the strength of these centers to make them weigh more.
15. Not separateness	The way the life and strength of a center depends on the extent to which that center is merged smoothly – sometimes even indistinguishably – with the centers that form its surroundings.

References

1. Coplien J and Schmidt D, Eds., *Pattern Languages of Program Design*, Reading, MA: Addison-Wesley, 1995.
2. Gamma E, Helm R, Johnson R and Vlissides J, *Design Patterns: Elements of Reusable Object-Oriented Software*, Reading, MA: Addison-Wesley, 1995.
3. Coad P, "Object-Oriented Patterns," *Communications of the ACM*, 35, 9 [September 1992]: 152–159.
4. Alexander C, *A Timeless Way of Building*, New York: Oxford University Press, 1979.
5. Alexander C, Ishikawa S, Silverstein M, Jacobson M, Fiksdahl-King I and Angel S, *A Pattern Language*, New York: Oxford University Press, 1977.
6. Alexander C, Silverstein M, Angel S, Ishikawa S and Abrams D, *The Oregon Experiment*, New York: Oxford University Press, 1975.
7. Alexander C, *The Nature of Order An Essay on the Art of Building and the Nature of the Universe: Book I - The Phenomenon of Life*, Berkeley, CA: The Center for Environmental Structure, 2002.
8. Alexander C, *The Nature of Order An Essay on the Art of Building and the Nature of the Universe: Book II - The Process of Creating Life*, Berkeley, CA: The Center for Environmental Structure, 2002.
9. Alexander C, *The Nature of Order An Essay on the Art of Building and the Nature of the Universe: Book III - A Vision of a Living World*, Berkeley, CA: The Center for Environmental Structure, 2005.
10. Alexander C, *The Nature of Order An Essay on the Art of Building and the Nature of the Universe: Book IV - The Luminous Ground*, Berkeley, CA: The Center for Environmental Structure, 2004.

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