CHRISTOPHER ALEXANDER'S DESIGN THEORY FROM NOTES ON THE SYNTHESIS OF FORM TO A PATTERN LANGUAGE

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ABSTRACT
Alexander's design theory was initially based on Cartesian rationalism for solving design problems. Problems are broken into their smallest components; each component is solved separately, and then finally synthesized into a grand solution. Later on, Alexander moved into almost the opposite direction where the importance to a holistic approach was emphasized. At present, he is trying to bring a experiential dimension to the design process.

The main objective of this paper is to examine the work of Christopher Alexander from Notes on Synthesis of Form to A Pattern Language and to look at how he developed his thoughts about the theory of design over time. The paper explores the use of Alexander's design paradigms as a basis for understanding the built environment. It critically examines the limitations of his approach and looks at how this approach can be used to achieve quality in the design of the physical environment. The paper begins with a brief description of Alexander's background in order to help make connections between his design theory and his educational preparation and early experience.

Christopher Alexander attended Cambridge University and graduated with an undergraduate degree in Mathematics and Chemistry. He then went into the Architecture program but was dissatisfied with it since he wanted to learn to make beautiful buildings which have a “timeless quality” (Grabow, 1983). Alexander did not complete his Architecture degree at Cambridge but instead came to Harvard to do his PhD (Shipsky, 1984; Grabow, 1983). His doctorate dissertation is published under the title Notes on Synthesis of Form in 1964. The development of Alexander’s design theory can be examined in three stages. The first stage deals with the evolution of his theory and it was at this stage that Notes of Synthesis of Form was published. The second stage led to the publication of “A City is Not a Tree”. The final stage culminated into the publication of A Pattern Language and The Timeless Way of Building.
THE FIRST STAGE: RATIONAL APPROACH

Notes on the Synthesis of Form emphasizes a Cartesian rationalism for the solving of design problems. It is supplemented by modern set theory, graph theory and the use of the computer. Problems are broken into their smallest components; each component is solved separately, and then finally synthesized into a grand solution (Alexander, 1964). Notes on the Synthesis of Form represents Alexander's attempt to find out what creates a successful design. He singles out a number of important approaches to design such as form-context, “fit” - “misfit”, and self-conscious - unselfconscious.

Alexander states that the final object of design is form and the problem of design is to fit form to its context. Form is an important part of the design over which designers have control. Context is also part of the design which puts demands on this form (Grabow, 1983).

Nowadays, many buildings are designed as art objects (or figures) with very little importance being given to the context or space around them. In many cases, the spaces around the buildings are dealt with afterwards and a cosmetic approach is used to beautify them with materials such as trees, sculptures, fountains and floor textures. The resulting buildings float in the negative space around them, and there is no figure/ground relationship. This, however, was not always the case; Sitte\(^3\) (1965) indicates that in the Renaissance cities of Europe, buildings and landscape or outside spaces were designed together as one element. Equal importance was given to both the building and the landscape in terms of context. There was a proper fit between form and context. Even though this is rarely seen in modern architecture, it can be found in Frank Lloyd Wright’s Falling Water. In this example, house and landscape completely belong to each other.

Notes on the Synthesis of Form focuses on methodology but not on providing the “ultimate solution.” Alexander’s approach is to take care of the misfits in the physical environment. He reduces the idea of “fit” to specific terms, using the example of a metal face which is tested against a steel block. The face of the block is inked and the metal face is rubbed against it. Any high spot shows immediately and demonstrates the “misfit” of form to context. The main problem for a design is to find the relevant variables of misfit. Alexander was not interested in conventional solutions. His method included regrouping the misfit variables, working out a solution to each of these groups, and combining these group solutions into a new whole (Alexander, 1964).

There are problems with Alexander’s concepts of “fit” and “misfit.” Firstly, it may be difficult to find all the misfits. Secondly, the information about fit may be as important as that about misfit. If there is not enough information about what fits, one may ignore the most appropriate solution for the design, and may end up in creating another misfit. Thirdly, the world is not divided into good/fit and bad/misfit.
In his study of an existing village in India, Alexander identified 141 “misfits.” Examples of these are as follows: treating cattle as sacred, and village women gossiping while fetching water or taking a bath (Alexander, 1964). Factors which may be considered misfit according to Western standards may not be, according to Eastern standards, because they are linked to culture. Different designers most probably will identify different misfits, in terms of number and content. Alexander believes, however, that in the end, all designers would achieve the same list of misfits (Alexander, 1964). This may not be true.

Notes on the Synthesis of Form makes important observations on the difference between the unselfconscious (traditional) approach and the self-conscious (specialized) approach to designing and building. In defining good design in architecture, Alexander chooses indigenous buildings made in traditional societies. Traditional societies have produced their architectural forms over a long period of time and after much trial and error. Changes in the society were slow and so they were well adapted into the system of building. Alexander argues that rapid changes in technology affect the quality of materials produced by the particular society (Alexander, 1964). In these modern times, changes can also be caused by foreign aid in the form of the introduction of modern sophisticated technology. The following example demonstrates this quite well.

Yemen, a small country in the Middle East received foreign aid in the early sixties. Aid came in the form of architects and engineers from many different countries. During the centuries of seclusion from the West, Yemen had evolved a uniquely sophisticated urban architecture. The foreign experts however failed entirely to recognize the country’s architectural heritage and wealth and instead, put their trust in modern technology and construction systems. The application of these modern construction techniques and materials demanded special construction skills (Brent, 1976).

Foreign professionals built almost every building with reinforced concrete. Yemen has a temperature differential of thirty to forty degrees Fahrenheit within a twenty-four hour period. As a result, expansion and contraction due to this temperature difference caused cracks in almost all the newly constructed concrete structures within a few months after their completion; these cracks endangered the structure of the buildings. The modern concrete buildings were also inappropriate for the climate since they became ovens during the day and refrigerators at night (Brent, 1976).

The traditional building material was mud bricks; this was appropriate to the climate and its application allowed for greater error and flexibility in construction. Within a short space of time, wealthy Yemeni who had wanted the status of modern houses returned to their traditional homes. A test conducted in a traditional Yemeni house revealed that the inside temperature varied only two degrees Fahrenheit over a twenty-four hour period while the exterior temperature fluctuated by thirty degrees (Brent, 1976). This shows that a study of the traditional way of creating buildings can enrich our current built environment.
THE SECOND STAGE: EMPHASIS ON WHOLENESS

In 1965, Alexander published the article entitled “A City is Not a Tree”. This makes a comparative analysis of the number of modern “planned” cities around the world which resulted from a tree-like structure, with the “natural” cities. He concluded that “planned” cities such as the Indian city of Chandigarh, the Brazilian capital of Brasilia and New Tokyo in Japan are not working the way they were designed and planned. This is because they were planned according to a rational method; problems and functions were broken into various categories. Alexander discovered that traditional cities which grew organically have a very complex pattern of an overlapping structure. He states “for a human mind, the tree is the easiest vehicle for complex thoughts” (Alexander, 1966). In contrast to the “planned” cities, the different landuses in the physical pattern of “natural cities” merge together; they are not neatly zoned and segregated. Looking superficially, one may observe that there is no order in the natural cities, but in reality, there is complete order hidden in them.

In the case of the master plan of Chandigarh, the city is conceived of in terms of a simple tree. The entire city is created in terms of superblocks known as sectors. The sectors are based on functional landuse such as residential, commercial, educational, recreational and industrial. They are connected together by an efficient transportation system. This is similar to a well run factory where the functions are first separated analytically, then assigned to different areas, and finally connected together in a most efficient manner possible. The designers made assumptions about how people were going to use the city without considering the traditional Indian way of life. Leisure Valley, a linear park area running from north to south through the entire city was provided for the residents but it is hardly used by them. The concept of a city wide park is familiar in the West but in India, parks are rarely used. This is because Indians are family oriented and their recreation takes place at home. The green spaces around the houses and backyard gardens are therefore important because they follow the traditional pattern very closely. Indian women generally stay close to home and their children also play nearby. Many of these problems could have been avoided if Corbusier had realized the durability of traditions: how society and the traditional city are related to one another (Brent, 1976). Alexander concluded that environmental planners and designers should think of cities in terms of semi-lattices rather than trees (Alexander, 1966).

After the publication of “A City is Not a Tree,” Alexander published in 1988 A New Theory of Urban Design. Alexander asserts that each town grows as a whole, according to its own laws of wholeness, not only on a large scale, but in every detail, from side walks to houses, shops, markets, parks and gardens. The book emphasizes the need to articulate principles in order to create wholeness in our modern cities (Alexander, 1988). In essence, he strongly suggests a framework for urban design and planning in which the development plan for a given site must be linked to the immediate and larger framework of its vicinity. For example, designing and planning a high rise
building must be analyzed in the framework of the regional, local and site context before decisions are made.

**THE FINAL STAGE: THE DEVELOPMENT OF PATTERN LANGUAGE**

Alexander realized that the methodologies he developed in *Notes of Synthesis of Form* and “A City is Not a Tree” still did not provide answers for the creation of beautiful buildings “with a timeless quality.” This was partly because he was not satisfied with modern architecture. At this later stage, Alexander’s design theory moved into a new direction. He focuses instead, on patterns and emphasizes the importance of the whole rather than the parts of the design.

This work is reflected in *The Timeless Way of Building* and *A Pattern Language*. These books emphasize the interaction between people and the environment. They have prescriptive intention and in many instances, Alexander asserts that patterns are “true invariant”. Patterns provide “all possible ways” for solving the stated problem; they are “archetypal” and will still be a “part of human nature” five hundred years from today. Alexander presented *The Timeless Way of Building* and *A Pattern Language* as design tools for humanizing places and endowing them with a life giving quality. He uses an interesting analogy between a pattern language and an “ordinary” language. He says that with a pattern language, people can have the capability to “create an infinite variety” of new and unique towns, buildings and urban spaces just as “ordinary language” gives them the capability to “create an infinite variety of sentences” (Alexander, 1979).

The book *A Pattern Language* provides patterns based on the way people have built and used their physical environment. Alexander lists 253 patterns which can be divided into the three major groups: towns, buildings and construction. Each pattern describes a problem which recurs over and again in the environment. Like words which can be strung together to form different sentences, patterns can generate an infinite number of design solutions. According to Alexander, patterns provide answers to design problems; the designer is not constrained to using the same solution more than once (Alexander, 1977 and 1979).

*A Pattern Language* does not provide a solution to all design problems. For example, if one wanted to design an entry to a building, one could not simply refer to the book in order to extract a pattern for the design. Since each design situation is unique, it is critical to analyze the problem within its context: to fully understand the function and the purpose of the entry, whether it is for a residential or an industrial building; the number of people who will use it; the form; and, context of the building. These will help to determine the appropriate size of the entry and what is suitable for the particular design situation. *The Timeless Way of Building* and *A Pattern Language* can provide valuable input for the design if one visualizes the design situation properly.
One can then go through the various patterns indicated in the books within the context of the problem. This provides a good basis or a starting point for design development concepts.

After the development of his pattern language, Alexander realized that his theory still did not fully answer the question in which he had always been interested: how the quality of timelessness could be created in the built environment. At present his research is focused on “Deep Structures”. He believes that there are two “types of order” in the built environment: one is functional order and the other is formal order. These are properties of space. Functional order can be found in the order of a “coke vending machine”. It is totally based on function and efficiency. It is very easy to take care of this functional variable because it can be described and analyzed objectively. Formal order is the order of a beautiful Chinese vase which remains essentially indescribable because the experiential factor is an important part of it. To describe the order of such a vase, one can only provide subjective answers which have little or no validity when compared with objective descriptions of functional order. These two “types of order” tie the design with human nature and feeling. This is called “wholeness.” In good design, wholeness can be found in every part of the structure (Alexander, 1983). There is, for example, wholeness in the design of the Taj Mahal. The four minarets, material, calligraphy and the setting are an integral part of the form and if one is disturbed, wholeness will be disturbed.

Functional order and formal order can also help to achieve quality in the built environment. They are missing from present day environmental design methodology (Alexander, 1983). Alexander is trying to bring experience and emotions into the design process. For example, in one of his design workshops, participants designed a bench using a holistic approach. As a first step, workshop participants created a full scale mockup bench with building blocks. The designed bench responded to their functional and emotional needs. Once the participants were satisfied, the bench was constructed and even ornamentation was applied. The design, construction, and the involvement of participants became an integral part of the process. They were performed at the site to achieve a wholeness in design (Shipsky, 1984). The bench does not have sleek modern lines, but it is comfortable and pleasing. Its form and location capture the experiential part of the site.

Through the use of pattern language, environmental designers do not have to make predictions about the success of a design and so, many uncertainties about future outcomes can be avoided. These patterns are the result of thousands of years of planning on the site as well as building experience. They can provide a valuable resource from which information can be extracted. Designers do not have to copy and recreate old architecture, but can use ideas which may provide some kind of frame work or basis for their design. In the Yemen example, people left their modern homes and moved back to the traditional houses which were better suited to the climate.

Alexander’s books about patterns provide a rich vocabulary which can help in creating quality built environment. One has to be very careful, however, in
the selection of proper patterns which will respond to the design criteria and site conditions. Patterns can only be used as guides for the development of design concepts and not as ready-made design recipes. In modern times, design decisions are divorced from site conditions and in some cases, designers even have preconceived design concepts before their site visits. The designer should not depend totally on working drawings but should be able to make changes or accommodations in his design. These changes should be in accordance not only with the physical condition and quality of the site but should also combine the experiential part of the site with the design. In Alexander’s words, the designer should be able to do “fine tuning” on the site if needed, in order to achieve wholeness and quality in the design. The fine tuning of the bench design was easy because of its small scale. In the case of large projects, the design process may be difficult, time consuming and difficult to administer.

CONCLUSION

This paper has traced Alexander’s thoughts about design theory from his Notes on Synthesis of Form to A Pattern Language. It started with his faith in a rational approach to design and then demonstrated how this approach fails to consider the inter-relationship of various parts in planning and design. The example of Chandigarh demonstrates that the city does not respond to the needs of its residents because it had been conceived of as a “tree”. “A City is not a Tree” makes a strong argument that cities have a semi-lattice pattern.

In Theory of Urban Design, Alexander emphasizes the importance of using wholeness as a basis for urban design and planning. From Notes on the Synthesis of Form where he advocates a rational approach to planning and design, Alexander moves almost in the opposite direction. A Pattern Language and A Timeless Way of Building provide rich material about the patterns of the built environment. These books should not however be treated as design bibles where the solutions to design problems can be easily found, but they should be considered as design guides. The Yemen example shows how the patterns of the traditional way of building and construction can be helpful in creating successful design solutions. Designs based on an understanding of patterns have a greater probability to be successful because they are the result of people’s experience over time. Pattern language can therefore provide a useful basis for the design of the physical environment. Finally, Alexander’s current research on “deep structures” may provide designers a new basis towards the creation of an environment with a “timeless quality.”

END NOTES

1.. A Pattern Language, 1977 is not Alexander's latest work but it is one of his well known works. His latest book is A New Theory of Urban Design, 1988 which is also discussed in this paper.

2.. Alexander says quality is without name (Alexander, 1979). In this paper, the term quality environment means the built environment which is functional and which also provides comfort, a sense of belonging, and a sense of security to users.
3. Alexander’s predecessor Sitte (1965) in City Planning According to Artistic Principles provides a framework for creating lively and pleasing urban plazas. This classical book, which was first published in 1889, is still relevant in modern times because designers seem to have forgotten some of the most fundamental means of creating a pleasing built environment.

4. Christopher Alexander’s (1966) “A City is Not a Tree” provides an excellent discussion on the concept of tree structure. Please refer to the references.

5. For a lucid and thorough discussion on Semi-Lattice structure in “natural cities”, please consult Alexander’s (1966) “A City is Not a Tree” in the references.

6. Although this is Alexander’s latest work, it is discussed here because it is related to city planning.

7. A Pattern Language is supported by The Oregon Experiment which is a case study for the development of the campus of the University of Oregon. In this, public participation is emphasized (Alexander, 1975).
REFERENCES


A Pattern Language isn’t a soothing hippie tome but a call to action. The next time I read Alexander, I did have two kids and was thinking about families on a larger scale. There are a series of housing projects from the 1970s that I always associated with the book: brown and terraced, arranged around courtyards and accessed via picturesque, hedge-lined passages, such housing combines the sweeping geometry of late modernism with the quirky planning of the Italian hill town. In my own early childhood in Cambridge, Massachusetts, children in my neighborhood emerged from their houses and congregated on the brick sidewalks, occasionally taking over the narrow street for kickball, or tunneling through centers of blocks by jumping the fences between adjacent yards. Start your review of Notes on the Synthesis of Form. Write a review. In this book, Christopher Alexander examines the problem of design at an elemental level. The act of designing, in this study, is the same whether you are designing a teakettle or a house or a village. As expected, it was as torturous as the underlying theory was. The perennial taunt for those of us with our heads in the clouds is to stick our feet on the icky muddy gritty slimy dirty ground and walk, so that we might actually get somewhere, but whenever exposed to the actual process of walking, we recoil and retreat. Thus I must commend Christopher Alexander, who at time of writing was only a couple years older than yours truly is now, for supplying a worked example at the end of this book.