Pattern theory, initiated by the architect Christopher Alexander, leads to insights and applications far beyond the original field of architecture. Its methods work for many types of complex systems – like cities, organizations, or the self – helping with their creation, design, development or unfolding. Alexander lets us think the world in a new way. Highly connected entities – instances of generic patterns – form organism-like and ecosystem-like structures. These are viewed in their wholeness as living systems, whether biological or not. The new concepts improve the perception, description and understanding of these systems, both as structures and processes. Transformations build on existing structure, unfolding it step-by-step. This is seen as the repeated application and adaptation of fundamental problem-solution-patterns, searching for overall system improvement and win-win situations. Such patterns can be collected as pattern languages, to be used, shared, and further refined.

Central to pattern theory is the human being as a designer and co-designer in numerous contexts. Pattern collections become pattern languages when they are used in communities to create a shared perception of the given systems and to bring about their future development. This means to access the cultural heritage of mankind in a conscious way, and to share and reuse its wisdoms, and to refine them for future generations. Alexander's message is important for the life of everyone.

Pattern Theory

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Introduction and Perspectives on the Tracks of Christopher Alexander

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Preface

The concept of the *pattern* as used in the title of this book means more than the simple word *pattern* in our everyday language; rather it aims at one specific form of pattern, the *problem-solution-pattern*. This can be used as the starting point for a *new way of scientific thinking*, one that can help us to better understand the world, especially when complex systems and creative processes are involved.

The concept *pattern* also stands, like a symbol or a banner, for a *method for designing living systems*, for a more humane kind of development. In practice, this means that patterns are collected in pattern languages by communities and used for collaborative forms of design or development, in an attempt to improve the world.

When talking about *living* systems, the word *living* is not used to indicate the biological state of being *alive* as opposed to *dead*. It is used for a gradual quality of life – the degree of structural and functional complexity, intensity, order and coherence in all systems, whether they are considered biologically alive or not.

A note from the time of translation in 2014: The English word *living* seems less able to communicate this meaning, compared to the corresponding German word *lebendig* which is more abstract and less biological in its associations. It is normal in German to describe a book, some music, a city, a lecture, a painting or a movie as *lebendig* (*living*). This problem in the English language showed up in connection with the concept of *quality without a name* instead of *living* in the earlier writings of Alexander. This needed a lot of explanation and added a

somewhat mystic and poetic touch that seems unnecessary to the author.

The author derived the term *Pattern Theory* to cover all of Alexander's concepts regarding design in an holistic way. To get this completely right, in a rigorous or scientific sense, will be the work of decades. Depending on the viewpoint, one may think about this as a theory, a way of thinking, a method, a conceptual framework or a paradigm. This book is an introduction, an overview of early applications which shows how pattern theory overlaps with and connects to some other ways of thinking.

The starting point of *pattern theory* is Christopher Alexander: a contemporary architect; an emeritus professor at the University of Berkeley, California; an outstandingly original systems theorist and a philosopher. His ideas are startling because they relate to the design of the world, something of great interest to everyone.

The political, economical and social problems in the 21st Century stack up in discouraging ways. Those in authority, politicians and managers, fail to offer systemic solutions which would need long-term strategies and ethical attitudes. Instead, they typically play down or reject obvious problems, simply leaving them for future generations to solve. In such a situation, Alexander's work seems a unique set of tools to overcome this stagnation and to lead us towards sustainable solutions. Everyone can and should understand his concepts and be able to use these tools within their own sphere of interest.

Consisting of more than 4,000 pages, the original texts (Alexander, 1964-2005) are not easy to cope with, largely due to their cost and sheer volume. In addition, Alexander wrote his 13 books across several decades of research work, during which time his concepts evolved. This means that his early and later texts are not always consistent in their wording, a situation which had improved by the time Alexander published his principal work, the four volumes of *The Nature of Order*

(Alexander, 2002-2005). These books, while also extensive, are highly recommended, offering as they do a revised theoretical construction. In addition, their unique images of architecture, nature and art allow intuitive access into Alexander's concepts and what he stands for.

This book opens with a short introduction, one which relies as little as possible on architecture, thus opening up the concepts for other domains of application. The aim is to make access easy, especially for the non-specialist; a rewarding thing to do, since few thinkers have so successfully created such a useful theory of life as Christopher Alexander. His work is waiting to be understood and used, crying out to be built on and extended.

The author of this book first came into contact with the topic of patterns as a software engineer in 2000, initially with *software design patterns,* an early application of Alexander's concepts in software development. This was followed by service as a pioneer of the *wiki* system, invented by *Ward Cunningham (Leuf & Cunningham, 2001),* a tool for collaborative writing on the internet (Wiki Wiki Web, 1995). Closely connected with the ideas of Alexander, the wiki has become world-famous because of the Wikipedia project (Wikipedia, 2001). Years of working with *online communities* showed that such techno-social systems, although very new and complex, can also be understood by the use of pattern theory.

These experiences motivated the author not only to dig deeper into the work of Alexander, but to bring it to the attention of partners and colleagues in ongoing projects. The lack of any introductory text proved to be an obstacle, however. While some texts already published on the internet were useful in describing particular aspects and in creating interest, they were no substitute for a comprehensive presentation.

Finally, in 2006, the idea was born to fill this need by writing a short introduction to Alexander's work. It quickly became clear, however, that generalizing pattern theory and putting it

into a few dozen standard pages had the potential both for opportunity and risk. While it would not be possible to follow each and every one of Alexander's arguments and viewpoints in detail, there was the opportunity to create clarity and to reach out to a larger audience. However, the necessary simplifications might introduce distortions of the original concepts. So the readers should consider this text as an interpretation and use it, preferably, as a starting point for their own explorations.

I am grateful to my publisher *Nausner & Nausner*, especially to Peter Nausner and Christian Eigner, for trusting me in the early stages; for encouraging and supporting the project; and to Esther Nausner and Elisabeth Payer for their organizational and technical work. I am also grateful to all the dear online and offline friends who have helped me develop the content of this book through discussion, criticism and suggestions; especially Christian Eigner, Florian Heiler, the editor of the English edition Jenni Jackson, Thomas Kalka, Thomas Leitner, the editor of the German edition Christine Maitz, Franz Nahrada, Peter Nausner, Jascha Rohr, Nikos Salingaros, Hermann Schaller, Sunir Shah and Norbert Witternigg. This does not mean, of course, that they agree with all that has been written or that they share responsibility for any errors. I am also grateful to my wife, Eva Leitner, for most of the initial typographical corrections and for her understanding of the amount of time that I have invested in this book.

Helmut Leitner, Graz;
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1 Introduction

Christopher Alexander is a great contemporary thinker, comparable to historical thinkers like René Descartes, Immanuel Kant, Isaac Newton, Albert Einstein, Sigmund Freud and Charles Darwin. This selection, it must be understood, is neither meant as a value judgement, nor is it complete. It simply exemplifies people who have fundamentally influenced and permanently changed human thinking. In my opinion this will also be the case with Christopher Alexander. While pattern theory originates in architecture, it is a general theory of development (of change, of transformation, of unfolding, of the creative process) and, as such, is relevant to almost every field of application, even for the very complex and for social systems. Pattern theory produces a new view of all phenomena and offers a method of dealing with the world in a creative and productive way. Pattern theory is deeply practical: its main theme is the development of human beings and their respective environments.

Critical starting points

Certainly Alexander did not intend to create a new philosophy when he asked: *"How to make beautiful buildings?"* at the start of his scientific career. To our modern ears this question may sound naive, but it was perfectly natural within traditional societies. Great works of art and architecture have always represented human values and symbolized spiritual concepts. Year on year, millions of tourists travel to Florence and to Venice; to the Taj Mahal and to the Alhambra to see these impressive creations of our cultural history.

In contrast Alexander notes that, from the 20th Century onwards, outstanding works of architecture have become rare. Most architects seem to have abandoned this goal, although, in parallel, the technical possibilities have grown incomparably. Any question that architecture can embody values seems to have moved into the background. Fitness for purpose and life-related aspects have been sacrificed in favor of superficial design effects. Alexander criticizes this contemporary attitude and, especially, post-modern architecture. He is concerned not only with the lack of great works of art but sees the same deficiency both in everyday architecture and in the commonplace products of a society that has turned its back on spiritual values in general.

Many contemporary architects feel devalued by Alexander's demands, his value-oriented perspective and his absolute standards of judgement. They are unhappy about his criticism and, therefore, it is understandable that he has more opponents than supporters among his fellow architects. He is also sometimes accused of traditionalism. Such long-running controversy over so many decades has enabled Alexander to extend and refine his arguments.

Alexander himself believes that our current problems are rooted in the dominance of a mechanistic-causal world view – one which explains the world by using a machine-like model. Natural science and technology have used this idea very successfully and have changed our lives in many and varied ways. But the question remains whether this success does not have side-effects that threaten both our societies and mankind as a whole. In this respect Alexander belongs to a large succession of critics.

Many of us have read Goethe's *Faust* at school:

> *I've studied now Philosophy*
> *And Jurisprudence, Medicine,--*
> *And even, alas! Theology,--*

> *From end to end, with labor keen;*
> *And here, poor fool! with all my lore*
> *I stand, no wiser than before*
>
> *...*
>
> *And see, that nothing can be known!*
> *That knowledge cuts me to the bone.*
>
> *...*
>
> *That I may detect the inmost force*
> *Which binds the world, and guides its course;*
> *Its germs, productive powers explore,*
> *And rummage in empty words no more!*

Essentially this situation has remained true for the scientist in the 200 years since Faust was published. Science, as a discipline, still gives few answers to the basic questions that people ask, both about their personal lives and about life in general.

Even more to the point is this quotation from Max Wertheimer's famous talk given 1924 in front of the *Kant Society* titled *Über Gestalttheorie ("About Gestalt theory")*:

> *What is the basic situation? [...] One turns from a living process towards science, seeking clearness, depth of understanding for the nature of what is going on. One is finding manifold instructions, informations and relations, but indeed, one is feeling poorer than before. [...] one has the clear feeling: there's a lot and it means nothing. Somehow, the most important, the essential life-quality of the phenomenon, got lost on that way.*

These quotations are examples of a great longing for true understanding, a longing which science has never really been able to answer. Analytical methodology produces an abundance of information, but mainly about details. "*We know more and*

more about the smaller and smaller; in the end we know every-thing about nothing." Important relationships and phenomena such as meaning, beauty, happiness, freedom and love are systematically neglected. And if the sciences remain silent about these concepts, surely then, must not the concepts themselves be responsible for that, – probably because they actually are irrelevant?

Admittedly, there is the vision that science will be able to explain everything sooner or later by its mechanistic models, but this is an illusionary ideal that diverts us from important questions and hinders innovative research. This book will, in the footsteps of Alexander, hint at the limits of traditional science and suggest new methods and models to get better results in many situations.

The goal: a science centered on life

According to Alexander, the problems that stem from a lack of values are sharply focused in architecture, which makes up the primary environment for the majority of people. It seems symbolic that the dreary suburbs of Paris became the battlefield for violent youth revolts in 2005. It has been argued that the planners of such inhumane environments should be treated as criminals. Whether Alexander has ever commented on that is not clear, but he was always in the vanguard of the fight against inhumane architecture, vociferously supporting the search for the best and most life-affirming designs and processes.

In this search, Alexander initially noticed analogies between growing structures in nature and the artificial structures of buildings, artifacts and cultural landscapes. He searched for similarities between the beauty of a biologically-living flower meadow and the materially-living ocean waves; between the splendor of a sunset and the Sacre Coeur; between the beauty of a painting by Vincent Van Gogh and the old city of Venice. He explored the nature of these systems and what it is that they

have in common, then finally published his life's work, his four-volume *opus magnum*, *The Nature of Order* (Alexander, 2002-2005), the title of which expresses this central concern.

The solution to the problem is, according to Alexander, the idea of a gradual *'quality of life'* which can be attributed to all systems, whether biologically alive or not. The boundary between living and dead matter is thus eliminated: everything that exists has this quality of life to a greater or lesser degree. This concept is perhaps more familiar in German than in English, because people speak about a living picture or a living essay ('*ein lebendiges Bild oder ein lebendiger Aufsatz'*). The German word *lebendig* is more general and includes ideas like *dynamism* and *vividness*. When German speakers talk about a 'living person' (*lebendiger Mensch*), they are referring not to a biologically functioning body, but to a positive, inspiring, charismatic spirit.

A note from the time of translation in 2014: Lacking a suitable word, Alexander started to write about a '*quality without a name'* which gave parts of his theory a mystic touch (Alexander, 1979). Later he switched to the formula '*quality of living systems'*. In latest writings the word '*wholeness'* sometimes seems to take this function. In the end, I think, the pattern community will either use the German word *Lebendigkeit*, the English word *vitality* (the favorite of my English editor), or switch to the new word *livingness* that I have suggested.

This general concept of 'Lebendigkeit/livingness/vitality' can also be used for mixed systems, for example for people, animals and plants in connection with architecture or landscape. The vitality of systems can be determined by looking at their structures and structural properties. The next step is to look at the dynamics of the individual steps of change, the transformation and the processes of development which lead towards a greater degree of Lebendigkeit.

Alexander defines patterns as 'recurring solutions to problems', solutions which contain the main body of the

cultural knowledge of mankind. Patterns like SINGLE FAMILY HOME, DRIVEWAY, MEDICATION, STATE, MARKET, CURRENCY or ORGANIZATION contain the collective experience of centuries of use. Tens of thousands of such patterns influence and determine our lives. Alexander is the first to create a general theory for understanding them.

Please note that the above capitalization of pattern names has become a standard in pattern communities. This means that e. g. MEDICATION stands for a generic problem solution with all its formal and theoretical implications and not just for medication in its everyday meaning.

Patterns are also an important means of communication. They are systematically collected in so-called *pattern languages* and used as formal languages in creative processes. As modular components, they facilitate the methodical development of systems. Thus, a cultural process that has involved many people over long periods of time becomes mentally accessible and the subject of a new kind of scientific methodological investigation.

When everything is dependent on this characteristic quality of life – for example the decisions on how to develop a city – one must find ways to handle it. Alexander made a fundamental discovery: humans feel a resonance to the Lebendigkeit of systems; they have a feeling for it that can be trained just as an ear for music can be trained.

For everyday usage, Alexander suggests simple comparison judgements: if two candidates are put side by side, then the better one gets selected (Alexander, 2002). This is easier than selecting from a larger number of candidates and simpler than judging a single candidate by assigning him an absolute value of measurement.

Collective judgement experiments show large degrees of agreement, and Alexander typically reports an 80-90 % consensus among participants. Decision situations must be designed to avoid third-party bias, however, and the designer should avoid

dominating the process, simply acting as a facilitator to guide the participants through the process.

On this basis we can build a new way of thinking that creates valuable insights into and possibilities for many spheres of life, such as economics, politics and society in general. Architecture – as an abstract concept – appears to represent all kinds of human design. Following Alexander, we progress from architecture to a general theory of life and to a practical method for developing systems through creative and participatory processes.

2 Starting Points

The effects of architecture

According to Alexander, the physical structures of the world act as the framework for all human activities. Architecture in particular influences all human life. A comfortable and relaxed environment makes it easy to lead a productive and conflict-free life. On the other hand, a family living in poor conditions or with limited space will have increased difficulties, both with relationships and with their ability to cope with various problems or disruptions.

In human beings, negative influences result in stress. Stress causes physiological activities that evolved to help the body cope, such as the release of adrenaline into the bloodstream which decreases the perception of pain and increases the available energy. This helps with the 'fight or flight' response in dangerous situations. What was originally a positive physical function to cope with danger is ill-adapted to the problems and life situations of our time. For instance, when someone is about to lose their job or has concentrated work to finish under tight time pressures, an increased pulse rate or raised blood sugar level actually create additional health problems, rather than helping. Along with the physical exhaustion caused by this alarm condition, the person loses concentration and sensitivity and, with them, the ability to focus on and solve the really important issues.

Stress is, according to Alexander, like a single phenomenon of being burdened. Whether the stress comes from physical pain, glare, excessive noise or from money problems is

secondary. The stress increases like water in a reservoir and must be reduced by relaxation if it is not to cause permanent harm. The higher a person's stress level, the less he will be able to perceive the realities of his life and the less able he is to deal with his problems. The increase and decrease of stress influences human qualities. This is especially true for architecture, but also for all other structures that surround us.

The simple architectural pattern LIGHT ON TWO SIDES OF EVERY ROOM described by Alexander calls for each room to have light from windows in two walls. This way people are able to see each other's faces well and can more easily recognize all the signals of non-verbal communication. This improves the quality of communication and avoids certain sources of stress. The measurable changes in lighting may be small, but are nevertheless important, just as are vitamins and catalysts which have important functions even in smallest quantities.

A reduced capacity to solve problems means a reduced ability to act appropriately. According to Alexander, this means a corresponding reduction of personal freedom. A free person is able to act appropriately in every situation. An environment that is hostile to life produces desperation, hopelessness and violence. A good and life-supporting environment helps people both to be free and to feel free.

Pattern theory will help to create positive environments which reduce conflicts and stress while increasing freedom and the quality of life. In addition, the resulting pattern method helps in solving the majority of problems by re-using existing solutions. The remaining problems become less burdensome because they are fewer in number and can, therefore, receive more attention and care.

The mechanistic world view

The mechanistic concept of understanding the world can be traced back to René Descartes, in around 1640. While he is best known for his *'I think, therefore I am'* (*cogito, ergo sum*), he contributed to a number of important concepts of the natural sciences. He introduced the *Cartesian coordinate system* and was the first to suggest a methodical description of scientific work. For example, he suggested it would be possible to solve complex problems by separating them into independent smaller problems until these sub-problems become solvable (Descartes, 1984).

Descartes also suggested the basic principle of methodical doubt, meaning that scientists must not believe in theories until they are proven beyond doubt. This fundamental principle was an explosive idea that led him into potential conflict with the Catholic Church. He moved from France to the more liberal Netherlands and, finally, to Sweden where he died, still in his prime. His main publications demonstrate a strong belief in God, perhaps to counter this dangerous element of doubt.

His most effective idea, however, was the mechanistic model: if one wants to understand how something works, imagine it as a machine. First isolate the aspect you are interested in; the rolling of a ball or the flow of blood in the human body, for instance, from all unnecessary details of the environment. Then create a mechanical model in your mind, a thought model of a machine, containing parts that follow certain rules and reproduce the desired properties.

As the observer, you stand outside and compare the world and the imaginary mechanism. In the event of discrepancies between the model and the world, the model is modified until a fair correlation is reached, at which point you have reached a degree of understanding; you understand the aspects of the world like a machine. This way of thinking was incredibly

successful and formed the core of natural science and modern technology.

Alexander argues that the mechanistic method has inherent problems. It leads to a limited perception of reality and its properties, allowing only facts about mechanisms, a binary true-or-false attitude, and direct cause-effect relationships. Mechanistic thinking identifies functional conditions that the model is required to meet. As it is unimportant which structure is used for that task, function and geometry suddenly have little to do with each other. Alexander, however, suggests that function and geometry are inseparable aspects of all systems in the world.

These days, dominated by the world view of the natural sciences, more and more people are finding it hard to think outside mechanistic causalities. Science perceives life, even human beings, as machines. Science believes that humans can only be understood as mechanisms, that is if they are to be understood at all. There is a strange intolerance against solutions that fail to explain humans as bio-robots. Many processes in society, ecology or psychology are seen as purely mechanical, able to be predicted and controlled, just given sufficient knowledge about mental states and causalities.

Opposing that, one can try to summarize Alexander to: "*The causal-mechanistic world view roughly corresponds to the classical physics of the 19th Century, understanding the universe as a value-free mechanism ruled by natural laws. While this world view has brought insights in physical phenomena and great progress, it has also led to a stagnation in society and the humanities. Descartes would probably have been shocked to see that people now actually think that the reality is that way when he meant his method as a model, a kind of mental trick.*

The result of the mechanistic world view is an arbitrariness of ideas and values, both inside and outside architecture, that has destructive consequences for the artist. First the 'I' was