Christopher Alexander's Battle for Beauty in a World Turning Ugly: The Inception of a Science of Architecture?

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Abstract

Christopher Alexander has been a leading pioneer of academic research on architectural and urban design since the early 1960s. He is also a practicing architect and builder with a passion for creating and restoring life and beauty to our physical environment. In this essay I review, evaluate, and reflect on some of his particularly fruitful, promising, or problematic ideas. I will put forth some ideas of my own for clarification, and to indicate avenues for future research. I argue that Alexander's notion of patterns (a verbal medium for capturing and conveying design knowledge in a systematic, reusable form) is in need of conceptual development along lines I suggest, even though Alexander downplayed the significance of patterns as he moved on to other theoretical ideas (mainly about aesthetics) later in his career. While I go into some detail about selected parts of Alexander's work, the intended readership of this essay is not restricted to specialists. I have made an effort to provide guidance and background information to readers not already familiar with Alexander's comprehensive body of theory.

1 His thesis was published as the (now classic) Christopher Alexander, *Notes on the Synthesis of Form* (Cambridge, MA: Harvard University Press, 1964). In it, he breaks a design problem down into manageable, relatively independent sub-problems using a cluster analysis computer program. The focus on sub-problems adumbrated what would later become known as "patterns."

2 Source of this bio-info: a "blurb" note at the end of Alexander's "New Concepts in Complexity Theory Arising from the Studies in the Field of Architecture: An Overview of the Four Books of the Nature of Order with Emphasis on the Scientific Problems Which Are Raised," *Katarxis Nº 3: New Science, New Urbanism, New Architecture?* 3, no. 3 (2004): 1–24, available at http://www.katarxis3.com/SCIENTIFIC%20INTRODUCTION.pdf. Regarding architecture at Cambridge, see Stephen Grabow's comprehensive biography: Stephen Grabow, *Christopher Alexander: The Search for a New Paradigm in Architecture* (Boston: Oriel Press, 1983), 30.

3 For an online gallery of examples, see Patternlanguage.com, and Center for Environmental Structure, "A Selection of Projects Designed and Built by Christopher Alexander and His Associates in Conjunction with the Clients, Users and Families of Users Who Worked with Us," *Katarxis Nº 3: New Science, New Urbanism, New Architecture?* 3, no. 3 (2004), online, available at http://katarxis3.com/Gallery/nav.htm. See also Michael W. Mehaffy, "Introduction to the Gallery: Toward a New Architecture of Life — or, Why Christopher Alexander May Be the Most Avant-Garde Modernist of All," *Katarxis Nº 3: New Science, New Urbanism, New Architecture?* 3, no. 3 (2004), online, http://katarxis3.com/Gallery.htm.

Introduction

In September of 1969, at the tender age of 19, I was enrolled in the architecture program at the Royal Danish Academy of Fine Arts in Copenhagen. I spent my first term of higher education in frustration — the teaching was largely irrelevant to architecture, and quite devoid of any theoretical foundation. After moving around a bit, I arrived in another department at the Academy. Things changed. Two of my new tutors, Jørgen Peder Hansen and Martin Rubow, gave a course on some strange new design theory *cum* method called *pattern language*. I am not talkative by nature, but something in that course loosened my tongue. Almost 50 years later, I still remember how exhilarated I was as I told my parents there was a guy who had tried to develop a *science* of architecture! His name was Christopher Alexander.

My fascination with Alexander's science project has persisted to this day. I would like to share some thoughts about it, contemplate its status today, and consider its potential for development. I will review selected aspects of Alexander's work in a constructively critical manner, and develop a few conceptual distinctions and clarifications of my own that I hope will shed new light on his ideas and reveal avenues for future research.

But this article is not primarily a report on new research. It was written for the "Reading the Classics" section of *She Ji*. Accordingly, it takes the form of an *essay* reviewing well-established research, with ample space for reflections and informed opinions on the subject matter.

So this is not a biography, nor a bibliography, nor is it a comprehensive survey. Even so, I will provide sufficient biographic information, references, and explanations of Alexander's ideas for the article to serve as an introduction to his theories, or as a kind of guide to his conceptual landscape. I do my best to anticipate and mitigate obstacles that his publications can present to new readers.

Christopher Alexander: A Short Biographical Sketch

Christopher Alexander initially studied chemistry and physics and later mathematics and architecture at Cambridge University. He then went to Harvard, where he earned a Ph.D. in architecture — the first of its kind there[1] — and was elected fellow in 1961. Subsequently, he worked both at Harvard and MIT. Finally, Alexander was appointed professor of architecture at University of California, Berkeley in 1963, a position from which he retired in 2001.[2]

Today, Alexander can look back at an impressive track record of publications, some undeniably classics of (architectural & urban) design theory. But he did not limit his research to the realm of academia. Because he was a practicing architect *and* a licensed contractor on top of being a professor, he could develop and test his theories in practice. He always worked collaboratively with his clients and often on the construction sites. With his colleagues he designed and led the construction of a considerable number of buildings around the world.[3] These were never conventional buildings, and never buildings designed and built by conventional methods. His design theories and construction methods, too, were (and are) very far from mainstream.

Alexander's colleagues and property developers saw his work as highly controversial — even offensive. Attempts were made to prevent him from

4   Christopher Alexander, *The Nature of Order: An Essay on the Art of Building and the Nature of the Universe*, 4 vols. (Berkeley: Center for Environmental Structure, 2002–2005).

5   Ibid., 350.

6   These dramatic events, and others, are recounted in Christopher Alexander, Hans Joachim Neis, and Maggie Moore Alexander, *The Battle for the Life and Beauty of the Earth: A Struggle between Two World-Systems* (New York: Oxford University Press, 2012). For once I will omit page references — so as not to spoil the suspense that comes from reading it for the first time.

7   Richard P. Gabriel and Jenny Quillien, "A Search for Beauty / A Struggle with Complexity: Christopher Alexander," *Urban Science* 3, no. 64 (2019): 1–32, DOI: https://doi.org/10.3390/urbansci3020064; Grabow, *Christopher Alexander*; Eva Guttmann, Gabriele Kaiser, and Claudia Mazanek, eds., *Shifting Patterns: Christopher Alexander and the Eishin Campus* (Zürich: Park Books, 2019), 177–87; Michael. W. Mehaffy, "Notes on the Genesis of Wholes: Christopher Alexander and His Continuing Influence," *Urban Design International* 12, no. 1 (2007): 41–49, DOI: https://doi.org/10.1057/palgrave.udi.9000182; Michael W. Mehaffy, "Assessing Alexander's Later Contributions to a Science of Cities," *Urban Science* 3, no. 2 (2019): 1–18, DOI: https://doi.org/10.3390/urbansci3020059. See also the comprehensive bibliographic survey in Hajo Neis and Gabriel A. Brown, eds., *Current Challenges for Patterns, Pattern Languages and Sustainability: Symposium Proceedings* (Portland: PUARL Press, 2010), 159–69. The survey includes works by Alexander as well as secondary literature pertaining to him.

8   Alexander's guides to *The Nature of Order* can be found in Christopher Alexander, "Topic: The Eishin Process," *Working References to Explanations and Examples in Nature of Order* (n.d.), available at https://www.livingneighborhoods.org/noorefs/eishinprocess.htm; Alexander, "New Concepts," 1–24; and Christopher Alexander, "Empirical Findings from the Nature of Order," *livingneighborhoods.org*, accessed June 26, 2020, http://www.livingneighborhoods.org/library/empirical-findings.pdf.

teaching architecture the way he wanted. For example, in the acknowledgements section at the end of his four-volume academic magnum opus, *The Nature of Order*,[4] Alexander writes,

> "I must express my gratitude, also, for the unrelenting hostility of certain of my colleagues in the Department of Architecture at the University of California, Berkeley. The extraordinary levels of attack, open and covert, unremitting over a twenty-year period … was testimony to the panic they felt — because, under the surface, they knew, I think, that [the material in the book, as taught to the students] was true…. For this unintentional but fervent acknowledgement, I am enormously grateful. At the times of darkest crisis … this never failed to give me strength."[5]

During work on his architectural magnum opus, the Eishin Campus near Tokyo, Alexander came up against attempted bribery and threats from the Japanese mafia (involved with the local construction industry), followed by violence towards his client. On one occasion, after a few drinks, Alexander found himself challenging a representative of a construction firm he was forced to cooperate with — a physically stronger man — to an arm-wrestling match. Alexander prevailed.[6]

His books and articles are totally unlike any other research publications I have ever read. As an author, he has a strong presence that sometimes verges on eccentricity, but does not compromise on serious treatment of the subject matter. While often academically innovative and ambitious (as one would expect from a prominent researcher), his publications show a disregard for the conventionally restrained, objective style. They are powered by a high degree of passion — and by the occasional drama, as exemplified above. Indeed, I wouldn't be the least surprised if one day the entertainment industry came up with a colorful movie or infotainment serial about Alexander's life and work "based on a true story."

About This Essay: A Preview

This essay, however, is not about the passion and drama of Alexander's life. Nor is it my aim to systematically present his body of work, be it academic or architectural. Others have already covered that ground[7] — including to some extent Alexander himself, who is in the habit of offering autobiographical snippets in his writings, and providing guides to *The Nature of Order*.[8]

What I will offer is a review and constructively critical discussion of selected ideas from Alexander's academic production. First, I introduce my main sources: two pairs of important books by Alexander (and co-authors). Since reading Alexander is such a special experience, and the importance of human feeling looms large in his writings, I will give special regard to how it feels reading those books.

Next I will delve more deeply into some of the central ideas Alexander developed in those four books (and elsewhere as well). To that end, I make a distinction between theoretical ideas (the outcomes of his research) and motivational ideas (sources of the passion powering his work). For, just as I felt the above presentation of Alexander himself was the necessary background for reading what follows — or at least helpful — I also believe that understanding his motivational ideas is a prerequisite for understanding

9   In other words, principles reminiscent of laws of nature ("nomological," of Greek origin, means "of or relating to laws").

10 The science at issue here is not about the fairly well understood technical aspects of building, but rather about contending with the artistic and human-istic issues that architects are (or should be) struggling with. I am presupposing, in alignment with Grabow, that tradi-tionally "the architect [was considered] fundamentally an artist, but one who *understands* [technical] science and can apply it to the problem of building. Although he may have great respect for science ... he is not a scientist." Grabow, *New Paradigm*, 7, original emphasis. That is precisely the view of architecture that Alexander wants to change and expand.

11 Christopher Alexander et al., *A Pattern Language: Towns Buildings Construction* (New York: Oxford University Press, 1977).

12 Christopher Alexander, *The Timeless Way of Building* (New York: Oxford University Press, 1979).

13 Alexander, *The Nature of Order, 4 vols.; Alexander et al., The Battle for the Life and Beauty of the Earth.*

14 Editorial note: Normally we give the full name of the publication throughout the whole article; however, in this case we are following the conventional philo-sophical practice using abbreviations for these book titles because they reoccur frequently.

15 Sustasis Foundation, "Christiopher Alexander: Life in Buildings (extended trailer)," interview by Michael Mehaffy, video, 20:31, March 24, 2016, http://www.sustasis.net/CA-FilmTrailer.html. Excerpts transcribed and quoted by kind permission from Michael Mehaffy, director of the Sustasis Foundation.

16 Ibid., 4:48–5:02, emphasis added.

17 Ibid., 5:36–6:25.

his theoretical ideas. Motivational and theoretical ideas will therefore be addressed in separate sections. The section on Alexander's theoretical ideas constitutes the main bulk of this essay. And the main bulk of that section comprises a detailed treatment of Alexander's theory of patterns, which I think remains one of his most important contributions (perhaps *the* most important contribution), even though his more recent work from *The Nature of Order* certainly merits serious consideration as well. To some extent I see it as complementary to the earlier pattern theory.

I then contemplate the architecture-science relationship, starting with how Alexander presents it when reflecting on the significance of his theo-retical ideas, then suggesting it might be seen in a rather different way. In doing so, I propose a distinction between three kinds of theory—nomo-logical principles,[9] methodology, and organization—in order to create an overview and take stock of Alexander's legacy of theoretical ideas. I believe the classification may also serve as a guide to future theory development extending or revising that heritage.

I conclude the essay by summing up the insights gained and suggesting an answer to the question hinted at in its title: *Did* Alexander's tremendous efforts, sustained over a lifetime, bring him and the rest of us closer to a science of architecture?[10]

Four Landmark Books: Two Brief Reviews

To me, two pairs of books in particular are landmark achievements in Christopher Alexander's remarkable career as a design theorist and prac-ticing architect: *A Pattern Language*[11] (*APL* for short) and its companion volume *The Timeless Way of Building*[12] (*TWB*), and *The Nature of Order* (*TNO*) and *The Battle for the Life and Beauty of the Earth* (*BAT*),[13] which describes the Eishin Campus project and demonstrates the theory from *TNO* applied in large-scale practice.[14] I will present each pair in turn.

To strike the appropriate note for each review, I will open with a brief ex-cerpt from a video-recorded interview Alexander gave to Michael Mehaffy in 2016, in which he tells the story of his academic life, succinctly summarizing its twists and turns.[15]

The Timeless Way of Building *and* A Pattern Language

Consider the following two snippets of what Alexander tells Mehaffy during the video interview.

> "Really one of the very largest problems that is facing the Earth just now, is rarely mentioned—and that is *the spread of ugliness*."[16]

> "Nine out of ten development projects that are being done now devastate the area where they are built. This is going on at a colossal speed, and no amount of planning and architecture, in the current way of thinking, is going to save it. In fact, if anything, architects are contributing to it by making their partic-ular contributions more and more fantastic, so that they can be on the cover of magazines."[17]

18   Murray Silverstein, "O Rose Thou Art
     Sick: Reflections on a Pattern Language,
     PUARL Lecture," in *Current Challenges for
     Patterns, Pattern Languages and Sustain-
     ability: Symposium Proceedings*, ed. Hajo
     Neis and Gabriel Brown (Portland: PUARL
     Press, 2010), 19.

19   Christopher Alexander et al., *Houses
     Generated by Patterns* (Berkeley: Centre
     for Environmental Structure, 1969);
     reprinted 1971 in *Architect's Yearbook* 13,
     84–114.

20   Alexander et al., *A Pattern Language:
     Towns*, dust jacket.

21   For example, see Silverstein, "O Rose
     Thou Art Sick," 18.

22   I write pattern names in capitals,
     following what has become a convention
     in the literature.

23   Alexander et al., *A Pattern Language:
     Towns*, 549.

That "nine out of ten" should not be taken too literally, I think; it is nothing more than a colloquialism describing the perceived magnitude of the problem. And regarding the harsh remark about the irresponsibility and vanity of Alexander's fellow architects, it just goes to show, once again, what a controversial figure he was, and is.

I see Alexander's dismay at "the spread of ugliness," and the implication that the architectural profession is too full of itself to show any concern for ordinary people's lives, as keys to understanding the general thrust of *APL* and *TWB*.

The readership of *APL* was intended to include (primarily) laypersons, and Alexander's political-idealistic aim was to *empower* non-architects — through public dissemination of practical hands-on architectural knowledge — to take control over their physical environments (apparently leaving little or nothing for the professionals to do). Underlying both of these books is a common vision: enable people to regain the (pre-industrial) ability to build beautiful and well-functioning environments for themselves. As Murray Silverstein, co-author of *APL*, once put it: that vision "is still alive and urgent: how to make of the urban region a humane and sustainable place. Whatever else it is, *A Pattern Language* is a 20th century neo-romantic, community-anarchist structuralist vision for a human city."[18] In the spirit of earlier empowerment-oriented work by Alexander and his colleagues,[19] *APL* was marketed as a do-it-yourself book. "You can use this book to design a house for yourself with your family … to work with your neighbors to improve your town and neighborhood…. And you can use it to guide you in the actual process of construction."[20]

Though reminiscent of a bible (1,171 thin pages; overall volume like a smallish brick), *APL* is a charming and easy-going read. No doubt this, combined with its "neo-romantic, community-anarchist" approach to architectural knowledge dissemination, is part of the reason why it has attained its current status as a popular classic. Despite the complexity and seriousness of the subject matter (nothing less than the structure and purpose of our built environment), you can read *APL* just for relaxation and pleasure — even, as I once did, for comfort and distraction from misery and self-pity when in bed with flu. Not surprisingly, *APL* is rumored to be one of the best-selling books on architectural design ever.[21] Furthermore, according to Alexander's personal Google Scholar profile, it is the most frequently cited of his publications (13,000+ citations from 1977 up to and including 2019).

APL presents its large body of architectural knowledge in short, accessible, well-illustrated text-nuggets called *patterns*: Each one is titled and contains a generalized, reusable, and (allegedly) more or less cross-culturally valid description of a design principle. It describes a *recurrent*, potentially problematic situation in the environment calling for a particular solution — hence the term "pattern." For example, according to ENTRANCE TRANSITION (pattern no. 112 in *APL*)[22] "The experience of entering a building influences the way you feel inside the building. If the transition is too abrupt there is no feeling of arrival, and the inside of the building fails to be a sanctum."[23] To avoid this problem, you should "make a transition space between the street and the front door. Bring the path which connects street

24 Ibid., 552.

25 Ibid., xv.

26 Sustasis Foundation, "Christiopher Alexander," 8:19–9:55.

27 Ibid., 10:07–11:34.

28 Christopher Alexander, *Sustainability and Morphogenesis: The Birth of a Living World, Schumacher Lecture* (Berkeley: The Center for Environmental Structure, 2004), 17, available at https://www.livingneighborhoods.org/library/schumacher-v17.pdf.

and entrance through this transition space, and mark it with a change of light, a change of sound, a change of direction, a change of surface, a change of level, perhaps by gateways which make a change of enclosure, and above all with a change of view."[24]

Many of the patterns seem reliable and well supported by argument, experiential evidence, or even academic research; others less so. But then they are only presented as mere "hypotheses, all 253 of them — and are therefore all tentative, all free to evolve under the impact of new experience and observation."[25] Thematically, the patterns in *APL* range from the regional scale all the way down to personal items in our private rooms. The patterns can be combined during design much like words can be combined into sentences — hence the title *A Pattern "Language."*

From an academic point of view, *TWB* has perhaps more to offer by way of food for scientific thought, since it is where Alexander develops the theoretical foundation for *APL*. (I will return to that later.) Yet the two books are so closely knitted together as to be "two halves of a single work," as the authors say in the opening sentence of *APL*. *TWB*, though a somewhat more demanding read, has some of the same light-footedness of exposition as *APL*, and uses illustrations in much the same entrancing manner.

The Nature of Order *and* The Battle for the Life and Beauty of the Earth

In his video interview with Mehaffy, Alexander explains the shift he made from pattern language theory to the much more complex theory developed in *TNO*:

> "When I finished the *Pattern Language*, I thought that I had come close to solving the problem of making good human environments. And that if people went to work and used all those patterns, something very beautiful and good would follow…. That turned out to be — not true…. I made experiments, to see what actually happened when people used this, and … I think people did things that were very, very helpful to them, and some of them are quite lovely … just in the sense of being informal and being about that person or this person or that place and so forth. But the buildings, and groups of buildings and so forth, were not really beautiful, to put it quite simply."[26]

> "What *The Nature of Order* is about is: what does it take to make the things beautiful? Really and truly beautiful, in the old-fashioned meaning of the word: so that it touches you in your heart…. And I certainly got closer in those books, than I did in the *Pattern Language* — a lot closer."[27]

If a single word could capture the essence of *TNO*, it would be "beauty." In this book (and its companion, *BAT*), we learn how beauty manifests itself in artifacts and in nature, and how to achieve genuine beauty in architecture — provided we abandon current ways of designing and thinking about architecture, and change the way the building industry is organized (!). If I were to add one more keyword, it would be "life." This does not refer to life in the biological sense — at least not exclusively — but in a sense that characterizes places with that "rough, gradually formed quality which makes it possible to be a truly comfortable person there."[28]

29 The lecture is called *Sustainability and Morphogenesis*, presumably because it was given to an organization promoting the sustainability agenda. But even if Alexander claims his ideas about architecture are conducive to that agenda, I think he is on rather thin ice. His approach may indeed be ethically compatible with sustainability, and adopting it might enhance people's sense of responsibility towards the Earth and its ecosystems. But despite his considerable talent and the merit of his ideas, the ideas contained in this work will hardly save us from climate disaster.

30 A word of caution: in the lecture, Alexander uses the word "center" the way he uses it in *TNO*, but does not explain this. His notion deviates from common parlance. If you read the lecture, you can think of a *center* as a part or component of the environment (though this is a bit simplistic).

31 For example, see Alexander et al., *The Battle for the Life and Beauty of the Earth*, 4, 58, 118.

32 For example, see Alexander, *Nature of Order*, vol. 1, 16–18.

33 A web-based, annotated index is available at Center for Environmental Structure, "Index of Certrain Major Topics Discussed in the Nature of Order," *Livingneighborhoods.org*, accessed June 30, 2020, https://www.livingneighborhoods.org/noorefs/annotated-index.htm. However, it is incomplete and contains errors.

That quote is from Alexander's *Schumacher Lecture*, a richly illustrated transcript freely available online. It can be read in maybe an afternoon and an evening, and reading it will give you a much better idea about the contents of *TNO* than I can hope to do here.[29]

An illustrated preview such as the *Schumacher Lecture* is helpful to a potential reader of *TNO*, for the four massive volumes of the book take up 2,165 pages in total.[30] This is one reason—though not the only one—why *TNO* is in another league of difficulty than *APL* or *TWB*. To be sure, *TNO* has numerous chapters and sections that are captivating and highly readable, brimming with original ideas, instructive examples and case studies, as well as cogent, well-chosen illustrations. However, while the language is generally fluent and eloquent, it is verbose, and the text as a whole feels somewhat repetitive, thus straining the reader's patience. In particular, I become uneasy when reading certain semi-lyrical passages that I perceive as wishful thinking about what architecture should make people feel deeply in their heart, and the like, which does nothing to unfold a coherent argument.

Please don't get me wrong: I subscribe to Alexander's view that human feeling in response to architecture (and other artifacts) should be taken seriously,[31] and that we should summon the courage to treat issues of value in our theories about design—even when it goes against scientific convention.[32] If the theories say nothing of what is (perceived by people in general as) good and bad, they are of limited practical use. But I insist that rationality and scientific rigor be maintained throughout, and wishful thinking goes against the grain of that.

There are further reasons why reading *TNO* is no smooth ride. Notes are inserted at the ends of chapters, not at the end of each volume or as footnotes; so unless ignored, they demand much flapping back and forth of pages. While there are tables of contents (for all four volumes, in every volume), they only show chapter headings (often rather uninformative ones at that)—no section headings. So acquiring an overall top-down understanding of what *TNO* is about by perusing the tables of contents is next to impossible. I would much have preferred just one table of contents per volume, with more detail, and more informative headings. Navigating bottom-up via an index is no option either, since there is no index.[33]

My experience of reading (in) *TNO* reminds me of wandering—and getting lost—in some medieval, self-grown townscape. You may encounter beautiful plazas, parks, landmark buildings, monuments, ornaments, quite a few dilapidated houses, and a network of narrow winding streets and murky alleys leading from everything to everything else, in no particular order. Walking such a network certainly has something to be said for it when it comes to experiencing humane architecture and urban environments. But as a model for the structure of a book I cannot recommend it.

As for *BAT*, one or two of these critical remarks may equally apply. But a firm and benevolent hand was obviously involved in editing the book, and so it has a clearer structure and more informative chapter headings. This, together with its comparatively modest size (a mere 505 pages—including a useful index!), makes the study of it a rather more enjoyable experience. And as a bonus, due to the dramatic events and intellectual conflicts so well

34 Alexander et al., *The Battle for the Life and Beauty of the Earth*.

35 Grabow, *Christopher Alexander*, 29.

36 Ibid., 23 and 25. As an illustration of the antagonism expressed here, it is interesting to read the transcript of a famous debate recorded in 1982, at Harvard's Graduate School of Design, where Alexander's ideas clashed with those of Peter Eisenmann, a prominent representative of the mainstream architectural thinking at the time. Christopher Alexander and Peter Eisenmann, "Contrasting Concepts of Harmony in Architecture: The 1982 Debate between Christopher Alexander and Peter Eisenmann," *Lotus International* 40 (1983): 60–68, available at http://www.katarxis3.com/Alexander_Eisenman_Debate.htm.

37 Grabow, *Christopher Alexander*, 25–26.

recorded in *BAT*, I enjoyed long passages of it in much the same way I enjoy reading a good thriller.

All in all (despite the grumpiness of some of the above remarks) I am in no doubt that *TNO* and *BAT* are both important books, each as worthy of the honorary epithet of "classic" as *TWB* and *APL*.

Motivational Ideas

Now let us get below the surface of the look-and-feel of Alexander's two major book pairs, and begin to consider more closely some of the ideas in and behind them.

We begin with what I call Alexander's "motivational ideas," since they seem to be the origins from whence his theoretical ideas have emerged. Alexander's social agenda of *empowerment* (see the earlier section on *APL*) might be counted as a motivational idea in its own right, but for simplicity and space economy I will regard it as an aspect of Alexander's *rebellion*.

Rebellion

An elaborate and fairly recent version of Alexander's critique of current building methods and the damage they cause to the built environment appears in Chapters 3 and 4 of *BAT*.[34] And as the book clearly documents (and suggests by its title), Alexander never restricted himself to criticism. He was leading a *battle* against conventional methods of property development and construction, which he saw as destructive and unable to produce "living" and beautiful places where people feel at ease — and for which they should be empowered to take emotional ownership, through active involvement in the creation of such places.

That urge to rebel can be traced back to the very beginning of Alexander's career: in 1955, at the age of 19, he entered the (Modernist) architecture program at Cambridge University — and was appalled by what he was being taught and expected to do.[35] So he finished and left as quickly as he could.

This early opposition to established views on architecture is certainly consistent with what Alexander explains to Stephen Grabow, his biographer, much later: Contemporary architects — "even the so-called great architects of our time" — seem well aware that miraculously beautiful places were created in earlier centuries, for example the Blue Mosque, or any old English church. Nevertheless these architects "have made do with some sort of incredibly mediocre second best," and somehow persuaded themselves to consider it a reasonable height of attainment. That attitude of complacency, Alexander says, is something he is not willing to tolerate.[36]

Grabow reflects on this sweeping condemnation of contemporary architects and their work, noting that by the standards of the prevailing paradigm such an assessment would be outrageous. But comparing Alexander to Copernicus, Grabow reaches the conclusion that Alexander's provocation can be understood as an attempt to launch a new paradigm, in the Kuhnian sense.[37] I agree with Grabow, to the extent that I can see Alexander as provocative at a Copernican scale. But is Alexander right? *Are* architects hankering after the glamor of magazine covers, and *is* spreading ugliness such a massive problem?

38 Alexander, *Timeless Way*, v.
39 Ibid., 19.
40 Alexander et al., *The Battle for the Life and Beauty of the Earth*, 387, emphasis added.
41 Alexander, "Empirical Findings," items 55 and 57.

I wouldn't know what architects in general are hankering after. But it would have been rather easy for me to grab my camera and illustrate my text with fairly local examples of conspicuous pieces of architecture clearly designed to draw attention to themselves, with no perceptible regard for people or context, let alone attempts to adapt to and enhance the *genius loci*: none of them are beacons of beauty. Even easier would have been to show recent, typical examples of residential developments whose buildings, though more modest in appearance, are so deadly unlovable that I would never consider living in them. So regarding "the spread of ugliness," I suppose many or even most of us can think of examples, more or less crass, in and around cities familiar to us. Of course you may disagree; I can only say I wish *I* could.

Religion

Over the years, certain passages in Alexander's writings have continued to puzzle me, because they seem out of keeping with the ethos of research and academic publishing. The following paragraphs contain a few examples.

In *TWB*, just after the title page[38] there is an otherwise blank page carrying the inscription, "To you, mind of no mind, in whom the timeless way was born." It looks like a dedication, or a liturgical formula of worship; but dedication to or worship of whom, or what? "Mind of no mind," if it makes sense at all, could refer to some deity, perhaps: but how could a deity engender "the timeless way" of building, which is what the book is about after all? Is it some demigoddess of the built environment, much like the numerous nymphs and higher-ranking deities of ancient Greek mythology, who specialized in rivers, trees, sex, and much else? Or could it be a more powerful and versatile god, who happens to take a keen interest in good architecture?

Chapter 2 of *TWB* is titled "The Quality without a Name" and begins with the following preamble: "There is a central quality which is the root criterion of life and spirit in a man, a town, a building, or a wilderness. This quality is objective and precise, but it cannot be named."[39] (As it turned out later, the nameless quality *could* be named after all; it is what Alexander calls "life" of a place in *TNO*, and the "rough, gradually formed quality which makes it possible to be a truly comfortable person" in the Schumacher Lecture.) The passage from *TWB* gives off a whiff of mysticism, which I would not have expected to find in a book published by Oxford University Press, the epitome of oak-paneled academic respectability. The same could be said about several passages in *BAT*, also published by OUP, including, "The life and magnificence of the building will come to fruition only if the architect, builder, artist, craftsperson, or apprentice engages the task of shaping it as *a sacred act*."[40]

Things come to a head when, in his summary of the "empirical findings" reported in *TNO*, Alexander writes, "An apparent link between environment, self, God, and matter has shown itself.... [It] may be best if we redefine the concept of God in a way that is more directly linked to the concept of 'the whole.'"[41] *Empirical* findings, indeed?

42 Christopher Alexander, "Manifesto 1991,"
    Progressive Architecture 7 (1991): 112,
    available at https://usmodernist.org/PA/
    PA-1991-07.pdf.

43 Alexander, *Nature of Order*, vol. 4, 304,
    emphasis original. For a more recent
    exposition with an emphasis on the
    religious aspect of Alexander's thinking,
    see Christopher Alexander, "Making the
    Garden," *First Things* (online), February
    2016, accessed June 30, 2020, https://
    www.firstthings.com/article/2016/02/
    making-the-garden.

44 At one point in a conversation between
    Alexander and Howard Davis, they
    discuss a somewhat similar motive for
    making good artifacts: "union with the
    basic stuff the universe is made of."
    Work driven by such a motive, Alexander
    says, "is what was going on in medieval
    Europe … it was going on, as far as we
    know, in Bronze-age China … in the great
    Buddhist periods of Japan; and probably
    [it is still] going on in quite a few prim-
    itive tribes." Today of course "primitive
    tribes" would be considered a derogative
    term, but Alexander does not use it as
    such. "In all of those times and peoples,"
    he says, "this [motive: the union] was
    quite clearly understood … [and consti-
    tuted] the basis for what they did, *what
    we now consider to be great art* and try to
    buy from art dealers in fashionable bou-
    tiques, and see in museums." Christopher
    Alexander and Howard Davis, "Beyond
    Humanism: Christopher Alexander
    Interviewed by Howard Davis," *Journal
    of Architectural Education* 35, no. 1 (1981):
    22, DOI: https://doi.org/10.1080/1046488
    3.1981.10758271, emphasis added.

45 Nikos A. Salingaros, "Beauty and the
    Nature of Matter: The Legacy of Chris-
    topher Alexander," *New English Review*
    (May 2019): online, available at https://
    www.newenglishreview.org/Nikos_Sal-
    ingaros/Beauty_and_the_Nature_of_Mat-
    ter%3A_The_Legacy_of_Christopher_Alex-
    ander/.

In his "Manifesto 1991," Alexander proposes a "Hippocratic oath for architects" in which he lists 16 moral obligations of architects; a code of conduct the profession should adopt in order to fight the spread of ugliness. Statement 16 reads

> "The architect acknowledges that all building is essentially a religious process. This does not mean that it is attached to any one particular religion. It means that the ultimate object of the work of building is to make a gift to God. And that the ultimate purpose of the work is to reach a level of art in which the inner nature of things — the universe — and God — stand revealed."[42]

In volume four of *TNO*, a whole chapter, "The Face of God," contains a detailed exposition of Alexander's religious motivation. Suffice it to mention here that he elaborates on the idea of building as "a gift to God." To Alexander, it is *necessary* in order to achieve the beauty, or level of art that he strives for:

> "It is not a pious extra…. The things which can and do most easily get in the way, are my own *idea*, my thoughts about what to do, my desires about what the building 'ought' to be, or 'might' be, my striving to make it great … or my exaggerated attention to [other] people's thoughts…. The reason why I must try and make the building as a gift to God is that this state of mind is the only one which reliably *keeps me concentrated on what is*, and keeps me away from my own vainglorious and foolish thoughts."[43]

Arcane though such ideas may sound to a non-religious reader, I have to admit that here they begin to make sense. And when I think of some of the new buildings in my home city that visually *scream* for attention — perhaps for reasons of vaingloriousness — it even makes very *good* sense. The principle that serious art should be made with a humble attitude to the difficulty of the task in hand, in a self-less state of mind, is something I can relate to. I'm prepared to believe that, as a mental technique for achieving one's best, it *works* (and probably has been working for centuries).[44] But I think it might work just as well — or better — without being expressed in religious terms. After all, it is possible to be serious, humble, and self-less without involving a notion of God.

Nikos Salingaros recently gave a lecture interpreting and commenting on the first 50 pages of *TNO* Volume 4, where Alexander develops ideas about the art-religion relationship.[45] Under the heading of "The Religious Dimension," Salingaros talks about a "religious traditional craftsman [who] would make something 'for the glory of God,' not for personal fame." Commenting on that selfless approach, he says, "This is not simply nostalgia for the past. Equally important are certain art objects, artifacts, and architecture of more modern times. A few great works, such as Hassan Fathy's adobe settlements (Egypt), Geoffrey Bawa's serene structures (Sri Lanka), and Josef Plecnik's delightful innovations (Austria, Czechia, Slovenia) approach the degree of life of older creations even though they were not subject to religious inspiration." So Salingaros and I seem to agree that a religious faith may help *some* artists (as it did Alexander) to achieve the appropriate selfless state of mind, but that that state can also be achieved without recourse to a notion of God.

46 Ibid., online, emphasis mine.

47 Ibid., online, second emphasis mine.

48 Recall that in the 1981 conversation with Davis quoted a little earlier, Alexander speaks of the artifact-maker's "union with the basic stuff the universe is made of."

49 This is explicitly addressed as such by Alexander; see for example Alexander, *The Nature of Order*, vol. 4, 36, where he seeks to understand "why it may be that the greatest built works of humankind … were inspired within a framework of traditional mysticism."

50 Alexander, "New Concepts," 2.

51 I quote the term here and elsewhere to indicate that Alexander uses it in a special meaning.

52 For example, see Patternlanguage.com, and Center for Environmental Structure, "A Selection of Projects Designed and Built by Christopher Alexander." For a more comprehensive sample of high-resolution images, consult Alexander, *The Nature of Order*, vol. 2, 286–95, 356, 405, 457, 623–31; vol. 3, 16–17, 133, 159–72, 365–80, 412–15, 418–19, 458–59, 583, 595, 618–33. See also Helmut Tezak's excellent photo series of the Eishin Campus in Guttmann et al., *Shifting Patterns*, 63–120.

53 Alexander et al., *The Battle for the Life and Beauty of the Earth*, 58, emphasis original. In a published conversation with his wife, Maggie Moore Alexander, he explains that he applies modern, high speed, labor-economic building techniques, using the time saved for making "subtle decisions." By this he probably means decisions on site about how to adapt new elements to those already constructed — an unconventional method also described in detail in *BAT*. Maggie M. Alexander and Christopher Alexander, "Conversations with Chris: I Don't Want to Hear about Green Buildings Any More," *Livingneighborhoods.org*, December 2003, http://www.livingneigh-borhoods.org/library/conversations/sustainability.htm.

However, regarding the examples of great works of art, Salingaros remarks that they "act as catalysts to *connect the self with the universe*."[46] And later he ends the lecture by saying, "In conclusion, Alexander insists that life *does* have meaning, and its point is *to achieve union with the universe* through beauty."[47] Thus Salingaros seems to follow Alexander one long step further than I can, in thinking of beauty as a *means* to achieve an *end*: namely a union (of the self) with the universe.[48]

In my view, inducing experiences of beauty in people would, quite simply, be an end in itself: one purpose of art among others. As for the notion of achieving a "union with the universe," I don't know what to make of it; it suggests a mysticism[49] that I cannot subscribe to. More importantly, I think that appealing to it in a book ostensibly about "a scientific foundation for the field of architecture"[50] (even a book that prominently features a theory of aesthetics) will only obscure matters and threaten to compromise the ethos of such a scientific foundation.

So I can't help wondering how many more readers Alexander might have convinced about the value of his theoretical ideas had he not sprinkled his writings with more or less direct references to notions of God and mysticism. Quite understandably, these references may have scared many an interested reader away from seriously considering his theories in their own right.

If you are one of those readers, I would urge you to have another go at reading Alexander, ignoring whatever religious-sounding passages you will encounter. That Alexander uses the metaphor of making a gift to God as a way of understanding art and keeping mentally on track as an artist, and that he looks to mysticism in order to understand what enabled people to produce sublime art in former times are facts about Alexander, not about his theories. His theories, I submit, can and should be appreciated or criticized quite independently, for what they have to say about architectural and urban design, and for the way they say it.

The Irrelevance of Nostalgia

As one reads on and studies the myriad photos of architecture reproduced on the pages of *TWB*, *APL*, *TNO*, and *BAT* in support of Alexander's arguments, an intuitive understanding emerges of the kind of beauty—"life"[51] as fully treated in *TNO*—that he longs to reinstate in our physical surroundings. However, from those photos, most of which show ancient or traditional architecture, and from the look of many of Alexander's own buildings,[52] one might get the distinct impression that to a large extent he is driven by nostalgia—as perhaps yet another motivational idea? Presumably, that would be as much a turn-off to some readers as his occasional use of religious idiom.

Alexander would no doubt plead not guilty to any accusation of nostalgia. For, as he claims, the new paradigm (to use Grabow's term) of architectural and urban design he seeks to promulgate "is emphatically *not* a re-creation of any past era…. It relies on a new kind of humane organization of building and creative processes, and is … congruent with the technical marvels we have come to expect as everyday."[53] Still, even if Alexander

54 Alexander, *The Nature of Order*, vol. 2, 137–74.

55 To avoid any misunderstandings, let me state explicitly that I do not intend to criticize Alexander's architectural style (though mine, had I chosen to practice architectural design, would have been different). Critics of architecture may call Alexander's style nostalgic or quaint, and they may be right. But even so, in the course of his career Alexander's style has grown powerful yet calm in a way that appeals to me emotionally. I find that quite often he and his colleagues have managed to capture some of the unpretentious and peaceful beauty that we find in much ancient or self-grown architecture. And that is no small achievement.

56 Alexander et al., *The Battle for the Life and Beauty of the Earth*, 26; Alexander, *The Nature of Order*, vol. 2, 515–30.

57 Discussed extensively throughout Karl R. Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge*, 5th ed. (London: Routledge & Kegan Paul, 1989). Alexander, however, does not use Popperian terminology.

58 Alexander, *Timeless Way*, 8–9.

does not deliberately strive for quaintness, the question remains whether or not buildings made according to his principles and methods will *ipso facto* resemble buildings of the past?

I think we should give Alexander the benefit of the doubt in this matter. After all, he does show examples of modern architecture (notably buildings by Frank Lloyd Wright) and other artifacts, in which he finds a high degree of "life."[54] These examples are stylistically quite unlike Alexander's architecture, and far from quaint-looking. So even if Alexander himself may be unable or unwilling to let go of stylistic traits of former times in his own practice, other designers have done so and been able to impart "life" to their artifacts, according to Alexander. So under the highly plausible assumption that he is able to recognize such "life" (a quality he spent decades studying and thoroughly analyzing) in the works of contemporary designers, this seems to prove that quaintness of style in an artifact is not a necessary consequence of its "life."

For our discussion of Alexander's theoretical ideas (among which "life" looms large) this is all that matters. Even if under duress Alexander were to confess to nostalgia, it would be irrelevant.[55]

Theoretical Ideas

If I am right about Alexander's motivational ideas, they can be seen as suggesting a schematic overall line of reasoning, along which his theoretical ideas may have developed. I am not claiming that this is exactly what happened as a matter of historical fact. Rather, the next couple of paragraphs amount to what is known in philosophy as a "rational reconstruction": an idealized exposition of a complex system of thinking, used as a vehicle to clarify and understand that thinking.

To begin with, there is his intuitive realization that "the spread of ugliness" is a symptom of a disease afflicting our built environment; a symptom manifesting itself in a lack of "life" and lack of ability to make people feel comfortable and at home. To diagnose and understand this disease, Alexander points out that a certain humble and selfless attitude towards our role in the world has been lost in modern societies: the attitude he expresses in the phrase "making a gift to God." In *BAT* and *TNO*, he also blames Taylorism and certain ways of organizing property development and society at large.[56] And finally, given this diagnosis, he proposes a cure. Not a cure fully operational all at once, but a cure developed over decades, in many steps involving what Popper would have called *conjectures*, *critical tests*, and *refutations*.[57]

What the cure boils down to is that (with a humble and selfless spirit) architects and urban designers should re-learn, or re-invent, an ability to facilitate a participatory (user-empowering) process of creating built environments that exhibit *a particular kind of beauty*. Namely the kind which, as Alexander points out in *TWB*, is found in "the Alhambra, some tiny gothic church, an old New England House, an Alpine hill village, an ancient Zen temple, a seat by a mountain stream, a courtyard filled with blue and yellow tiles among the earth," and which he sums up poetically as "that sleepy awkward grace which comes from perfect ease"[58] in *TWB*, also known as "the quality without a name," and known in *TNO* as "life."

59 The notion of a (well-delimited) *problem*, which is an essential aspect of the idea of a pattern, can be traced all the way back to Alexander's *Notes on the Synthesis of Form*.

60 Alexander et al., *Houses Generated by Patterns*, 53, emphases original. For an even earlier definition, see Christopher Alexander, Sara Ishikawa, and Murray Silverstein, *A Pattern Language Which Generates Multi-Service Centers* (Berkeley: Center for Environmental Structure, 1968), 15.

61 Alexander et al., *Houses Generated by Patterns.*, 75–78. The report was a competition entry for a residential development project in Lima, Peru. It was reprinted in *Architects' Yearbook* 13, (1971): 84–114. My page references are to the original version. The passage just quoted was followed by a discussion, over a couple of pages, of how the activity nuclei should be structured in order to create these concentrations of people.

In the course of developing his cure over several decades, Alexander produced a large body of interesting and interrelated theoretical ideas. One key idea is that of patterns; another is the idea of "life." In the coming sections, my main emphasis will be on the pattern idea, partly because I have some previous research experience with it, and partly because I believe Alexander left some unfinished business concerning his patterns when he moved on to the "life" of places. I will argue that the idea of patterns, suitably clarified, is still theoretically viable and valuable, perhaps more than Alexander is prepared to acknowledge.

However, given the sheer magnitude of Alexander's production, let me apologize in advance for any important theoretical ideas I have missed yet ought to have taken into account.

Patterns and Related Ideas in The Timeless Way of Building *and* A Pattern Language

In my review of *TWB* and *APL* earlier, I gave you a loose sketch of the idea of a pattern as a titled nugget of text describing a generalized, re-usable, more or less universally valid principle of design that aims at solving a recurrent potential problem. It is time to be more precise.

The idea of a pattern did not occur at a particular point in time, but developed gradually over at least a decade, mainly from the late 60s to the late 70s, with roots further back.[59] Before we discuss the mature pattern theory of *TWB* and *APL* (published 1979 and 1977, respectively), it is instructive to consider an earlier version that appeared in a report by Alexander and associates in 1969: *Houses Generated by Patterns*. Having stressed the re-usability of patterns (which I agree is highly important and commendable), the authors offer the following definition:

> "A pattern defines an arrangement of parts in the environment, which is needed to solve a recurrent social, psychological, or technical problem. Each pattern has three … sections: *context*, *solution*, and *problem*.
>
> "The *context* defines a set of conditions. The *problem* defines a complex of needs which always occurs in the given *context*. The *solution* defines the spatial arrangement of parts which must be present in the given *context* in order to solve the *problem*."[60]

A sample pattern from the 1969 report reads as follows:

> "ACTIVITY NUCLEI
> [Project-specific information omitted; irrelevant for the general principle described.]
>
> *Context:* Any community large enough to support community facilities.
>
> *Solution:* The community facilities are clustered round a small number of very small open spaces which we call activity nuclei…. All paths in the community pass through these activity nuclei.
>
> *Problem:* One of the greatest problems with new communities, is the fact that … public life in them is spread so thin that it has no impact … and is not … 'available' to the members of the community. Yet studies of pedestrian behavior make it clear that people seek out concentrations of other people, whenever they are available, (e.g. Jan Gehl, 'Mennesker til Fods (Pedestrians),' *Arkitekten* no. 20, 1968)."[61]

Here we can make three observations:

1 *Format of context:* In the above sample pattern, the context is stated explicitly. (As in the other 67 patterns in the 1969 report.)
2 *Parts as bearers of properties:* The definition is stated in terms of arrangements of *parts* of the physical environment. In the sample pattern, for example, the parts mentioned in the solution are open spaces that should be "very small," and paths that should "pass through" those spaces. So in the pattern solution, the arrangements of parts is specified in terms of properties that parts should have (instantiate), and relations that should hold among parts. (We can boil the relations down to properties of parts as well, since relations can be conceived of as properties that two or more entities can have collectively.)
3 *Logical structure of a pattern:* Commenting on the definition of "pattern," the authors say that the arrangement of parts prescribed by the solution, "or an equivalent one," must always be implemented for the problem to be solved. It is not clear what they mean by an arrangement equivalent to the one stated, given that the phrase "*the* spatial arrangement" in the definition implies that there is only *one* arrangement.[62] Probably the authors mean that the equivalent is an alternative arrangement that solves the problem, too. In other words, they may have had a vague inkling at the time that a solution might sometimes need to describe two or more alternative arrangements, i.e., ways of solving the problem.[63] But apparently, in 1969, the logical structure of a pattern was still in the making.

Let us move on to the more mature patterns of *APL* and *TWB* (1977 and 1979, respectively), and discuss them with regard to the above three observations. Just as their early precursors from 1969, patterns are now titled nuggets of text, consisting of three sections: context, problem, and solution—albeit in that more intuitive order.

Be aware that Alexander uses the term "pattern" in two ways: in the verbal sense, the term refers to a nugget of text as described above; in the physical sense, it refers to the portion of the environment that implements (is organized according to) the solution section of such a text nugget.[64] While strictly speaking such equivocation is not good scientific practice, the relevant meaning is generally clear from the context, so I will not quibble about it. But I will stick to the verbal meaning of "pattern" (unless explicitly switching to the physical meaning).

Format of Context and Order of "Unfolding"
As for observation 1, things have changed since 1969. The context of *APL*-patterns is now given implicitly. For example, a revised version of AC-TIVITY NUCLEI (quoted above) appears in *APL* under the title "ACTIVITY NODES" (pattern number 30).[65] Its *context* is no longer stated as a condition under which the rest is relevant, but is suggested (rather vaguely) by a kind of prologue containing a commented list of references to other patterns: "this pattern forms the essential nodes of life which *help* to generate [i.e.,

62 At least according to a famous paper by Bertrand Russell, where he proposes a logical analysis of the definite article "the." Bertrand Russell, "On Denoting," *Mind* 14, no. 56 (1905): 479–93, available at https://www.jstor.org/stable/2248381.

63 For example, imagine a pattern (not proposed by Alexander) about how to avoid the problem of cluttering a high-density urban environment with parked cars. It might contain a solution prescribing a multi-story car park, *or* an underground parking facility, *or* it might rule that parking be relegated to open car parks outside the area to the extent that the resulting walking distances remain acceptable.

64 Possibly his notion of a pattern is even more complex, as suggested by this passage in in *TWB* that I always found confusing: "The pattern is, in short, at the same time a thing, which happens in the world and the rule which tells us how to create that thing, and when we must create it. It is both a process and a thing; both a description of a thing … and a description of the process which will generate that thing." Alexander, *Timeless Way*, 247. Later in the book, a pattern is also described as "an operator which differentiates space." Ibid., 373, emphasis omitted.

65 Alexander et al., *A Pattern Language: Towns*, 163–67.

66   Ibid., 164, emphasis added.
67   Ibid., 80–85.

implement the solution section of] IDENTIFIABLE NEIGHBORHOOD (14), PROMENADE (31)…, PEDESTRIAN STREET (100),"[66] and so forth. The same method of implicit context description is applied throughout the collection of patterns in *APL* (except number 1, INDEPENDENT REGIONS, for which no context is indicated).

In *APL* and *TWB* the reader is assumed to understand the inter-pattern relation *helps* — and its inverse, *is helped by* — intuitively from context and examples. As I understand these relations, when we say that a pattern P_1 *helps* a pattern P_2, it means that implementing the solution section of P_1 — organizing some portion of the built environment according to that solution section — may or will contribute to implementing the solution section of P_2. And that a pattern P_2 *is helped by* a pattern P_1 means that P_1 *helps* P_2.

As we saw, according to its prologue, ACTIVITY NODES (no. 30) *helps* IDENTIFIABLE NEIGHBORHOOD (no. 14)[67] — no. 14 *is helped by* no. 30. This is because the small open spaces along major pedestrian paths prescribed by the solution section of ACTIVITY NODES (to stimulate social life) contribute to making a neighborhood identifiable to its inhabitants, as it should be, according to the solution section of IDENTIFIABLE NEIGHBORHOOD.

The relation of *helping* among patterns organizes the collection of patterns into a *network* that can be depicted as a directed graph with nodes representing patterns, and arrows running from a node N_1 to a node N_2 if and only if the pattern represented by N_1 helps the pattern represented by N_2. The inverse relation of *helping* — being *helped by* — can be depicted by the same graph, only with all the arrows pointing in the opposite direction.

Arrows depicting the *helped by* relation usually run from nodes representing patterns about relatively large portions of the environment to nodes representing patterns about relatively small portions. For example, an entire neighborhood is larger than the activity nodes it may contain.

In a manner similar to Alexander's network-illustration on page 314 of *TWB*, Figure 1 shows some of the *helped by* relations that ACTIVITY NODES (no. 30) is involved in. Note that ACTIVITY NODES and PROMENADE are helped mutually by each other, according to their prologues on pages 164 and 169 of *APL*.

Figure 1
Patterns related to ACTIVITY NODES (no. 30). Arrows run from the name of a pattern to names of others it is *helped by*. The number on each arrow indicates a page in *APL* where the relation represented by the arrow is mentioned (or implied) in a pattern prologue. © 2020 by Per Galle.
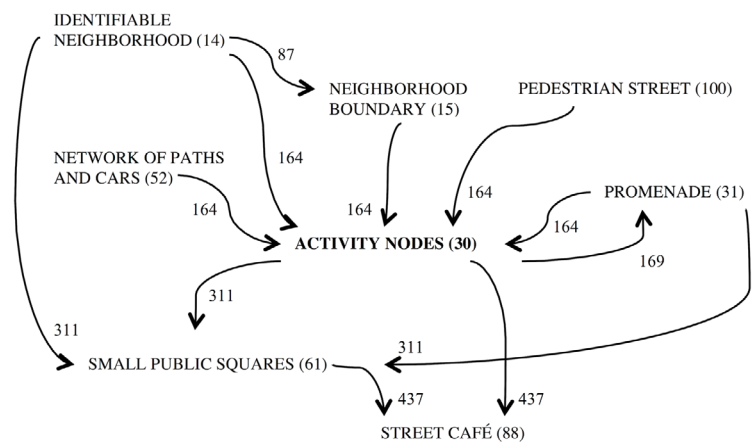
68 Alexander et al., *A Pattern Language Which Generates*, 51.

69 Alexander, *Timeless Way*, Chapter 16.

70 Alexander et al., *A Pattern Language: Towns*, xxxviii–xl.

71 Alexander, *Timeless Way*, Chapter 19. An example of adaptation occurs on p. 369, and another on pp. 374–377, though not (yet) under that name. Adaptation was treated more thoroughly later — for example, see references to "adaptation" in the index in Alexander et al., *The Battle for the Life and Beauty of the Earth*, 499. Alternatively, see sections II and VI of Alexander, "Sustainability and Morphogenesis," online.

72 Per Galle and László Béla Kovács, "Introspective Observations of Sketch Design," *Design Studies* 13, no. 3 (1992): 229–72, DOI: https://doi.org/10.1016/0142-694X(92)90208-R.

73 Murray Silverstein, "[Contribution to] Panel Discussion: A Roundtable Discussion with the Authors of a Pattern Language," in *Current Challenges for Patterns, Pattern Languages and Sustainability: Symposium Proceedings*, ed. Hajo Neis and Gabriel Brown (Portland: PUARL Press, 2010), 37.

74 Jean-Pierre Protzen and Christopher Alexander, "Value in Design: A Dialogue," *Design Studies* 1, no. 5 (1980): 291, DOI: https://doi.org/10.1016/0142-694X(80)90063-0, originally publilshed in *Concrete* 1, no. 6.

75 Alexander, *Timeless Way*, 314–16.

76 This is the way Alexander and his colleagues employed the "CASCADE" diagram (as a supplement to the explicit context descriptions in the patterns) in Alexander et al., *A Pattern Language Which Generates*, 17–18, 51–56.

77 See for example Kees Dorst and Nigel Cross, "Creativity in the Design Process: Co-Evolution of Problem–Solution," *Design Studies* 22, no. 5 (2001): 425–37, DOI: https://doi.org/10.1016/S0142-694X(01)00009-6.

This idea of a network structure among interrelated patterns appears in rudimentary form quite early on,[68] and is elaborated in *TWB*,[69] and also in *APL*, where the user is instructed on how to pick a project-relevant *sequence* of patterns from the network of patterns listed in the book.[70]

A recurrent theme in Alexander's writings is the metaphor of architectural and urban design and construction as the *unfolding* of an embryo through a process of *differentiation* of (things in) space, involving what he later called *adaptation*. He describes adaptation in detail in *TWB*,[71] where he emphasizes the importance of applying the patterns in the right order to get a good result. This emphasis on the sequence of steps (pattern applications) during a design or construction process is probably the reason why the contexts in *APL* became implicit (referring to other patterns in the network).

However, while the steps involved in differentiating an embryo *must* follow a particular order for the organism to be sound and viable, such strict ordering is not essential in design and construction. In my experience, the application of patterns in a design process is much more flexible. What triggers their use (or discarding or modification or even invention) depends very much on design decisions made along the way, not on any pre-defined sequence or network of patterns. These were some of the findings of a study of sketch design for a residential area, where I sketched during sessions of varying lengths over a 10-day period, using patterns with explicit context descriptions (in the manner of the early Alexander patterns), and subsequently produced a written account for analysis of my design process.[72]

This is perfectly in alignment with *APL* co-author Murray Silverstein's assessment in retrospect that "the methodology … outlined at the beginning of the book, 'using the language,' [is] where the real weakness lies," and that the idea of "creating a sub-language, a sequence, etc. was a mistake…. And more important, it just hasn't been true to my experience."[73] Moreover, locking the application of each pattern into a network or sequence makes pattern theory somewhat vulnerable to Protzen's critique, according to which *APL* does not allow each user the freedom it promises.[74]

Discussing the network graph in *TWB*, Alexander considers swapping the order of two patterns, PRIVATE TERRACE ON THE STREET (140) and ENTRANCE TRANSITION (112) — one helping the other, or vice versa. As he points out, this suggests two quite different ways a dwelling might be configured.[75] It is not clear to me that one configuration is better than the other, nor does Alexander say so. I take this as support for my contention that the order of application of patterns during design can be flexible.

So all in all, I think the embryo metaphor should be taken with a grain of salt; and that the idea of sequencing and implicit context descriptions derived from it should be abandoned. Patterns (once internalized by the designer) work just fine with explicit context descriptions. Perhaps, though, a supplementary graph of *helped-by* relations among patterns can be pragmatically useful as a roadmap suggesting which patterns might be treated together, or in what order when designing;[76] but taking the graph as a rigid prescription of how to proceed with unfolding the design might kill the creativity potentially enabled by co-evolution of problems and solutions.[77]

78 Nikos A. Salingaros, "The Structure of Pattern Languages," *Architectural Research Quarterly* 4 (2000): 149–61, available at http://zeta.math.utsa. edu/~yxk833/StructurePattern.html.

79 Alexander, *Timeless Way*, 88, emphasis original.

80 Ibid., 91.

81 Grabow, *Christopher Alexander*, 45, 119.

82 Per Galle, "Alexander Patterns for Design Computing: Atoms of Conceptual Structure?," *Environment and Planning B: Planning and Design* 18, no. 3 (1991): 328–31, DOI: https://doi.org/10.1068%2Fb180327.

83 Alexander et al., *A Pattern Language: Towns*, xiii, emphasis added.

84 Otherwise known as "needs" in the 1969 version. Alexander et al., *Houses Generated by Patterns.*

85 Alexander, *Timeless Way*, 254, emphases added.

86 Otherwise known as "configuration"; ibid., 282.

Other theorists, however, are less skeptical about (static) inter-pattern relations, notably Salingaros who explores elaborate mathematical structures that systems of such relations might exhibit.[78]

Parts as Bearers of Properties

Regarding observation 2, the notion of *parts* from the 1969 report has been banned from the pattern theory contained in the *APL + TWB* book pair.

In Chapter 5 of *TWB*, Alexander describes patterns (in the physical sense) as "elements" (parts) of the environment maintaining relationships to other elements. For example, the aisle of a church would not be an aisle at all if it "were not parallel to the nave, were not next to it, were not narrower than the nave, did not share columns with the nave" and so on. But, he adds, looking closer we realize that what appear to be elements (parts) "*themselves* are patterns of relationships."[79] Continuing this line of reasoning rather too long, he ends up with the surprising conclusion that "the world is entirely made of all these interhooking, interlocking nonmaterial patterns."[80] So even patterns in the physical sense are no longer physical!

In Grabow's biography, Alexander explains the genesis of this peculiar idea of a world made up of patterns of patterns of patterns (ad infinitum), referring to its consistency with "modern mathematics and physics."[81] This being as it may, I think adopting this idea for a theory of architecture was a serious mistake, and did nothing but obscure the notion of a pattern. I have criticized it at length elsewhere,[82] so will not do so again here. Suffice it to note that unless we think of verbal pattern solutions as descriptions of properties of physical parts (including relations among such parts), the clarifying analysis I will propose later in this essay would not be possible.

Logical Structure of a Pattern — According to Alexander

As for observation 3, the idea of alternative arrangements specified by the solution has become somewhat more explicit: it is really about the empirical content of each pattern, and the logical structure a pattern should have in order to convey that information in a useful way.

As the authors explain in the introduction to *APL*, solutions are stated "in a very general and abstract way — so you can solve the problem … in your own way, by adapting it to your preferences and the local conditions at the place where you are making it. For this reason, we have tried to write each solution in a way that imposes nothing on you." And that is why a solution of a pattern "contains only those essentials which *cannot be avoided* if you really want to solve the problem."[83] Note that the italicized phrase here suggests *necessity*. (I return to that later.)

In *TWB*, Alexander claims, "each pattern is a self-contained logical system which makes a *double statement of fact*, not merely a declaration of value, and is therefore capable of being true or not." The double statement being "*first* that the given problem (the stated conflict among forces)[84] exists within the stated range of contexts" — unless the solution is implemented there, that is! — and "*second*, that in the given context the given solution solves the given problem"[85] which is to say that whenever the arrangement[86] described in the solution is implemented, the problem does not occur.

87 This section presents an interpretation and elaboration of Alexander's ideas about the logical structure and empirical content of patterns. It is more "technical" than the rest of the essay, so if you have no patience with technicalities, you can skip the section. I do recommend, though, that you read the informal parts of Definitions 4, 5, and 6, since I use the terms defined there later on, near the end of the essay.

88 The notions of "empirical adequacy" and "empirical completeness" of patterns are partly inspired by Alexander, who elaborates on his "double statement of fact," speaking of "two *empirical conditions:*" Alexander, *Timeless Way*, 282, emphasis added. About 30 years ago I developed a lengthy analysis of Alexander's claims about the logical structure of *APL*-patterns along lines quite different from what I propose here. *See* Galle, "Alexander Patterns," Sections 1–6, pp. 327–39. There I proposed formal definitions of patterns and their empirical adequacy and completeness, employing *set-theoretical* concepts. The purpose back then was to pave the road for development of so-called knowledge-based systems for computer support of architectural sketch design, as discussed in Section 7 of that article (pp. 339–43)—an aim I no longer pursue.

As you may remember, my overall aim was to evaluate the extent to which Alexander's academic work has brought us closer to the science of architecture that he envisaged. Seen from that vantage point, the passages just quoted are extremely important—but also in need of some clarification, which I will try to provide below.

Empirical Adequacy and Completeness of a Pattern:
Proposal for a Clarification[87]

For this clarification of the logical structure of patterns, we need to make use of a small amount of symbolic notation. I will provide "translation" into natural language in due course, but the symbolic notation is indispensable because it highlights structure in a way that natural language cannot. If in the following discussion you encounter terms or symbols that you are unfamiliar with (and which do not become clear from the way I use them), you may be able to find an explanation in the appendix.

Let us try to express Alexander's "double statement of fact" symbolically. We construe the context, the solution, and the problem of a pattern as *predicates* defined over *parts* of the environment, and ascribing *properties* to those parts (see observation 2, above, for comparison). Let us call the three predicates "C," "S," and "P," respectively. Let e be an object variable ranging over parts of the environment. Then the descriptions "Ce", "Se", and "Pe" are true or false sentences depending on which environment-part the variable e stands for.

For example, in the pattern ACTIVITY NUCLEI, the context-description "Ce" might be written out as follows: "e is a community large enough to support community facilities." The problem-description "Se" would be something like, "In new communities such as e, one of the greatest problems is the fact that…" and so forth.

Of course for practical use, patterns should be written in plain, clear, natural language, without use of variables or other symbolic notation. But for our current purposes of theoretical discussion, I propose to render the two sections of the "double statement of fact" symbolically as shown by the formulae in 4 and 5, following. A pattern complying with the formula in 4 we call *empirically complete*; if it complies with the formula in 5, we call it *empirically adequate*.

4 *Empirical completeness* of a pattern: *Necessarily* $\forall\, e\, (\, (Ce\, \&\, {\sim}Se) \rightarrow Pe\,)$. Informally: No matter what may happen, any part of the environment that matches the context description but not the solution description exhibits the problem.

5 *Empirical adequacy* of a pattern: *Necessarily* $\forall\, e\, (\, (Ce\, \&\, Se) \rightarrow {\sim}Pe\,)$. Informally: No matter what may happen, any part of the environment that matches the context description and the solution description does not exhibit the problem.[88]

The word "necessarily," which I glossed informally using the phrase "No matter what may happen," is there for a reason: without it, a pattern might unjustifiably qualify as empirically complete, and/or empirically adequate.

89 This phenomenon, that a conditional sentence can be true for purely technical reasons of logic, even though its contents intuitively suggests that it should be false or meaningless, stems from "the standard analysis" in formal logic of conditional sentences. Many attempts have been made by logicians to remedy the counter-intuitive effects of the standard analysis, but solutions proposed tend to come at a very high price of lost theoretical simplicity. For a book-length treatment of the logic of conditionals, see Jonathan Bennett, *A Philosophical Guide to Conditionals* (Oxford: Oxford University Press, 2003). Other treatments can be found in Dorothy Edgington, "Indicative Conditionals," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta, last updated October 2, 2014, https://plato.stanford.edu/archives/win2014/entries/conditionals/; Dorothy Edgington, "On Conditionals," *Mind* 104, no. 415 (1995): 235–329, DOI: https://doi.org/10.1093/mind/104.414.235. See also James W. Garson, *Modal Logic for Philosophers*, 2nd ed. (New York: Cambridge University Press, 2013), Chapter 20.

Please pretend for a moment that I had not written "necessarily" in 4 and 5. Now imagine a pattern about how to build supermarkets on Mars. Its context description Ce would specify something like "e is a supermarket on Mars." But since no part e of the physical world currently satisfies the context predicate C (at the time of writing there are no supermarkets on Mars, I dare say), the if-part of both 4 and 5 (the part in the innermost pair of parentheses) for this imagined pattern would be false. (A sentence of the form "p & q" is false if "p" is false, no matter what "q" is.) But this would mean that for any part of the world—in its current state—that that "e" could stand for, the entire conditional sentence would be true, because its if-part was false. (According to standard logic, a sentence of the conditional form "p → q" is true, unless "p" is true and "q" false.[89]) So (according to 4 and 5, expressed *without* "necessarily") our Mars pattern—which could be totally idiotic for all we know—would enjoy recognition as empirically complete and adequate, for the sole reason that its context predicate were not currently satisfied by anything. This is clearly absurd.

Consider another example where the context predicate *is* satisfied by some part of the environment: the 1969 pattern we discussed before, but now with a new solution (and title):

FLASHING ACTIVITY NUCLEI

Context: Any community large enough to support community facilities. (They exist.)

Problem: One of the greatest problems with new communities is the fact that public life in them is spread so thin that it has no impact and is not "available" to the members of the community….

Solution: All community facilities are equipped with a very tall pole on top of which a powerful lamp flashes the Morse code for "C F," so that people can easily locate them from far away, and go there.

It seems safe to assume that this silly "solution" has never been implemented in any community. So even though several parts e of the environment would satisfy the context predicate C for this pattern, none of them would satisfy the solution predicate S. Therefore, in this case "(Ce & Se)" would be false regardless of what "e" stood for. Hence the conditional would come out true, and the pattern would absurdly qualify as empirically adequate (according to 5, *without* "necessarily").

Now consider 4 and 5 as written, but *with* "necessarily." This makes it much harder for a pattern to achieve a status as empirically complete and/or adequate. For now 4 and 5 are not just about the world as it currently *is*, but as it is *and* as it might *become*: the universal sentence would have to hold true for anything "e" could stand for, including supermarkets on Mars, and community facilities with lamps flashing Morse code above the roofs. So for the Mars pattern to be empirically adequate, for example, it would have to make genuine good sense under the conditions on a colonized Mars; and as for the FLASHING ACTIVITY NUCLEI pattern, it would fail miserably and deservedly, because its solution would never really solve the stated problem.

90 Popper, *Conjectures and Refutations*.

91 Alexander et al., *A Pattern Language: Towns*, xiii.

92 The authors of *APL* were aware of this (although using different terminology). They describe a rating system used for the patterns: zero, one, or two asterisks. Two asterisks means the pattern is something like what I call empirically complete; zero asterisks means that "there are certainly ways of solving the problem different from the one which we have given;" and one asterisk indicates that "some progress" has been made towards giving all possible ways of solving the problem. Alexander et al., *A Pattern Language: Towns*, xiv-xv.

93 Alexander, *Timeless Way*, 254.

94 Serious work on pattern development within architectural and urban design is still taking place (using the exact same format as the patterns of *APL*). See Michael W. Mehaffy et al., *A New Pattern Language for Growing Regions: Places, Networks, Processes* (Portland: Sustasis Press, 2020). Interestingly, this collection of 80 new patterns incorporates principles of aesthetics from Alexander's *TNO*, for example "Local Symmetry" (178–81) and "Boundaries" (treated under the title of "Framing," 189–92). Twenty of the 80 patterns can be seen at https://patterns.architexturez.net/doc/az-cf-193137. A wiki version of the collection is available at http://npl.wiki/assets/home/index.html.

So, for any given pattern, 4 and 5 in their complete form constitute a plausible interpretation and clarification of Alexander's "double statement of fact" made by that pattern. They should be taken as a pair of hypotheses that can be tested empirically; which is to say they can be disproved by counter-examples if false, but never irrefutably proven if true. All of this is in keeping with Popper's ideal of falsifiability as the hallmark of genuinely scientific hypotheses.[90]

Yet I have a slight reservation about the notion of empirical *completeness* of patterns. Theoretically it is clear enough, and it certainly seems to capture what the authors of *APL* had in mind when they wrote that a solution of a pattern should contain "only those essentials which cannot be avoided if you really want to solve the problem"[91]—that is, a solution should only specify what is *necessary* to solve the problem. Their motivation for writing so was perfectly reasonable, too—to preclude overly detailed or otherwise restrictive pattern solutions that might limit the user's options for decision making.

But demanding empirical completeness is a very tall order.[92] After all, a medical researcher devising a cure for some hitherto incurable disease is not required at the same time to come up with all *alternative* cures there might be for that disease; yet his or her result may be highly valuable, both scientifically and in daily clinical practice. So by analogy, for practical purposes of pattern theory the following weaker requirement might be enough. A pattern complying with the formula in 6 we will call *empirically relevant*:

6   *Empirical relevance* of a pattern: *Possibly* $\exists e$ ((Ce & $\sim$Se) & Pe).
    Informally: It may be the case that some part of the environment, which matches the context description but not the solution description, exhibits the problem.

Demanding empirical relevance (instead of empirical completeness) of new patterns does not ensure solutions comprising only unavoidable essentials, but it does ensure that, as Alexander said in *TWB*, "the given problem … exists within the stated range of contexts" (first part of his double statement of fact).[93] In other words, empirical relevance ensures that no pattern is written to scratch where it doesn't itch.

Viability of the Pattern Theory

To sum up: with parts and explicit context predicates reinstated as they were back in 1969, and with the empirical import of patterns clarified as just discussed, I believe patterns could still be viable as a vehicle for development of scientific theory of architecture and other kinds of design.

Alexander was disappointed in his pattern theory because (as he explained in the interview quoted earlier) applying pattern theory did not result in beautiful buildings. But beauty in architecture is one thing, and the scientific rigor of theories about architecture is another. Both are worthwhile goals, and neither should be sacrificed to achieve the other. No doubt Alexander is right that patterns (as we know them from *APL* and its predecessors) are not enough to achieve beauty in architecture, but they seem too valuable as a vehicle for scientific rigor in architectural theory to let them fall by the wayside.[94]

95 Alexander, "New Concepts," 9.

96 Alexander et al., *The Battle for the Life and Beauty of the Earth*, 131, note 1, emphasis mine.

97 These examples were taken from Alexander, *Nature of Order*, vol. 1, 84, 85, 92, and 103, respectively.

98 Alexander, *The Nature of Order*, vol. 2, 245, first emphasis added. Chapter 13 of volume 2 describes the conception and role of patterns in the new theory.

99 Ibid., vol. 2, 344, emphasis original.

100 Alexander et al., *The Battle for the Life and Beauty of the Earth*, 131, note 1.

101 Ibid., Chapter 9.

"Life" (and Related Ideas) in The Nature of Order *and* The Battle

"Scientists speak constantly as if there is some kind of great divide between fact and aesthetics," Alexander writes. Yet "the whole purpose [of *TNO* is to advocate] a single view of science that embraces both what we now think of as [scientific] fact [and] what we regard as aesthetic facts and observations."[95] In other words, a *unification of art and science* is his goal — one he also seemed to pursue in *APL* and *TWB*, but without attaining it.

Patterns and Centers

For readers familiar with the notion(s) of patterns from *APL* and *TWB*, it may be confusing to discover that in *TNO* "pattern" is used in new ways, now related to "center," which is a key term in *TNO*. Roughly, a *center* can be thought of as a perceptually significant part or component of the environment. Alexander describes it as "*a distinct physical system, which occupies a certain volume in space, and has a special marked coherence.*"[96] Some examples of centers discussed by Alexander are: a fish pond, a kitchen sink, the "donut of space" around the trunk of tree, and even beams of sunlight visibly traversing the interior space of the Hagia Sophia.[97]

In *TNO*, Alexander equivocates between a verbal and a physical sense of the term "pattern" (much as he did in *APL* and *TWB*). In the verbal sense, "pattern" denotes a rule about centers. In the physical sense, "pattern" is used about the centers themselves. For convenience, I will talk of verbal patterns and physical patterns, respectively — rather than the two senses of the term.

A *verbal* pattern is described (defined?) in *TNO* as "a rule that describes a *type* of strong center that is likely to be needed, on a recurring basis throughout a particular environment or class of environments…. [It] also describes a *relation* between other generic [i.e., types of] centers."[98]

A *physical* pattern is more or less the same as a center: "The entities we called patterns [in *APL*] were — albeit in an early formulation — somewhat similar to the entities I now call *centers*."[99] Furthermore, a "[physical] pattern is a center, made up of [other] centers at many levels of scale. Altogether, the centers that form a [physical] pattern take care of some recurring problem or opportunity in the life of the community."[100]

We see that there are echoes of the old notions of *context* ("a particular environment or class …"), *problem* ("likely to be needed;" "recurring problem or opportunity"), and *solution* ("strong center;" "relation between other … centers").

However, when used in actual practice, the patterns seem to have lost the strength they originally had as *reusable* nuggets of text that conveyed general design knowledge, supported by arguments and evidence. For example, the so-called "pattern language" for the Eishin Campus[101] merely consists of a project-specific list of loose notes about what (the users imagined or wished) should be built: a shopping list, or at best a kind of design brief. I wonder why, apparently, genuine (verbal) patterns were not used as a basis for discussion with the users. Instead, Alexander here uses "pattern" in a watered-down (physical) sense, more or less synonymous with "center."

102   Alexander, *The Nature of Order*, vol. 1, 144, emphasis original.

103   In objects rich in life, "there are big centers, middle-sized centers, small centers, and very small centers." Alexander, *The Nature of Order*, vol. 1, 145.

104   That centers are "strong" means that they reinforce each other. "For instance, a long religious building with a series of bays leading to one end will mean more if the bays become more and more intense, leading to a climax, than if they are all equal." Alexander, *The Nature of Order*, vol. 1, 155.

105   For example, "the plan [of the Alhambra] is a marvel of centers formed in a thousand combinations, and yet with beautiful symmetrical local order at every point in space." Alexander, *The Nature of Order*, vol. 1, 187.

106   Roughness comes with local adaptation: buildings with life "have various small irregularities in them, even though they often conform to approximate overall symmetries and configurations. By contrast, buildings which are perfectly regular seem dead. This arises because real things have to adapt to irregularities in the exterior environment correctly." Alexander, *The Nature of Order*, vol. 1, 214.

107   Names of Alexander's 15 properties are conventionally written in capitals (like pattern names).

108   Alexander, *The Nature of Order*, vol. 1, Chapter 5. For each of the 15 properties, a section labelled "Functional Notes" explains how that property is related to ideas from *APL* patterns. These notes are helpful to readers already familiar with *APL*, and demonstrate a degree of continuity in Alexander's thinking.

109   Alexander et al., *The Battle for the Life and Beauty of the Earth*, Chapter 22.

110   Nikos A. Salingaros, "A Scientific Basis for Creating Architectural Forms," *Journal of Architectural and Planning Research* 15, no. 4 (1998): 283–93, available at www.jstor.org/stable/43030470.

111   Gabriel and Quillien, "Search for Beauty," 26–27, emphases added.

112   Alexander, *The Nature of Order*, vol. 1, 446–48.

113   For a long time I thought "wholeness" was the name of some property of a part of the environment; but after a close reading of the technical appendix, I came to understand wholeness as a mathematical structure that can be imposed on any region of space (although the function *c* has not been defined mathematically).

"Life," Wholeness, and Centers — Revisited

For twenty years Alexander spent "two or three hours a day looking at pairs of things — buildings, tiles, stones, windows, carpets … comparing them, and asking [himself]: *Which one has more life?* And then asking: *What are the common features of the examples that have most life?*"[102] In this way he discovered 15 structural properties that kept recurring in the things with most "life." Some of those properties are LEVELS OF SCALE,[103] STRONG CENTERS,[104] LOCAL SYMMETRIES,[105] and ROUGHNESS,[106] to mention but a few.[107] They are described in detail and exemplified in *TNO*,[108] and in *BAT*.[109] LEVELS OF SCALE has been formulated mathematically by Salingaros,[110] based on an early draft edition of *TNO*.

Alexander's notion of life is not easy to grasp. Before we go into some detail for the sake of precision, it may be helpful to quote a few lines from Richard Gabriel and Jenny Quillien's lucid survey paper that captures the intuitive meaning of Alexander's "life" in a nutshell.

> "In the most basic terms, Alexander's search for Beauty was confounded by the essential need for complexity in the built world. What Alexander admired is *complex but organically so*: ancient city plans, rustic buildings, stave churches, Japanese gardens, classical music, how people interact socially, and nature…. [In *TNO*,] Alexander was describing *the edge of chaos — a place balanced between order and chaos, or between simplicity and complexity*. When we look too deeply into chaos, we find only disorder; when we look too deeply into order [which Alexander was accusing many contemporary architects and planners of doing], we find only the botfly of boredom; when we look in between, we find Beauty, poetry, life."[111]

In a technical appendix, "Definition of the Wholeness" that I will now try to interpret and summarize my understanding of,[112] Alexander says that what he has called "life" he will now also call "*coherence*." Furthermore, he explains, coherence is something we perceive in the world (consider his many comparisons of pairs of things). Although we cannot measure it precisely, we can distinguish various degrees of coherence.

For example, an entire apple has a high degree of coherence. A half apple has a somewhat lower degree of coherence. The core a still lower degree, and a random portion of it would have almost no coherence. The apple or its various parts can be thought of as sub regions of space filled with matter in some configuration.

In general, any sub region of a given space is more or less coherent, depending on its shape and what is in it; it has a degree of coherence.

Although we do not have a technical instrument for measuring it, we can think of the degree of coherence of a sub region as expressible by a number ranging from 0 (no coherence at all) to 1 (maximal coherence). So perceiving sub regions and their degree of coherence amounts to perceiving some part of the environment and getting a feeling of how much "life" it has.

Given a region R and a function *c* that assigns a degree of coherence to any sub region of R, we get a mathematical structure consisting of R, its sub regions, and the function *c* mapping each sub region to a real number from 0 to 1. This structure is called "the wholeness W" (for R).[113]

114 Alexander et al., *The Battle for the Life and Beauty of the Earth*, 131, note 1, emphasis added.

115 Bin Jiang, "Wholeness as a Hierarchical Graph to Capture the Nature of Space," *International Journal of Geographical Information Science* 29, no. 9 (2015): 1632–48, DOI: https://doi.org/10.1080/13658816.2015.1038542; Bin Jiang, "A Complex-Network Perspective on Alexander's Wholeness," *Physica A* 463 (December 2016): 475–84, DOI: https://doi.org/10.1016/j.physa.2016.07.038.

116 Alexander adopted this term after the publication of *TNO*. It better expresses the nature of the transformations than "structure-preserving transformations" used in *TNO*. Alexander, "Empirical Findings," p. 5, item 16.

117 Bin Jiang, "A Recursive Definition of Goodness of Space for Bridging the Concepts of Space and Place for Sustainability," *Sustainability* 11, no. 15 (2019): 1–13, DOI: https://doi.org/10.3390/su11154091; Bin Jiang, "Living Structure Down to Earth and up to Heaven: Christopher Alexander," *Urban Science* 3, no. 3 (2019): 1–20, DOI: https://doi.org/10.3390/urbansci3030096.

118 One prominent line of work related to Alexander's *TNO* theory is biophilic design. For example, see Nikos A. Salingaros, "The Biophilic Healing Index Predicts Effects of the Built Environment on Our Wellbeing," *Journal of Biourbanism* 8, no. 1 (2019): 13–34, available at http://zeta.math.utsa.edu/~yxk833/BiophilicIndex.pdf; Ann Sussman and Justin B. Hollander, *Cognitive Architecture: Designing for How We Respond to the Built Environment* (New York: Routledge, 2015).

119 Bin Jiang and Nikos A. Salingaros, eds., "New Applications and Development of Christopher Alexander's the Nature of Order," special issue, *Urban Science* 2019-2020, available at https://www.mdpi.com/journal/urbansci/special_issues/new_applications_development_nature_order.

But for practical purposes, we are only interested in sub regions of R with a high degree of coherence (for example a degree higher than 0.99). Such sub regions are what we call *centers* (in R). Note that this definition of "center" nicely formalizes and clarifies the one from *BAT* that we saw earlier: "a distinct physical system, which occupies a certain volume in space, and has a special marked *coherence*."[114]

On the basis of this close reading and interpretation of Alexander's formal definition of wholeness (of a place, a region of space), I will conclude that it goes a long way towards a new understanding of aesthetics, partly mathematical. Partly, because it still relies on the intuitive idea of measuring the degree of coherence by the function *c*, which has not been (and perhaps cannot be) defined mathematically. Even so, the idea of a wholeness invites us to think of the world not in the simplistic terms of distinct parts put together one next to the other like Lego blocks, but in terms of centers that can overlap and nest within each other, and which mutually may strengthen each other's coherence.

This is a challenging idea that invites further research. And the challenge has been accepted by Bin Jiang, who proposes an interesting formalization of the notion of wholeness in terms of graph theory,[115] which he applies, by way of illustration, to the plan of the Alhambra. He also offers a nice presentation of the 15 structural properties on which Alexander based his notion of "life"-cum-coherence.

Wholeness-Extending (a.k.a. Structure-Preserving) Transformations

To design and build something *good* featuring many strong centers with a high degree of "life" (coherence), one needs a *method* in order to benefit from the *principles* just presented.

This is what virtually all of *TNO* volume 2 is about. This material is too rich and complex to be summarized or discussed in any detail here. Suffice it to mention that the lesson to be learnt, as I understand it, is to begin with whatever wholeness there is in the relevant place (region of space), and then proceed by means of 15 wholeness-extending *transformations*,[116] through a process of *unfolding* that establishes or enhances the 15 structural *properties* that Alexander distilled from his comparative contemplation of places with more or less "life." (Some of the ideas from *TWB* are here re-emerging in new and more elaborate forms.)

Again, Jiang has taken up the challenge of developing Alexander's complex ideas from *TNO* further.[117] So have Mehaffy, Salingaros, and several others.[118] It would exceed the scope of this essay to review in detail the emerging literature about or building upon *TNO*, but a recent special issue of *Urban Science* (edited by Jiang and Salingaros) provides a good entry point.[119]

The Architecture-Science Relationship

Alexander's View

In his struggle to counteract the spread of ugliness, it is clear from his writings that Alexander employed the full range of intellectual resources acquired in virtue of his formal training, both as an architect, and as a scientist.

120 Alexander, "New Concepts," 2, emphasis added.

121 Ibid., 2, emphasis added.

122 Ibid., 17.

123 Alexander's thinking has already had some influence outside his native fields of architecture and urban design, though perhaps not in quite the way he hoped for. In particular the idea of pattern languages has become popular, notably in software engineering. For example, see Christopher Alexander, "The Origins of Pattern Theory: The Future of the Theory and the Generation of a Living World," *IEEE Software* 16, no. 5 (1999): 71–82, DOI: https://doi.org/10.1109/52.795104; Erich Gamma et al., *Design Patterns: Elements of Reusable Object-Oriented Software* (Boston: Addison-Wesley, 1995). For a systematic survey of the reception of pattern theory in other fields than architecture and urban design, see Neis and Brown, *Current Challenges*, 164–66. For a recent review of Alexander's influence, see Mehaffy, "Assessing," 1 and 11–12.

124 Christopher Alexander, "The Interaction of Architecture and Science (Foreword by Christopher Alexander)," *Katarxis Nº 3: New Science, New Urbanism, New Architecture?* 3, no. 3 (2004): online, available at http://www.katarxis3.com/Alexander_Architecture_Science.htm.

125 Alexander, "Empirical Findings," 11.

Regarding the latter, my initial impression from half a century ago has been confirmed: Alexander's aim and ambition was indeed scientific in nature—though very much artistic as well. For, as he says in one of his guides to *TNO*, "The four books of *The Nature of Order* were written, originally, in order to lay *a scientific foundation for the field of architecture*."[120] But as he goes on to explain, the scope of his project expanded along the way, "touching *not only architecture, but other scientific fields* as well.… I was never writing directly from the point of view of physics, or mathematics, or cosmology, or biology, or ecology or cognitive theory. Yet all these fields are likely, in one way or another, to be touched by some of the findings I have made." As a result, while architecture used to be "very much the recipient of received wisdom from the natural sciences," architecture is now, Alexander contends, producing "ideas of its own, which have direct bearing on the solution of problems [of science …], and doing so in ways which … have not arisen before in the mother fields of science itself."[121]

Later in the same guide, Alexander notes that he has "had some considerable success" answering the questions posed in *TNO* about "what kind of processes [of design, construction, and so on] might enable us to get a higher rate of success in reaching good structures in our surroundings." And he adds, with no false modesty, "it seems to me that the scientific community might learn a great deal about complexity, by focusing on the character and technique of this success."[122]

These statements summarize Alexander's understanding of the relationship between architecture, as per his *TNO* theory, and natural science: it involves a view of architecture as one science among others, and an extremely ambitious vision of how various fields of natural science might one day adopt some of Alexander's ideas for purposes of their own.[123] But *internally*, within the field of architecture, his vision is almost as ambitious:

> "The purpose of a scientific view of architecture is to enable us to create … more satisfying design, more eternal forms, more valuable places, more beautiful buildings. The new theory is not merely a gloss on architecture, to raise its intellectual level. It is above all, a source of help—artistic help—to pull us out of the mud pit we have fallen into during the last eighty years, by making, following and copying over simplified forms, only because commercial instincts have robbed the field entirely of the kind of awareness which was needed.…"[124]

Obviously, the abrasive anger expressed here is part and parcel of Alexander's rebellion against the predominant paradigm of architecture.

An Alternative: Nomological Principles, Methodology, and Organization

Reflecting on his experimental work, Alexander rounds off his "Empirical Findings from The Nature of Order" guide by conceding that "more rigorous experiments along the same lines can be done." He finds that his experiments "have established a prima facie case" and "now simply need confirmation through experiments conducted along more rigorous lines"—work for which he looks to his "colleagues and to a new generation of scientists to carry … forward."[125] So allow me briefly to propose some

126 This proposal would seem quite con-
     genial with the spirit of *APL*, where
     the authors remark, "… if you like, each
     pattern may be looked upon as one of
     the hypotheses of science." Alexander et
     al., *A Pattern Language: Towns*, xv.
127 Alexander, *The Nature of Order*, vol. 1,
     144.
128 Alexander et al., *The Battle for the Life
     and Beauty of the Earth*, 421–28.

ideas of my own about how future research might benefit from the legacy from Alexander.

There is no doubt in my mind that this legacy is immensely valuable and could inspire many years of serious research. But I do not think that future research should merely be concerned with confirming Alexander's results as they stand. Nor should it refrain from developing his theories along different lines, or clarifying his conceptual apparatus (as I have done elsewhere here), if that might lead to new insights or pragmatic benefits in terms of applicability.

I would also recommend the time-honored principle of "separation of concerns" to make new theory-formation more manageable (and to make the heritage from Alexander more manageable as well). More specifically, I propose that we make a distinction between *nomological principles*, *methodology*, and *organization*.

- *Nomological* (law-like) *principles* would be theory describing *causal relations* between (geometrical) properties of parts of the (built) environment on the one hand, and human reactions (emotional or practical) to those properties on the other. Much as laws of nature can be seen as describing causal relations between some properties of the environment and other properties of the environment, our ambition should be to develop for the design professions principles that correspond to laws of nature in natural science.

The pattern theory in *APL* and *TWB* (*mutatis mutandis* as discussed earlier) seems a promising step in the direction of such law-like, project-independent principles.[126] The 15 properties characteristic of environments with a high degree of "life" that were developed in *TNO*[127] and employed on a large scale in *BAT*[128] might form the core of another such principle, with an emphasis on aesthetics. Perhaps this principle could even be stated in the form of a comprehensive pattern, which in the spirit and style of Alexander, we might call PLACES OF LIFE AND BEAUTY. Its *context* would simply be any part of the built environment. Its *problem* would be about "the spread of ugliness" caused by modernist machine-like aesthetics (or simply lack of regard for beauty), and the way the building industry and its professions have developed throughout the 20th century. The *solution* would be "living" environments possessing (many of) the 15 properties.

Such a pattern would almost certainly be e*mpirically relevant* (see Definition 6), and presumably *empirically adequate* (Definition 5), but I suspect that making it *empirically complete* (Definition 4) would be much harder and require further research into aesthetics.

- *Methodology* would be theory about how to construct, develop, and preserve the environment in accordance with the nomological principles.

Alexander's *TNO+BAT* offer much to build on in this regard, too. First and foremost the 15 wholeness-extending transformations that are meant as practical steps to be taken so as to ensure that a part of the environment

129   Alexander, *The Nature of Order*, vol. 2, Chapter 2, and pp. 507–9. See also Alexander et al., *The Battle for the Life and Beauty of the Earth*, 428–40.

130   Alexander, *The Nature of Order*, vol. 1, Chapter 8. See also 350 for notes linking to other relevant places in *TNO*.

131   In other fields than architecture, emotional design has been a well-established line of research for quite some time. For example, see Pieter M. A. Desmet and Anna E. Pohlmeyer, "Positive Design: An Introduction to Design for Subjective Well-Being," *International Journal of Design* 7, no. 3 (2013): 5–19, available at http://www.ijdesign.org/index.php/IJDesign/article/view/1666; and Donald A. Norman, *Emotional Design: Why We Love (or Hate) Everyday Things* (New York: Basic Books, 2004).

132   Center for Environmental Structure, "The Relationships between Pattern Languages, Sequences, and Generative Codes," *Livingneighborhoods.org*, 2006, accessed July 1, 2020, https://www.livingneighborhoods.org/ht-0/pattern-languages.htm.

133   Christopher Alexander et al., "Generative Codes: The Path to Building Welcoming, Beautiful, Sustainable Neighborhoods," in *New Urbanism and Beyond: Designing Cities for the Future*, ed. Tigran Haas (New York: Rizzoli, 2008), 14–16, 23. For a full-scale example of a generative code, see Christopher Alexander and Randall Schmidt, *The Generative Master Plan for the New Town of Harbor Hills, Brookings, Oregon* (Berkeley: Center for Environmental Structure Publishing, 2005), available at https://www.livingneighborhoods.org/library/brook-2.pdf.

134   See references for the entry "direct management" in the index to Alexander et al., *The Battle for the Life and Beauty of the Earth*, 500. See also Alexander et al., "Generative Codes: The Path," 24–28.

135   Perhaps "bodies of theory" would be more to the point, due to the comprehensiveness of Alexander's work.

136   In a larger context, I see this contribution as pertaining to an emerging theory of science for design.

instantiate the 15 properties.[129] For psychological measurement of the degree of "life" in a place or thing, methods more rigorous than those described in *TNO*[130] should be developed, informed by expertise in psychology and design of psychological experiments. Presumably, such methods should also take into account the body of research in emotional design.[131] The most recent descendant from pattern theory is the theory of *generative codes*.[132] These are documents that specify the sequence of steps that must be taken to construct a particular neighborhood through a process of embryo-like "unfolding" (via the 15 wholeness-extending, or structure-preserving, transformations) so as to ensure the "life" (beauty) that comes from local adaptation.[133] The theory underlying such generative codes might also be developed as a contribution to methodology.

- *Organization* would be theory about how to reorganize the building industry and its professions, empower users, and so on, so as to make the methodology work—technically, politically, economically, psychologically, and ethically.

Once again, *TNO+BAT* have laid a foundation on which to build, whether or not one agrees with Alexander's ideas or considers them politically viable: for example, by employing fee-based project managers working under a fixed budget, and non-profit contractors and developers who have no incentive to save money by speeding up processes and lowering the quality of materials or construction.[134]

Conclusion

In this essay, it was never my aim to present you to all of Alexander's work. I concentrated my research review on his *pattern theory* from the two books *The Timeless Way of Building* and *A Pattern Language* (and some earlier versions of the theory), and his more recent *theory of aesthetics* (and much else) from two of his other classics, *The Nature of Order* and *The Battle for Life and Beauty of the Earth*.

Within this scope, my main emphasis has been on the pattern theory. For, as I have argued, when it comes to the issue of developing a science of architecture—or, more broadly, design for that matter—which involves how architecture (design) interacts with the life and feelings of human beings, Alexander's patterns have a crucial role to play. Even though they did not work quite as he had hoped—as a tool empowering lay people to build truly beautiful environments—it would be a mistake to dismiss them as merely semi-successful precursors of his more recent theory of aesthetics. As I have argued, the two theories[135] are valuable in their own right, each in its own way. But none of them is perfect, and much work can and should be done to develop them further. Some such work is already under way, as I have briefly indicated.

As a modest contribution to the development of pattern theory, I have proposed new and precise definitions of what it means for a pattern to be *empirically complete*, *empirically adequate*, and *empirically relevant*.[136] And

I have shown how these concepts relate to ideas already present in work by Alexander and his colleagues.

To come to grips with Alexander's complex and multifaceted body of work, I found it useful to distinguish between what I call his *motivational* and *theoretical ideas*. Regarding the latter, I proposed a classification into ideas concerning *nomological* (law-like) *principles, methodology,* and *organization*, briefly suggesting how each might be explored.

As a side effect of all this, the present essay may also serve as a guide to Alexander's thinking. To that end, I addressed two potential stumbling blocks for new readers: the fact that Alexander occasionally makes use of a religious vocabulary, and the fact that among the examples he uses to illustrate his theory of aesthetics there is a predominance of ancient or traditional architecture. I argued that none of these facts invalidate Alexander's theoretical ideas, so readers in whom religion or references to the past arouse suspicion should not, for those reasons, refrain from serious consideration of the theoretical ideas.

Finally, let me address the question suggested by the title of this essay. *Did Alexander bring us closer to a science of architecture?* Not everything Alexander wrote qualifies as science, as we have seen. After all, he is an artist and humanist as much as he is a scientist. However, based on the insights summarized above, it is fairly obvious to me that the question can be answered in the affirmative, even though a full-blown and mature science of architecture (or indeed design) is not yet available. In pursuing the goal of such a science, I have experienced that, when reading Alexander (as I urge you to do), it is sometimes even more stimulating to disagree with him than to accept what he says. But one way or the other, for saying it we owe him deep respect and gratitude.

Declaration of Interests

There are no conflicts of interest involved in this article.

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i   If you want rigor, you should consult a textbook on formal logic, covering sentential and first-order-predicate calculus. I recommend the relatively intuitive approach known as natural deduction, taken for example by Donald Kalilsh, Richard Montague, and Gary Mar in their book *Logic: Techniques of Formal Reasoning*, 2nd ed. (1964; New York: Oxford University Press, 1980).

ii For example, suppose "p" says that for any x, if x is a building, then x is at most n stories tall (where n is the number of stories in today's tallest building.) Then "p" is true. But "*necessarily* p" would only be true if it were impossible (physically) to make a building taller than n stories. (This might be difficult to decide in practice, but that is beside the point.

iii A sentence may be true (or false when its negation is true); but sentences may also be *necessarily* true, or merely *possibly* true. The science about these (and some other) *modes* of truth is called *modal logic*. Ways the world might be are often called "possible worlds". For a short and accessible introduction to that notion, see: Daniel Nolan, "Modality," in *Central Issues of Philosophy*, ed. John Shand (Chichester: Wiley-Blackwell, 2009), 98–100. Alvin Plantinga, *The Nature of Necessity* (New York: Oxford Universty Press, 1974), 44–45. A thorough introduction to and philosophical discussion of modal logic is offered by Garson, *Modal Logic for Philosophers*. (He employs natural deduction.) On different notions of necessity etc., see particularly his Section 5.3.

Appendix: The Bare-Bones of Symbolic Notation

In the bullet list below I introduce the bare minimum of symbolic logic notation needed for the discussion of the logical structure and empirical import of patterns. Descriptions of syntax and semantics are incomplete and sketchy, but will do for the purpose.[i]

- If "p" is a sentence, then "~p" is a sentence readable as "not-p" (true when "p" is false).
- If "p" and "q" are sentences, then "p & q" is a sentence readable as "p and q" (true when both components are true).
- If "p" and "q" are sentences, then "p → q" is a *conditional* sentence readable as "if p, then q" (false only when "p" is true, but "q" is false).
- A predicate is a verb-phrase that ascribes a property to one or more "objects". E.g. "_ is a footpath" is a predicate (being a footpath is a property). Relations among two or more objects are also considered properties, so "_ passes through _" is a predicate, too. (In the natural-language phrases, underscores suggest places for indicating an object.)
- A predicate applied to an object constitutes a sentence. E.g. "*El Camino* is a footpath." When the sentence is true, we say the object *satisfies* the predicate.
- Predicates are symbolized by capital letters. For indicating the relevant objects, they use "object variables" $x, y, \ldots$ (or names as in "*El Camino* is a footpath"). Thus "_ is a footpath" may be symbolized as "Fx", whereas "_ passes through _" could be symbolized "P(x, y)". Such constructs are also regarded as (symbolic) sentences.
- Let "v" be an object variable [could be any other letter: x, y, e, etc.; or a pair, triple, … such as "(x, y)" above], and let "… v …" be some (symbolic) sentence constructed according to the above rules, containing one or more predicates using "v" to indicate an object. Then "$\forall v$ (… v …)" is a *universal* sentence, readable as "For any v, (… v …)" or "For all …." Its meaning might be glossed: "No matter what object 'v' stands for, '… v …' is true of that object." (In standard logic, it is assumed that there is one or more objects that "v" stands for.)
- Similarly, "$\exists v$ (… v …)" is an *existential* sentence, readable as "For some v, (… v …)". Its meaning might be glossed: "For at least one object that 'v' stands for, '… v …' is true of that object."
- If "p" is a sentence, then "*Necessarily* p" is a sentence. It is true just in case "p" is true *for any* way the world might be: namely as it actually is, or as it would become through some change not violating the laws of physics.[ii] (Compare *universal* sentence above.)
- If "p" is a sentence, then "*Possibly* p" is a sentence. It is true just in case "p" is true *for at least one* way the world might be, without violating the laws of physics.[iii] (Compare *existential* sentence above.)
- Parentheses are used as needed for clarity and disambiguation.