A Sustainable Pattern Language:
A Comprehensive Approach to Sustainable Design
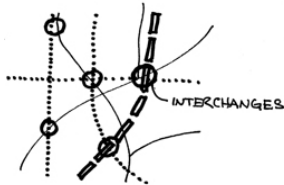
Master of Architecture thesis, University of Cincinnati, 2008. Below are the abstract, thesis statement, and a summary of arguments. The design work is available here. The full thesis document, however, is not currently available.

Abstract

A truly sustainable society requires substantial change to our economic structure and social order. However, sustainable design as presently practiced focuses on technical solutions, ignoring the socio-cultural dimensions of sustainability. Architecture must begin to engage both the social and technical dimensions of sustainability.

This thesis attempts to understand the architectural implications of these deeper, harder changes by developing and applying social-spatial patterns. The outcomes are (1) a menu of patterns, or a "pattern language," (2) a design methodology for pattern development and application, and (3) design explorations in two contexts.

Thesis Statement

A system that is viable over the long term (sustainable) — be it an ecosystem or society — exhibits of a number of characteristics that allow it to change adaptively over time without experiencing overshoot or collapse — characteristics such as resilience, decentralized control, rapid feedback mechanisms, and self-organization, to name a few. Achieving a sustainable society therefore has to do, at its core, with these structural characteristics, and therefore means substantial change to our economy and social order — not simply more efficient buildings or renewable energy technologies (important though these may be).

Architecture and design more broadly have yet to seriously address these most important systemic changes. Although "sustainability" is becoming increasingly important in the discipline of architecture, it is largely being addressed at a technological or mechanical level — an approach that ignores the vital social dimension of sustainability. Because the built environment both embodies and perpetuates social norms and patterns, and because a truly sustainable society requires substantial change to our economic structure and social order, architecture must critically engage social and economic praxis. This thesis attempts to understand the architectural implications of these deeper, harder, more systemic changes.

A prerequisite for this investigation is an understanding of the nature of the required social and economic changes. The theory of Jürgen Habermas, Amory Lovins, Herman Daly, and Vernon Scarborough form the primary basis of understanding, and reveal important principles for a sustainable society, including *resilience, diversity, decentralized production and consumption, labor-based economics,* and *abundant social capital*. These principles guide the selection of specific patterns that support a sustainable society.

One framework for understanding the architectural implications of broad principles is presented in *A Pattern Language* (1). A *pattern* is a formal relationship between a human activity and the geometry of the physical environment; thus patterns have both a social and spatial dimension. *A Pattern Language* provides a framework for creating patterns, understanding their interconnections, and exploring their architectural manifestations. It also provides a system flexible enough to navigate between multiple scales, from the city to the building detail. The processes of pattern development and application are themselves non-linear and interconnected: design explorations simultaneously test the validity of

patterns, suggest improvements, and create new patterns entirely.

This thesis will: (1) assemble a menu of patterns from a variety of existing sources, based upon the principles outlined above; (2) develop a methodology for simultaneous pattern analysis and design development; and (3) explore the implementation of selected patterns through urban and architectural designs in several contexts and at several scales.

What follows is the beginning of what promises to be a far larger study: an initial exploration that will continue to evolve long after the end of this thesis. The primary intent, then, is to lay the foundation, both theoretical and pragmatic, for a far deeper exploration.

1.1: Summary of Arguments

The intent of this thesis is to navigate between the general principles of a sustainable society on one hand and the specific design of the build environment on the other. The focus is on a methodology that will allow this type of exploration — one that simultaneously provides a logical framework and allows different results in every context. Rather than presume to know what we mean by "sustainable design," this thesis interrogates this question and asks if there are other, more fundamental ways than those currently in vogue that architecture can contribute to the project of a sustainable society.

Organization

There are three questions implicit in the thesis statement presented at the beginning of this document. These questions must be answered (in the given order) for the thesis to proceed. They are: (1) What is sustainability? (2) What is a sustainable society? and (3) How do we design for a sustainable society?

This, roughly, is the organization of the thesis. The first question, "What is sustainability?" is the subject of section 1.2: Sustainability, Defined. The second question, "What is a sustainable society?" is actually comprised of three sub-questions: (2a) What is *un*sustainable about our current society? (2b) What are the important conditions for sustainability? and (2c) What might a sustainable society look like?

Question (2a) is addressed by section 1.3: The Current Social Order. This examination will help us answer question (2b), which will subsequently help us answer question (2c). These questions are taken up in section 1.4: A Sustainable Alternative. This section will end by summarizing the conditions for a sustainable society.

Finally, the third question, "How do we design for a sustainable society?" is the subject of the remainder of the thesis. This is primarily a question of methodology; hence, a methodology will be presented and tested through design.

Disclaimer

This thesis lays the foundation for a much deeper investigation. More concretely, I intend to revise and add to this document after graduation; those looking for more information or the most recent version are encouraged to contact the author at the contact listed below the copyright [carlsterner (at) gmail].
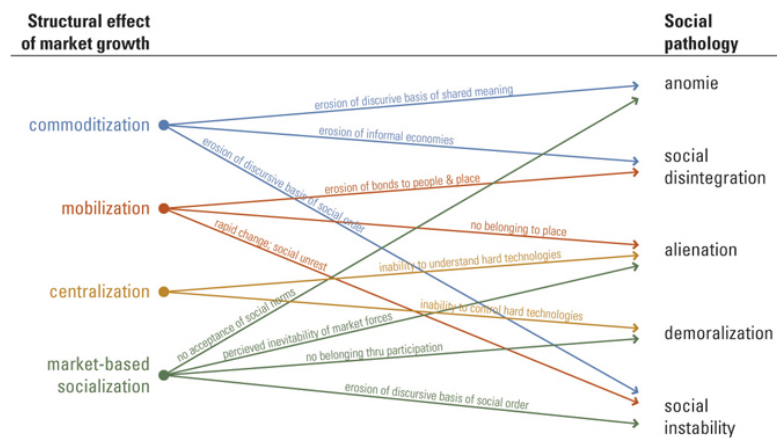
Summary of Arguments

1. What is sustainability? Sustainability is the ability of a system to maintain viability over the long term. Here we are primarily interested in the human-natural system, or the multi-directional interactions of human society and the natural environment. A large number of variables affect this interaction; to add to the difficulty, many of these variables change over time at varying rates. For ease and simplicity, the significant variables, as far as they can be determined, are grouped into three conceptual categories: society, economy, and environment. Each of these categories has a corresponding form of capital that must be preserved to achieve the long-term human-natural viability being pursued: social capital, economic capital, and natural capital. The individual variables — or components — within these three categories are debated; this thesis attempts a preliminary synthesis.
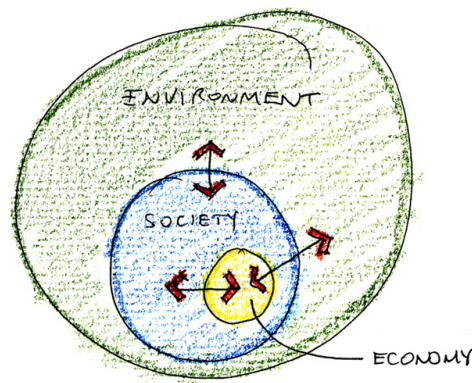
2a. What is unsustainable about our current society? Drawing from Jürgen Habermas, Amory Lovins, and Herman Daly, this thesis argues that the current social order is dominated by a growth-oriented market economy steered by internal imperatives of production and profit, rather than by collective (democratic) decision-making. The growth-oriented market erodes natural capital (1) by growing indefinitely, or increasing the throughput of energy and natural resources through the economic system beyond the capacity of the natural environment to renew resource or assimilate wastes; (2) by favoring resource-consumptive production methods that, while they maximize production and profit, do not use resource or energy wisely; and (3) by creating a system that is brittle and vulnerable should any of its exacting requirement not be met — a system created in part by the centralized resource-consumptive methods mentioned above, and that, due to its vulnerability, is prone to unpredictable, rapid change that is antithetical to the goal of long-term viability.
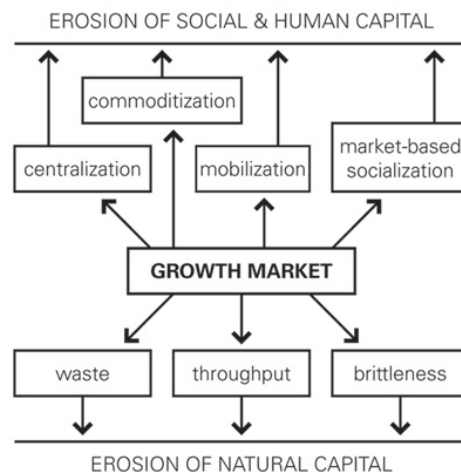
The growth-oriented market erodes social capital (1) by growing into and appropriating the contents of informal economies that sustain communities (commoditization); (2) through its preference for centralized, large-scale, hierarchically-maintained production methods, which by their very nature are controlled by powerful individuals and institutions, and are incomprehensible and/or uncontrollable by ordinary people (centralization); (3) via economic processes that favor flexibility and mobility, further eroding bonds to people and place (mobilization); and (4) ultimately socializing individuals according to the values supported by the market (market-based socialization). These social effects undermine the collective (social) processes necessary to put moral or ethical limits on market activity, or reorient the economy toward qualitative *development* rather than quantitative *growth*. The self-organizing collective capacity for social change can affect both daily practice and established laws, and this thesis, following Habermas, relies explicitly on these communicative processes for just and equitable change. At the same time, social capital and solidarity are desirable ends in themselves that increase community decision-making capacity, self-reliance, and human wellbeing. Thus the ends and means of a sustainable society are inseparable.

Structural effect of market growth → **Social pathology**

Left nodes: commoditization, mobilization, centralization, market-based socialization

Right nodes: anomie, social disintegration, alienation, demoralization, social instability

Connection labels:
- erosion of discursive basis of shared meaning
- erosion of informal economies
- erosion of discursive basis of social order
- erosion of bonds to people & place
- rapid change; social unrest
- no belonging to place
- inability to understand hard technologies
- inability to control hard technologies
- no acceptance of social norms
- perceived inevitability of market forces
- no belonging thru participation
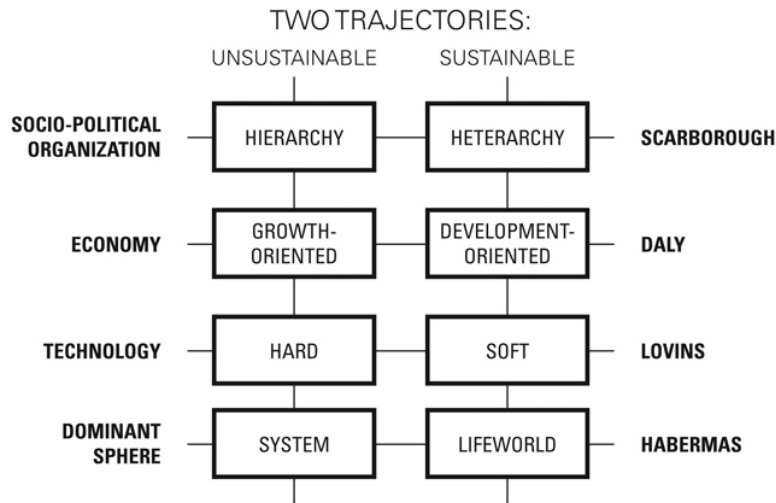- erosion of discursive basis of social order

2b. What are the important conditions for sustainability? Following from the above analysis, there are several conditions that must be met in a sustainable society. First, the growth-market must be re-oriented toward qualitative *development* rather than quantitative ("resource-crunching") *growth*. This requires that the market be guided by moral/ethical norms and values which prioritize sustainability. The development and enforcement of these norms and values requires collective action (or, in Habermasian terms, communicative action), which relies upon social and human capital (in Habermasian terms, an empowered lifeworld). The formation of social capital, and therefore collective action, occurs locally and depends upon human relationships, and therefore depends upon *appropriate scale*. Similarly, efficient and equitable production methods depend on matching the scale and distribution of production to the scale and distribution of end-use needs — that is, they, too, depend upon *appropriate scale*. In general, sustainable economies and communities will be decentralized. This simultaneously allows adaptation to place, local control, and rapid feedback; these things enhance flexibility and resilience. *Alternative economies* — local, informal, and household — will play a larger role: they can enhance the efficiency of production and provide numerous other benefits, including the development of social capital. *Cyclical economics* will also play a major role: all materials must be seen as part of the cyclical flow of matter through the ecosystem or industrial system (or, more accurately, both: the latter is embedded in the former). The shift in focus from growth to development comes with a simultaneous shift in focus from resource consumption to human labor. A sustainable economy will rely to a greater extent on human labor to make products that last longer, and to repair, reclaim, and recycle all material. Finally, all of these conditions reinforce *diversity* and *resilience*. They favor small units dispersed in space, redundancy, short supply lines, rapid feedback, and decentralized control. Interestingly, these are many of the same conditions necessary for the effective functioning of market economies according to Adam Smith (and neoclassical economics) — but they are conditions that the market itself cannot maintain, and require steering by an outside source. Resilience and diversity are of vital importance due to the very nature of complex systems. But they are not only important for stability and longevity; they are also intrinsically valuable because of their ability to add depth and variety to the human experience.

2c. What might a sustainable society look like? Drawing from anthropologist Vernon Scarborough, as well as the primary theorists listed previously, this thesis describes two social trajectories. One is dominated by a growth-oriented market economy, centralized "hard" technologies, and hierarchical socio-political organization. The other relies on a very different economic logic: accretional development that draws on appropriate-scale "soft" technologies, is organized heterarchically, and is steered by collective decision-making that emerges, as Habermas argues, from rational discourse in the public sphere. It relies upon the following conditions, which are seen as the basic principles for a sustainable society:

1. **resilience,** or resistance to outside perturbations;
2. **diversity:** compositional, structural, and functional;
3. **self organization** via collective action and participatory democracy;
4. **abundant social and human capital,** upon which collective action relies;
5. **equitable provision of basic needs,** a prerequisite to the formation of social and human capital;
6. **abundant natural capital,** including renewable resources, non-renewable resources, and ecosystem services;
7. **decentralization** (which is, in fact, the general result of a focus on appropriate scale and distribution);

8. **labor-based economics** (which is, in fact, the general result of a focus on appropriate means); and
9. **cyclical economics,** which focues on the flows of matter and energy through the environment.

These principles are used as a summary of a sustainable society as the thesis moves forward. The designs and methodologies are focused on achieving these principles.

TWO TRAJECTORIES:

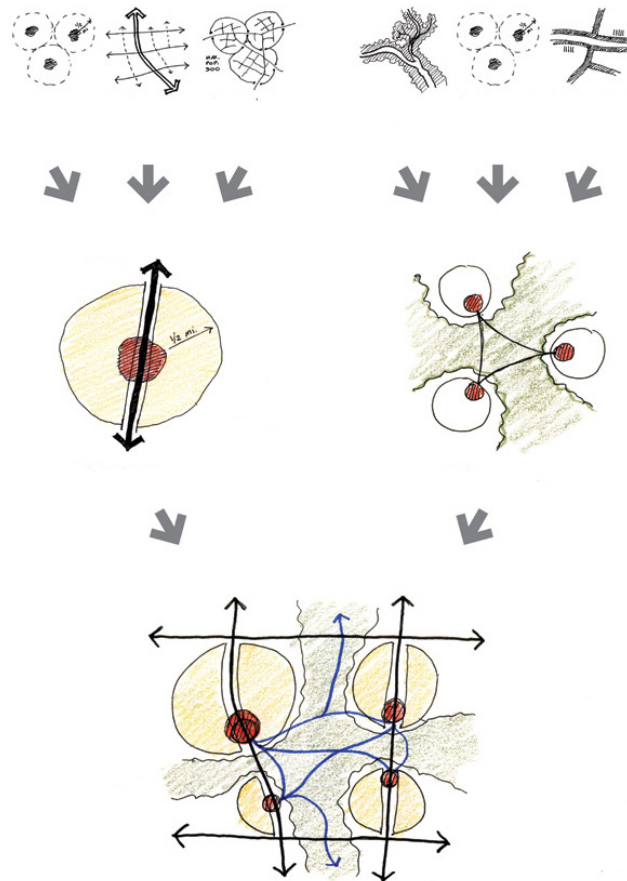|	UNSUSTAINABLE	SUSTAINABLE	
SOCIO-POLITICAL ORGANIZATION	HIERARCHY	HETERARCHY	**SCARBOROUGH**
ECONOMY	GROWTH-ORIENTED	DEVELOPMENT-ORIENTED	**DALY**
TECHNOLOGY	HARD	SOFT	**LOVINS**
DOMINANT SPHERE	SYSTEM	LIFEWORLD	**HABERMAS**

But how do we *create* a sustainable society? The principles described above explicitly favor small-scale, decentralized, locally-controlled development. By its very nature this can be done incrementally, piece by piece. It does not require universal changes implemented by a powerful central governments; rather, it relies upon many, small, diverse, and locally-responsive changes implemented by neighborhoods, communities, and cities. These changes slowly withdraw support from existing centralized systems by creating a viable, and more desirable, alternative. Once again, the ends and means of a sustainable society are inseparable.

Equally significant, two of the most important elements of a sustainable society — scale and distribution — have spatial implications. Designers therefore have a role in the incremental, participatory creation of a sustainable society.

3. How do we design for a sustainable society? After reviewing a number of methodologies, this thesis settles on *A Pattern Language* as a framework for understanding architectural implications of broad principles at many scales. Among its many strengths, patterns (1) connect social and spatial considerations; (2) are multi-scalar, operating from the regional scale to that of the building detail; (3) are mutable rather than prescriptive, and can be adapted to many different contexts; and (4) are amenable to participation, an important processual component of sustainable design that is not explored in depth here.

Fundamentally, patterns are a way of thinking about and understanding design. Like a good design parti, they can clarify intentions and provide conceptual rigor. They can provide the constraints within which creativity and innovation can blossom — but they are not arbitrary constraints, invented by designer or created by the client. Rather, they are constraints based upon the conditions necessary for a sustainable society. Patterns are a way of consciously linking our intentions to our methods to our final products so that all of these can be interrogated, discussed, and modified over time based upon feedback and evaluation. Patterns are also a way of exploring some of the complex interconnections within our built environment in order to be more aware of the implications of various design moves. Pattern selection and design decisions, of course, are ultimately the responsibility of designers, and rely upon the judgment and sensibilities of the designer and/or participants. Patterns are not necessarily a recipe for good design: good design still depends, as it always has, upon the skill of the designer. But, if used thoughtfully, these patterns can be a recipe for *sustainable* design.

How is this thesis different from Christopher Alexander's *A Pattern Language?* Why re-do what's been done? *A Pattern Language*, although it includes invaluable information and is generally oriented to sustainability, it is not specifically oriented to the principles described above. In addition, changes in science, philosophy, and design since the 1970s require that new ideas be incorporated — ideas that have the potential to achieve the goals outlined above.

The "Sustainable Pattern Language" is synthetic: it draws from a variety of sources (LEED, New Urbanism, Jane Jacobs, etc.). Patterns come from many places: research, precedent study, interdisciplinary dialogue, and/or design. It is a work in progress, constantly evolving: a way of opening the door to numerous other explorations. The methodology is successful if it (1) can demonstrably connect the above principles to design; (2) is flexible enough to operate well in several contexts and respond well to different situations; (3) can navigate between multiple scales; (4) reveals opportunities based upon interconnections between patterns, creating synthetic meta-patterns that achieve multiple aims at once; and (5) can evolve and change as necessary, without losing its fundamental characteristics. Design explorations test the patterns according to these criteria.

This thesis conducts two design explorations: one in Darrtown, Ohio, a small town in a rural area, and one in Forest Park, Ohio, a 1970s suburb north of Cincinnati.

Ultimately, this thesis takes the stance that the principle problem is not inefficient buildings. It is not fossil energies. It is not even car-centered urban fabric. The principle problem is the driving force that lies behind all of these manifestations: it is a social order dominated by the imperatives of a growth-oriented market economy. Without addressing the processes that drive unsustainability — processes that are inherently social, political, and economic — we will never achieve "sustainability." This thesis represents a preliminary attempt to address these deeper, harder, more systemic changes and connect them in a meaningful and rational way to the design of the built environment.

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