The European School of Urbanism and Architecture

A MODEL CURRICULUM TO MEET THE CHALLENGES OF THE 21ST CENTURY EUROPEAN BUILT ENVIRONMENT

Volume V: E-LEARNING

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"You have to show me how [your project] relates to human life, how it relates to their well-being and the freedom to be well. And the freedom not only to be well, but the freedom to lead the kind of life they value leading."

- Nobel Prizewinning Economist Professor Amartya Sen, speaking at LSE Colloquium, Removing Unfreedoms: Expanding Development Frameworks[1]

[1] *Courtesy Removing Unfreedoms Tools of Change (TOC) UK Ltd, a group of international architects and urban planners who worked in collaboration with Amartya Sen since 2002 to apply his ideals to urbanism, architecture and the built environment. www.removingunfreedoms.org*

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Whatever Happened to Urbanism?

An Introductory Course in the Principles of Sustainable Urban Design

How to Use This Module

This is an introductory e-learning module for a series of courses in urbanism and architecture known as the "European School of Urbanism and Architecture." The programme was designed for new students to the professional study of urbanism, and for professionals who wish to increase their level of understanding of important new topics in best practice. More information in this programme is available at www.esua.org.

If this is your first time learning about this subject, and you find this module interesting, you will have the option to take more modules on line in the future. But this on-line element is really only a part of the full course of study. This module is designed to be integrated with a hands-on learning programme that will allow you to learn in the most effective way known: "learning by doing". You will have the opportunity to participate in field studies of actual urban projects, working alongside leading practitioners, and using the latest tools and techniques.

This introductory module is specifically designed for those entering the programme for the first time, or those considering the programme who would like to try a course.
The full project-based curriculum is now in the pilot phase, and is planned to be launched as a full-time programme after several years of development. You can learn more at www.esua.org.

Each e-learning module begins with a short reading, then gives you links to additional reading. The final examination includes a short multiple-choice section, and a written essay portion that you can enter through a form, or email to the course instructor as a text document.

Introduction

> *Modernism's alchemistic promise -- to transform quantity into quality through abstraction and repetition -- has been a failure, a hoax: magic that didn't work. Its ideas, aesthetics, strategies are finished. Together, all attempts to make a new beginning have only discredited the idea of a new beginning. A collective shame in the wake of this fiasco has left a massive crater in our understanding of modernity and modernization.*
>
> *- Rem Koolhaas, Whatever Happened to Urbanism (in S, M, L, XL)*

Undoubtedly, the Twentieth Century was an era of phenomenal growth and advancement in medicine, sanitation, transportation, electronics, construction, and many other fields. **For architects and urban planners, it was a time to implement an age-old dream of humane habitation for ordinary people** – safe, comfortable, dignified and attractive.

As the Twentieth Century has given way to the Twenty-First, that vision has been met with a series of humiliating and often disastrous failures. Projects intended to deliver decent habitation have become blighted, violence-prone "sink estates". Rapid growth has led to sprawling and chaotic development. Technological responses to one set of challenges have very often brought their own unintended consequences, and a new set of challenges. Efforts to specialise on one set of problems have seen a failure to anticipate the connections to another.

Especially now, we are seeing the limitations of resources -- notably the fossil fuels that provide the energy to create and power the modern settlement pattern. Climate change, and the structural failures within the economic system itself, have called into question the very foundations of modern urban technocratic economies. At times it seems a "perfect storm" of challenges has arrived: environmental, economic, and socio-political.

Clearly it is in cities that many of these contemporary challenges will play out. And it is for the makers and re-makers of cities that there is a special obligation now to understand what has happened to their structure over time, how it has changed – for better and for worse – and what must be done to learn from past mistakes, and meet the all the challenges ahead.

It is in the structure of cities, suburbs and towns – that is, in settlements – that we will determine whether we can live in a sustainable way, with less damage to sensitive ecosystems, with less wasteful patterns of consumption and more efficient use of resources. It is in settlements that we will learn – or fail to learn - to combine a high quality of life with a sustainable use of limited resources.

All of us must therefore begin to think of ourselves in a different way – not only as architects, or landscape architects, or developers, or government officials, but as people who are concerned at heart with the functionality, the durability, and the quality of urban structure. All of us are now "urbanists".

What is Urbanism?

People sometimes think that "urbanism" just refers to big cities. But the term can refer to small towns and other forms of settlement too. **"Urbanism" is really any collection of buildings, together with the public space around them, working in a system.** The public spaces include roads, sidewalks, plazas, parks and other places where the public is able to enter and move about. Under this definition, it's easy to see that the smallest hamlet can have its own kind of urbanism.

Another important thing about urbanism is that there is not just one kind of public space that surrounds private building interiors. Instead, **there can be many zones or layers of space, from more public to more private.** For example, in the fairly typical London neighborhood below, there is the street, the sidewalk, the sidewalk café areas, the interior

of restaurants and retail establishments, the private balconies that are viewable by the public, and the interior spaces that look out on the street and the other public areas.

Urbanism in a London neighbourhood

Notice the **web of connections** that exist between all these different places – both visual connections, and connections of movement. (There are also connections of sound and smell.) **Along with these connection, there are also disconnections** – barriers to movement, privacy screens, panes of glass and other "membranes" that allow some connections and not others (like vision but not sound). This system of connections and obstructions forms a pattern in space that shapes where you can go, what you can see and hear, and who you might interact with.

Notice that it is all a remarkably intricate and complex system, even in this relatively simple example.

Re-thinking the Link Between Architecture and Urbanism

Architects rightly think a lot about the interior function of buildings, and how they shape human activity and experience. When it comes to the outside, often the dominant goal is to shape the visual attributes of a building from a range of points of view, with a focus on the experience of the building as a sculptural form. <u>But a building shapes the activities of people on its outside too – sometimes far more than we realise</u>. So **an urbanist perspective asks: how does a building affect the shape of public space, and the activity within it?** How does a building join with other buildings to, in effect, create "urban rooms"? What characteristics will they have – what zones or layers, what connective relationships?

What can people do, or not do, in the urbanism around the building?

When looking at urbanism this way, many of the issues that seem very important from a strictly architectural point of view do not seem so significant – or at least, look very different. For example**, the question of style and artistic expression** is no longer seen in a vacuum, but now takes its place alongside more pragmatic considerations of **day-to-day functionality and experience.**

What is the sequence of movements and experiences of those outside the building? How comfortable do pedestrians feel around a given building? How coherent is the streetscape as a whole, with all its buildings taken together? Are there interesting details at a range of scales and positions as pedestrians move through the space? **Is there a well-ordered and well-connected structure of public and private space?**

Of course one must also consider the range of activities and uses of a building – and the way these connect to other nearby activities and uses. Are there activities that draw people into interactions, that support interest and walkability? (Researchers have noted that people in open-air Farmers' Markets, for example, interact with others 10 times more often than people in enclosed supermarkets.) Do they work together with other nearby uses, in other nearby buildings?

Time is a critical dimension in urbanism. Is there flexibility in the buildings, so that activities in the area can change over time? Is there a range of flexibility, so that some things that probably need to be more permanent (like civic buildings) can remain the same, while other things that need to change frequently (like open-air markets) can do so too? Can the buildings be repaired, and kept up by local people with readily available resources?

Of course there are functional criteria for the success of any urban space. Is it accessible? Is it near to where people live? Can they see and identify the activities that might draw them there? Can people walk to it? Is it served by public transport, or does it have the ability to accommodate cars?

But in addition, **we are recognizing the qualitative factors that make an urban space successful.** Do people want to be in that area? Are they drawn to its qualities, and do they have reasons to linger and to engage in additional activities?

These qualitative factors also contribute to the question of the sustainability of an urban space. If people do not want to be in an area because it has become dated and unfashionable, then it is not likely to be a sustainable urban space. If they are uncomfortable there, or they do not feel safe, or they find it ugly, then they will be less likely to use the space, or walk through it. If it is not pleasant and safe to walk or bike, they may instead opt to drive a car more often.

We are increasingly recognising that people will care for what they love – and this includes urban spaces and public buildings as much as anything else. People might love some exciting or original qualities created by designers. But they are more likely to love those qualities that human beings have always loved – especially natural qualities.

This instinctive love of nature, or "biophilia", is an important tool for urbanists to use to create places that endure and that are loved.

If we want to create sustainable and low-carbon environments, this is a crucial point to acknowledge. **People must <u>want</u> to live in a low-carbon** neighbourhood – to buy or rent homes there, to start businesses there, to conduct social activities there, to linger and shop there. When it comes to sustainability, efficient technology is certainly important – but so are the enduring qualities of well-loved urbanism.

The Question of Mixed Use

In the example from London shown earlier, notice that there is a remarkable mixture of residential, shops, restaurants and other uses. **This "mixed use" pattern has been found to be a very important quality of urbanism.** Just as the pattern of urban spaces forms a web of connections – a "network" – so does the pattern of uses. This is important because people need to be able to go back and forth from one business to another, and from their homes to their daily businesses. Studies have shown that this is a functional requirement, and also a requirement for good social interaction and lively urban activity.

We can see this need operating at the smaller scale of the neighbourhood street. **But it also operates at larger scales too** – at the scale of the neighbourhood, and at the scale of the city. If all of the places of work are isolated in a single district, then everyone will have to travel back and forth to that district. Both will suffer: during the day, the residential areas will be empty, and during the evening, the business area will be empty. More importantly, people will not be able to interact as much with each other in the course of their activities.

Studies in the carbon emissions of various urban patterns show that the parts of cities with more mixed use tend to have lower carbon emissions, other things being equal. There is good evidence that mixed use also supports other social and economic dimensions of sustainability too.

The Question of Diversity

As the urban scholar Jane Jacobs noted, **diversity is an important component of healthy ecosystems – and healthy cities too.** She was speaking of diversity in building types, diversity in populations, and diversity in activities. Why is this? It seems to be similar to the reason that mixed use is important – it brings people into greater contact and creates more opportunities for commerce and exchange.

In nature, ecosystems that have a limited number of species are more vulnerable to disease and collapse. Many farmers have learned this, and begun to mix their crops, so that if a disease or crop failure hits one of their crops, others might still fare better.

In cities, social and economic studies provide evidence that something similar seems to happen. If a neighbourhood has only one kind of building, and that building becomes unmarketable, then the whole neighbourhood will suffer disproportionately.

If a part of a city has only one level of income, there is likely to be less opportunity for residents to change their level of income, by meeting new people and finding new opportunities. If it has a single ethnic population, there may be more prejudice against outsiders, and against the ethnic population by outsiders as well. The result may be a lack of creative exchange and energy. If it has a single age group, that group will likely feel isolated and unstimulated by the energy of other age groups.

At the same time, often people do tend to seek out others who are similar to themselves – sometimes for very sensible reasons - and it is common to see "enclaves" of particular incomes, ethnic neighbourhoods, and elderly communities. The question is, whether urbanists will seek to balance this tendency with a counter-trend to create good mix at a relatively small neighbourhood scale. (The architeect Christopher Alexander has proposed a neighbourhood design pattern he calls a "mosaic of subcultures", that recognizes the desire of people to seek out others like themselves, but balances it with a mixing of boundary zones.)

In any case, **the evidence suggests that the most creative and successful cities maintain a relatively diverse mix of incomes, ethnicities and life stages.** This is an important goal for urban designers to keep as a key objective.

The Question of Density

Another important dimension of urbanism is its compactness, or density. **Studies show that higher-density parts of cities tend to have markedly lower rates of carbon emissions, where other things are equal.** Density seems to promote efficient interaction and connectivity. There seem to be other important benefits too, such as the ability of public transport to function successfully.

Some people have taken this insight and used it to recommend a "once size fits all" policy for high urban density. But it is important to remember that **diversity is also a critical aspect of density,** just as it is with social and economic factors. People may want and need to live in a more rural condition that has a lower density – if they work in agriculture, for example. Some parts of neighborhoods might properly be very high density, while other nearby areas can be quieter and lower-density.

The principle of choice comes into play here. **Choice is more than a core element of a consumer society. It is a need of human beings to determine for themselves the conditions that best fit their own lives, and their unique circumstance.** It is a critical dimension of life itself. People may have very good reasons to choose different densities, after carefully weighing all the tradeoffs and civic obligations.

The important point is that density is not a uniform variable, but a tool that urbanists can use to increase interaction and vitality – or to create areas of relative quiet and retreat.

The Question of Connectivity

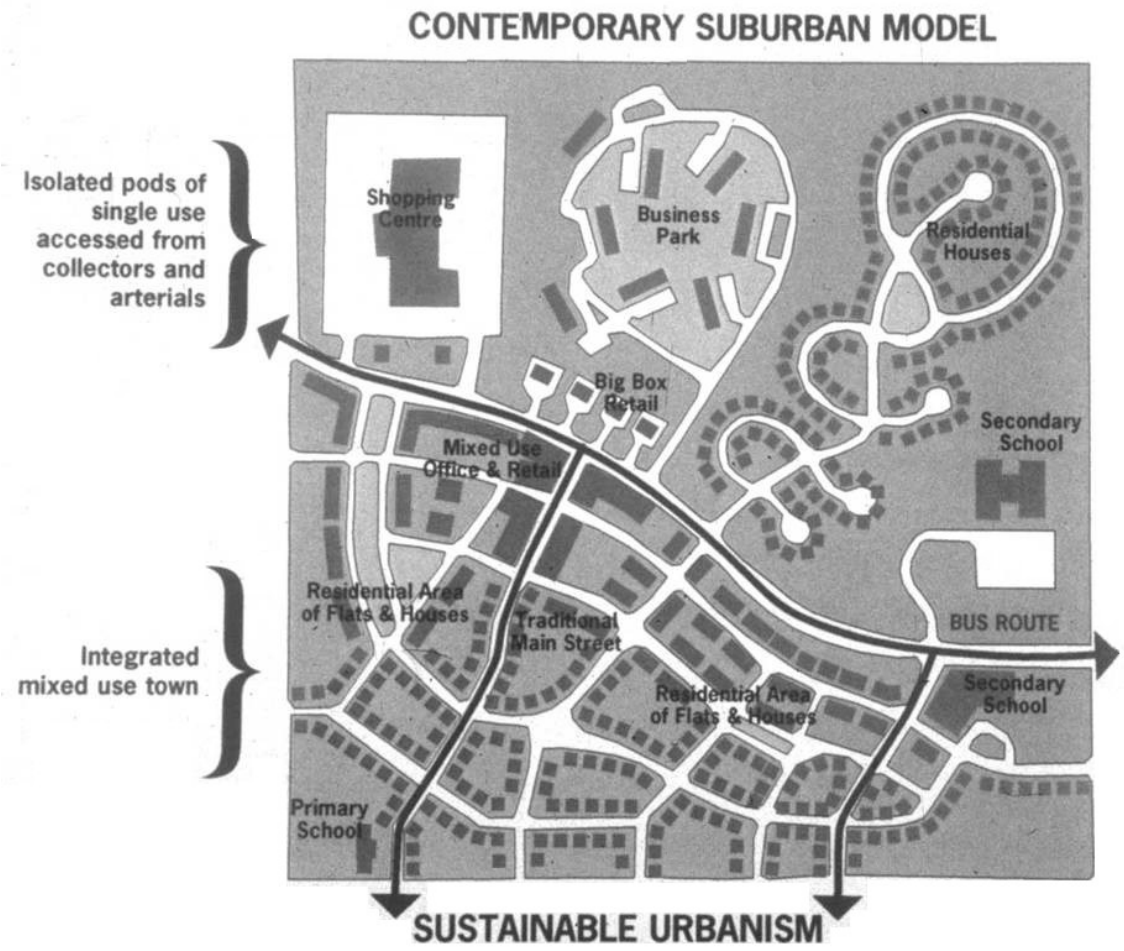
Another critical dimension of urbanism is its **degree of connectivity.** Even when there is mixed use, diversity and compactness, if the roads and paths are fragmented and not inter-connected, then the urbanism will not function well.

For example, a common road system in modern suburbs is a **tree-like "hierarchy"** of highways, arterials, collectors, and local streets that do not connect well. This forces cars and pedestrians into a single "choke point" and makes average trips much longer. An alternative model, which is more common in older cities, is a **street grid or network.** Although it may not have the large and relatively higher-speed roads of the modern suburb, it makes up for this liability by having many more paths that cars and pedestrians can take.

In the example below, **the neighbourhood on the top side of the main road has a street structure that is a hierarchical, "tree-like" system.** There are few inter-connections. Cul-de-sacs create dead ends, meaning that paths between any two points are, on average, much longer than the linear distance. Children are not likely to be able to walk safely from their homes to the school, and trips by bicycle would likely be long and dangerous. Transit would not function well because few people would be able to walk to a transit stop.

In the neighborhood on the lower side of the main road, the streets are **much more interconnected, and they form a rough grid pattern or network.** The path between any two points is, on average, only a little longer than the linear distance between them. That means that walking and biking are easier and safer.

The neighborhood on the top side of the main street also separates uses, features lower density, and probably does not accommodate much diversity. Research has demonstrated that it is **likely to produce significantly higher carbon per person, to reduce social interaction, to discourage walking and exercise, to contribute to sprawl and farmland consumption, and to carry other drawbacks.** In the parlance of the day, it is not a "sustainable" pattern of development.

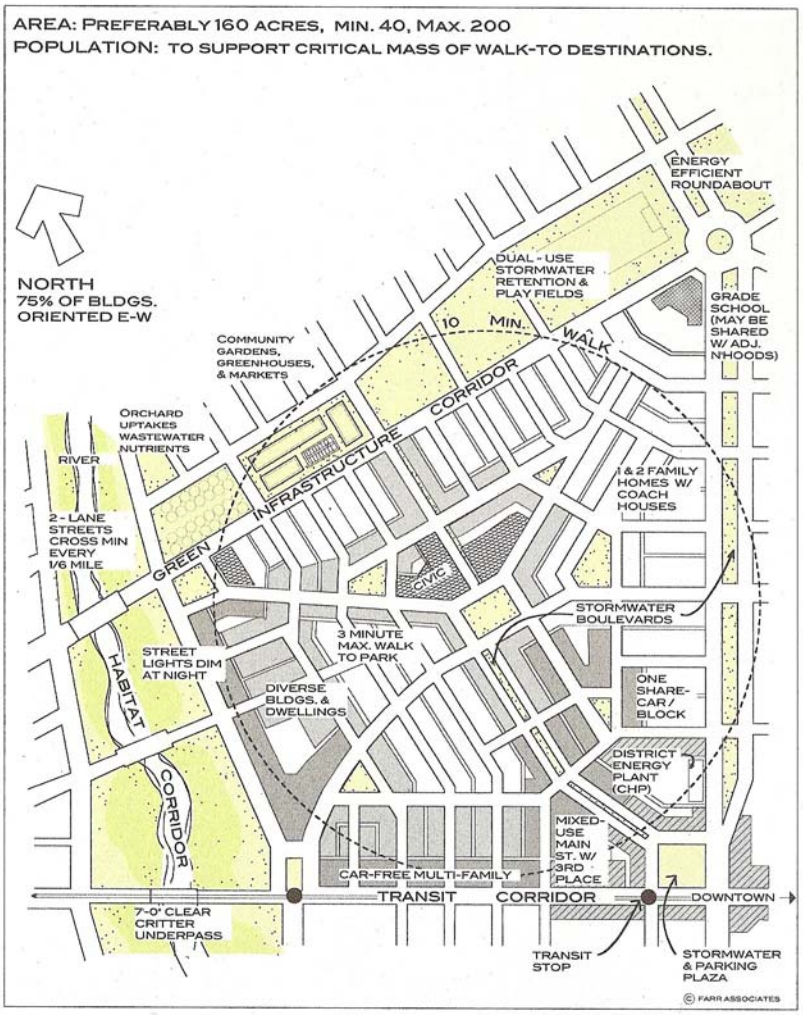


The Question of Sustainability

What is sustainable urbanism, then? The term has been used imprecisely, to say the least, but it is perhaps easier to begin with what is <u>not</u> sustainable urbanism. There is a growing perception that **many of the characteristic fragmented patterns of modern urban development over the last half-century are not sustainable** – that is, given the limited resources, environmental damage, social consequences, economic failures and other increasing problems, we simply cannot keep on building in the same way.

What does a more sustainable neighborhood look like? It probably looks like the lower neighborhood in the example above. It will likely be organised with **many daily needs within walkable distance, offering transit, recreation and other needs. It will easily allow walking, biking and social interaction.** It will incorporate **facilities for clean stormwater, habitat corridors, perhaps district energy, community gardens and other ecological features.**

Here is an example from the book *Sustainable Urbanism*, by Doug Farr:



A Sustainable Neighborhood Unit (Building Blocks of a Sustainable Corridor)

As this drawing illustrates, the sustainable urban neighbourhood is built around the fundamental unit of the **pedestrian shed** – a zone in which any point can be reached from any other point within about ten minutes.

Notice that the sustainable neighbourhood also includes the other characteristics we have already discussed – **network or grid street connections, mixed use, diversity of types, compactness, and ability to support a richly-layered streetscape**.

Sustainability, Resilience and "Self-Organisation"

An urban designer is partly responsible for creating a structure that may endure for decades or centuries. There will be many changes over that period, many of which cannot be predicted. Some of those changes will pose major challenges to the integrity

of the neighbourhood and its vitality. Therefore **it is vital to build a resilient structure that allows new growth and adaptation over time.**

This is particularly true for the economic activity, including retail and office uses. The urban designer cannot know which business or activity will occupy a given place over the span of decades, or even perhaps on opening day. So **it is important to "plan for the unplanned**", to plan for general needs and requirements, to allow and encourage a vibrant mix of activities, and to allow specific things to grow and change.

Moreover, an urban neighbourhood is a complex social and economic system. It follows its own laws of organisation and growth over time. **It is important for the designer to understand and to facilitate the processes of its growth and "self-organisation",** by designing structures that will accommodate its growth, change and complexity.

The Complexity of Urbanism in History

Scholars of urban morphology are often amazed at the sophisticated order and functioning of historic urban structures. While they lacked modern comforts, they had other attributes that have proven remarkably complex and successful. They often had very clever ways of adapting to local climate and terrain. They often allowed people to interact and enjoy civic life together in a remarkably beautiful and successful way.

An "organic" traditional city – the town of Ronda, in Spain

There is a great deal of debate about the extent to which these qualities were intentionally "designed," or arose on their own through natural processes. What seems clear is that some of both seemed to occur. More importantly, **the design strategies also allowed growth and change over time,** by using flexible design elements that could be structured in a modular way, and by introducing overarching design structures that could be "filled in" and completed later by others.

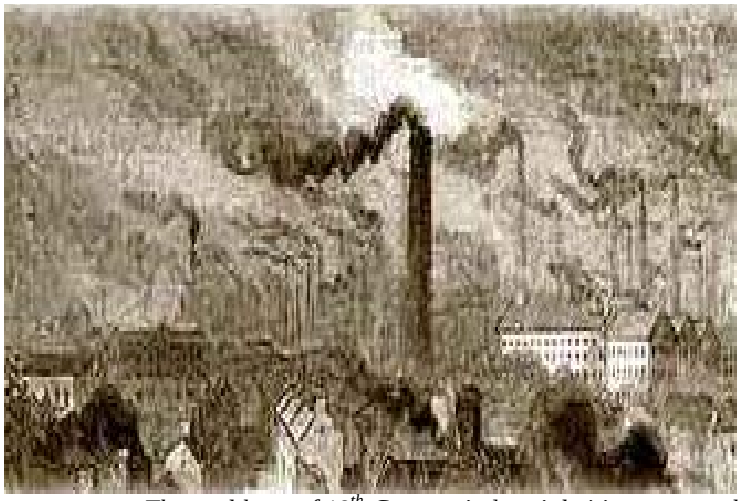
As we look for lower-carbon forms of living today, many designers and scholars have argued that we can draw some very useful lessons from these places. Their elements seem remarkably well-adapted to one another. They seem remarkably beautiful and durable. They are compact, and yet remarkably appealing and livable. They demonstrate mixed use, walkability, connectivity, diversity and other efficient forms of self-organisation.

So, Whatever DID Happen to Urbanism?

All of these things seem sensible, perhaps even self-evident. And yet, the dominant urban form of the last half-century has been in marked contrast to these characteristics. How did this happen? And how can we fix it?

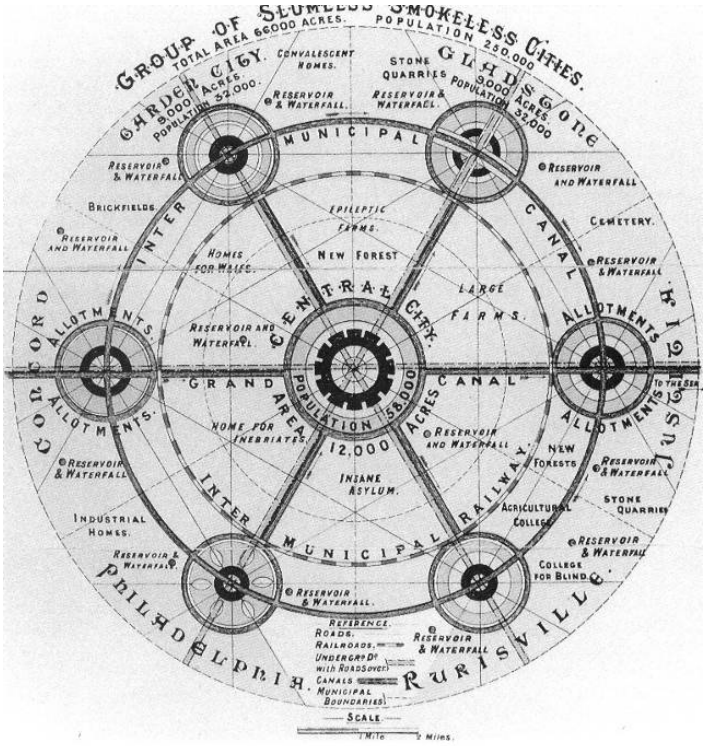
Garden Cities and Beyond

The early stages of industrial development brought rapid growth in the population of cities. In the Nineteenth Century in particular, cities like Manchester, London and Paris grew explosively, bringing overcrowding, poor sanitation, disease, crime and civil unrest. Many reformers called for alternative settlement patterns. One prominent school advocated new settlements in the countryside, planned along ideal concepts of social justice, order and tranquility.



The problems of 19th Century industrial cities were real enough.

Toward the end of the Nineteenth Century, the **Garden Cities** movement in England was led by visionary planners such as Ebenezer Howard, Raymond Unwin and Barry Parker. **The goal of Garden Cities was to create humane, attractive, efficiently organised new towns in the coutryside, separated from the problems of the city. The notion of separation was key.** Where cities like London mixed uses such as work and home, the Garden Cities would segregate them, so as to keep the noise, smoke and danger of the workplace away from the home.



Ebenezer Howard's conceptual diagram of garden cities.

There was also an important moral component in Garden City planning. It was felt that cities were morally dangerous places, especially for women and children. The new Garden Cities and Garden Suburbs would place women in safe, isolated suburban environments. Howard's drawings showed segregated locations for homeless children, alcoholics, the insane and others. **Segregation was a fundamental concept.** It was planning with a place for everything and everything in its place.

To be sure, the Garden Cities and Garden Suburbs were remarkably attractive, durable and successful places. Communities like Letchworth Garden City, Welwyn Garden City, and Hampstead Garden Suburb, remain desirable and successful places even today. **But they did usher in an era of segregated uses and low-density suburban-style patterns.** Homes were created on a model of a small country house, complete with its own yard – the model of the modern suburb to this day.

The Modernist Dream Fulfilled – Almost

In the years of the early Twentieth Century, the machine age had begun to change civilisation in profound ways. **The automobile in particular seemed to challenge the very foundations of modern cities.** Perhaps we hardly needed cities any more, when we could drive far away to wonderful "towers in a park", where we would be above the noise, dust and smells of the modern city?

Pioneering architects like **Le Corbusier** in France, and **Walter Gropius** in Germany, developed detailed plans for settlements based upon this model. **Automobiles (and perhaps even aircraft) would play the primary role of connecting people to places, and pedestrians would become marginalised.** The mixed-use street would be replaced by the broad highway, and buildings would be pulled away from this dangerous and foul-smelling corridor. Massive, towering buildings would sit far back from the road, dedicated to efficiency and specialized for single uses.

This was the model of the city as machine: a system of efficient and standardized parts, in which the parts are all separated, simplified, smoothly functional and economic. It was a vision of humanity finally delivered into a rational and prosperous era, powered by machines and fuelled by cheap energy.

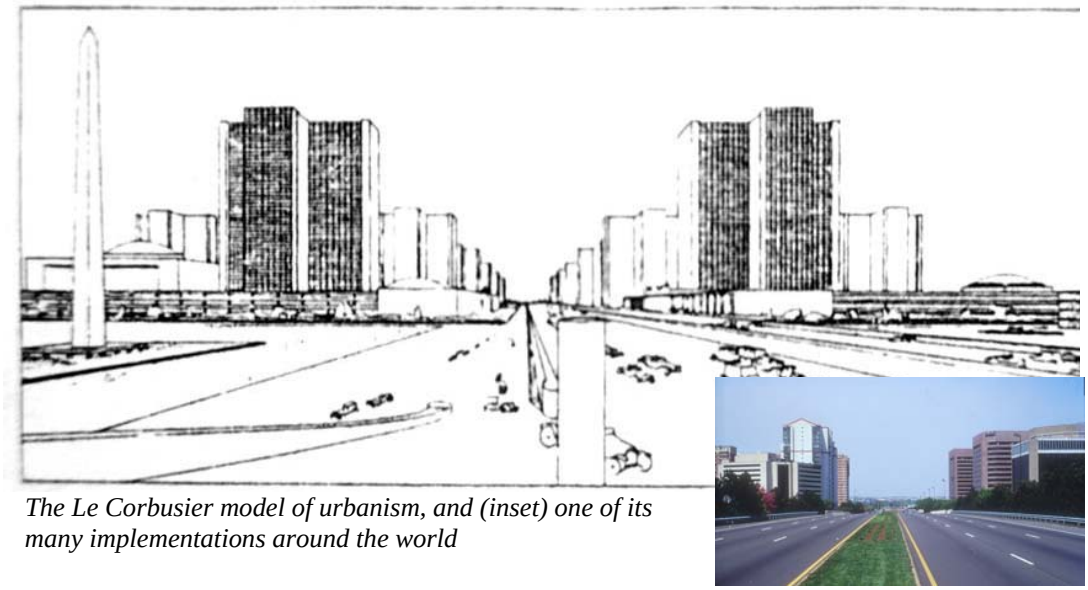
Le Corbusier's unrealised Voisin plan for the demolition and reconstruction of a major part of Paris

Le Corbusier, speaking in his landmark 1923 book *Towards a New Architecture*, sounded almost rhapsodic about the benefits of this new technological approach to city-making:

> *A great epoch has begun.*
> *There exists a new spirit.*
> *Industry, overwhelming us like a flood which rolls on toward its destined ends, has furnished us with new tools adapted to this new epoch, animated by the new spirit.*
>
> *Machinery contains in itself the factor of economy, which makes for selection.*
> *The house is a machine for living in.*

…the most noble quarters of our cities are inevitably the manufacturing ones where the basis of grandeur and style – namely, geometry – results from the problem itself… an admirable order reigns in the interior of markets and workshops, has dictated the structure of machines and governs their movements…

Note that a key element of this vision was the concept of an isolated and standardized part: house as machine, city as machine. This was in accord with the mechanical science of the time, which sought greater efficiencies through standardisation and economies of scale. **By contrast, the science of the Twenty-first Century has focused more on biological structures, which are more unique, more customised, and more inter-dependent in their operation.** Even machines and machine-systems are more complex than was once appreciated. We see their complexity in the failures of modern mechanical systems, and the "unintended consequences" of their operation in an age of climate change and peak oil.



The Le Corbusier model of urbanism, and (inset) one of its many implementations around the world

The Dream Implemented

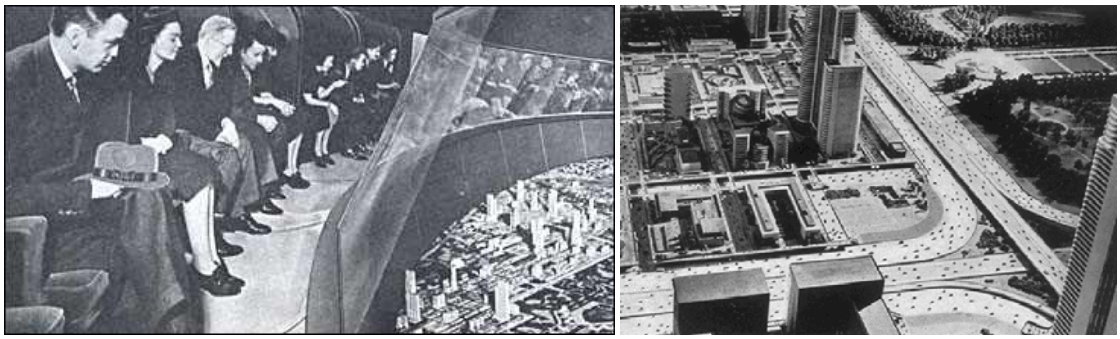
It is important to understand that the vision of the early modernists was a humane vision that sought to turn an existing industrial era toward human ends. But it did so by accepting the industrial realities of that age, and developing an architecture based upon that aesthetic and technological system. **Walter Gropius,** another modernist pioneer, spoke eloquently about that aim in his 1943 book *Scope of Total Architecture*:

MACHINE AND SCIENCE IN SERVICE OF HUMAN LIFE…[There is] a portrait of the early pioneers of the modern movement as men of rigid, mechanistic conceptions, addicted to the glorification of the machine and quite indifferent to intimate human values. Being one of these monsters myself, I wonder how we managed to survive on such meager fare. The truth is that the problem of how to

humanize the machine was in the foreground of our early discussions and that a new way of living was the focus of our thoughts… To devise new means to serve human ends, the Bauhaus, for instance, made an intense attempt to live what it preached and to find the balance in the struggle for utilitarian, esthetic and psychological demands.

This vision originated in Europe, with pioneers like Gropius, Le Corbusier, Mies Van der Rohe and others -- though **it freely borrowed from the industrial advances of the United States. In turn, it was in the United States that some of the most dramatic stages of implementation occurred.**

One of the most important was in 1939, when the American industrial designer Norman Bel Geddes designed a highly influential diorama for the General Motors pavilion of the World's Fair in New York. Called "Futurama," it laid out the futuristic vision of Le Corbusier, Gropius and other modernist pioneers in stunning detail. It showed a hypothetical world of 1960, in which Americans would travel in comfort and speed in private automobiles, moving along efficient highways. Sleek tall buildings were set far back from the roads.



3The Bel Geddes diorama at the World's Fair, based upon the Le Corbusier model

Bel Geddes' vision became a kind of blueprint for American post-war development. The Eisenhower administration built a massive Interstate highway system, and created incentives for new single-family subdivisions far from city centres. Banks created "red-line" policies that limited mortgage financing of many inner-city homes. Cities and towns increasingly adopted segregated-use zoning, which prohibited mixed use and forced buildings to set back far from the street.

A neighbourhood of Dallas, Texas, built on the Bel Geddes blueprint

One important departure from the vision of Le Corbusier and others was in the pattern of residential development. A high percentage of homes were detached and single-family, on relatively large lots, fronting single-use residential neighborhoods – most often with cul-de-sac street patterns. But in other respects, the template of modern sprawl faithfully followed the machine-based and car-based vision of the early modernists.


"Tree-like" sprawling suburbs in the USA

As one unintended consequence of this development system, inner cities became social and economic "sinks," trapping only the most vulnerable populations – minorities, the poor, the elderly. Urban populations, and their tax base, plummeted, setting off a spiral of inner-city decline. Inner-ring suburbs too began to decline, as development leapfrogged into ever newer greenfield rings.

Appalled at the inner-city decline, many reformers advocated redevelopment following the modern model. Glittering new "projects" rose up on inner-city sites, following the Corbusian model of "towers in the park". **But something also went seriously wrong with these places:** the parklands became deserted and dangerous, the units became tower prisons, and in cities across the US and Europe, the projects became "sink estates" – trapping the most vulnerable populations, and leaving no means to

transition to more successful socio-economic conditions. Many of those projects became outright failures, and scores of towers were torn down, to be replaced by more traditional neighborhood designs.

But in the USA and other countries, the suburban model became an explosive success, fueled by abundant and cheap energy.

The Dream Reconsidered

Of course, that cheap energy was derived from fossil fuels, and their supply was hardly unlimited. The economies of scale and standardisation that worked to produce modestly priced housing for many young families no longer functioned as well as fuel prices rose. Moreover, **those neighbourhoods did not hold up well over time.** The wave of mortgage defaults and foreclosures of 2008 hit the far-out subdivisions hardest – where homeowners had relied on cheap fuel to drive long distances to work. Those cheaper homes appeared to be a bargain, luring homebuyers who would "drive until they qualified" -- only to realize much later that fuel prices and commuting time made the deal less than attractive.

There were many other drawbacks too. **The sprawling land use pattern consumed large areas of farmland and sensitive natural areas. The extra miles driven per person – up to three times higher than city locations – contributed greatly to carbon dioxide emissions, and other forms of pollution. The sprawling living pattern fragmented social interaction and created measurable levels of stress. The growth of these subdivisions followed the same "throwaway" pattern of other parts of the consumer economy:** quickly and cheaply built, quickly declining, left to be replaced with a new, more distant ring. Clearly this was not a sustainable development pattern.

Can Urbanism Be Recovered?

Modern reformers have sought to reverse the pattern of sprawl with a new wave of zoning and regulatory reforms, and incentives for compact, in-town development. Many countries have added tolling and other "pricing signals" to road projects, and placed new restrictions on "out of town" development, including retail.

There are indeed positive examples to show that the pattern of sprawl can be reversed, at least partially, if there is a consensus of both voters and buyers. In Denmark, stringent new anti-sprawl laws have been enacted, and combined with policies to revive the inner city and restore its urban vitality. In England, new laws have restricted "out of town shopping" and created incentives for infill and "brownfield" projects (on former industrial sites). Even in the United States, cities like Portland, San Francisco, Boston and even Los Angeles have adopted urban-friendly policies, and built new streetcar and light rail lines.

Portland, Oregon: a successful example of inner-city urban regeneration

But there remain significant economic, social and political challenges. Within the culture of design, debates rage over the degree to which urbanism can really be regenerated under modern conditions. Post-modern sceptics such as Rem Koolhaas believe the economic and technological conditions dictate a new reality, and a new, inherently weaker kind of urbanism. They argue that we cannot return to the kind of "organic urbanism" that existed prior to the industrial era. By contrast, "New Urbanists" such as Andres Duany believe that urbanism can be designed, so long as the technical and economic parameters are made part of the design problem.

Other theorists have argued that it is technology itself that is evolving, and moving past the current terms of debate. The old assumptions about economies of scale, standardisation and segregation are yielding to a world of computerised adaptation and customisation, biological replication and differentiation, and integrated ecological systems. Along with these terms are coming new tools and new ways of thinking about the world and its design problems.

Thinkers such as Jane Jacobs and Christopher Alexander have made important connections between modern 21st Century science and urban design. Other theorists and practitioners have developed practical tools for application, including **Bill Hillier** and his Space Syntax, **Jan Gehl** and his principles of urban space, the New Urbanists and their charrettes and collaborative design processes, and many others.

All of them make the essential link to modern science, and to the basis of a modern understanding of ecology and sustainability. To be sure, technological efficiency is an important part of the equation; but there is an equal or greater emphasis on deeper cultural and economic sustainability, in the adaptability and the resiliency of the environment. There is also a recognition of the power of art as a core dimension of human culture; but also a recognition of the dangers when art becomes too abstracted from real urban problems, and too "magical" in its thinking – as if we could solve our

problems if our metaphors were strong enough. **For art alone cannot save the city. We need art and science together.**

This is a period of lively debate and fertile development of ideas. Surely the challenges demand such a period of strong development. In the modules to come, we will explore these ideas, their modern context and their applications, and their background in the history of architecture and urbanism.

> *"People used to say that just as the 20th century had been the century of physics, the 21st century would be the century of biology... We would gradually move into a world whose prevailing paradigm was one of complexity, and whose techniques sought the co-adapted harmony of hundreds or thousands of variables. This would, inevitably, involve new technique, new vision, new models of thought, and new models of action. I believe that such a transformation is starting to occur... To be well, we must set our sights on such a future."*
>
> - *Christopher Alexander, The Nature of Order*

Following are reading assignments to conclude this module. When you have completed them, we encourage you to discuss them with your colleagues, or email to your instructor with any questions. Then take the exam, including the written portion.

Jane Jacobs: Excerpt from last chapter of "The Death and Life of Great American Cities":
http://www.katarxis3.com/Jacobs.htm

Christopher Alexander paper: "A City is Not a Tree":
http://www.patternlanguage.com/archives/alexander1.htm

Andres Duany, interview:
http://www.katarxis3.com/Duany.htm

Bill Hillier, "The Golden Age of Cities":
http://www.tectics.com/hillier06--goldenagecities-urbdesign%201.pdf

Questions

Instructions: Download and open the document titled "Exam Questions" that is also included with this document on the ESUA website. Fill in your name, and answer the questions. Then type in your essay question responses. Email the completed and saved document, saved under your last name, to your course instructor. (See the website for details.)

1. Urbanism is important because

   A. It is in cities that many modern challenges to humanity will play out.
   B. The pattern of urban activities affects emissions and pollution.
   C. The pattern of urban form affects land use and protection of ecosystems.
   D. All of the above.

2. Urbanism is described here as

   A. The space between buildings
   B. The connected system of public and private spaces
   C. Big cities
   D. The public realm

3. A factor that is not critical to the success of urbanism is

   A. The level of detail at pedestrian scales
   B. The style of buildings
   C. The shape and position of buildings, and how they shape public space
   D. The aesthetic character of buildings

4. The aesthetic quality of urbanism matters most because

   A. It reflects the vision of leading contemporary artists
   B. It stimulates shopping and economic activity
   C. It raises property values
   D. It promotes quality of life and sustainability

5. Mixed use is important because

   A. It promotes interaction between different people during the day
   B. It provides visual interest
   C. It provides social equality
   D. It increases economic performance

6. Diversity was noted to be important because

A. It creates a fairer and more just city
B. It promotes urban creativity and success
C. It creates visual interest
D. All of the above

7. Diversity should include variations in

A. Income
B. Ethnicity
C. Age
D. All of the above

8. Density is important because

A. It tends to be associated with lower carbon emissions
B. It can be used to create urban interaction and vitality
C. It supports connectivity and public transport
D. All of the above

9. Higher density should be applied

A. Uniformly
B. Only in large cities
C. In a range of situations, depending on context
D. In a range of situations, but always as high as possible

10. The difference between a hierarchy and a network is

A. A hierarchy is more complex
B. A hierarchy is more ordered
C. A network branches out like a tree
D. A hierarchy branches out like a tree

11. The fundamental element of the sustainable neighbourhood is the

A. Pedestrian shed
B. Transit stop
C. Wildlife corridor
D. District energy plant

12. Design for change and resilience is important because

A. A neighbourhood will grow and change in unpredictable ways
B. A neighbourhood's growth must be controlled
C. The urban designer needs to know which businesses or activities will likely occur
D. A neighbourhood can always be rebuilt when it becomes unfashionable

13. Urbanism in history has been found to be

A. Surprisingly primitive
B. Surprisingly sophisticated and complex
C. Surprisingly rigid and formal
D. Surprisingly chaotic

14. According to the author, which of the following statements is true?

A. The world is completely different today, and there are few important lessons to learn from history.
B. The design strategies of historical urbanism often allowed growth and change.
C. We must copy the successes of historical urbanism.
D. The most important thing about urban design is the excitement of a new artistic vision.

15. Garden cities were

A. A humane response to real problems in industrial cities.
B. Based on segregation of people and functions.
C. A model for modern low-density suburbs.
D. All of the above.

16. Early modernists like Le Corbusier advocated city planning based upon

A. Isolated and standardised components
B. Differentiated components
C. Organic complexity
D. Regional differences

17. The early modernists were motivated primarily by

A. The need to make profits
B. The need to serve humane goals
C. The need to make cities more efficient
D. The need to create work for architects

18. The blueprint for post-war development in America was largely inspired by

A. Le Corbusier's vision of "towers in the park" in France
B. The suburban model of the Garden Cities in England
C. Bel Geddes' Futurama exhibit at the New York World's Fair
D. All of the above

19. Which of these was NOT a major problem with the suburban development model?

A. It consumed valuable farmland and sensitive ecological areas
B. It created social inequality
C. It increased emissions from automobile travel
D. It drew people out of declining city cores

20. Which of these statements best reflects the author's point?

A. We cannot go back to the kind of organic urbanism that once existed
B. We must understand the technical and legal conditions of urban development in order to change its characteristics
C. Technology is evolving, and we must re-examine the old assumptions about urban development
D. This is a time of lively debate and fertile development of ideas

Essay questions

1. Do you think it is possible to recover a high quality of urbanism in the modern world? To what extent? If not, why not? If so, what do you believe are the key elements needed?
2. What kind of problem is a city, according to Jacobs?
3. Why does it matter whether a city is not a "tree" according to Alexander?
4. What does Duany mean by "replacing the system" instead of destroying it? Why does he use the analogy of a virus?
5. What does Hillier say are the key areas we still don't understand about the self-organising nature of cities?

The Craft of Place

An Introductory Course in the Evolving Culture of Building

How to Use This Module

This is the second e-learning module for a series of courses in urbanism, architecture and building crafts known as the "European School of Urbanism and Architecture." The programme was designed for new students to the study of urbanism and building, and for professionals and practitioners who wish to increase their level of understanding of important new topics in best practice. More information in this programme is available at www.esua.org.

If this is your first time learning about this subject, and you find this module interesting, you will have the option to take more modules on line in the future. But this on-line element is really only a part of the full course of study. This module is designed to be integrated with a hands-on learning programme that will allow you to learn in the most effective way known: "learning by doing". You will have the opportunity to participate in field studies of actual projects, working alongside leading practitioners, and using the latest tools and techniques.

This module is specifically designed as an introductory course for those coming to study building crafts in the programme, but may be taken by others as well.

The full project-based curriculum is now in the pilot phase, and is planned to be launched as a full-time programme after several years of development. You can learn more at www.esua.org.

Each e-learning module begins with a short reading, and then gives you links to additional reading. The final examination includes a short multiple-choice section, and a written essay portion that you can enter through a form, or email to the course instructor as a text document.

Introduction

What is the role of building craft in the modern world?

Some believe that craft in the traditional sense is obsolete, rendered irrelevant in an age of mass production methods. Others believe that craft is now to be found in the modern production methods themselves, and the way they are fitted together to produce a well-crafted design. Still others believe that craft is important in the conservation of heritage buildings and places, and in finding new economic uses for them. Others believe that craft must exist as a kind of supplemental activity for enthusiasts – not a very high

percentage of what is built, but something that gives pleasure and meaning to a minority of individuals with a particular interest.

Yet another perspective, which will be the focus of this course, is that all of these perspectives are partly right – but that there is also, in some sense, an emerging new place for craft, in the emerging new practices and methods of sustainable building. Indeed, this new for of craft is emerging in some surprising places within the culture of technology. And it offers us some very useful opportunities, for our careers, and for our roles as useful parts of a new culture of sustainable building. We will explore this idea in greater depth below.

The crafted character of the treasured places of history

One of the most fascinating and moving things one can do is to study – really, carefully study -- the most loved buildings and places made by different cultures around the world, at different times over the last several thousand years. Despite enormous variety of resources, technology and aspiration, these structures almost always had one thing in common: a remarkably high level of craftsmanship.

That is, they were somehow made to be uniquely beautiful, in a way in which all the parts fit together with one another, and into a complex whole, from the larger scales, down to very fine scales.

These finely crafted structures were very often created with huge amounts of human labour. Moreover, that labour was frequently painstaking, intricate, and highly skilled. It was not just brute force, but the result of a careful stepwise process, of carefully fitting, shaping, and articulating parts in relation to one another. The structures and their artistic ornaments were often seamlessly integrated into a beautiful, highly coherent, emotionally powerful place.

We are gaining new respect for the sophistication of such places. Where we once dismissed them as “primitive” and beneath our “modern” standards of achievement, we now know that they often had many remarkable qualities that we can no longer achieve, or at any rate achieve easily. Increasingly, it appears they have much to teach us, even today.

The modern obsolescence of craft?

Nowadays we usually think of this kind of craftsmanship as an extravagant extra in the building process – too expensive, or too slow, or both. At best it is only for the rich; if we are concerned with the quality and dignity of ordinary people, we must be more concerned with the craftsmanship inherent in mass-production technology.

Or we talk about craftsmanship in the limited sense of a careful plasterer or a skilled painter. But in almost all cases, no matter how skilled – and often it is very highly skilled - the work done is standardised and inter-changeable. It is not craftsmanship in the sense above, of a customised, fine-scaled, almost seamless fitting of parts.

And indeed, there is an important historical reason for this. Since about 1800, modern production technology has relied on a key innovation, that of the standardised part. In one of history's transformative moments, it was found that parts could be created from routine processes of stamping, cutting, drilling or casting, in a series of standardised steps that anyone could perform. In turn, anyone could assemble these parts quickly and inexpensively, with a minimum of training. All that was needed was a set of drawings that specified the standard assembly of the parts. This standardisation let loose a flood of productivity, and – it is not too much to say - created the very basis for modern technology.

It also very nearly erased all of what we knew up to that time as craftsmanship.

But today, something very interesting is happening to craft, particularly where it applies to the making of buildings and settlements. It is re-appearing on the scene, in interesting new guises. We have design-build construction systems, and artisan-builders who design and make their own constructions. We have a new concern for the maintenance and re-use of historic buildings, which requires a new generation of craftspeople skilled in the old ways. We have architects and planners who seek to understand the ways that crafts processes can be part of their work, and who exert a fine degree of craft over their own designs, models and drawings.

Most radically, we have a new sense of craft in the planning process itself – less a process of detailing everything out at once, in a mechanical fashion, and more a process of gradually "crafting" a design, using step-wise, sometimes complex, collaborative and participatory methods. It does seem that in some respects, we are beginning to come full circle.

There are important reasons why the imperative of sustainability is bringing crafts back into the picture, which we will discuss in more detail later in this course.

In any case, it is undoubtedly important for all those involved in the building arts to understand the role of craft in their work. They may themselves be craftsmen and women, actively shaping parts for a customised role. They may be working closely with craftspeople, particularly on important heritage and regeneration projects, and have a need to be able to collaborate effectively. Or they may simply want to understand how their industry is changing, and how the processes of craft are creating important new dimensions, and new career opportunities.

What do we mean by "Craft?"

People commonly think of craft as the making of things by hand, particularly if that's one's trade or profession. As a definition, that's not a bad start. But it turns out that many of the things made in factories are made by hand, by people who are engaged in a trade or profession there. But these things are not "crafted" in the stepwise custom-fitting sense we have been discussing, but more often assembled from standardised parts, with just minor trimming and adjustment. That's not to diminish the skill that is often required to operate the machines and to work with the products as they are assembled.

But by contrast, there is a suggestion in the word "craft" that implies something being created as part of a longer, elaborated process – being refined, shaped and detailed. The parts are not just assembled or "composed" as independent elements, but in some sense, they are articulated as parts of the whole, and parts of the space in which the whole resides.

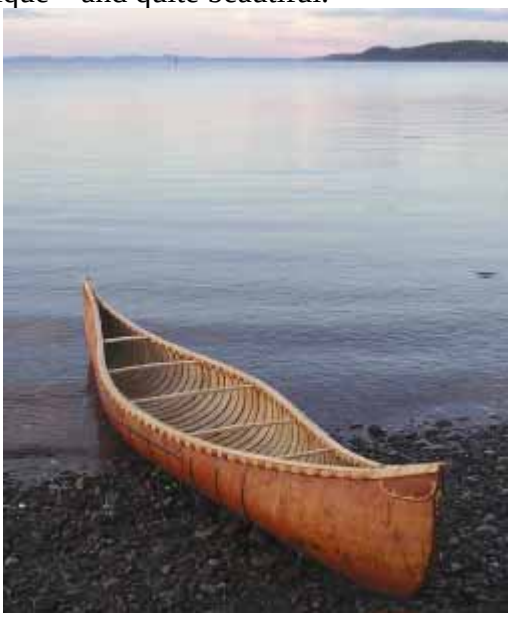
The crafting of a traditional Native American birchbark canoe is an instructive though not unusual example. When one sees its rough early steps, it's hard to visualise a canoe coming out of it! In fact the thing looks like something of a mess – little more than an unpromising pile of wood, rocks and stakes.

Photos by Mikedup, Flickr.com

But gradually, the details are articulated and strengthened with new parts added, and the structure seems almost to slowly come alive.

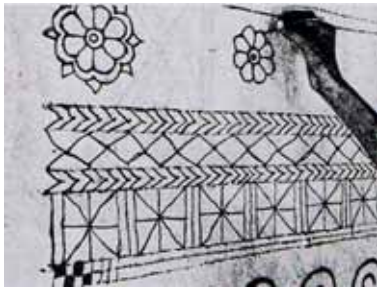
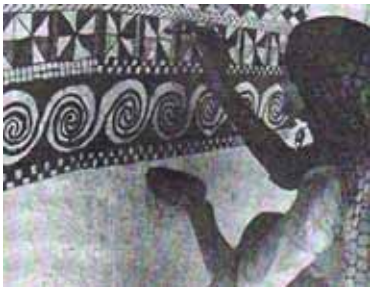
Step by step, the structure is stiffened, articulated, detailed. More details are added, and the coherence of the structure increases with each careful step.

By the time the structure is complete, it has undergone an astonishing transformation: it is shapely, organised, unique – and quite beautiful.



And notice that it fits quite beautifully in its larger context as well. It is not merely an object set down in a neutral landscape, but somehow, has a sense of having "grown" in its environment. This is because just as the individual parts are crafted with one another, the canoe itself is crafted to fit with its environment -- with the water, the sun, the wind, the other forces that will act on it, and that it must manage to be an effective and useful thing. And this craftsmanship is quite a beautiful quality.

We can see other similar step-wise processes in other crafts traditions. Carpet weavers, wall muralists, many others can be seen to shape their design as they create the work, articulating the space that is there before them, evolving each step in response to all that has gone before.

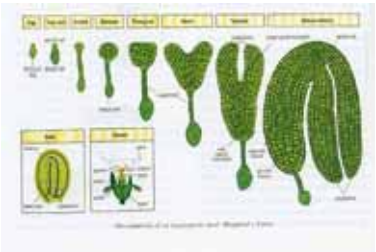




As in the example above, we can see craftspeople articulating regions of the work, fitting the new elements together with the ones made earlier, in a step-wise process of elaboration. Sometimes the actions are guided by really rather simple requirements:

“place a sideways V next to the last V, and don’t crowd it too much,” or “fill in every other triangle with black ink.” At each step, the action doesn’t look that impressive, but over time, a complex, coherent and beautiful pattern builds up. At the end the result can be breathtaking.

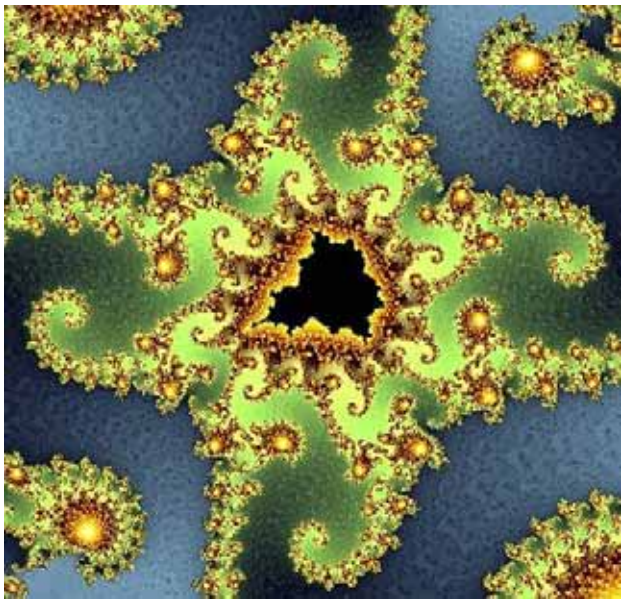
Surprising parallels with modern complexity science

It turns out that this kind of stepwise, “iterative” process -- following simple rules for subdividing, articulating and differentiating -- happens all the time in nature. We now know that it’s the way that organisms form through the stepwise process of morphogenesis. It’s even the way that water droplets splatter and stretch out into elaborate new forms. Far form being a dusty old lesson with relevance only for the past, this insight is at the forefront of modern complexity science.



We can produce similar patterns with very simple but powerful computer algorithms, which at their heart have exactly the same kinds of simple step-wise rules: “check what you’ve just done, take another little bit and articulate it, using all that you’ve just done and applying a simple rule to tell you what to do next,” etc. In the case of the computer the pattern looks rather “mathematical” – a lot of symmetry and repetitive pattern. But it

also has the same characteristic of stepwise articulation of space. The articulation is quite complex and detailed -- and, for most people, it is quite beautiful.



The above illustration shows a so-called “fractal” pattern – so called because you can “fracture” a piece of it, and it will still look similar to the whole, and to other fractured pieces at other scales. Again, the pattern has a strong relation to the algorithms that create it. Many authors have noted the strong fractal quality of much traditional work around the world.

There are other, related geometric properties that almost all traditional building crafts share - and even with all their variety, they seem to do so across cultures and periods of history. We will not go into the details of this subject here, as it is a topic of major study in its own right. What we will do here is to note that these geometric properties have a strong relation to the patterns in which they are created – just as the pattern above has a relation to the way the computer uses an algorithm to create it.

So let us use this definition for “craft:”

Craft is the step-wise articulation of the parts of space, in an evolving whole.

We are shaping the whole, but also shaping its parts. We are working back and forth from the whole to its parts, taking steps to articulate them within the field of space where we are working.

Moreover, we are creating a new thing, a new “design” – but it is not “design” in the sense of a pre-planned thing. It is something that emerges and evolves continuously, as we work on it.

This can be contrasted to the way many things are made in modern production processes, from carefully detailed and precise blueprints created ahead of time. But we now know that natural processes don’t work this way. There is not a little blueprint drawing of your fingernail within your DNA. Rather, the DNA is more like a “recipe” that contains steps for growing a fingernail. And the fingernail will be slightly different each time, and different over time. It will also be different in you than it is in any other person.

Consider the following structures, and whether it would be desirable, or even possible, to create them using fully detailed blueprints, created in advance:

These happen to be very ordinary flowers growing in an ordinary garden. But as you can see, they are quite beautiful. This beauty is quite literally "garden variety" – it emerges from the process of growth of these flowers, their patterns, their symmetrical order and their casual asymmetries too.

You can also see that it would be absurd to try to reproduce these flowers by creating drawings, and planning them out ahead of time. You might be able to imitate them through such a process. But you could never create such structures in the first place. That is because you would lack the process of growth, the step-wise way that the stems grow up and branch out, then the leaves unfurl, then the petals bud and unfold, and so on.

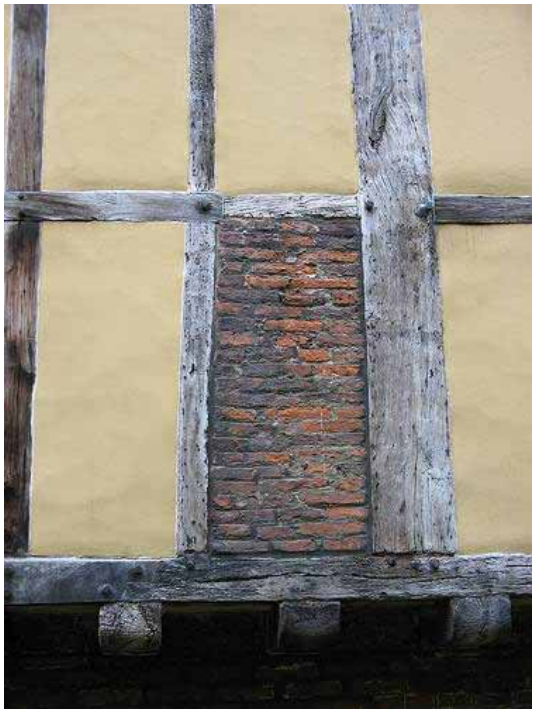
In a real sense, these structures have "crafted" themselves, using their DNA as the stepwise code for growing proteins, shaping them, unfolding them, and so on – creating these lovely emergent structures.

Urbanism as the Craft of "Many Hands"

We have seen the workings of "emergence" in human craft too. At the urban scale, often such emergence occurs as the result of many people working together, and working over a long period of time.

Consider the construction of the city of York, in the north of England. It was built by artisans and craftspeople – crafted, in this sense, in stepwise acts of building that

followed the same kinds of local rules we see in other crafts processes. Everything was fitted, articulated, shaped to harmonize with everything else, and to work in a way that strengthened the new part, the old part, and the whole of which they are parts.



One of York's beautiful buildings, and a passageway known as a "snickleway."
Courtesy Peter Whelerton (Darwin70, wwwflickr.com)

We can see that parts of buildings were made this way. But what we can appreciate, especially in fine old examples like York, is that the entire city was crafted in this way – the lovely wending streets, quirky passageways, delightful little corners and gathering spots. And the pattern of the city skyline is a piece of craftwork in its own way. It was not planned from the bold geometries of an abstract plan, conceived in advance. Rather, it emerged from the step-wise unfolding processes of the people working together, shaping their work to create something functional, durable, beautiful….


Courtesy Ian Britton, www.freefoto.com

But what about the cathedral, the magnificent York Minster (above right)? Wasn't it "designed" in the more conventional sense? No, in fact it was built as a series of very elaborate design-build projects employing hundreds of craftsmen, stretching out over 200 years, and culminating in the consecration in 1472. It was, in a sense, a hugely complex craft project.

It is a surprise to many people to learn how little was "designed" in advance in such cathedrals, and how few drawings they actually had. Often there was one great floorplan, and one bay elevation, drawn in ink on plaster. That was about it. And then there were hundreds or thousands of shop drawings and sketches, working models, test pieces, changes made to refine the result… an intensely crafts-based process through and through.

This, then, was the way the world was built, up to the last several hundred years. We may say that this was a tortuous process, and that life was too difficult for workers. But we must also admit that the result of this kind of process was a great treasury of human buildings and cities around the world.

An interesting question to ponder is, can we employ such processes again, in a way that is more egalitarian, and more socially consistent with our modern values? Are they doomed to be forever in the past? Or are there new reasons to consider their ecological merit, and their applicability to integrate with newer production systems?

The Coming of the Industrial Revolution

One of the great breakthroughs of modern science of the last four centuries has been to identify standard sets of elements that make up great varieties of phenomena in nature.

The atomic structure of matter is a classic example. We now understand that all molecules in the universe are made from a group of only about 100 atoms. In turn, all of these atoms are made from a combination of only three subatomic particles: protons, neutrons and electrons.

This is an enormously powerful insight, and it has yielded powerful capabilities: the chemical sciences, the atomic sciences, nuclear power and biochemical medicine.

But it doesn't follow from this insight that one can simply "put together" protons, neutrons and electrons, and create a person, or a house. There are vast steps of transformation in between, and – especially in the case of making a living creature – vast sequences of highly ordered growth and transformation over time. There are not mere steps of assembly of components, but steps that the biologists call "differentiation." There are ways that patterns and forms get created, and changed, slowly, in step-wise sequence.

Nonetheless, for scientists, the insight that there are standard parts within many of the wholes of nature was a powerful idea. It wasn't long before others were deeply inspired by this idea as well, and sought to exploit it in our technology. And as a powerful but limited idea, it worked very well indeed.

From Guns to Gears

Shortly before the beginning of the Ninetheenth Century, French gunsmith Honore le Blanc developed a very clever system for the manufacturing of rifles using standardised parts. The fact that all the parts were made identically meant that one could make many parts quickly, and then assemble them into functional weapons, also quickly. They may not have been finely crafted, but they certainly did the job.

This innovation happened to get the attention of Thomas Jefferson, then the American envoy to France, who relayed the concept to President George Washington. Recognising that this might give the young country a much-needed capability of low-cost manufacture for its own weaponry, Washington commissioned Eli Whitney, the brilliant inventor, to set up just such a system in the US. It worked amazingly well.

About the same time, the Englishman Henry Maudslay worked with the French emigrant engineer Marc Brunel to develop the world's first assembly line, where workers would cut, drill and assemble pulley blocks for the Royal Navy. This proved to be a highly efficient and low-cost way of producing what had previously been a very expensive hand-made item. This routine production system meant that many blocks could be made identically, very quickly and very cheaply, achieving "economies of scale." The more you make, the cheaper each one is.

Standardised parts. Assembly lines. Economies of scale. These proved to be enormously powerful innovations for the decades to follow.

Technology and its unintended consequences

No doubt you know the rest of the story. These innovations were applied to automobiles, to buildings, and to whole cities – by people like Henry Ford, Frederick Winslow Taylor, Frank Gilbreth, Robert Moses and countless others. They created the enormously productive "Age of the Machine." They paved the way for rapid advances in sanitation, medicine, and prosperity for many ordinary people, to a degree unprecedented in history. Today vast numbers of us fly, dine, heal, in a manner undreamt of by the richest kings of history.

But these advances have also left us with some unintended side-effects: pollution, resource depletion, ecological damage, social disruption, and fearsome challenges like climate change.

For some people, these changes have also left our world degraded, uglier, impoverished. They see a connection between social and ecological unsustainability, and the disordered aesthetic character of our cities.

This is not such an implausible idea. After all, evolutionary biologists tell us that our aesthetic sense is highly evolved to detect things that are likely to make us unwell – from the smell of rotten meat to the feeling of a cold damp room.

Such protests are not new. They go back to the beginning of the Industrial Revolution – to the chaotic growth of the industrial cities, and the intolerable conditions of many workers and their families. Burgeoning cities like Paris, London and Manchester were overcrowded, polluted, suffered from poor sanitation, and lacked access to essentials like fresh air, clean water, and green space for recreation.

Protests from the Arts and Crafts Movement – From Ruskin to Morris

The English writer John Ruskin (1819-1900) was one of the most influential critics of the dehumanising consequences of the Industrial Revolution. He wrote eloquently of the corrosive effects of mechanisation and standardisation, in both the quality of what was produced, and the quality of life of the workers who produced it. He decried the treatment of workers under industrialism, and what he saw as the unethical laissez-faire economics that was fuelling its growth. He argued for a return to the craft-based practices of traditions like those of Gothic architecture. Ruskin was an enormously influential figure in the Nineteenth Century, and his ideas helped to spur the labour movement, trigger a revival of Gothic architecture, and inspire many later artists, writers and thinkers, including Tolstoy and Gandhi.

Ruskin has been described as a Romantic, with impractical notions of how people can live well. But he himself was critical of Romanticism, and he argued for a way of life

that provided a decent if very modest standard of living for all, through the added value of labour given by crafts work, in the production of buildings, implements, foodstuffs and the other needs of daily life.

Ruskin was an inspiration to many later reformers who were appalled at the ongoing effects of standardised industrial development. The most important movement to grow out of these concerns was the Arts and Crafts movement, launched in England, and spreading to the rest of Europe, the US, Canada, Australia and other countries.

Perhaps the most important early leader of the Arts and Crafts movement was the English architect William Morris. He and others were not against machines per se, but they opposed the division of labour of industrial methods. They believed that each worker should take responsibility for the whole of what he or she was making, and act as a kind of "master craftsman," guiding the design through its production.

The Arts and Crafts movement was extremely influential in the late 19th and early 20th Centuries. The American architect Gustav Stickley, publisher of the magazine *The Craftsman*, published hundreds of house plans in the so-called "Bungalow" style. Today many tens of thousands of these homes are spread across the US. Stickley also had a profound influence on the architect Frank Lloyd Wright, who later became a major influence in architecture around the world. Stickley promoted the idea of organic architecture – the notion that a building and its elements should form one seamless, interrelated, crafted whole.

The English approach to Arts and Crafts was contrasted with the approach on the continent, where, for example, the German Arts and Crafts proponent Hermann Muthesius was a champion of mass production, and affordable democratic art. In France, "manufactories" separated the steps of production, and individuals or groups would produce just one item. This followed from the successful innovations of gunsmith Honore le Blanc, whose work inspired the American Thomas Jefferson to work with the inventor Eli Whitney to set up similar successful systems in the US.

This sense of the usefulness of mass production as a potential humanizing force would become a dominant theme within the modernist movement in architecture. For pioneers like the German Walter Gropius, the craft of architecture was to be seen in the fine design, the availability and fitness for use by many ordinary people. Craft was to be a matter of executing a well-made machine product, which served to elevate the standards of utility, comfort and beauty for a far broader cross-section of ordinary citizens.

The Arts and Crafts - Abandoning Cities?

One criticism of the Arts and Crafts movement is that it was, in a sense, anti-city. Certainly it was anti-industrial cities, when those cities offered only overcrowding, poor sanitation, long hours of dehumanising labour, and lack of access to fresh air and greenery. But the movement did trigger a wave of new "utopian" villages and, later

“garden cities,” which critics argued set the stage for later suburban sprawl. They seemed to suggest – at least to some – that the answer to the problems of the cities was to abandon them. Moreover, they also seemed to suggest that separation and segregation in general was the answer to any of the problems of urban settlement. This can be seen most clearly in the Garden Cities diagram of Ebenezer Howard, where work is to be segregated from home, and even “inebriates” and “waifs” are to be set apart, in their own encampments.

But this was a later trend. It must be noted that the Arts and Crafts practitioners themselves decried specialisation and division of labour, and it would follow that the specialisation and the divisions of the city were, for them, equally undesirable. Yet it is often the case in such historical developments, that the reform efforts meant to correct one deficiency, result in another. This is certainly true for the effects of industrialisation itself. Yet this example shows that it is also true, quite ironically, even for the effects of a counter-reaction to industrialisation!

Craft makes a surprising reappearance

The work of the Arts and Crafts movement has survived and continued to be popular, in the form of bungalows, textiles, lamps and furniture. But the ideals of crafts-based production methods, emphasizing step-wise articulation and differentiation by skilled craftsmen, took a back seat to the dominant production techniques of standardisation, replication and mass-production.

But something very interesting is happening today. In addition to standardisation and replication, customisation and differentiation are finding a new place. Craft is re-entering the scene, in a significant way.

First, let’s consider the notion of standardisation. Henry Ford famously said that in buying one of his cars, “you can have any colour, as long as it’s black!” Today, you can go into the dealership, and not only pick out your own colour – you can just about order your own custom car, with a dizzying array of custom options. Computers will process your order and make sure that the features all go together into the car you want.

This is one of many examples. You can create your own book and sell it on Amazon, in custom one-off orders. The production system has geared itself to be almost as economical as the mass-printing processes of earlier decades. You can order coffee cups with your own design, or

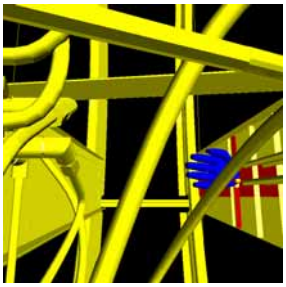
As for differentiation – the ability of a product to be adapted to its local context and opportunities – that's happening in the design-build methods that are gaining popularity. Fast-track production also proceeds in many cases with a much simpler set of drawings, and the detailing of the drawings comes along the way. So the process is more like a stepwise craft process.

What about standardisation? Many products have taken on the ability to have unique characteristics. Cabbage Patch dolls, for example, are made according to a computer algorithm that

As for craft itself, this is happening much more often than we realise. First, it is often the case that the designers of a new product go through a very elaborate, crafts-based process of developing the prototype.

Second, we know that many people practice a craft-like process in their professions. Dentists often operate as fine crafters, shaping fillings and working with other crafters to create beautiful new porcelain teeth. And doctors have known for many years that a patient cannot be treated in anything like a standardised process, but must be treated in a "procedure" that relies upon a stepwise cycle of action, evaluation and adjustment – very much like a crafts process. There must be a diagnosis, there must be a treatment,, there must be support of the existing natural processes that help to heal the patient – and all of this must proceed in a stepwise cycle.

In the high tech world, things are if anything more surprising. The Boeing 777, one of the most advanced aircraft in the world, is not assembled according to a rigid kit of parts or formulas – far form it. It is carefully built up in prototypes, tested, refined, and tested again, until its form takes on a lovely, aerodynamic, "crafted" quality.



And as for its complex internal systems, technicians have found that the best way to fit everything together properly is for a skilled designer to wear a set of “virtual reality” goggles and a glove, and to “craft” a design using the computer!

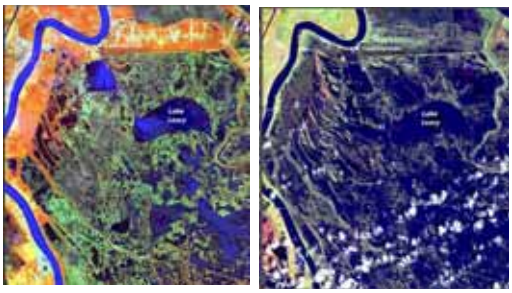
Many of these recent innovations are fairly limited, and don’t get us back to a full crafts-based approach. But they point the way to the trend that is emerging in many fields.

The Future of Craft

As we deal increasingly with ecological challenges in the future, the role of craft is likely to loom larger. To see why, consider the following comparison.

In the wetlands around New Orleans, engineers determined that they could make more “efficient” shipping lanes, drainage canals and other structures, by carving out a series of razor-straight pathways through the “messy” delta wetlands. They did not adapt to the subtle patterns of the delta: they simply imposed lines across the landscape with abstract precision.

Unfortunately, this proved to be an ecological disaster. The complex mix of fresh water and saline water was disrupted. The complex flow of water feeding the plants and trees was disrupted, killing many. When Hurricane Katrina hit, it was not slowed by a wetland buffer. Its storm surge was not diffused by a healthy wetland network.



Wetlands before Katrina, and 24 hours later

In effect, engineers had built a kind of hurricane highway, straight to one of the world’s great cities – and very nearly destroyed it. It certainly destroyed vast stretches of the same wetland structure, which had grown and adapted over centuries.

Contrast this scenario with the construction of rice paddies on the slopes of many Asian countries. These paddies are very complex, and carefully fitted to the landscape. They also happen to be very beautiful.

It can be seen readily that it would be folly to try to build such structures as razor-straight impositions on the landscape.

Indeed, this has been tried, and the result as been, we can say frankly, a mess.

We might say that the rice paddies require mind-numbing toil, and we should seek a better life for such farmers. But the important thing is not how much work is involved – we could just as easily build razor-straight canals with backbreaking labour too – but what kind of process was used to build them. Whether it was an adaptive process of articulation, in this step-wise way. As we have seen, even modern technology can be used to employ a process that is more like the step-wise process of craft. And increasingly, this is happening.

Increasingly, it now appears, this must happen, for the ecological reasons that these two examples suggest. Ecologies are also complex, adaptive structures that are built up and articulated in stepwise fashion. If we want to interact with them successfully, we have to take the methods of the doctor following a procedure. We have to pay attention to the patient's health, and follow a careful step-wise process, diagnosing, performing treatment, supporting the existing natural processes.

We see such places in the landscape, part of the heritage of the world in many places, and we note that they are very beautiful. We also note that they have many desirable ecological properties that we are very much in need of today. Not least, they have proved their ability to endure and to sustain themselves. Does their beauty have a relation to their sustainability? This is a very interesting and perhaps important question.
What we can say with confidence, is that such treasures are very valuable. They embody carbon and energy, and re-using them gives us a carbon and resource advantage. They also seem to be well-adapted to being re-used, and re-adapted to other uses. They are

readily repairable, typically using locally produced materials and local labour. This provides a "local multiplier effect" for the local economy. And they seem to encourage people to like them, to use them and care for them, and keep them around.

So in the new "age of sustainability," we must take care of the beautiful old places. Moreover, we must learn from them, and from the crafts-based processes that made them so successfully.

That is not to say we can't also employ new methods, new computer-assisted processes, the very latest in evidence-based science. We do this in medicine, and increasingly, in ecology. So we can do it in making our cities and towns and landscapes too.

And as we have seen, far from being an un-modern notion, this idea of craft taught to us by the old places, may well prove to be at the forefront of a survivable, sustainable modernity.

Questions

Instructions: Download and open the document titled "Exam Questions" that is also included with this document on the ESUA website. Fill in your name, and answer the questions. Then type in your essay question responses. Email the completed and saved document, saved under your last name, to your course instructor. (See the website for details.)

Multiple Choice questions (20 questions, 4 points each)

1. What does the author suggest is the role of craft in the modern world?

   A. Craft is now to be found in modern production methods/
   B. Craft is important in the conservation of heritage buildings and places.
   C. Craft has an emerging role in sustainable building.
   D. All of the above.

2. The most loved buildings and places around the world have in common

   A. High economic activity due to tourism
   B. A high level of craftsmanship
   C. Threats from modern development
   D. All of the above.

3. Craft in these places was the result of

   A. Brute force
   B. Extremely advanced technology and skill
   C. Carefully fitting, shaping, and articulating parts in relation to one another.
   D. All of the above.

4. Craft is returning to the modern scene in the form of

   A. Design-build construction systems
   B. The maintenance and re-use of historic buildings
   C. The planning process itself
   D. All of the above.

5. The best definition of "craft" is

   A. The making of things by hand
   B. Operating machinery to produce goods accurately
   C. A step-wise articulation of the parts of space
   D. All of the above.

6. There are surprising parallels with modern complexity science because

A. Craft today requires advanced math skills
B. Computers cannot produce craft-like objects
C. Science has discovered similar step-wise processes in nature
D. None of the above

7. Modern technological processes are different from crafts-like processes in which of the following ways?

A. Modern processes tend to use blueprints of everything planned in advance
B. Modern processes are always less expensive
C. Modern processes are more beautiful
D. All of the above.

8. What is the best description of the creation of the historic City of York, UK?

A. It was planned from the abstract geometries of a bold plan conceived in advance
B. It happened chaotically
C. It was built by one very skilled master builder
D. It was the result of “many hands” working to craft the parts of the city

9. Medieval cathedrals like that of York often had how many working drawings?

A. A floorplan and a bay elevation, along with many shop drawings
B. Over one thousand detailed architectural drawings
C. No drawings at all
D. None of the above

10. All the molecules in the universe are made from different combinations of how many different kinds of atoms?

A. Twenty
B. About 100 or so
C. Ten thousand
D. None of the above

11. You can’t “put together” protons, neutrons and electrons to get a person or a house, unless you have

A. Electricity
B. Huge collections of particles in the right amounts
C. Vast steps of transformation in between
D. None of the above

12. One of the first widespread uses of standardized parts was for the manufacture of

A. Automobiles
B. Pulley blocks
C. Rifles
D. None of the above

13. Which is true about the “Age of the Machine?”

A. It has been enormously productive
B. It has left us with unintended consequences
C. It has produced great prosperity
D. All of the above

14. Which is not true of the English writer John Ruskin?

A. He was critical of the dehumanising consequences of the Industrial Revolution
B. He admired the Romantic movement
C. He was influential in the later labour movement
D. He was critical of laissez-faire economics

15. Which is not true of the English architect William Morris?

A. He was an important early leader of the Arts and Crafts movement
B. He opposed the division of labour of industry
C. He opposed the use of machines
D. He influenced the Americans Stickley and Wright

16. English Arts and Crafts was different from Arts and Crafts on the continent in which of the following ways:

A. Arts and Crafts leaders on the continent embraced the use of mass production
B. Arts and Crafts leaders in England opposed the use of machines
C. Arts and Crafts leaders on the continent believed mass production was dehumanising
D. All of the above

17. Which is true of the legacy of the Arts and Crafts movement?

A. It influenced the later “Garden City” movement
B. It tended to be anti-city
C. It demonstrated that the reform efforts meant to correct one deficiency, often result in another
D. All of the above

18. Craft-like processes are coming back today in sometimes surprising ways, including

A. Design-build methods
B. Custom selling of books on Amazon
C. Doctors and Dentists
D. All of the above

19. Crafts-like processes may have important applications in

A. Cooking
B. Engineering of ecological features
C. Customising car colors
D. None of the above

20. Which is <u>not</u> true of the future of craft, according to the author?

A. We can combine it with new methods and new computer technology
B. It will play an important role in sustainability
C. Its beauty has no relation to its sustainability
D. It will be part of a new modern approach to technology

Essay questions (up to 4 points each)

1. Can we employ crafts-based processes again, in a way that is more egalitarian, and more socially consistent with our modern values? Or are they doomed to be forever in the oppressive past?

2. What does crafts have to do with modern complexity science?

3. What is the relation between beauty and sustainability, if any? Why do you think this is?

4. In what sense is a city like York "a piece of craft?"

5. Discuss the definition of craft as "the stepwise articulation of parts of space." What does this mean to you?

What is Sustainable Urbanism?
An Introduction to Concepts, Metrics and Strategies

How to Use This Module

This is the third e-learning module for a series of courses in urbanism, architecture and building crafts known as the "European School of Urbanism and Architecture." The programme was designed for new students to the study of urbanism and building, and for professionals and practitioners who wish to increase their level of understanding of important new topics in best practice. More information in this programme is available at www.esua.org.

If this is your first time learning about this subject, and you find this module interesting, you will have the option to take more modules on line in the future. But this on-line element is really only a part of the full course of study. This module is designed to be integrated with a hands-on learning programme that will allow you to learn in the most effective way known: "learning by doing." You will have the opportunity to participate in field studies of actual projects, working alongside leading practitioners, and using the latest tools and techniques.

This module is specifically designed as an introductory course for those coming to study building crafts in the programme, but may be taken by others as well.
The full project-based curriculum is now in the pilot phase, and is planned to be launched as a full-time programme after several years of development. You can learn more at www.esua.org.

Each e-learning module begins with a short reading, and then gives you links to additional reading. The final examination includes a short multiple-choice section, and a written essay portion that you can enter through a form, or email to the course instructor as a text document.

Introduction

Today the word "sustainability" in very much in the news, and in professional thinking and discussion. Its prominence reflects real scientific concern that our current practices are not sustainable, and if we do not reform them, we will face severe shortages of critical resources, and other severe social, ecological and economic consequences in the years and decades ahead. Among them, the phenomenon of climate change looms as particularly serious.

But what is sustainability, to be precise? How can we know when we have achieved it, and when we are perhaps just fooling ourselves – doing small things to make ourselves

feel better, when bigger problems go unsolved and even unaddressed? And if we do know what it is that we really need to achieve, how can we do so effectively?

This introductory course will look at these topics, with a particular focus on the urban built environment. It will also point you in the direction of further independent study.

The built environment plays a dominant role in the question of sustainability, and for good reason. A major portion – perhaps half or more -- of the energy and resources we consume today are consumed as a result of the characteristics of the built environment, and the ways we interact with it. The buildings, their heating and cooling, their furnishings, their appliances, all are major users of resources, generators of wastes and toxins, and emitters of carbon and other greenhouse gases that contribute to climate change.

Moreover, this is only the start of the story. Buildings do not exist in isolation from one another. If they are widely separated or poorly distributed, we may use much more energy in moving between them, and in distributing energy and resources to them. If they are not grouped so as to take advantage of shelter, sun, shade, they may use significantly more energy. If they do not take advantage of natural efficiencies such as waste energy recovery and district energy systems, they are likely to use more resources.

Finally, if the buildings, and the urban pattern that surrounds them, is built to support and to accommodate a high-consumption, high-throwaway lifestyle, then the evidence suggests that their inhabitants are much more likely to use more energy and resources. The built environment will not force them to do so, but it will shape their options, and make it more difficult to do otherwise.

Conversely, if buildings, and the urban systems that surround them, are built to support and to accommodate a high-efficiency, low-energy, low-resource-waste lifestyle, then the evidence shows that their inhabitants are far more likely to live in that lifestyle. If the inhabitants can easily walk or take transit; if they need not travel as far for their daily needs, which are well-distributed; if they have inviting outdoor space nearby, where they can spend time with others, without using large amounts of energy and resources; and if more people can share efficient facilities like power generation and infrastructure; then the evidence shows that even those with relatively high household income, can have a relatively resource-efficient, energy-efficient lifestyle.

Therefore, what we are learning from the research is that the urban form is a critical aspect of the challenge of sustainability. This means that when designing for sustainability, we must move beyond the scale of the building, and design for sustainable urbanism.

What is sustainability?

First, let us be clear on our definitions of the problem. Perhaps the best-known definition of sustainability, and therefore the one we will use here, is the one given by the Brundtland Commission (formally known as the World Commission on Environment and Development), a panel convened by the United Nations in 1983. The commission was created to address growing concern "about the accelerating deterioration of the human environment and natural resources and the consequences of that deterioration for economic and social development."

Among other things this meant that sustainability is not just an environmental problem, but a social and an economic one too.

The Commission established a definition for sustainable development that is still widely used today.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs"

On the one hand, human beings have essential needs (food, clothing, shelter, culture) which must be met through activities in the environment – such as agriculture, fishing, construction, mining and logging. On the other hand, these resources have limits, and if they are depleted, or if the activities cause intolerable damage to the environment (such as excessive pollution), then the ability of future human beings to meet their needs will be compromised – perhaps severely.

So the challenge is to balance the needs of all human beings, and assure their access to resources – not only those in the future, but those today who live in poverty.

And not only are we concerned with those who will live in the relatively near-term future – the next century, say – but we must also think about the needs of our descendants in ten centuries, or a hundred, or a thousand centuries. Therefore, the use of resources must be put on an entirely different level, one in which critical non-renewable resources are used in an endless pattern of recycling – much as natural systems already tend to operate. Their sustainability often spans millions of years – hence we would do well to take notes.

The “Triple Bottom Line” of Sustainability

Moreover, the matter of access to resources does not exist in a vacuum, but requires a social and technological system of delivery. Hence sustainability means that we must address the full social, economic and technological aspects of society. In that sense, sustainability requires accounting with a “triple bottom line:” not only ecological

sustainability, but also social sustainability and economic sustainability. If one of these elements is missing, the other two will not be achievable either.

Therefore, social sustainability – the ability of a city or a region to maintain social organization, cooperation and well-being – is a critical dimension of sustainability too. If parts of the population are increasingly excluded and alienated, causing disruptive social problems, then this will increasingly distract from the capacity of the community to deal with other challenges. If the population is not well-educated, then they will be less able to respond politically to the real long-term challenges facing their society. (There is some evidence that this is occurring on the issue of climate change)

Similarly, economic sustainability is a necessary condition for a society to deal with its challenges. If an unsustainable economic activity depletes economic resources, then the society will be less able to apply those resources to other needs. Clearly, if an entire society is impoverished by unsustainable economic practices, then it is not able to deal with other challenges, and may not even remain viable as a society.

Moreover, all of these three "legs of the stool" of sustainability depend on each other. The depletion of ecological resources will certainly impoverish a society and contribute to economic unsustainability. In turn, a society that is economically unsustainable and impoverished can be expected to put greater pressure on ecological resources. Social unsustainability increases the likelihood of economic unsustainability, and the likelihood that the necessary steps to manage ecological sustainability will be taken. And of course, ecological unsustainability can also have a devastating effect on social sustainability ,as we have seen in parts of the world that have suffered ecological disasters.

Resilience, Capacity and Organic Growth

However, it should be noted that there is one important difference in ecological sustainability, putting it in a different class from the other two. Declines in both social sustainability and economic sustainability can be reversed relatively quickly. Economies can rebound, and populations can greatly improve their levels of education, organization and social well-being. But ecosystems can be damaged beyond repair – particularly when species become extinct. We do not understand all of the links between species, but we know that there are critical thresholds, beyond which, if too many species become extinct, entire ecosystems will collapse permanently – along with the resources and the services they provide to humans.

This ability to recover from damage is called ***resilience*** – and it is an important concept in sustainability theory. We recognize that we do not control, in a conventional sense, complex systems like ecologies or economies or social systems. Rather, we must recognize how we can facilitate their own internal ***capacity*** for renewal – how we can assist in promoting the "capacity-building" of these systems.

The tools required are not unlike the methods of biological science, or medical science. We need good measurements, and good analytical understanding of what is happening. We need to, in effect, "diagnose" this. Then we need tools to promote the health of the system – "prescriptions" of steps that can be taken. Finally we need qualitative and quantitative evaluation of the result, and refinements for further action.

Or, to use a related analogy, we need to act as "gardeners" as well as "carpenters." A carpenter has a design and executes it in a fairly linear process, and uses tools designed for this: hammers, saws etc. A gardener has to use tools and methods that respond to the complex phenomena of biological growth. The gardener might use a carpenter's techniques to build trellises and other structures to support growth. But the gardener will also plant seeds, fertilize, water, prune, weed – all the things needed to support the growth of the plants themselves.

The Complex Interrelationship of Sustainable Resources

Some of the key resources that are threatened by unsustainable practices:

Depletion of non-renewable resources:

- Fossil fuels
- Metals
- Fresh water

Depletion of renewable resources:

- Soil
- Fisheries
- Forests
- Other natural biological products (pharmaceutical products, etc)

These are fairly easy to understand. If we deplete the world's reservoirs of oil, for example, we make them unavailable to future generations.

Somewhat more complex, and therefore somewhat more difficult to anticipate, are cumulative changes to the environment from our practices that have damaging effects to the things on which living systems depend – and very likely, human beings will depend on them as well.

Damage to ecosystems:

- Pollution of air, water, soil (including ocean acidification)
- Destruction of habitat
- Destruction of "ecosystem services"

Most complex, and perhaps the most difficult to understand and anticipate, are so-called "systemic" effects of our actions: that is, things that happen to one part of the environment, that then trigger a problem, often unexpected, in another part.

Triggering of systemic effects:

- Extinction processes
- Climate change
- Other interactive effects

These effects are often the result of the other unsustainable practices mentioned previously – for example, climate change is caused by the depletion of oil and release of CO2 in the atmosphere – and at the same time, they go on to make the other problems worse.

For example, the deforestation in the Amazon basin may accelerate the effects of climate change, which may trigger diseases and infestations in trees, greatly accelerating the problem of deforestation.

The warming of the oceans from climate change may accelerate the release of methane sequestered in ocean beds, causing even greater warming. The same phenomenon of release through heating may happen to the methane sequestered in the peat beds that occur in vast stretches of the Northern Hemisphere.

These effects would tend to accelerate the effects of climate change. On the other hand, other effects might also serve to dampen climate change. For example, the increased levels of CO2 might increase the growth of plants and ocean algae, which would then consume the CO2 and release it back as oxygen.

The problem for those who study this phenomenon is that it is one that is exceedingly complex, and very hard to predict. Indeed, these effects are especially worrisome to those who study this subject, because they could create "runaway" effects that become severe – even catastrophic – in ways that we cannot understand.

The phenomenon of extinction is a similar problem. We might well wonder why we should care that a few species might go extinct. But beyond a certain threshold, the extinction of certain populations triggers the extinction, or the massive die-off, of other species on which they depend. The ripple effects could be enormous, and cause collapse of whole ecosystems.

Such ecosystems can recover if the key species are intact. But if those species are extinct, the ecosystem may not recover for many thousands or even millions of years – the time it may take for new species to evolve or adapt to the gap in the ecological system.

As the saying goes, "extinction is forever."

This could be a hugely important issue when it comes to the integrity of fisheries around the world, for example. A massive collapse in key fisheries due to the extinction of key species could lead to starvation and desperation in populations that rely on fishing. In turn they might be prompted to extract even more species of fish that had been considered inedible previously, threatening to cause more extinctions.

Or the extinction of a number of land creatures could trigger the explosion of very undesirable species that were held in check by them – perhaps crop pests that could greatly affect crop yields.

Once again, we see the complex effects of interactivity, making it difficult to predict the future consequences for human well-being. But we know the dangers are very real, and potentially catastrophic. That is why the question of sustainability – imprecise though it may be – has risen to the forefront of global awareness and action.

The particular challenge of climate change

It must be stressed that climate change is only one manifestation of the challenge of sustainability. It is a sad fact that if we could somehow solve the challenge of climate change tomorrow, we would still face almost all of the other serious challenges on the list above. Even without climate change, we would be severely compromising the ability of future generations to meet their own needs. We might very well be subjecting them to a world of increasing shortage, mass starvation, political instability, epidemic disease, and other consequences of a breakdown of the sustainable delivery functions on which our well-being depends.

And yet it must be said, the consequences of climate change in particular could be even more horrific. We could pass on a world wracked by massive disastrous weather events, widespread crop failures, the spread of epidemic diseases, loss of access to potable water, mass emigrations, enormous political instability, and worse.

Moreover, the challenge of climate change is closely linked to these other unsustainable activities and effects. In that sense, climate change does a remarkably good job as a "proxy," to represent all the other challenges of sustainability too.

For example, the depletion of oil and other fossil fuels is responsible for much of the increase in CO2 in the atmosphere. Deforestation and soil erosion also remove vegetative cover, which in turn tends to add to climate change. CO2 causes ocean acidification, which is predicted to cause the death of many shellfish and other ocean organisms. Activities such as construction and mining that damage habitat also contribute to climate change through their removal of vegetative cover, and through the use of non-reflective materials that absorb heat.

In turn, climate change makes many of these other issues much worse. Warming causes the death of species, including valuable forests, grasslands and crops. Storms and

flooding damage access to fresh water. Climate change hastens the destruction of habitats and ecosystem services on which we depend, and very likely increases the rate of extinction greatly, even catastrophically.

So climate change, because it is both an urgent and a comprehensive issue, can serve as a kind of "lens" through which we can look at other, less urgent issues, that have therefore been ignored for too long.

Climate change: a summary of the science

The field of climate change research is a dynamic one, and it is important for professionals to keep themselves informed with updates in this rapidly changing field. Media coverage can be confusing and superficial, and interest groups can distort the true implications of new findings.

Broadly speaking, this is what is known in late 2009.

Human activities have introduced a number of so-called "greenhouse gases" into the atmosphere – so-called because they tend to trap heat in the Earth's atmosphere, much as the glass of a greenhouse traps heat entering from the Sun. Among the gases are carbon dioxide, methane, and various other hydrocarbon compounds.

These substances exist in the atmosphere naturally, but have risen markedly in the age of human industrial activity. One complication is that some of the gases act more strongly than others to produce solar heating. Therefore, scientists use a figure called a "carbon dioxide equivalent" or "CO2 equivalent," which expresses the equivalent concentration of CO2 if that were the only gas present, to produce the equivalent effect.

At present the level of CO2 equivalent gas in the atmosphere is approximately 380 parts per million. That is, if one separated out the molecules in the atmosphere, there would be an equivalent of 380 CO2 parts, and 999,620 non-CO2 parts.

This may not sound like much. But the historic level of CO2 parts per million is about 270, meaning that the world has seen roughly a 50% increase in concentration.

It is possible to examine evidence from ice cores and fossil records, and correlate the concentration of CO2 and other greenhouse gases with the Earth's average temperature. From this evidence, we can construct a fairly reliable model about the likely increase in temperature that will arise from corresponding increases in greenhouse gas concentrations. We now know that a rise to 450 parts per million is likely to be associated with a rise in average global temperature of two degrees centigrade.

This, too, sounds like a modest increase. But we know that its effects are likely to be profound. The fossil record indicates that a 6 degree centigrade increase in the Earth's temperature occurred some 56 million years ago, in a 20,000 year period known as the

Paleocene-Eocene Thermal Maximum. That rise resulted in the extinction of up to 50% of deep ocean life, and other dramatic biotic changes.

Current models suggest that we might reach the 6 degree rise in far shorter than 20,000 years – perhaps in as little as 100 years – with severe disruptions of the critical rainfall patterns and ecosystems on which humans depend.

The effects of climate change that are of most immediate concern to human populations are:

- Disruption of rainfall patterns for crop irrigation in large parts of the world;
- Inundation of coastal areas, making them uninhabitable;
- Severe storms, heat waves, wildfire breakouts and other highly disruptive weather events that will likely kill many thousands and destroy settlements;
- Severe disruption of fresh water supplies, through weather events and through contamination from flooding;
- Catastrophic collapse of species on which humans depend for food and other needs;
- Severe shortages of resources, prompting mass migrations of whole populations;
- Severe political instability and possibly catastrophic conflicts as a result of all of the above.

Climate change: Mitigation and adaptation

We know that some effects of climate change are already under way, and other effects are likely to be inevitable. For example, some coastal areas are likely to be inundated as sea levels rise. The steps we take to adapt to these changes – such as building dykes, or raising structures on piers, or removing people from coastal areas – are referred to as ***adaptation***, in contrast to steps we take to ***mitigate*** the factors that are causing climate change in the first place.

While some adaptation is inevitable, it must be understood that adaptation is often extremely expensive, and may even be ineffective. For example, it will simply be prohibitively expensive to protect many coastal settlements, and the cost of building new settlements will also be extremely high.

Urbanism and climate change

What is the role of urbanism in contributing to climate change? What does that imply for the role of urban designers?

(We have defined urbanism as the complex system of partial public and private realms that exist between buildings. Therefore large cities are not the only examples of

urbanism – it can exist in the smallest town too, or even in some cases, in a rural farm complex.)

Let us consider two facts. First, it is in our homes and neighbourhoods that we first generate the demand for the world's resources. Here we eat most of our food, do much of our transportation, buy, use and dispose of most of the world's end products. Here we use much of the world's energy for heating and cooling, lighting and operating appliances.

So the question of whether these places increase or decrease demand for these resources is one we must examine carefully.

Second, it is already known that in our buildings, including homes, shops and offices (and not including manufacturing operations), we consume roughly half of the resources that contribute to climate change, in the activities, like heating and cooling and running lights and appliances, that are likely to trigger the release of greenhouse gases somewhere else. Moreover, we consume additional resources in the ways we furnish our houses, prepare and eat food, and go about our other activities of consuming goods. (There is a significant question of whether the design of the house and its neighbourhood have an effect on our tendency to consume in certain ways, such as purchasing large quantities of disposable goods; we will discuss this point later.)

So the shape of buildings, their efficiency of layout, their exposure to heat loss, their tendency to gain or lose heat energy, and their ability to accommodate our various habits of consumption – all have a significant effect on energy use and carbon emissions.

Add to that the energy we use to move between buildings, and a number of other patterns of consumption and energy efficiency (which we will discuss below) – and you come to roughly two-thirds of the demand for resources that cause climate change, coming from the built environment. (The other roughly one-third comes from commercial transportation, manufacture, and the production of the energy itself.)

So clearly, the built environment has a major role in generating the causes of climate change, and other unsustainable practices. It follows that built environment professionals must have a major role in making reforms.

But what are the specific factors that designers must take into account? Roughly speaking, they are factors at the scale of the building, and factors at the scale of the neighbourhood and region. And as we will see, these two sets of factors are more interrelated than they might appear.

Thus architects must think in terms of urban design, and urban designers must also think in terms of architecture. We will see this point emphasized as we go through the detailed factors.

Factors of low-carbon sustainability at the building scale

We begin this section with a caveat that every urbanist should know by heart: no building is an island. It does no good to have a low-carbon building that is located so remotely that the energy required to drive to it negates the savings. And it does no good to abandon a historic structure (as recently happened in a well-publicised case) to build anew a "green" structure that requires so much initial energy and resources that the owners have in effect dug themselves a "carbon hole" from which they will not even get back to even for some years. Far better, in that case, to retrofit the existing building.

Nonetheless, we know that there are a number of very important things that can be done at the building scale – particularly when it comes to heating, cooling and lighting, which account for a large portion of energy consumed by the built environment.

- Building energy systems: obviously these must be as efficient as possible, while remaining reliable over time and with changing conditions – a characteristic that is known as "resilience." Exotic technologies that may break down, or parts that may become unavailable, mean the system is non-resilient, and may not be sustainable under changing conditions. The more the systems can rely upon renewable energy (solar photovoltaic systems, solar hot water, passive solar heating) the better. Best of all are fully passive systems, that don't rely upon any technological inputs.
- Building envelope: high insulation value to maximize efficiency of heating and cooling, while retaining livable conditions. There is an optimal balance which may be hard to predict in practice. For example, greater window area often makes a building more livable, but fully glazed curtain walls may be too extravagant. (Ken Shuttleworth, the designer of London's "Gherkin," which is a full curtain wall building, has famously called curtain walls "a thing of the past."

Factors of low-carbon sustainability at the urban scale

These factors may be summarized as follows: infrastructure efficiencies, location efficiencies, efficiency of characteristic building types, ecosystem services, urban macro-effects, and behavioral effects.

Infrastructure efficiencies come from the pattern of the infrastructure, and the compactness of the functions it serves.

- Well-connected multi-modal transportation system, including public transit, walking, bicycle and car;
- Well-connected street network, facilitating shorter trips, and encouraging walking and biking;
- High density of end uses of energy, requiring shorter lengths of infrastructure, and lower operating, maintenance and embodied energy;
- Ability to capture waste heat and other forms of energy at a district level;
- Ability to reduce transmission losses.

Location efficiency comes from the well-distributed range of daily needs and activities:

- Jobs to housing balance;
- Optimal distribution of schools, shopping and other daily needs;
- Mixed use retail and commercial, with walking range of many residences;
- Optimally efficient regional distribution of large and small centers. Research shows that the most efficient patterns tend to follow a "power law," a distribution of many small centers, fewer medium centers, and very few large centers.

The efficiency of characteristic building types is closely connected to the efficiency of urban pattern. Again, no building is an island, and the size, shape and orientation of an individual building is closely related to the size, shape and orientation of the neighbourhood itself. The characteristic buildings that are likely to be built in a neighbourhood are in turn related to the neighbourhood's connectivity, density, characteristic appeal, market dynamics, and other factors.

The building characteristics include:

- Attached types, which tend to save heat from common walls;
- Buildings that are oriented to take maximum advantage of passive solar exposures;
- Buildings that are well-sheltered from the negative effects of sun and wind;
- Buildings that line the street and support an attractive streetscape, conducive to pedestrian activity;
- Buildings that make maximum use of small outdoor spaces, reducing wasted space around them, and the water, fertilizer and maintenance energy they require;

So-called "ecosystem services" are functions that the world's ecosystems perform for us, often unacknowledged, without which we would have to pay extravagant costs to perform them ourselves (if indeed that would even be possible). They include:

- Purification of water from wetlands, and from groundwater re-infiltration
- Purification of air from vegetation (especially conversion of CO2 into O2)
- Generation of soil nutrients from vegetation (especially conversion of nitrogen and CO2 into soil nutrients)
- Pollination of crops by bees and other insects
- Natural pest management by predators within stable ecosystems
- Possible regulation of weather and atmospheric composition by ocean plankton and algae (damaged by marine pollution and waste)

Urban macro-effects are effects that are created by the urban pattern itself, rather than being created independently and merely being conditioned by the urban pattern. They include:

- Albedo effect. The tendency of darker buildings and paved surfaces to convert solar energy to heat energy, which increases the greenhouse effect, and adds to the heating of cities, and the cooling load for climates and seasons when cooling is required;
- Heat island effect. The tendency of air to become trapped between buildings – especially tall ones – and to become heated above ambient levels. Again, this increases the heating of cities and can exacerbate heat wave effects. It can also add to cooling load in climates and seasons when cooling is required.
- Negative effects of tall buildings. While higher density is generally more beneficial from a sustainability point of view, there can be a drop-off of benefits above about 100 persons per hectare, and as certain negative effects of tall buildings become significant. They include:
    - Embodied energy in steel, concrete and other high-energy materials
    - Inefficient floorplates due to egress requirements, increasing the embodied energy per square meter even further;
    - Higher exposures to sun and wind, especially when curtain wall assemblies are used;
    - Shadowing effects on other buildings that may benefit from solar access;
    - Ground effects that may damage the viability of low-carbon urban spaces. These include wind effects, shadowing, and "canyon effect" (trapping exhaust gases in higher concentrations);
    - Social and psychological effects. More research is needed, but there is enough research to indicate some precaution is needed, both in the quality of life for residents of tall buildings (especially children) and in the psychological effects of tall buildings for the livability of the surrounding neighbourhood. There is also reason to be concerned that tall buildings can effectively serve as "vertical gated communities," isolating their residents from the street life below, to the detriment of both.

  There are ways to mitigate many of these issues. But the key conclusion is that there are indeed significant issues to manage, and tall buildings must not be over-sold as a "green" building type. The burden of proof must be on those who propose tall buildings as the most sustainable solution in a given context -- very carefully considering their true carbon footprint and their effect upon the surrounding urban structure.

The last category is the most difficult to assess, but may well be one of the most important: the effect of behavioural issues. Evidence suggests that if we live in a neighbourhood in which it is very difficult or impossible to walk, and very much easier to drive to daily needs, then we are much more likely to get into the frequent habit of driving. The more we develop such a habit, the more we are very likely to avail ourselves of ever more of the resources it affords us – the big-box shopping, drive-through restaurants, and other more distant activities that might be only marginally better than closer ones.

Conversely, the evidence suggests, the more we live in an appealing urban neighborhood, with inviting walkable streets, well-distributed amenities and public spaces, the more we

are likely to use these low-carbon activities, and interact with our neighbours who are doing the same. The more we live in a neighborhood with optimally distributed services (regular needs met with many small shops and services, less frequent needs met with fewer larger ones) the more we are likely to use a more efficient combination of large and small facilities.

Less clear is the effect upon consumption of other resources, like food, electronics and other household goods. But there does seem to be evidence that a more compact, urban lifestyle encourages a more selective consumption pattern – fewer household goods and electronics for smaller homes, and fresher market foods (which tend to be more available). Conversely, a lifestyle in a larger suburban home seems to encourage (or at least associate strongly with) more purchases of relatively disposable household goods and electronics, more purchases of highly packaged and processed foods, and more caloric intake per person (including more meat-based foods, which are much more energy-intensive to produce). But much more research is needed in this area.

It must be stressed that this is not behavioural determinism. The built environment does not force us to behave in one way, as opposed to another way. But it can certainly make it almost impossible to behave in certain ways – to walk to a neighbourhood farmer's market to buy fresh produce, for example -- or make it very much easier to behave in certain other ways. It can constrain our choices, or facilitate them. When it comes to sustainable patterns of activity, it is clear that this is a crucial topic.

Adding up the numbers

In dealing with sustainability, as we have just seen, many of the factors are inevitably qualitative: how appealing are low-carbon neighbourhoods and lifestyles? How well can we live in a more efficient lifestyle, in a more efficient urban pattern? To what extent will we value, care for, and take care of, buildings and urban spaces over many years?

How desirable, how livable, how beautiful, are our low-consumption neighbourhoods? These are inevitably important qualitative questions.

Nonetheless it is crucial to be able to measure the aggregate effects of various choices we might make, so as to optimise our choices, and to reach a much more sustainable condition. We can also measure the qualitative factors, by measuring the expression of human preferences and evaluations. Indeed we do this all the time when we count votes, or count rents, or count funds for socially important goals.

We must not let the quantitative information replace the qualitative information, but rather, serve as a complement to it. We must not be like those who, it is said, know the cost of everything and the value of nothing. This would be to misunderstand the value of qualitative information in its own right, and in combination with quantitative information.

What are metrics?

In the challenge of sustainability we speak of "metrics" as specific measurable dimensions. If we want a city to be sustainable, then we must ask, what is the rate of resource use, and the percentage of recycling versus waste? What is the period of time that pattern can be sustained?

What are the health statistics of the community – the longevity, well-being, mortality, morbidity (rates of sickness)? The social statistics, such as crime, poverty, social support and interaction? The economic statistics, like prosperity relative to resource use, jobs stability, local economic activity, stable trade patterns?

In the case of climate change, the numbers are particularly stark. How much carbon is each person generating, from their household back to the factories and farms that produce all that they consume? How much difference does it make to change the layout of a city? To change to a more efficient kind of automobile, like a hybrid? To change the availability of public transit?

There is a great deal of research on such metrics -- but it must be said, there is also a great deal of confusion. That is in part because it is possible to define such metrics in many different ways, which may or may not be consistent. And it is easy to overlook many important factors.

Moreover, it can be very difficult to get reliable and consistently defined information. As an old saying goes in computer science, "garbage in, garbage out." If our inputs are not clearly defined and accurately gathered, the results will likely be meaningless – or worse, misleading.

And it is crucial to get a full picture, and not look only at one set of factors, which can be equally misleading. Part of the problem is in the nature of specialization: specialists are trained to look at only one set of factors, so as to try to make it as reliable as possible. But if that misses gaps between disciplines, the picture will not be complete..

For example, an urban sustainability researcher might assess a population that seems to be reducing carbon emissions, but might overlook one possibly crucial factor: the number of trips taken by jet aircraft, which contribute high levels of carbon, and in an especially detrimental part of the atmosphere.

Unfortunately, it is easy to manipulate statistics by making just these kinds of omissions, intentionally or through unconscious bias. The public discourse - as well as the scientific debate -- can be clouded by such incomplete statistics. In part that is the nature of the scientific process: to sift through such inaccuracies and gradually to correct them. In the case of public discourse, where those with particular interests may distort the process, it is more important to find a path through the thicket of inaccuracy and to develop a public consensus on the issue.

This is all the more difficult because the subject itself is a dynamic one, and the terms of reference themselves may change over time.

Thus it's crucial that professionals working on sustainable urban development strive to develop as comprehensive and accurate a picture as possible, presented with the clear outlines of a working consensus.

Our job is like that of doctors, who need to make a prescription to a patient on how best to improve their health. Our job is not to debate with the patient all the complexities of the latest medical research – though we shouldn't hide that wither. Rather, we should identify what, in our professional judgment, the preponderance of the evidence is telling us, about the best course of action available to deal with the condition at hand.

Specific Metrics of Climate Change

There are a number of well-established metrics that we can use to track the likely contribution of climate change from an urban settlement and its morphology. These include:

Vehicle Kilometers (or Miles) Traveled: This is the average distance each person drives in a given unit of time. If the average fleet vehicle efficiency is known, and such factors as idling and other contributions, it is relatively easy to work out form this the average CO2 emitted per person from the driving activity.

Non-Tailpipe Vehicle Emissions per Person. As noted earlier, this includes vehicle manufacture, maintenance, extraction, refining and delivery of fuels, and all the other factors. They generally amount to 50% again of "tailpipe" energies, but will vary based on the rate of use of the vehicles and other factors.

Other Transportation Emissions per Person. This includes public transportation, which can vary greatly in efficiency, and other modes that are small but not negligible contributors. (For example, a person who rides a bicycle long distances every day and consumes a high-meat diet to do so may actually contribute significant CO2 from that fact alone.)

Transportation Infrastructure Embodied, Operating and Maintenance Energy per Person. This is the share each person carries for the roads, bridges, lights, rails, and other infrastructure elements of the transportation system.

Domestic Energy Per Person: Again, this is relatively easy to work out for a given area, based on utility company statistics on delivered energy, and residential household composition. Once the use of energy in the various forms is known, it can be calculated what the extraction, refining, transportation, production and transmission energies and emissions are per unit of energy, and from there, per person.

Again it is vital to look beyond the energy and emissions at the building, and understand the hidden sources of energy and emissions in production and distribution.

Consumption of Water, and Use of Wastewater Per Person. This includes water for drinking, cooking, washing, human waste, plant irrigation and other uses. It may also include water for evaporation cooling units or other mechanical equipment.

Waste Versus Recycling Per Person. The degree to which resources are recovered from the waste stream, and the additional energy and resources required to so. Waste is also a problem in its own right as it can generate methane gas, a greenhouse gas that is over 20 times more effective in trapping solar heat than CO2.

Other Infrastructure Embodied and Operating Energy Per Person. This includes pipe construction and repair, pumping, power line and telecom and cable construction and repair, and other utilities.

Transmissions Losses Per Person. These include electric power loss, and leakage from pipes. They can be significant percentages of total use, and they can be proportionally minimized with shorter distances per person.

Other Transportation Per Person, Including Inter-City. These include the very significant factor of air travel, as well as travel by car, rail and boat.

Embodied Energy in Materials in Buildings and Urbanism Per Person. This includes all the concrete, steel, glass, wood, brick, and other component of the built environment. There are great variations in the embodied energy and the potential for emissions in various materials. For example, wood is generally a low-energy material, and an excellent "carbon sink" – when harvested sustainably, it pulls CO2 out of the atmosphere and locks it away in the building for its life. Concrete and steel, on the other hand, require comparatively high levels of energy and resources for their production.

The life span of a building is also highly relevant. A wood building that lasts ten years may be worse than a concrete or steel building that lasts 100 years.

Consumption of Food Per Person. This is a very large component of energy and emissions per person. It includes the production of energy required to grow, harvest, process, transport, refrigerate and deliver foods, including fertilizers, farm equipment, irrigation and pumping, trucks, rail, stores, restaurants, refrigerators, and other equipment and processes. The range of food types varies greatly, with meat products estimated to consume as much as five times more per calorie than vegetable foods. In addition, foods requiring extensive transportation and/or extensive processing and storage also require more energy and emissions per calorie than foods grown locally, or delivered more quickly with minimal refrigeration. Finally, the waste factor is significant: the more foods can be used without wasting a significant percentage (by spoilage, or from rejected cosmetic blemishes, or from restaurant over-production) the lower will be the consumption per person.

Consumption of Goods Per Person. This include all the other goods one consumes, together with all the goods required to make that possible. In the former category are the clothes, furnishings, paper, tools, appliances, electronics and other end-user goods of our daily life. In the latter category are all the things needed to produce and deliver them: the mining equipment, machines, factories, offices, trucks, railroads, aircraft, stores, and other parts of the manufacturing and deliver system.

Of course this system is a global one, and components of even a rather ordinary household electronic device may come from many parts of the world. The question is to what extent this supply chain uses energy and resources, and to what extent it uses other unsustainable methods – a question that is increasingly hard to answer in a complex, global-scale production system.

All Other Resources Per Person. In this category are all the incidental acts of consumption of resources and/or energy: burning of waste piles, flaring of excessive industrial gases, burning of campfires,

Other Metrics – Human Impacts

In a distinct category are the other so-called "footprint" activities: the disruption of ecosystems and the services they may provide us.

Deforestation and loss of vegetative cover per person. Vegetative cover removes CO2 and reduces albedo effects, by converting solar energy to biomass. It is important to emphasise that this metric is measured per person. Thus a compact city that has little greenery within it, but leaves the surrounding land undisturbed, may actually be better per person than a sprawling city with significant greenery. Of course, a compact city may also feature greenery (such as street trees and green roofs) and that may confer many other benefits as well.

Deforestation and loss of vegetative cover is usually measured in hectares or square km (or acres or square miles), and graphed over time.

Loss of infiltration, recharge and wetland areas. This can lead to drastic decline in water quality and other negative effects, requiring energy-intensive (and expensive) systems to mitigate the problem.

Loss of wetland and recharge areas is usually measured in hectares or square km (or acres or square miles), and graphed over time. Growth of impermeable cover (e.g. pavement that does not allow infiltration) is also measured in area over time.

Loss of animal services. These include pollination from insects and birds; predation of pests by other species; consumption of undesirable "weed" species by various grazing animals; and other services performed that economically benefit humans.

Beyond the Specifics of Climate Change: Other Ecological Metrics of Sustainability

In addition to the resource depletion issues described earlier, other ecological metrics include:

Pollution. A very broad and important category, and one that includes air, water and soil pollution. Metrics typically specify parts per million (pollutants to contaminated media). In soil, it might be measured in the cubic volume of contaminated material, in meters or yards.

Ironically, some air pollutants may actually reduce the effects of climate change, by creating a reflective layer of haze in the atmosphere. But they often come with other pollutants that greatly increase the effects. (For example, vehicle exhaust contains particulates that help to shield from the effects of climate change, but also contains CO2 and other greenhouse gases.)

Erosion of Soil. Given its role in supporting crops, a healthy soil system is a critical resource for the welfare of humanity. But erosion and depletion have reached the point that roughly half the historic level of soil has been eroded away and flushed into the oceans. This half-way mark has led some to term the challenge "Peak Soil." Soil depletion is usually measured in depth of soil (cm or inches) and graphed over time.

Destruction of habitat. This can be from one of the specific human impacts above, like deforestation, or it can be from other less direct sources, such as climate change. Or it can be simply from the displacement of ecosystems by human structures such as roads, buildings, houses and the like. This is usually measured in area (hectares or acres).

Depletion of fisheries and other wildlife stocks. This can happen from over-fishing, or from other impacts such as pollution or climate change. This is measured in number of animals, or else in weight of the animals, and percentage of change.

Social and Economic Metrics of Sustainability

It is important to remember that sustainability is not just about sustaining the natural environment, but about sustaining the human one as well. For the following variables, it may matter less how high the variable is in absolute terms, than that the variable is not dropping over time. It is also important to determine a minimum threshold at which we consider a sustainable society must provide for its members.

For example, hunter-gatherer societies were sustainable over hundreds of thousands of years. But they included aspects of society that we would probably not accept today: levels of disease, sanitation, infant and childbirth mortality, and other factors.

The built environment does not directly control these factors, but it does shape them. For example, improper shelter in a cold climate will affect levels of morbidity (illness). Similarly, we can use diagnostics of other health and social well-being to identify factors that may be contributors within the built environment.

Does the environment offer shelter, security, comfort? Does it facilitate social interaction, or make it difficult to achieve (for example, by isolating people)? Does it facilitate healthy levels of commerce, close-by shopping, a variety of healthy foods? Often the metrics we use to determine this are not in themselves conclusive, but are "indicators" of the need for further research and prescriptive action.

Some of the "indicator" metrics we can use to "diagnose" possible problems in the built environment that affect its social and economic sustainability:

- Longevity
- Morbidity
- Rates of suicide
- Rates of treatment for depression
- Rates of other psychological disorders
- Rates of substance abuse
- Rates of crime
- Rates of poverty
- Indicators of social capital, including
    - Numbers of social groups
    - Percentages of membership in social groups
    - Ability of strangers to cooperate and share resources
- Self-reported well-being
- Economic vitality

The factors of so-called "social capital" are particularly important. It appears that higher social capital is closely associated with higher resilience. People in distress are more able to rely upon each other to meet needs, and more likely to work cooperatively to solve problems and recover from adversity. Research shows that the built environment does play a role in facilitating the formation of social capital. Environments that isolate people do a poor job of facilitating social capital. Environments that allow people to share public spaces safely, and to interact in moderated ways, seem to facilitate the growth of social capital.

Research is painting a clearer picture about the comparative advantages of a walkable environment with a well-designed, functional public realm.

Qualitative and "Biophilic" Components of Urban Sustainability

Finally, we must remember that sustainability is about being physically and mentally well, as much as it is about merely surviving. If we are not well, then by definition

something is going wrong, something that may well rise to the level of a threat to sustainability. From an evolutionary point of view, our ability to feel well or unwell is a biological capacity to recognize these factors, even when we do not do so consciously or rationally.

It used to be thought that our qualitative evaluation of an environment didn't matter much: it might add to our pleasure, but it didn't seriously affect our well-being. We now know, through evidence-based research, that the perceived quality of our environments can have a measurable effect on our psychological health, and even our physical health.

In particular, the characteristics of what is called "biophilia" – our innate love of natural and biological forms – are now well-known to have a marked effect on well-being. For that reason, biophilia is now a major trend in the design of hospital and patient care environments, which incorporate water, vegetation, sunlight, and other characteristics of "natural" environments.

By contrast, sparse, antiseptic environments can have a negative effect on well-being and health. In one famous study, patients on a recovery ward with a view of a blank wall healed more slowly than those with a view of a natural scene with trees. Other studies show similar results for alien, unfamiliar kinds of environments.

There are likely to be important implications for the creation of sustainable environments.

Putting It All Together

As we saw with the topic of resilience, there is one more vitally important characteristic of urban sustainability, and of sustainability in general: it is a complex product of many factors working together. It is not a mere addition of parts, but has the characteristics of a system. The system includes our urban systems, but also includes behavior and consumption patterns that extend beyond the urban system. (If we buy goods from overseas, or ship our waste overseas, we need to assess these overseas impacts too.)

What this means is that, as designers, we are not able to simply add up numbers by themselves, and satisfy ourselves that our work is "sustainable." Sustainability is not a formula. Rather, it is a state like health, that is dynamic and complex. It has to be continuously measured, and the factors that promote it will very likely need to be continuously adjusted.

But like health, sustainability is also a characteristic that develops under its own laws of resilience and equilibrium. Sometimes the best thing we can do is to know when to do nothing, and let people or places develop on their own. Sometimes we can give just a nudge, and the environment will do the rest. Sometimes we will have to take more aggressive action.

In any case, we need the tools to be able to manage this complex condition. We need to be able to diagnose what is happening, using the metrics and the tools that are appropriate for a given region. We need prescriptive tools too, including new technologies, new designs, and new economic and social tools.

Sustainability plans have become important tools to assess and improve the sustainability of a city, neighborhood or other area. A detailed discussion of such tools is beyond the scope of this overview, but following are the kinds of elements they might include:

Diagnostic assessment tools
- Ecological metrics
- Economic metrics
- Social metrics
- Qualitative metrics

Prescriptive tools
- Master plans
- Regulations
- Codes
- Economic incentives
- Social incentives (e.g. certification systems)
- Social capacity-building resources

As designers, we need to be able to work with other specialists – economists, social scientists, ecologists, engineers and others – to be able to develop designs and design approaches that will enhance the sustainability of a place. As consultants, we need to be able to develop framework approaches, combining analytical tools, diagnostic assessments, prescriptive tools and other resources to enhance the capacity of the community to improve its own sustainability.

<u>Additional Reading (Optional):</u>

Van der Run, S and Cowan, S. Ecological Design. Island Press, New York, 2005.

Farr, D. Sustainable Urbanism: Urban Design with Nature. Wiley, 2007.

Questions

Instructions: Download and open the document titled "Exam Questions" that is also included with this document on the ESUA website. Fill in your name, and answer the questions. Then type in your essay question responses. Email the completed and saved document, saved under your last name, to your course instructor. (See the website for details.)

Multiple Choice questions (20 questions, 4 points each)

1. The built environment plays a dominant role in the question of sustainability because
    a. Architects feel a special responsibility to help promote sustainability
    b. The built environment changes slowly, and therefore it must be made sustainable
    c. A major portion of resources and energy use results from characteristics of the built environment
    d. All of the above

2. The Brundtland Commission defined sustainability as
    a. Highly efficient use of energy and resources
    b. Protecting the natural environment
    c. Ensuring that buildings are built in a way that allows adaptive use by future generations
    d. Meeting the needs of the present without compromising the ability of future generations to meet their own needs

3. The Brundtland Commission definition included which of the following concepts:
    a. The concept of needs, especially by the poor
    b. The concept of re-use and recycling of resources
    c. The idea of limitation of technology and social organization on the ability to meet needs
    d. A and c but not b

4. The "triple bottom line" of sustainability includes:
    a. Ecological, social and economic factors
    b. Architectural, engineering and financial factors
    c. Human, animal and plant factors
    d. All of the above

5. The author says that ecological sustainability is in a different class because:
    a. Ecosystems can be damaged beyond repair
    b. Species can become extinct
    c. Humans can lose resources and services
    d. All of the above

6. Resilience is defined here as
    a. The ability to recover from bending
    b. The ability to recover from poison
    c. The ability to recover from damage
    d. None of the above

7. Examples of interactive effects which may increase the effects of climate change include:
    a. The deforestation of the Amazon
    b. The release of methane in ocean beds
    c. The increased growth of plants and algae from higher CO2 levels
    d. A and b but not c

8. In 2009 the level of "CO2 equivalent" greenhouse gas was:
    a. 220 parts per million
    b. 380 parts per million
    c. 450 parts per million
    d. 560 parts per million

9. The difference between mitigation and adaptation is:
    a. Mitigation is finding ways to cope with climate change
    b. Adaptation is finding ways to cope with climate change
    c. Mitigation is finding ways to avoid climate change
    d. b and c

10. Examples of location efficiency include:
    a. Jobs to housing balance
    b. Optimal distribution of schools, shopping and other daily needs
    c. Optimally efficient regional distribution
    d. All of the above

11. Which is not a low-carbon building characteristic?
    a. They are attached
    b. They are solar-oriented
    c. They reduce wasted space around them
    d. These are all low-carbon characteristics

12. Which of the following is *not* an example of infrastructure efficiencies?
    a. well-connected street network
    b. well-insulated buildings
    c. ability to capture waste heat
    d. well-connected multi-modal transportation system

13. Which of the following is an example of ecosystem services?
    a. Purification of water by wetlands
    b. Pollination of crops by bees
    c. Regulation of atmospheric composition by plankton and algae
    d. All of the above

14. Albedo effect is :
    a. The tendency of darker surfaces to convert solar energy to heat energy
    b. The tendency to trap heat in urban areas
    c. The negative effect of tall buildings
    d. All of the above

15. Which of the following are *not* reasons discussed here why behaviour may be an important factor of low-carbon sustainability?
    a. A more compact urban lifestyle may encourage a more selective consumption pattern
    b. If we live in a neighbourhood where it is easiest to drive, then we may get into the habit of driving more
    c. If we watch too much television, we may be persuaded to consume more
    d. If we live in an appealing neighbourhood with inviting walkable streets, we may get into the habit of walking more

16. Which of the following is *not* a metric discussed in this section?
    a. Vehicle Kilometres (Miles) Traveled
    b. Non-tailpipe emissions per person
    c. Cost of housing per person
    d. Domestic energy per person

17. Which indicator metrics of social and economic sustainability were not discussed in this section?
    a. Morbidity
    b. Rates of suicide
    c. Rates of crime
    d. Rates of extreme wealth

18. Biophilia is defined as:
    a. The innate love of natural and biological forms
    b. The innate love of cities and towns
    c. The innate love of the countryside
    d. None of the above

19. Which of the following is *not* true about biophilia?
    a. A famous study showed that some patients healed faster in the presence of a natural scene with trees
    b. It is known to have a marked effect on well-being
    c. Our qualitative evaluation of an environment doesn't matter
    d. Biophilia is being used successfully as a strategy to promote healing

20. Which of the following is *not* true of sustainability, as the author discusses it in the final section?
    a. It is the product of many factors working together
    b. It develops under its own laws of resilience and equilibrium
    c. It is not a formula, but more like a state of health
    d. It is mysterious, and can only develop on its own

Essay Questions (1 paragraph each):
‘

1. What do you think will be required to achieve sustainability in 500 years?
2. What do you think the author means when he says we need to act as "gardeners" and not just "carpenters?"
3. Do you think contemporary buildings are as resilient as those from 200 years ago, on average? Why or why not?
4. How is climate change linked to other unsustainable activities and effects?
5. Why is biophilia related to climate change?

Evolving Settlements
Participation and Emergence in the Human Environment

How to Use This Module

This is the fourth e-learning module for a series of courses in urbanism, architecture and
building crafts known as the "European School of Urbanism and Architecture." The programme was designed for new students to the study of urbanism and building, and for
professionals and practitioners who wish to increase their level of understanding of important new topics in best practice. More information in this programme is available at
www.esua.org.

If this is your first time learning about this subject, and you find this module interesting,
you will have the option to take more modules on line in the future. But this on-line element is really only a part of the full course of study. This module is designed to be integrated with a hands-on learning programme that will allow you to learn in the most
effective way known: "learning by doing." You will have the opportunity to participate in
field studies of actual projects, working alongside leading practitioners, and using the latest tools and techniques.

This module is specifically designed as an introductory course for those coming to study
in the programme, but may be taken by others as well. The full project-based curriculum is now in the pilot phase, and is planned to be launched as a full-time programme after several years of development. You can learn more at www.esua.org.

Each e-learning module begins with a short reading, and then gives you links to additional reading. The final examination includes a short multiple-choice section, and a
written essay portion that you can enter through a form, or email to the course instructor
as a text document.

Introduction

Are settlements planned, or do they evolve?

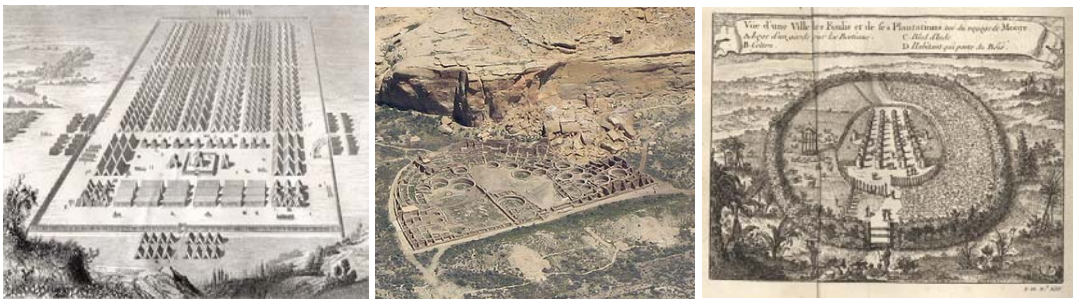
Of course the answer is that they do both. How they do so, and in what combination, is the subject of this e-learning course. In particular, we will examine how people work together to develop a settlement: not only the architects and urban designers, but the other participants in the planning, building and maintenance of the environment. And we will consider how this engagement has changed in recent

years, with more involvement from members of the public, and the challenges and opportunities that this presents.

The Planned and the Unplanned: A Historical Fugue

Settlements have always involved a degree of planning, from the very beginning of agricultural civilization. Indeed, the origin of planned settlements can be dated at roughly ten thousand years ago, with the careful planning of the first irrigation systems. Much of what we think of as civilization followed from the needs generated by this planning: the requirement to serve a political authority (in this case a water bureaucracy), the definition of legal rights and administrative obligations, the duty to pay fees or taxes, and the need to establish and maintain infrastructure, streets and public spaces.

History since then has been full of diagrammatically planned settlements: the regimented, linear military encampments and city-states; the carefully solar-oriented complexes of Anasazi sites; even the huts of simple agricultural villages. But history has also exhibited emergent patterns of urbanism throughout – often starting with the emergent patterns of natural terrain, or the paths of animals, and including the evolutionary accretions of individual builders over time.



Diagrammatically planned settlements: (L-R) Roman Castra, Anasazi settlements, African villages.

Medieval settlements (seen in the cores of many older cities today) are particularly striking for their complex wending geometries. These often emerged from the additive accretions of successive builders, who did not necessarily follow the exact angle of their neighbor – but who did follow a logic in the layout (such as a minimum road width, a maintenance of sun, and other rules), and that logic became evident in the complex pattern.

Moreover, it is clear now that the deeper logic of the patterns was not always intentional. Some of the most efficient urban characteristics – such as an optimal distribution of shops and services – emerged from the natural distribution and behaviors of residents, which tended to reward some locations over others. Refinements over time often winnowed out all but the most visible, and therefore most successful, sites.

A medieval town: Ronda, Spain

The complex connectivity of the street system also emerged in this way: owners tended to seek more global connectivity for their own local place, and hence were more willing to make through connections of local streets. Often half a lot on a busy through street was much better than a full lot on a dead-end street.

Self-Organization in Nature

What is significant is that all of these "bottom-up" processes tended to create an over-arching order throughout the urban system. We can see the same kinds of processes occurring in the natural world -- in the adaptive processes that create optimization in an ecosystem, for example, or in an evolving organism.

Often such over-arching order results from the application of very simple rules. For example, the birds within a bird flock can follow simple rules about spacing with neighbors. But as the flock moves, it can form remarkable ripple-like patterns that extend across the entire flock. A simple local rule is creating a strong global pattern.

On the other hand, nature also certainly has its "top-down" processes – those that execute a single act that has the effect of ordering many other elements. A river cuts through a bank, and creates a long, serpentine line. A volcano builds up a large, symmetrical cone. Even a bird flock will have a single leader, whose movements are propagated through the matching movements of many other birds.

The bird flock is an example of a combination of top-down and bottom-up effects – and they are common in nature too. Along with the top-down effects of a river, the bottom-up effects of trees create a more varied pattern of green along the serpentine bank. The effects of rain create patterns of wending streams on the face of the volcano. And so on.

Top-down and Bottom-Up in the City

The same is true, certainly, in the City. Top-down authorities often create roads, or impose codes on citizens about how they may build, and where. But them bottom-up; forces arise to actually carry on the building, roughly conforming to the top-down structure, but with significant variations along the way.

The situation is a bit like that of a gardener, creating trellises, doing pruning, cutting paths through the growth. But then the growth occurs along the trellis or the pathway. The gardener, too, may facilitate this "bottom-up" growth, using seeds and fertilizer, doing a bit more pruning, weeding, and so on. In this way, the gardener is combining top-down and bottom-up, in a kind of iterative process. And the result is both more adaptive, and more orderly.

Many of the most loved cities employ this combination of top-down and bottom-up forces. Paris, for example, had a very intense medieval core, with many wending streets. In the time of Napoleon III, Baron Haussmann ordered new streets to be cut through the medieval core, but leaving much of it intact. The result is the highly

regarded structure of Modern Paris, with its grand boulevards, and its quiet, charming medieval back streets. The combination itself is its strength.

Many other cities went in the other direction, adding bottom-up to a strong top-down form. The Roman Castra, for example, were fort cities made with simple, distinctive cross-street patterns. By our standards, we would think of them as highly regimented. But the areas between the streets tended to fill in with wending medieval streets – and this pattern can be seen in many historic European cities today.

A former Roman castrum: Chichester, UK

Top-down in the Age of Democracy

But there is one key difference in the forces of urbanization in the modern age: in many parts of the world, it's no longer so easy for a Baron Haussmann to command huge roads to be cut through the city. Citizens are deemed to have rights to shape their own environment, and to resist the planning authorities when they have grand schemes that might compromise the citizens' quality of life.

The establishment of rights in the built environment was a slow and painful process. In the USA, the legendary Parks Commissioner of New York, Robert Moses, was able to successfully force through several very large road projects, until he was finally stopped by a citizens' group led by the urban scholar Jane Jacobs and others in the early 1960s.

The problem for urbanists is that this recognition of rights creates the ability to stop bad projects – but it also creates the ability to stop good projects. One person, with a particular narrow interest, may block a much larger project that benefits many more people. For example, a new urban extension may benefit from high connectivity to the existing neighborhood – but a resident living along one of the existing streets may object to increased traffic in front of their home. Thus a small negative is allowed to block a larger positive.

There is a principle at work in such processes that is known as ***subsidiarity***. It means that decisions that affect only the homeowner and their immediate neighbors should be left for them to decide – but issues that affect the larger community, such as the road connection, should be decided at the level of the larger community. Care must be taken to minimize harm to those at a subsidiary level; but at the same time, their narrow interests must not be allowed to obstruct the pursuit of larger goals. An optimum balance must be achieved.

One of the largest goals is to secure the quality and safety of the public realm. This is in fact essential to the creation of a successful city or town. The problem is that "the

public" is an abstract group, which can easily dissolve into a collection of individuals, all looking out for their own narrow interests. Therefore, some process needs to be established, where individuals with narrow interests can work together to balance those interests with larger interests they share.

Charrettes and Participatory Design Processes

One such process is the design charrette, or (as it is known in the UK) the Enquiry by Design. The goal of such a process is to bring together the stakeholders of an area (residents, businesses, NGOs, political leaders and so on) with the specialists who can create and implement a design (urban designers, architects, engineers, economists, and so on).

The aim is to develop very specific design concepts, through a cycle of inputs, hypotheses, testing and refinement. Charrettes are often completed in an intense period of one to two weeks, with a preparation period of research, and a follow-up period of detailed execution. Often the smaller components that are identified in an initial charrette will become the subjects of their own more detailed charrette.

A distinguishing feature of charrettes and Enquiries by Design is that they are not only collections of intentions or aspirations. They are actual design processes, and their development of ideas is always grounded in specific design proposals. This has the important advantage of being able to solve the problems that often cause purely aspirational goals to fail.

If a community, say, wishes to have a pedestrian crossing in a certain area, and the street authority says that this is not possible, then the community can, on the spot, ask the street authority to show where such a crossing would be feasible – or perhaps, what design changes would make it feasible in the original location.

In this way, the actors who, in a more serial process, might gradually subtract from an aspiration and leave it as a minimal compromise, instead become collaborators in a real-time problem-solving process, which is able to explore many more alternatives to address the problems.

The process has been shown to be remarkably effective in producing good designs that are much more likely to proceed to implementation.

Of course, other unknown factors can arise that prevent a design from being completed, or that change the set of opportunities that were understood at the time of the design. For that reason, it is important to think of the charrette process as continuing through implementation, with the original participants able to convene by telephone or email, or in smaller groups in person. In rare instances, it may be desirable to re-convene the entire charrette team.

Other collaborative tools: the Urban Code

The master plans created by charrettes can be thought of as “top-down” methods of guiding a construction. But there are other, more flexible tools that can be created, either by a charrette process, or by other community processes. They serve to orchestrate, and in some cases to generate, the actions of many individual entities as they build houses, businesses and other elements of a neighborhood or city. One of these tools is the urban code.

A code is, very simply, a set of instructions that guide actions. One simple code might specify colors, or materials. Another might specify where one can build on a lot. Yet another might actually include a “menu” of design options, among which the builder can select their choices.

Urban codes have existed for millennia, and it’s clear that the qualities we love about many cities stem from the specifications of their codes. For example, the colors that most people find so alluring about Siena, Italy, were specified very precisely in that city’s code, along with other features of that city.

More recently, urban codes began to specify what uses could take place on given pieces of land. These so-called “segregated use” codes had a profound effect on urbanism, because they had the effect of fragmenting the City into functional zones. One worked in one part of the city, slept in another part, shopped in still another part. The result was that daily movement vastly increased – propelled by the automobile – and the scale of buildings and public spaces also increased. The resulting fragmentation is what we now know as “sprawl.”

As a reform of this problem, a new generation of “form-based” codes has recently become prevalent. Like the earlier generation of codes, they specify density, volume, height, setbacks from streets and property lines, and other “parametric” requirements. But they do so in a much tighter configuration, with buildings re-oriented to the street and the pedestrian realm.

Moreover, unlike the earlier use-based codes, form-based codes do not specify use, and in fact they encourage mixed use. That means that residential, retail, office, civic and industrial uses can all be more optimally mixed and spaced, so that individuals on average do not have to travel very far, and can often do so on foot, or on transit.

Generative Codes

But some critics have noted that form-based codes still do not account for the variations that individual builders might make in their constructions. At best the form-based codes create a minimal coherence of building groupings, street walls, and building features like balconies and the like. At worst, say the critics, such codes can be overly regimented and mechanical.

The architect Christopher Alexander has proposed a “generative code” in response, which functions more as a set of rules for responding to a previous set of conditions.

In such a code, each builder will have requirements for responding to previous builders in a much more contextual way.

The architect and urban code scholar Besim Hakim has described how medieval codes worked in a similar way. They provided rules for responding to previous acts, with ethical standards for avoiding harm – for example, avoiding the shading of an adjacent yard, or the placement of a window to violate privacy, and so on.

Such codes can offer big advantages in very dense urban environments, where the residents seek to avoid a high degree of regimentation. Such a generative code allows much more complex patterns of morphology, and can accommodate a complex inter-penetration of public and private spaces – for example, small pedestrian passages, bridges, overhead room extensions, and so on.

Generative Tools – Pattern Books, Pattern Languages

In addition to codes, we can also create other flexible design resources, that do not specify exact designs, but rather, specify the elements of a design, together with the way they go together. One such resource is the pattern book, which was developed and used successfully by builders for many decades, notably in the Nineteenth Century. The pattern book offers particular collections of designs, together with rules for their combination. A given pattern book might be configured for a given region, a given kind of building, or a combination.

Pattern books originally focused on individual buildings. More recently, urban pattern books (developed by Urban Design Associates in the USA, and others) have been used to guide the design of urban areas. They can specify characteristic street geometries, public spaces, building types and locations, colors, materials and other elements.

Pattern languages were developed by the architect Christopher Alexander, and are more configurational, usually less geometrically precise, specifications of design solutions. They have proven enormously effective in computer software design, and in other fields. Recent work in architecture and urban design has sought to broaden the subjects they cover, and enlist a wider set of collaborators in their development. The 1977 book by Alexander and his colleagues, *A Pattern Language*, has certainly proven highly influential to a generation of architects and new urban designers.

Conclusion: Adaptive evolutionary environments

In thinking about evolving settlements, it is important to note that not all structures are able to evolve to the same degree. Some structures are very rigid, and don't accommodate much change. Some others are so plastic that they seem to be in a continuous process of change. It seems that an optimum range is somewhere in between, such that buildings can evolve and adapt to new conditions, while at the same time retaining important problem-solving information when it remains useful.

Designers often err on one side of this balance or the other. Most common in contemporary practice, designers tend to exaggerate the need for novelty and so-called "creative solutions." But many problems in the built environment are not new, and do not change much over decades or even centuries. The essential biological and psychological needs of human beings are fairly constant. The essential cycles of the planet are certainly constant: the cycle of the day, the cycles of the seasons, the presence of sun at certain angles at different times, and so on.

Evolutionary processes in nature are very highly adapted to these patterns. Structures within animals change when these patterns change, but often do not change otherwise – and often this is true for many millions of years. Human beings, for example, evolved rapidly over just a few million years, as the forests of Africa gave way to more open savannahs. (Of course the evolution of human technology has been much more rapid still.) By contrast, many sharks, turtles and crabs have barely changed over hundreds of millions of years.

It seems there is a range of rates of change that designers must understand, and try to respond to. Some things in the human environment will change very rapidly: clothing, for example, generally does not last longer than several years, and so can be made with new designs that change in style and fashion. At the other extreme, the natural setting of a settlement will likely not change for hundreds of years, perhaps longer, and so the human response to the natural conditions should remain adaptive to this stable condition.

The author Stewart Brand has described these rates of change in his book, How Buildings Learn. When we misunderstand the proper rates of change, he says, something like a "stripping of gears" occurs. Our buildings become too dependent on rapidly-changing fashions, and are in danger of becoming dated. This damages their adaptive ability and their ability to retain important problem-solving information. In effect, we induce a kind of amnesia in place of the problem-solving intelligence that has been built into the human environment through its evolutionary processes.

The psychologist Abraham Maslow made a related point when he described the "hierarchy of needs." Human beings need art, but before they need art, they need shelter. Before they need shelter, they need food and water. These more primary needs must be satisfied, or else the preconditions for the less primary ones will not be present.

The built environment must take this hierarchy into account. It must, in effect, do a job as a part of the natural world in which humans reside. It must contain artistic expression, because that is an important human need – but before that, it must provide for shelter, social contact and other needs.

Biophilia

The psychologist Erich Fromm has described the phenomenon of "biophilia," the love of natural characteristics – that is, the evolved instinctual preference by human beings for certain kinds of natural environments. The biologist E.O. Wilson has described these in more detail, and they include such qualities as access to vegetation, water and

sunlight, sense of refuge combined with vista or prospect, and presence of certain kinds of geometric patterns that exist in nature (such as fractal patterns).

Designers of health care environments found strong evidence of the importance of these biophilic properties when the measured rates of patient recovery in different environments. In one widely-noted study by the environmental psychologist Roger Ulrich, patients on one side of a recovery ward with a view of trees recovered from surgery more quickly, with measurably fewer drugs required, than patients in the same ward with a view only of a wall.

Evolutionary design: Retaining success, removing failure

All of the tools and methods described in this module have in common the ability to add useful information to a design, so as to evolve it in better adaptation to the needs of human beings. The charrette and other participatory designs give designers the ability to work with real users to uncover important local and human information that is needed. The pattern books and pattern languages offer ways of coding successful solutions and other useful information so that it can be retained and re-used in a coordinated way. The urban code is also a way of coding information, and its rigidity can be compensated for with the use of more generative methods.

Finally, we have seen that settlements are a weave of evolutionary processes, some of which are planned by human beings – that is, some of which are intentional and pre-meditated – and some of which are more "emergent". Perhaps the most useful new approach we can take now is to combine these two kinds of processes, in a larger, more transformative kind of process -- one in which we don't know the specific result, but we know that the process is likely to produce the intelligent characteristics that we seek. As we confront complex phenomena like climate change, it appears that this kind of approach offers us an important new opportunity. It broadens and deepens what it means for us to design.

Questions

Instructions: Download and open the document titled "Exam Questions" that is also included with this document on the ESUA website. Fill in your name, and answer the questions. Then type in your essay question responses. Email the completed and saved document, saved under your last name, to your course instructor. (See the website for details.)

Multiple Choice questions (20 questions, 4 points each)

1. Are settlements planned, or do they evolve?
    a. They are planned
    b. They evolve
    c. Both A and B
    d. Neither A nor B

2. Settlements have featured some degree of planning since
    a. The Renaissance
    b. Roman times
    c. The dawn of Classical civilisation, approx. 3500 BC
    d. The dawn of agricultural settlements, approx. 10,000 years ago

3. Examples of diagrammatically planned settlements include
    a. Military encampments
    b. Anasazi sites
    c. The huts of simple agricultural villages
    d. All of the above

4. The wending geometries of medieval cities emerged from
    a. The strict codes of military rulers
    b. The additive accretions of successive builders
    c. The application of complex diagrams
    d. None of the above

5. Some of the most efficient urban characteristics of medieval cities
    a. Arose from their very high density
    b. Resulted from ancient codes
    c. Emerged from the natural distribution and behavior of residents
    d. All of the above

6. The complex connectivity of street systems could emerge because
    a. Owners were rewarded for increasing global connectivity by building street segments
    b. Governments could provide incentives for street-building
    c. People could gradually identify the best places for streets
    d. All of the above

7. Which of the following is true:
    a. It is impossible to create an over-arching order through bottom-up processes alone
    b. Self-organization is a very rare phenomenon in nature
    c. You cannot have both top-down and bottom-up
    d. None of the above

8. Top-down structure in the city is like gardening in which of the following ways?
    a. Creating trellises
    b. Pruning
    c. Cutting pathways
    d. All of the above

9. In many parts of the world, top-down actions can no longer be taken without
    a. Amassing political power
    b. Recognizing democratic rights of citizens
    c. Paying citizens for their confiscated land
    d. All of the above

10. Subsidiarity means
    a. Decisions should be made at the level where they have greatest impact
    b. An optimum balance must be struck between the rights of some and the rights of all
    c. Narrow interests must not be allowed to obstruct the pursuit of larger goals
    d. All of the above

11. Which of the following is not true about charrettes?
    a. They contain a cycle of inputs, hypotheses, testing and refinements
    b. They are so complete that they usually do not require follow-up
    c. They bring together professionals and local stakeholders
    d. They are completed in an intense period, often one or two weeks

12. A distinguishing feature of charrettes is
    a. They allow brainstorming of ideas
    b. They give everyone a chance to offer their ideas
    c. They can stretch over many months
    d. They are actual design processes grounded in specific proposals

13. “Segregated use” codes had a profound effect on urbanism because
    a. they allowed features like colors to be harmonized
    b. they existed for millennia
    c. they fragmented the city into functional zones
    d. none of the above

14. Form-based codes are primarily different from most earlier codes because
    a. They do not specify uses
    b. They specify parametric requirements
    c. They separate workplaces from residences
    d. They act as “generative” codes

15. Which of the following is true about generative codes?
    a. They are rules for responding to previous conditions
    b. They have a precedent in medieval codes
    c. They can offer advantages in dense urban environments
    d. All of the above

16. Pattern books are
    a. collections of designs, together with rules for their combination
    b. books of building plans
    c. written by Christopher Alexander and colleagues
    d. none of the above

17. Which of the following is true about pattern languages?
    a. They have proven effective in computer software design
    b. They are more configurational specifications of design solutions
    c. They have proven influwntial to a generation of architects and urban designers
    d. All of the above

18. It is important to design with rates of change in mind because
    a. some things never change
    b. people like to see changes in fashions
    c. different components have different lifespans
    d. all of the above

19. Biophilia is
    a. the imitation of biological forms
    b. the instinctive fear of biological forms
    c. the instinctive preference for biological forms
    d. all of the above

20. The author concludes that evolutionary design means
    a. designing in a more biological pattern
    b. retaining success and removing failure
    c. removing emergence from design
    d. removing top-down planning from design

Essay Questions:

21. What does the author mean by the term “historical fugue?”

22. Can you give an example of self-organisation in a city?

23. To what degree do you believe planners should be required to take residents’ views into account? What if they stop good projects?

24. Do you think the charrette is a helpful tool in the planning process? Why or why not?

25. Why is Maslow’s hierarchy of needs important for planners and urban designers?

The DNA of Place

An introduction to the topics of local identity and heritage, and their continuing importance for the human environment

How to Use This Module

This is the fifth e-learning module for a series of courses in urbanism, architecture and building crafts known as the "European School of Urbanism and Architecture." The programme was designed for new students to the study of urbanism and building, and for professionals and practitioners who wish to increase their level of understanding of important new topics in best practice. More information in this programme is available at www.esua.org.

If this is your first time learning about this subject, and you find this module interesting, you will have the option to take more modules on line in the future. But this on-line element is really only a part of the full course of study. This module is designed to be integrated with a hands-on learning programme that will allow you to learn in the most effective way known: "learning by doing." You will have the opportunity to participate in field studies of actual projects, working alongside leading practitioners, and using the latest tools and techniques.

This module is specifically designed as an introductory course for those coming to study in the programme, but may be taken by others as well. The full project-based curriculum is now in the pilot phase, and is planned to be launched as a full-time programme after several years of development. You can learn more at www.esua.org.

Each e-learning module begins with a short reading, and then gives you links to additional reading. The final examination includes a short multiple-choice section, and a written essay portion that you can enter through a form, or email to the course instructor as a text document.

Introduction

Every act of building destroys something that came before. At the same time, perhaps paradoxically, almost every act of building incorporates some of what came before too. How are we to understand the relation between these two apparent opposites? How are we to balance them in practice?

In particular, how important is it to retain and to build upon aspects of what came before, as a unique expressive pattern of a local place?

Many contemporary methods of design and building emphasize the new aspects of what is built – the promise of innovation, the hope of improvement, the removal of what was painful, or what is simply no longer valuable. Indeed, modernism as a design movement – the dominant movement of the 20th Century, which is still highly influential - has contained within it a powerful impulse to celebrate the new, and to sweep away the old. In turn modernism recognised and sought to celebrate the fact that technological innovation, in itself, often generates its own "creative destruction," sweeping away what came before so as to allow for rapid growth.

But of course, this can be very dangerous. As we have seen over the last century, the promise of the new can be unfulfilled. What we regard as outmoded may simply be temporarily out of fashion, but may return to offer a stronger, more enduring value. The problems we associate with particular existing structures may in fact be repairable, while the promise of a new start – a "tabula rasa" – proves an illusory fantasy, lacking the richness of a real place, and the quality of what came before.

In a global age, this problem is compounded. The latest internationally fashionable architecture can become dominant, taking the place of locally differentiated architecture. The result can be a language of architecture that has no particular relation to a given setting, or worse, has highly incompatible features. As one notorious example, we can get buildings with extensive glazed curtain walls in hot desert regions. Therefore this can be a very serious obstacle toward the goal of more sustainable settlements.

Moreover, there is reason to worry that this homogenization can prove highly damaging to the heritage and local identity of such places. The meaningful and cohesive urban pattern that has grown over centuries can become fragmented and degraded. This is not only a cultural concern, but equally an economic one: it may severely damage the ability of such places to attract and hold viable economic activity, such as heritage tourism.

The damage can also be ecological. Instead of locally available materials, such buildings may rely upon imported materials with high levels of "embodied" energy. While some imported materials may appear to be long-lasting, maintenance costs may be high, and require more imported materials. Because the global architecture generally takes an iconic, sculptural form, the ability to be modified and adapted to new uses can be highly constrained. There is also evidence of a poor ability of materials to wear well over time, and to continue to be regarded as attractive, desirable and worthy of care.

Lastly, there are questions about how well such buildings perform in supporting a coherent and sustainable urban fabric -- one that allows neighborhoods that are more compact, walkable, mixed-use, transit-served, and sustainable on other metrics.

We have seen many such failures over the last century, and the results have been impoverished environments for human beings – at best degrading the quality of life for those living in them, at worst having to be torn down mere decades after being

built. This is of course the antithesis of sustainability. Moreover, on some level, it is a failure of our professional duty to make the built environment an increasingly better place.

Today, in the age of sustainability, we cannot afford to repeat such failures. While we cannot hold onto the past, neither can we afford to throw away valuable treasures whose replacements are, on the face of evidence, inferior. We need a more intelligent combination of the old and the new. We need vibrant, attractive, efficient, low-carbon places, that will promote the well-being of our clients, and of the community as a whole.

Today we have new understanding of the enormous economic value of heritage structures – for example, for tourism and business recruitment - and of their other qualities. We have a growing appreciation for the social and ecological benefits of many heritage structures and patterns. And we have a new understanding of the value of building on context, within the architectural context as well as the context of nature and ecology.

Such lessons come home most powerfully in the recovery of areas damaged by natural disaster – for example, areas hit by earthquakes, hurricanes or tsunamis. In these places there is an urgent need to rebuild quickly, and to incorporate new technologies that are more resistant to natural disaster in the future. This can translate into inferior, unsustainable architecture, that degrades the overall quality of the built environment. But with the right tools and approaches, evidence shows, this need not be the case.

This module will discuss these insights, and their implications for our work to shape the built environment.

The Lessons from Biology

> *"People used to say that just as the 20th century had been the century of physics, the 21st century would be the century of biology... We would gradually move into a world whose prevailing paradigm was one of complexity, and whose techniques sought the co-adapted harmony of hundreds or thousands of variables. This would, inevitably, involve new technique, new vision, new models of thought, and new models of action. I believe that such a transformation is starting to occur... To be well, we must set our sights on such a future."*
>
> *- Christopher Alexander, The Nature of Order*

The science of physics describes well the ways in which bodies interact in a space. If we have two billiard balls on a table, we can describe their motions and dynamics in relation to one another very accurately. We can also remove the two billiard balls and replace them with a new pair, and describe their dynamic relationship in an identical way, with equal confidence. It isn't important that the white ball is a different white ball; with respect to the mathematical pattern of its relationship to another ball, it is interchangeable.

But in the realm of biology, things are usually much more complicated. At any given point, we are generally dealing with a structure that exhibits evolutionary complexity. There is a kind of "tissue' of growth, containing an organic web of connections that is in fact far more important than the constitution of the elements that make it up. Indeed, few such elements can be isolated in an elementary or mechanical way, without a profound effect upon them, and upon the system in which they are embedded.

Here is a simple example that illustrates the point. If I am working on a car built of standard parts, I can take the car apart and re-assemble it, and it will very likely run perfectly again. But if I take apart a cow, and then stitch the cow back together, I find that it will not "moo" again. In the process of disassembly, I have destroyed a complex web of adapted connections – a structure on which the life of the system depends.

Surgeons do indeed sometimes replace organs with other organs. But they must do so with the greatest care to continuously maintain the integrity of the organism, and the function of all the other organs during the process – often with highly complex secondary procedures and technologies. They must take the greatest care with tissue matches, blood types and other contextual factors. And they must adapt their own procedures carefully and continuously to the health of the patient – the heart rate, gas absorption, temperature and many other factors. To do this they are making constant adjustments, and constant adaptations, to the health of the patient.

In the built environment, it now appears that something not so different is going on. Parts of a city do indeed grow in adaptive equilibrium with others, and we cannot just sever some aspect without threatening the vitality of other parts. The city is not a machine, in the sense of being a collection of interchangeable parts. It is much more like an organism – contextual, interconnected, and in a sense, living. In any case, it is certainly an extension of our own living processes – and as we are now learning, it can have a profound effect upon our own health and well-being.

One of the characteristics that a city must adapt to is its unique location: its climate, terrain, views, vegetation, materials, culture, and so on. All of these together produce a strong local identity – a unique set of qualities for that place, forged of a unique set of local conditions. This local identity is not a mere appearance, but a reflection of the city's adaptive processes - the very things that make it vibrant, successful, and alive.

The natural setting is often the most obvious component of local identity. Consider, for example, Rio de Janeiro with its striking beaches and Sugarloaf Mountain; Venice with its lagoon setting; San Francisco or Vancouver with their powerful waterfront backdrops. But there are other, more subtle aspects of local identity too: the colors of the terrain and vegetation, the smells of flowers and plants, the sounds of birds – all of these make a unique mix, which is further compounded by changes in the seasons, and other changes over time. The resulting pattern is exceedingly complex, and as unique as a fingerprint.

Even more complex can be the cultural response to these natural factors: the characteristic materials, colors, features and details of the buildings and spaces; the

activities of people, as they go about commerce, recreation, festivals; the aromas of cooking, the sights and sounds of urban bustle, the sounds of one or more languages.

Because this is such a dynamic pattern, much of it is constantly changing. Yet much of it is not changing. Moreover, the way in which it changes is not one of mere ***substitution*** but one of ***adaptive evolution***. We will explore what this means – and why it is important to adjust our methods of thinking and action in response.

The Problem of Modernity

But modern technology often presents a problem. It is largely dominated (or has been, until only recently) by methods that are standard and interchangeable. This has produced great efficiencies, and great economies of scale: we can have large centralized factories, making the same standard things, going together in standard ways, regardless of the local context. This strategy has great advantages – particularly in the ability to generate large quantities at reduced costs. But it also carries severe limitations and risks, as we now see.

One of the most obvious results of modern methods of production and commerce is in the homogenizing effects of globalisation. City centers around the world are virtually indistinguishable – down to the ubiquitous Starbucks that looks and even smells the same, in New York, Beijing or London. Many new buildings seem to have little to do with their local context, and much more to do with the current artistic interests of an internationally active cadre of architects.

But other than presenting an odd sense of discord, is this really a problem? After all, globalisation has been with us at least since Genghis Khan and Christopher Columbus. (Tomatoes were not native to Italy, nor was tobacco native to England.) Many of the sights, sounds and smells we associate with a particular place today in fact originated elsewhere. If we wanted an authentic local architecture for the Northeast United States, perhaps, we might insist on Algonquin lodges. (Though they too were likely derivative of Asian structures of millennia past!)

Thus the critical factor is not whether an element originates in a local context, but whether it has come to be adapted, through an evolutionary process, to the other elements of the local context. That is, it must be mutually adapted to a number of other variables working synergistically in a system – the characteristics of an ***organic structure***. And it must achieve this through ***adaptive evolution***.

It turns out that this capacity for adaptive evolution matters a great deal, because it is through such adaptations that a given element of a society becomes integrated and optimized. Thanks to the insights of evolutionary biology, we now understand that it is through such a process of responding to what came before, evolving mutations, and adapting them to fit, that structures can self-organize into highly efficient, ordered and successful structures. It is through such a process – and not merely the works of a few geniuses - that the great cities and other great artefacts of civilisation came to be.

As we discussed, it is a central characteristic of modernity that it has been reliant on a kind of technology that is much more elementary than this organic kind of process. It has been based much more on the standardisation and replication of parts, and the production of large quantities. (Remember the example of the car.) As noted, this is

indeed a very powerful form of technology – but if it is not coupled to adaptive processes, we may find that we begin to suffer very serious unintended consequences. We may, in fact, be headed for a global crisis. There is reason to think this is indeed the predicament we find ourselves in today.

Two kinds of technology: Linear, and mutually adaptive

Consider two different models of technology. (In practice they can be and are often mixed, but for these purposes we will consider them separately.) One is what we may call "top-down" – it identifies a goal, then determines a sequence for implementation, and then proceeds in a categorical fashion: first the larger steps, then the smaller steps, then the final, smallest steps.

This is a hierarchical model – one that proceeds in a pre-planned, linear progression from larger to smaller to still smaller categories of action. There is no "backing up" and returning to modify steps. There is no "overlap" that allows one set of steps to affect another parallel set. Everything is planned ahead to be neatly contained within its categories, and to proceed according to the plan.

Another model might be called "bottom-up." It allows modification of steps at any point, in response to what is encountered. The elements of the steps can adjust to one another, and to what is found along the way. The smaller steps can even result in modification of the larger steps, based on what is found. The plan itself can change and evolve.

Moreover, what is found in one set of steps can affect a neighboring set of steps. The steps do not sit within planning "silos" but, in effect, "talk to each other" and allow mutual modification.

It turns out that many processes in nature, including most of the activities of cells within the human body, operate in this way. The cells that grow into the various tissues of the human body are not directed by a central blueprint, but follow a process of differentiation based on recipe-like instructions for responding to contextual clues.

Some other processes in nature are more like "top-down" processes: they impose a structure wholesale on the landscape, and then impose articulations from within that structure. The most obvious example is a crater formed by a meteor – a single dramatic event that is quite literally "top-down" -- which is then followed by complex processes of erosion, formation of streams and so on.

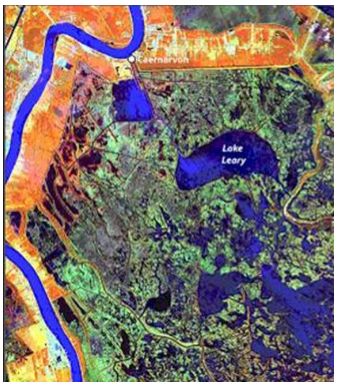
Many processes in nature combine both top-down and bottom-up aspects. For example, as a result of a flood, a river might cut a new channel through a delta area, leaving an island of silt – a top-down kind of process. Then vegetation might grow up on the island, in a chaotic, bottom-up way. Thus the overall structure combines both aspects.

Top down, and bottom up: stream channel, and trees

Humans have exploited the power of linear and hierarchical processes in our modern technologies, achieving great levels of productivity and economies of scale. We have paid less attention to the power of adaptive evolution, and indeed we have only

recently begun to understand its high problem-solving capacity and its many other advantages. But in fact we have exploited adaptive evolution in many of our traditional technologies – which turn out to be more sophisticated and potentially useful than we had recognised until very recently.

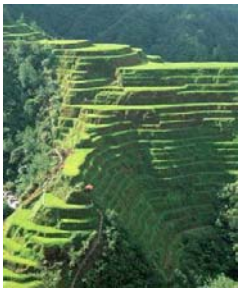
Consider the following two examples from human engineering practices. In the Mississippi Delta of the USA, shipping navigation was cumbersome, so engineers proceeded to construct a series of razor-straight canals through the delta. These were thought to be rational and superior to the "messy" conditions of the marsh. But in fact the marsh represented a highly complex ecosystem, with much adaptive ability to handle storms and other stresses on the system. They were in fact ***resilient*** systems – able to manage stresses.

So when Hurricane Katrina came in August 2005, the canals had destroyed the resilience of the delta. There was no longer any capacity to absorb storm surges, or protect trees against intrusion of saltwater, or do any of the other complex jobs that the delta had done. The result was a virtual "hurricane highway" that allowed Katrina to sweep into the heart of New Orleans, and very nearly destroy one of the world's great cities.

Note that it would be relatively easy to plan the canals that cut through the Delta. It would be much harder to plan the complex pattern of meanders and vegetation and other elements that form the Delta itself. It would be like trying to plan the structure of a very elaborate plant. Of course what nature does is simply to grow the pattern, without conventional top-down planning.

A second example comes from Asia, and the terraced rice paddies that are common on many steep hillsides in the Philippines, Vietnam and other countries. These paddies are quite complex, and they are built without conventional plans. Instead they are built in a stepwise process that follows the natural contours, and maintains a manageable wall height. They are then continuously repaired and maintained. The result is that these structures are very resilient and long-lasting, with careful maintenance over time. It can also be seen that they are very beautiful.

This engineering process may seem on the surface to be more "primitive," but in fact it is not. It is made up of many small step-wise adaptations that form a highly ordered, responsive and resilient pattern.

The latest technology is beginning to learn these lessons. As we discussed, medical procedures routinely follow such stepwise adaptive processes. The design of Boeing 777 aircraft, though standardised between planes, relied in its development upon a stepwise adaptive process in which engineers using virtual reality goggles and gloves crafted the fit between some complex parts of the aircraft. The field of biotechnology has also had to rely upon stepwise adaptive processes. This is a promising and exciting new trend.

Mutually adaptive technologies in cities

What are the lessons of these insights for cities? First, such adaptive evolutionary processes have already been at work, and have helped to produce – along with more top-down methods – many highly complex, highly functioning cities throughout history. Secondly, as the above examples from medicine and aircraft design illustrate, such adaptive technologies are still available to us today – and indeed, they hold out great promise.

Consider examples from so-called "primitive" medieval cities of the Islamic world. At first glance they may seem to be a chaotic jumble of tangled roads and lanes, with no order behind them. Closer inspection reveals a highly ordered pattern of connectivity, with a distribution of lengths of roads – not unlike the highly ordered patterns of veins, arteries and capillaries in the body. Similarly, the pattern of shops and other facilities follows a remarkably ordered sequence of optimal distribution, without much planning.

Sidi Bou Sa'id, Tunisia

What of the buildings themselves, and their features? Here again, the gifts of adaptive evolution can be seen in the traditional processes of development and refinement over time. We can see surprisingly sophisticated features that help to cool or shade buildings in hot climates, create privacy and quiet in the middle of dense cities, or create opportunities for social interaction and commerce. We can see an evolution of beautiful designs for buildings and elevations over time, that help to make the city a more attractive, livable place. (That they aim to show off their owners' good taste is also a common motivation.)

Harvesting Local DNA

Many people – including architects - assume that the unique features of a particular locale are purely the result of cultural conditions, expressive intentions, political realities, or even philosophical worldviews. But this is to reduce architecture to a

purely semiotic (symbolic) act - a kind of making of codes. Of course it is much more than that. It is, in fact, the embodied pattern of adaptation to many complex factors, of which distinctive cultural or political expression is only one. Others include climate, terrain, materials, available building technology, and, of course, essential human needs, as they play out in a given set of conditions.

For example, humans must be comfortable within a thermal range. In some very hot dry regions, heavy masonry buildings with small windows do a relatively good job maintaining thermal comfort without modern technologies. In other, temperate climates, it is more important to open the buildings up to natural ventilation. The colonnades of Bologna maintain thermal comfort in a warm and sunny climate, while they would be dark and dank in the climate of, say, Sweden.

Social spaces like the colonnade must adapt to the thermal factors of a region, as well as to the particular social conditions. The front porch of the American South is a sophisticated layer of semi-public space that helps to connect a house to the street, to promote social interaction between neighbors, and to promote cooling of the house.

But some critics believe that the porch is only an expression of a particular social and political mindset – specifically, that of the Ante-Bellum South, in which white plantation owners maintained African slaves to tend their crops. Some favor the end of the porch, as an act of revolution and severing of ties to a painful past.

But the question for these critics is this: are architectural features nothing more than a kind of "flag" to signify a certain mindset? Do they have other, important properties – useful in solving the problems of human beings living in settlements, and even remaining useful across different eras? Are these properties useful even today in returning to a lower-carbon, relatively high-quality form of urbanism? Increasingly, the evidence suggests, the answer is yes.

For many people, this is a matter-of-fact proposition. You find something that works, and you re-use it. But for reasons we will discuss, this is a troubling notion for many architects today.

But what about the dangers of historicism?

"Historicism" is the term that architects and critics use to describe architecture that seems to copy that of a previous age. This is one of the most contentious, and sometimes oddly emotional, issues within architecture today. The term is most often used as a pejorative, to suggest that such architecture is inappropriate.
It is true that there is often little reason to replicate the architecture of a previous era down to the finest detail. But history is full of "revivals" – eras in which a previous language or style of architecture has returned, and usually, added new adaptations (new materials, technologies, features – e.g. glass windows, electric lights, etc). Indeed, many of the most loved and successful cities of the world – Paris, London, Rome – did create buildings in a revival of styles that were, at the time, many centuries old. If this strategy was so successful then, why would it not be successful now? We must find evidence for such a bold categorical assertion.

Moreover, such places are still demonstrably successful today – accommodating many modern businesses, and many residents (including many architects) living a modern lifestyle. These places have sustained for many decades or centuries. They are successful, and they solve many problems of people living well together in cities. Does it really make sense for us to declare that "we must never ever build anything like them again?"

Why, exactly?

Some architects and critics say that this is because we now live in a new age, with new technologies and new ways of living. True, but every age is in some sense "new," and often introduces new technologies, and changes in the way people live. History is full of the introduction of new technology, which usually gets absorbed easily into the existing architecture. The invention of glass, for example, or electric lights, did not require a new architecture – but they did allow architects to explore new possibilities within the classical and traditional architectures that already existed.

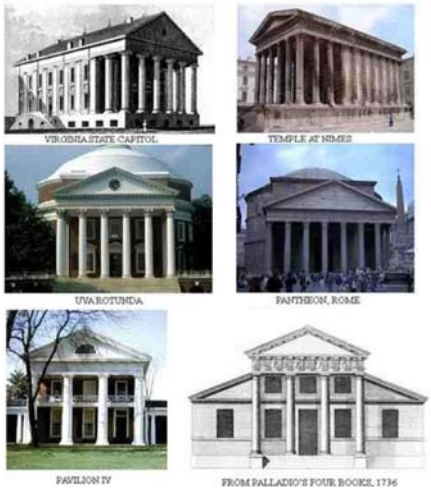
As we see even today, many old buildings have indeed accommodated new technologies like lighting, heat and electronics very well, and new buildings in the same architectural language have been able to integrate them easily too. There is simply no evidence that such buildings can't be retrofitted, and abundant evidence to the contrary.

What of the notion that new technologies must be allowed to shape new architectures – for example, the ability to cantilever on steel beams, or to build exotic new shapes with reinforced concrete, or to open up walls with full sheets of glass? It is indeed wonderful that such new possibilities exist, and that some are willing to explore them. But it doesn't follow that therefore everyone must live in buildings structured this way. That would be a kind of technological determinism – suggesting that if a technology exists, then it must be used.

An evidence-based approach suggests that if a new technology exists, it be tried out – and the results should be carefully assessed, and integrated into standard ways of doing things with careful trial and error. From an evolutionary point of view, we should resist wholesale, radical replacements of one entire system of building with another. Nature is incremental, and there is a good evolutionary reason why this is so. It allows careful testing and refinement, and greater chance of success.
What of the notion that architecture is an expression of political realities, and the new modern reality is more democratic and more plural – and thus, it requires a new architecture, modeled on these democratic ideals? But again, this is a reduction of architecture to a kind of flag-waving semiotics.

Moreover, it is a simple-minded semiotics, that suggests that one thing can only represent one idea. We now know that this is not at all the way that language works. And in architecture, we know that it is an absurd notion to suppose that, say, Classicism can only represent empires and dictatorships of a particular sort --- as some extremist critics have argued.

Within the world of Western Classical architecture – which is only one form of traditional architecture in the world today - we can find a breathtaking array of political systems and attitudes (and a similar range of cultural and technological circumstances). The politics ranged from Athenian democracy to Roman Empire, from the bourgeois world of the Renaissance to the Communist society of Josef Stalin, from the German fascism of Adolf Hitler to the American democracy of Franklin Delano Roosevelt.



Classicism in Imperial Rome, Renaissance Italy, and Democratic America.
Courtesy Dino Marcantonio

Modernism, too, spanned a similar range, and could be found in Socialist Germany, Fascist Italy, or modern corporate America. Le Corbusier, the pioneering modernist architect, was a collaborator with the Nazi-controlled Vichy government of France, and lectured in Rome by appointment of Mussolini.

So it is simply not true that a particular form of architecture is limited to a particular historic or political era. The truth is far more complex – and happily for us, far more liberating. We are free to choose the best solutions, from whatever source.

Modernist "pastiche"

But what of the objection to the notion of "pastiche" – that in making such a choice, we will inevitably indulge in a clumsy amalgam of previous styles or design ideas, which must be an inauthentic response to the intrinsic requirements of the design problem?

The trouble is, this is a highly selective notion, usually used to defend a particular ideological view of the "right" form of architecture for modernity. It is quite true, a design needs to be a well-adapted fit to its users, their physical needs, and their needs for art – and as we have argued here, also their local context, its terrain, climate and so on.

But what of the form of architecture that is usually proposed as the answer to this problem of "pastiche" – modernism and neo-modernism?

Many schools of architecture today, and many architects, happen to favor this form of architecture. The reasons are beyond the scope of this module, but they have to do with what is assumed to be a truly authentic response to the means of production, the materials available, the technology, and so on. As noted, there is a fear that there is something deeply inauthentic about reviving the architecture of a previous era: after all, we live in a different age, calling for a different kind of architecture.

Perhaps the answer to that proposition is, yes and no. Many things have changed, it is true – but many have not. The sun still rises in the morning; humans are still in need of thermal comfort (at about 21 degrees Celsius); we need social contact; and so on.

Moreover, with a bit of logical investigation, the attack on "pastiche" can be seen to lack a sound logical foundation. Take, for example, the work of the highly influential modernist pioneer Le Corbusier, who argued perhaps as forcefully as anyone for a "new architecture" -- casting off the old sentimental forms, and embracing a rigorously scientific, functionalist approach.

But did his work actually embody this bold prescription?

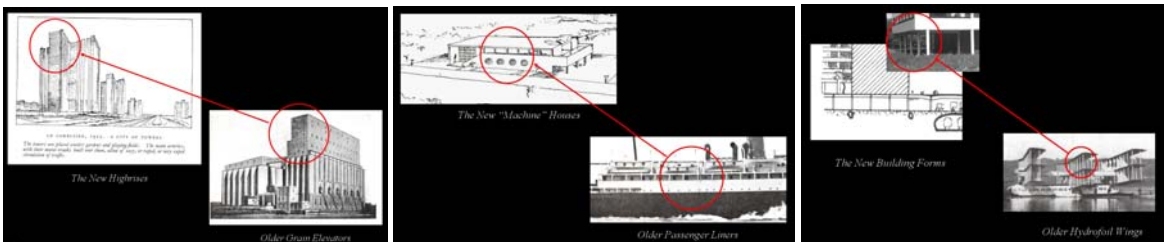
No, in fact it did not. In his highly influential 1923 book *Towards a New Architecture,* Le Corbusier appealed quite openly to the coldly rational vertical forms of American grain elevators; the simple portholes and flat decks and other minimalist forms of cruise ships; and the rows of struts and sleek lines of biplanes. He argued that these forms must be incorporated into all new buildings, and he formulated these into his later "Five Points Towards a New Architecture." There he argued for buildings raised up on stilts or "pilotis," like the wings of aircraft; for roof decks like the decks of cruise ships; for lightweight walls hung from the sides of buildings, like the lightweight panels of ships and airplanes; for ribbon windows, like those of cruise ships; and for flexible interior spaces, like those of an industrial warehouse.

Was this a rigorous standard of functionalism? In fact it was a remarkable form of romanticism – not of nature, as had occurred in the previous century, but now, of industry itself.

Why should buildings or humans be tall, like grain elevators? This problem is unrelated to the functional requirements to store a grain of rice or wheat over many months.

Why should buildings for humans be sleek and lightweight, like cruise ships? They are not in motion, and the functional problems are quite different.

Why should buildings for humans be sleek and minimalist, like a biplane or a cruise ship? Again, the latter are in motion and must conserve both weight and drag. A building has no such requirement.

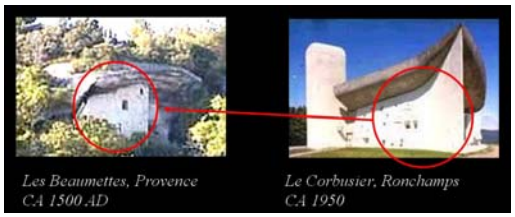


From Le Corbusier, Towards a New Architecture *(1923)*

We may decide that such buildings are highly appealing, aesthetically speaking, and want to have them in our midst. That is a legitimate desire, of course. (Depending on what we do to the environments of others in the process, and whether we violate their

rights or the quality of their world.) But this is not the same thing as saying that such buildings, and the aesthetics they represent, are necessary, inevitable, and required.

For at their core is an aesthetic preference. In the case of Le Corbusier, this preference took the form of a romantic idealization of the new industrialism. It was a moving artistic celebration of the new, the liberating, the rational, and the technological. But we now see that it was not, as claimed, a logical, scientific process of determining design.

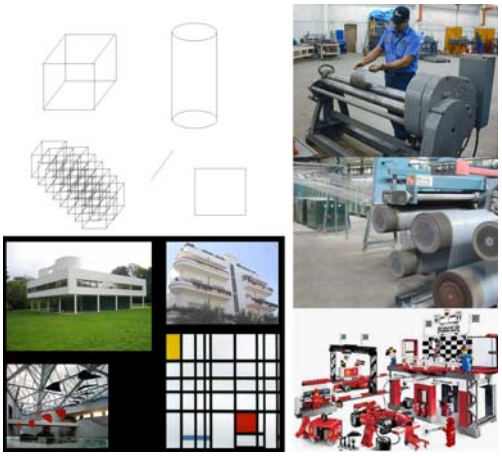


Elsewhere, Le Corbusier seemed to revive much more ancient forms, such as the traditional "baumettes" of southern France in his Chapel at Ronchamps. Perhaps there is little reason to object to such a practice. After all, the chapel at Ronchamps is a successful building, reflecting its site in a strong way. That it also echoes an ancient French building perhaps gives it all the more strength of local and national identity.

Of course, this practice of revival is a time-honored one. Many of the most successful and most-loved cities around the world are full of revivals of earlier traditions and languages of form. The cities of London or Paris are unimaginable without the revivals of Christopher Wren and many other architects. The Renaissance itself was of course a daring revival, beginning with the radical ideas of Brunelleschi and others.

Moreover, these places are still highly useful today, and arguably they offer greater evidence of genuine sustainability, for the simple reason that we can observe that they have actually sustained. They are often durable, well-loved, and relatively low-maintenance (when cared for properly over long periods). They seem to meet human needs even today very well indeed.

Of course, modernist architecture has been very successful as a system of production around the world. It was indeed a successful expression of then-evolving methods of production. The processes of casting, rolling, sheeting, stamping, slicing and bending, were highly influential in forming the shapes of cruise ships, grain elevators and other forms that Le Corbusier and others admired.



The form language of modernist architecture was rooted in the industrial technology developed in the early 20th Century: slicing, rolling, extruding, stamping, etc.

The aesthetic qualities of modernism, in its many varieties and revivals, now take their part as historic contributions to the languages of architecture. They are available to designers to deepen the poetic qualities of space, and to

express serene minimalist characters. They surely enrich the possibilities of architecture.

But few can now argue that the current industrial technology determines the architectural style that we must have. Technology has become more elastic, and there is no longer reason to argue that technology must limit us to certain geometries today. Indeed, there is reason to suppose that technology is taking us in the direction of living systems, and their adaptive responses to the environment. As we have seen, there are surprising echoes in our history. Perhaps it is in this direction, only partly explored, that a sustainable human future lies.

Thinking through to a more evolutionary approach

These discussions remind us again of the dangers of thinking poetically and metaphorically, and regarding problems of the built environment solely as problems of the expression of ideas, aspirations and sentiments. Of course, they have that aspect, but there is much more at stake. In the end, acts of building are acts of nature, subject to the same merciless laws of success or failure, adaptation or extinction. And they incorporate and affect all the other problems of human life – economic, social and environmental.

This problem is particularly acute when architecture is seen almost exclusively through the lens of fine art. But in an age in which sustainability is paramount, we now begin to see that we must take a more rigorous, evolutionary approach; and our art must weave itself within this matrix. It is hubris of the most dangerous sort to imagine that our art – or any human creation -- can substitute itself for nature.

To follow the evolutionary laws of success and failure, we must take an evidence-based approach, just as nature does. We must adopt what is most successful, from whatever source, and modify or eliminate that which is not successful. And we must look at the full range of criteria for success, and not merely the degree to which a given structure appeals to us, or entertains us, or speaks to us as a moving piece of art.

Dolphins evolved the best solution to the complex problems of turbulence in their dorsal fins – and had no qualms about reviving a "pastiche" of the much older shark fin

So let us ask the question, what is the state of the built environment today? How has it been transformed under the 20th Century model of architecture and building, and how is that transformation occurring now – and in what direction for the future?

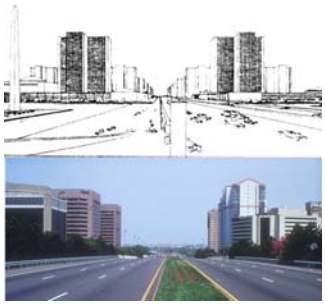
Is the evolution of the built environment moving in a direction that is more sustainable, more durable, more beautiful, and therefore more likely to allow human beings to survive and prosper – or is it less so?

The evidence here is overwhelming. For anyone who cares to look without ideological agendas, the quality of the built environment across the globe, from a human point of view, has decayed severely in the last century, and is continuing to decay. And it is using unsustainably high levels of energy and resources. It is not ecologically sustainable.

This is not only because we are using the wrong sources of energy. It is because our cities have become fragmented, disordered and highly inefficient. Our way of life itself has become fragmented, and overly dependent on high-energy systems like the car, and a high-resource lifestyle. Our sprawling "urban obesity" is causing severe damage to the biosphere on which life depends.

Athens before and after 1900

This ecological unsustainability translates into economic unsustainability, as the costs of maintaining this level of resource use mount. "Peak Oil," the phenomenon in which demand for oil grows faster than supply, is only one example of the likely soaring costs we will face in years ahead.



Moreover, there is a social dimension to this unsustainability too. There is a high price to be paid in the physical and mental health of people who are increasingly fragmented, lacking in social contact, lacking in exercise, put under stress by their environment. There are likely to be grave social and political consequences of further ecological damage, as populations lose access to adequate supplies of drinking water and arable land.

How do the structures that exist today compare to those of our heritage – say, a century or more ago? A full geometrical analysis is beyond the scope of this module (see for example the companion module, "Whatever happened to urbanism?") but we can summarize as follows. The buildings and neighborhoods of our heritage generally had the following desirable characteristics:

Neighborhood scale:

- Greater compactness, and integration of high-quality spaces;
- Greater connectivity between spaces – particularly public, semi-public, semi-private and private spaces;
- More fine-scaled distribution of daily needs and amenities (including employment);
- Strong, human-scaled public realm;
- Facilitation of walking and outdoor interaction;
- Many diverse choices between areas of public interaction and private tranquility.

Building scale:

- Efficient, low-carbon methods of effecting ventilation and daylight;
- Strong connection between the building and the public realm;

- Judicious placement of smaller window openings, for energy conservation and privacy;
- Easily adaptable forms for new uses;
- Easily repairable materials and systems, using local labor (and therefore providing more sustainable local employment);
- Durable aesthetic character that remains attractive over time, and is less sensitive to the whims of design fashions (which can result in a building becoming disused and even demolished).

Clearly there is much that we can still learn from these buildings.

Conserving the "hardware" of heritage, and also the "software"

Few people disagree that we should conserve the most important examples of our built heritage, and many scholars and officials devote their careers to doing so. But what of the lesser examples – the more ordinary buildings that generally far outnumber the ones considered "important?" Most people agree that we should try to conserve as many of these buildings as possible, because they are often considered attractive and potentially successful places for our activities today. There is also a growing awareness of the ecological value of doing so, since such buildings conserve resources and "embodied energy."

More controversial is the notion that we need to conserve the "software" – the knowledge and the patterns that these buildings embody. As discussed above, there is a common feeling that the re-use of such patterns is somehow "inauthentic" in the modern world. But as we have seen from the strong analogies with biological evolution, this may be a misunderstanding of the importance of such patterns, based upon an over-emphasis of the purely novel expressive intentions of art.

From the perspective of greater sustainability, there is an excellent argument for re-using these patterns. It is that many of the problems that are solved by such buildings are recurrent ones, which we still face today. We must again find lower-carbon ways of maintaining thermal comfort. We must find ways that more compact, higher-density environments can be more successful and more "livable" for people – to conserve the ecologies of the countryside, and to make our own patterns of consumption more efficient and more benign. And as always, we must still provide good connections and contact between people, indoors and outdoors – something we have begun to do poorly in recent decades.

Moreover, we must still find reliable forms of daily beauty that reward us and provide the properties that we find biologically satisfying. These are not only expressive artistic qualities, but also qualities of the human environment that research has shown to be beneficial to the health and well-being of people.

The field of "biophilia" is a burgeoning one, closely related to the field of "evidence-based design." Both are concerned with an empirical process for determining the factors in the built environment that are beneficial to the well-being of people. It turns out that many factors play a role. For example, in a famous study by Roger Ulrich, patients on a hospital ward with a view from a window onto vegetation and

trees had a measurably higher recovery rate than did those who had a view to a contemporary building wall. Many other such factors have been shown to be beneficial – obvious ones like sunlight, fresh air and water, but also less obvious ones, like scaling patterns, or earth tones, or a sense of refuge combined with a sense of prospect.

Moreover, historic buildings seem to perform remarkably well in evaluations of biophilic properties. This may well be because they were evolved over a longer period of time to contain more of these traits – particularly those pleasing geometries, like scaling patterns, or biomorphic shapes that resemble trees and leaves.

In any process of evidence-based design, there is always one central challenge. It is that environments are complex. They are web-like structures of adaptations, and not simple mechanical assemblages of design factors. Therefore it is extremely difficult to assemble a successful combination of elements quickly, without recourse to the fruits of an evolutionary process. This is one central weakness with an experimentalist, "tabula rasa" approach to architecture.

But this is also precisely the advantage of the "software" of historic structures: it often contains just such still-useful information. It may not be sufficiently adapted to a particular time and place – but it may also be far ahead of any other option. And it may be possible to complete such an adaptation relatively easily, by applying local materials and methods. Indeed, history seems to be full of such examples of transplantation and re-adaptation.

In this sense, then, local identity is not a rigid thing. It, too, is constantly evolving – but not by wholesale erasure of what came before, but by transformation, re-application and re-adaptation of it. It is, in a sense, a living character, expressing the qualities of a place as they endure and transform.

Epilogue: Re-thinking the Venice Charter

The policy in much of the world regarding regeneration of historic monuments and sites is governed by the International Council on Monuments and Sites (ICOMOS), a UN-sponsored NGO created in 1964 by the Second Congress of Architects and Specialists of Historic Buildings. Simultaneously, the Congress adopted the Venice Charter, a document with 16 articles covering essential principles of conservation, restoration and related practices.

Because so many cities contain heritage buildings and neighborhoods, the Venice Charter has come to be highly influential beyond the realm of heritage buildings, in shaping the thinking about the kinds of structures that are appropriate in a modern context more generally.

In particular, one article has come to be seen as highly significant, in heritage conservation and beyond:

> *ARTICLE 9.* The process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original

> material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp…

The intent was to stop the "falsification" of history, which could be caused by new structures that could be confused with those of an earlier time. Such a confusion could be damaging to the memory of what was authentic in our heritage. Thus the phrase "must bear a contemporary stamp" has been interpreted to mean "must be distinct from the identifying characteristics of earlier periods, such as styles, materials, colors etc."

This concept has been extended to suggest that *any* new work, in virtually any context, must eschew repetition of stylistic characteristics that might confuse it with the work of the past.

But as we have seen, such a view of history and style is much too pat. History is not a neatly "segmented worm" in which one era has only one distinctive architecture, another era has another. Rather, it is a complex weave, with recurrences, transformations, echoes, and all manner of other fuzzy borders. (The good architects of England did not wake up in 1837 and pronounce, "Victoria is Queen, so from now on we must practice a wholly new style of architecture, and continue to do so until her death!" Rather, the label; "Victorian" was ex post facto, by later historians.)

It is not the job of the built environment to be "readable" to those who have an interest in understanding the chronologies of history. Rather, that is the job of conservators, who must develop interpretive materials that help citizens to understand what it is that hey are seeing. Is this monument representing the state of the house in 1740, or 1750, or 1760? Should that wing be demolished because it was not original, but was added in 1830 – or is it indeed its own piece of relevant history, to be kept and described as such?

Certainly we should not say that the University of Virginia rotunda (built in 1826) looks far too much like the Pantheon, and might be confused with its time, and therefore we must demolish it!

Likewise we must not say that a building built today that has similarities with another historic building, must not be built on that account alone. Again, there is a powerful evolutionary argument for permitting and indeed reviving such buildings: the recurrence of suitable solutions in nature, which must be allowed to proceed,. The porpoise must not be banned from having a dorsal fin that looks too much like a shark's – lest ichthyologists become confused.

As the INTBAU Venice Declaration notes (see Appendix II) built environments are more than museum cases – they are organic structures that continue to evolve and transform dynamically. We must recognize the ongoing role of historic buildings to continue to serve our needs -- which might require their adaptive re-use in ways that a historic purist might find disquieting. But the alternative might be that they fall into utter disuse and destruction. At the same time, we must recognize the role of historic patterns to continue to meet our needs, of solving the many timeless problems of living well together.

As we think about our daunting challenges of sustainability, let us remember only one of many renaissances that have occurred throughout human history – the one that we recognize by that name, that began in Italy in about 1400. Filippo Brunelleschi, Cosimo de Medici and a few others had an audacious idea: that they could re-make a great civilization, based upon the ancient patterns and the natural principles and materials of their own land. Six hundred years later, many of their achievements remain the most loved and enduring achievements of human civilization. We can now be grateful that they did not say to themselves, "this architecture is now over a thousand years old, and it is no longer of our time. We must build a wholly new architecture instead."

There were indeed many innovations, and many breathtaking new expressions. But there was, at its core, the recognition that in nature and in history – in one's own nature and history – lie all the treasures we need. The latest lessons of our sciences today – evolutionary biology, complexity, cognition, and much else -- only reaffirm that ancient lesson.

ADDITIONAL READING

Semes, Steven. *The Future of the Past: A Conservation Ethic for Architecture, Urbanism, and Historic Preservation.* WW Norton, New York. 2009

Adam, Robert. "Creating local identity through architecture." World Architecture News. Accessed at http://www.worldarchitecturenews.com/index.php?fuseaction=wanappln.commentview&comment_id=128

Jacobs, Jane. *The Death and Life of Great American Cities.* Random House, New York. 1961.

Christopher Alexander. *The Nature of Order.* Center for Environmental Structure, Berkeley. 2003.

Appendix I: The Venice Charter

INTERNATIONAL CHARTER FOR THE CONSERVATION AND RESTORATION OF MONUMENTS AND SITES

Imbued with a message from the past, the historic monuments of generations of people remain to the present day as living witnesses of their age-old traditions. People are becoming more and more conscious of the unity of human values and regard ancient monuments as a common heritage. The common responsibility to safeguard them for future generations is recognized. It is our duty to hand them on in the full richness of their authenticity.

It is essential that the principles guiding the preservation and restoration of ancient buildings should be agreed and be laid down on an international basis, with each country being responsible for applying the plan within the framework of its own culture and traditions.

By defining these basic principles for the first time, the Athens Charter of 1931 contributed towards the development of an extensive international movement which has assumed concrete form in national documents, in the work of ICOM and UNESCO and in the establishment by the latter of the International Centre for the Study of the Preservation and the Restoration of Cultural Property. Increasing awareness and critical study have been brought to bear on problems which have continually become more complex and varied; now the time has come to examine the Charter afresh in order to make a thorough study of the principles involved and to enlarge its scope in a new document.

Accordingly, the IInd International Congress of Architects and Technicians of Historic Monuments, which met in Venice from May 25th to 31st 1964, approved the following text:

DEFINITIONS

ARTICLE 1. The concept of an historic monument embraces not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilization, a significant development or an historic event. This applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time.

ARTICLE 2. The conservation and restoration of monuments must have recourse to all the sciences and techniques which can contribute to the study and safeguarding of the architectural heritage.

AIM

ARTICLE 3. The intention in conserving and restoring monuments is to safeguard them no less as works of art than as historical evidence.

CONSERVATION

ARTICLE 4. It is essential to the conservation of monuments that they be maintained on a permanent basis.

ARTICLE 5. The conservation of monuments is always facilitated by making use of them for some socially useful purpose. Such use is therefore desirable but it must not change the lay-out or decoration of the building. It is within these limits only that modifications demanded by a change of function should be envisaged and may be permitted.

ARTICLE 6. The conservation of a monument implies preserving a setting which is not out of scale. Wherever the traditional setting exists, it must be kept. No new construction, demolition or modification which would alter the relations of mass and color must be allowed.

ARTICLE 7. A monument is inseparable from the history to which it bears witness and from the setting in which it occurs. The moving of all or part of a monument cannot be allowed except where the safeguarding of that monument demands it or where it is justified by national or international interest of paramount importance.

ARTICLE 8. Items of sculpture, painting or decoration which form an integral part of a monument may only be removed from it if this is the sole means of ensuring their preservation.

RESTORATION

ARTICLE 9. The process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp. The restoration in any case must be preceded and followed by an archaeological and historical study of the monument.

ARTICLE 10. Where traditional techniques prove inadequate, the consolidation of a monument can be achieved by the use of any modem technique for conservation and construction, the efficacy of which has been shown by scientific data and proved by experience.

ARTICLE 11. The valid contributions of all periods to the building of a monument must be respected, since unity of style is not the aim of a restoration. When a building includes the superimposed work of different periods, the revealing of the underlying state can only be justified in exceptional circumstances and when what is removed is of little interest and the material which is brought to light is of great historical, archaeological or aesthetic value, and its state of preservation good enough to justify the action. Evaluation of the importance of the elements involved and the decision as to what may be destroyed cannot rest solely on the individual in charge of the work.

ARTICLE 12. Replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence.

ARTICLE 13. Additions cannot be allowed except in so far as they do not detract from the interesting parts of the building, its traditional setting, the balance of its composition and its relation with its surroundings.

HISTORIC SITES

ARTICLE 14. The sites of monuments must be the object of special care in order to safeguard their integrity and ensure that they are cleared and presented in a seemly manner. The work of conservation and restoration carried out in such places should be inspired by the principles set forth in the foregoing articles.

EXCAVATIONS

ARTICLE 15. Excavations should be carried out in accordance with scientific standards and the recommendation defining international principles to be applied in the case of archaeological excavation adopted by UNESCO in 1956.
Ruins must be maintained and measures necessary for the permanent conservation and protection of architectural features and of objects discovered must be taken. Furthermore, every means must be taken to facilitate the understanding of the monument and to reveal it without ever distorting its meaning.

All reconstruction work should however be ruled out "a priori." Only anastylosis, that is to say, the reassembling of existing but dismembered parts can be permitted. The material used for integration should always be recognizable and its use should be the least that will ensure the conservation of a monument and the reinstatement of its form.

PUBLICATION

ARTICLE 16. In all works of preservation, restoration or excavation, there should always be precise documentation in the form of analytical and critical reports, illustrated with drawings and photographs. Every stage of the work of clearing, consolidation, rearrangement and integration, as well as technical and formal features identified during the course of the work, should be included. This record should be placed in the archives of a public institution and made available to research workers. It is recommended that the report should be published.

The following persons took part in the work of the Committee for drafting the International Charter for the Conservation and Restoration of Monuments:

Piero Gazzola (Italy), Chairman
Raymond Lemaire (Belgium), Reporter
Jose Bassegoda-Nonell (Spain)
Luis Benavente (Portugal)
Djurdje Boskovic (Yugoslavia)
Hiroshi Daifuku (UNESCO)
P.L de Vrieze (Netherlands)

Harald Langberg (Demmark)
Mario Matteucci (Italy)
Jean Merlet (France)
Carlos Flores Marini (Mexico)
Roberto Pane (Italy)
S.C.J. Pavel (Czechoslovakia)
Paul Philippot (ICCROM)
Victor Pimentel (Peru)
Harold Plenderleith (ICCROM)
Deoclecio Redig de Campos (Vatican)
Jean Sonnier (France)
Francois Sorlin (France)
Eustathios Stikas (Greece)
Mrs. Gertrud Tripp (Austria)
Jan Zachwatovicz (Poland)
Mustafa S. Zbiss (Tunisia)

APPENDIX II: The INTBAU VENICE DECLARATION

The INTBAU Venice Declaration
on the conservation of monuments and sites in the 21st century

The Athens Charter of 1931 made an important contribution toward the development of an extensive international movement for the safeguarding of our common heritage for future generations. The Venice Charter of 1964, noting problems which have continually become more complex and varied, re-examined the Athens Charter, made a thorough study of the principles involved, and enlarged its scope in a new document.

Almost half a century later, we have witnessed new problems and new complexities. Foremost among them is the challenge to maintain coherent and sustainable urban environments, within which historic monuments are often seamless elements, and living repositories of important and useful knowledge. It has also been noted that the Venice Charter did not sufficiently address challenges beyond Europe and the United States, and overlooked the vital role that traditional building crafts continue to play. Lastly, a number of logical contradictions have become evident within the Charter itself, or within its over-rigid interpretation.

Accordingly, a group of international leaders in conservation, architecture, urbanism and environmental planning, met in Venice in November, 2006, and agreed that the time has come to clarify the Venice Charter and its interpretation, addressing in particular the following issues:

- The PREAMBLE notes our common responsibility to safeguard ancient monuments for future generations and to "hand them on in the full richness of their authenticity". It is now understood, however, that any act of conservation or restoration is inevitably an act of alteration based upon historically partial knowledge. Hence the goal of authenticity must not be interpreted to require an absolute state of preservation of pre-categorized moments in time. Rather it must reflect the complex pattern of change and recurrence across the ages, including the present. It is to be established as much in interpretive materials as it is in the techniques of accurate conservation.

- ARTICLE 1 wisely includes urban and rural settings in the definition of an historic monument. We note that this may also include an historically unique settlement pattern or organisational structure within the landscape, which may embody important knowledge for future settlements.

- ARTICLE 2 calls for recourse to all the sciences and techniques which can contribute to the study and safeguarding of the architectural heritage. We emphasize the importance of scientific investigation, particularly for useful but overlooked knowledge embodied in historic monuments, which may prove to be relevant in unforeseeable ways to our challenges today and in the future. The participation of the public in scientific, educational and political exchanges on these topics is vital.

- ARTICLE 4 calls for the permanent maintenance of monuments. We note that maintenance using new elements in a compatible character is not "false historicism"

provided the new elements can be readily distinguished by experts, or with the aid of interpretive materials.

- ARTICLE 5 prohibits changes to the lay-out of a building, even when making use of it for some socially useful purpose. But such changes must be allowed where the alternative is a threat to the building's survival, where the changes are not inharmonious as called for in Article 6, and where careful documentation of the changes is maintained. As much as possible, such changes should also incorporate the building's original spatial quality and structure.

- ARTICLE 9 calls for new work which "must be distinct from the original composition and must bear a contemporary stamp". But this goal must be dynamically balanced with other needs, including the need for coherent and enduring human environments. Thus, new work may be distinct from the original composition while still harmonizing with that composition. A contemporary stamp may be provided in a number of ways, including interpretive information or identifying marks or characteristics. It is not necessary to create a striking juxtaposition, which may violate the mandate to preserve the traditional setting or the relations of mass and color (Article 6, Article 13).

- ARTICLE 11 states that "the valid contributions of all periods to the building of a monument must be respected, since unity of style is not the aim of a restoration". But styles cannot be strictly assigned to a unique origin in a specific time or context, as they may be found to recur in repeated revivals within different periods and contexts. Therefore a variation of styles can be tolerated and accepted for any period, including the present. At the same time, a unity of composition can be maintained, and does not require a unity of style.

- ARTICLE 12 states that "replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence". However, this need not be interpreted to forbid replacements in a compatible style. It requires only an honest distinction of the new work, which may be made identifiable with the aid of interpretive information.

- ARTICLE 13 prohibits additions that detract from the interesting parts of a building, its traditional setting, the balance of its composition and its relation with its surroundings. Together with other articles, this must be interpreted to mean that contemporary additions that politely take their place within the harmonious composition (including revival styles, if deemed appropriate, as well as innovative new styles) are allowable. Additions that are deliberately discontinuous, discordant, or self-consciously dominant, must not be allowed to damage the balance of the composition or the relation with its surroundings.

Signed this 8th day of January 2007 by the authors:
In alphabetical order

Robert Adam - UK

Questions

Instructions: Download and open the document titled "Exam Questions" that is also included with this document on the ESUA website. Fill in your name, and answer the questions. Then type in your essay question responses. Email the completed and saved document, saved under your last name, to your course instructor. (See the website for details.)

Multiple Choice questions (20 questions, 4 points each)

1. The author says the modernist movement contained a powerful impulse
    a. to celebrate the new, and to sweep away the old.
    b. to preserve the past
    c. to celebrate technological innovation
    d. a and c

2. The danger of internationally fashionable architecture is that
    a. It can result in highly incompatible features
    b. It can damage the heritage and local identity of places
    c. It can result in ecological damage
    d. All of the above

3. The author states that the age of sustainability requires
    a. That we cannot afford to repeat failures
    b. That we cannot afford to throw away valuable treasures
    c. A and B
    d. None of the above

4. The 21st Century of biology, according to Christopher Alexander, means
    a. The ability to solve problems of physics
    b. Returning to old models of thought and action
    c. The co-adapted harmony of hundreds or thousands of variables
    d. A and C

5. Evolutionary complexity in biology means
    a. An organic web of connections
    b. Elements that cannot be isolated without a profound effect upon the system
    c. Interchangeable parts
    d. A and B

6. Cities are like organisms in that
    a. They are not just collections of interchangeable parts
    b. They contain living people
    c. They must consume resources
    d. A and C

7. Components of local identity include
    a. The natural setting
    b. The characteristic materials, colors, features, and details of buildings and spaces
    c. The presence of exciting new architecture
    d. A and B

8. Which of the following is true about globalisation?
    a. It can have homogenizing effects
    b. It has been present since Genghis Khan and Christopher Columbus
    c. It is an effect of modern methods of standardisation and interchangeability
    d. All of the above

9. According to the author, we have become reliant on a form of technology that is
    a. Highly sophisticated
    b. Based on standardization and replication
    c. In danger of causing a global crisis
    d. B and C

10. Which of these is NOT an example of mutually adaptive technology mentioned by the author?
    a. Medieval cities of the Islamic world
    b. Computer-based modern design
    c. The rice patties of Asia
    d. None of the above

11. The author notes the following about architectural features:
    a. They can be useful in solving problems of human beings in different ages and locales
    b. They are more than “flags” to signify a certain mindset
    c. They may be useful in returning to a lower-carbon, high-quality form of urbanism
    d. All of the above

12. Which is NOT true about the colonnades of Bologna, according to the author?
    a. They would be dark and dank in the climate of Sweden
    b. They contribute to the local identity of Bologna
    c. They protect the people of Bologna from wind and rain
    d. They embody more than semiotic (symbolic) expression

13. Which of the following factors does the author NOT mention as requirements for architecture to adapt to?
    a. Social conditions
    b. Fashion
    c. Technology
    d. None of the above (the author mentions all of them)

14. Engineers working in the Mississippi delta failed to understand:
    a. The frequency of hurricanes
    b. The beauty of wetlands
    c. The complexity of the marsh ecosystem
    d. All of the above

15. The author argues that the problem with using “historicism” as a criticism is:
    a. It would apply to many of the most loved and most successful cities of the world
    b. The term “pastiche” is more accurate
    c. No one does historicism anyway, because it isn’t appropriate
    d. A and B

16. The author argues that Le Corbusier’s “pastiche” could be found in his “inauthentic” (non-functionalist) combination of romantic images from
    a. Ships
    b. Airplanes
    c. Grain elevators
    d. All of the above

17. Which of the following does the author NOT say about modernist architecture?
    a. Many people do not like the style, and people deserve what they like
    b. Its aesthetic qualities take their place as historic contributions to the languages of architecture
    c. Technology today is pointing us in a very different direction, toward living systems
    d. Few can now argue that the current industrial technology determines the architectural style that we must have

18. The author argues that an evolutionary approach is necessary because:
    a. The built environment has declined in important ways
    b. The conception of architecture as a metaphorical fine art form has come to dominate
    c. It offers an evidence-based method for finding and refining what works
    d. All of the above

19. The author argues that we must conserve both the ”hardware” and the “software,” which means
    a. The drawings, and the skills
    b. The buildings, and the knowledge and patterns they contain
    c. The biophilia, and the evidence-based design
    d. None of the above

20. According to the author, which statement about the Venice Charter is NOT true?
    a. It has come to be highly influential in shaping thinking about the kinds of structures that are appropriate in a modern context
    b. It allows “pastiche” architecture
    c. Its concept of “contemporary stamp” has been used to obstruct evolutionary revivals in architecture
    d. None of the above (all are true)

Essay Questions:

1. What are three examples of local identity in the town or city where you grew up?

2. What is your definition of resilient settlement, based on the ideas discussed here?

3. What are three examples of traditional building technologies that you think are particularly well-adapted to their local context?

4. What is your opinion of the benefits of globalization in relation to local identity?

5. What is your view of the coming changes in technology, and the argument that it will be more “biological?”