

Architectural Technology III

|



ARCH 523 | Environmental Controls

This Week's Introduction: *Apologies... ;-(*

This Week's Plan of Attack: *Avanti Popolo!*

Last Week's Media Material: *Deeper Shades of Green*

This Week's Presentation

- > Review: Worksheet #2;
- > Eco Effectiveness;
- > Environmental Resources;
...> Worksheet #3a;
- > This Week's Media Material: *From Gray to Green*;
- > Sites and Resources;
...> Worksheet #3b;
- > Historical Context: *The Well-Tempered Home* (Banham);

So On With The Show!

Colored Vision

PBS Video Series: *Design E²*

This week's showing: Deeper Shades of Green

Last Week: Introductory Concepts

Worksheet #2

... 1) *Malcolm Wells' architectural value scale is best described as:*

- (a) being based upon wilderness and reflecting sustainable design values;
- (b) being based upon the USGBC LEED green building program;
- (c) arguing strenuously against restrictive building codes
- (d) the basis for the ASHRAE/IESNA Standard 90.1 energy efficiency requirements

Last Week: Introductory Concepts

Worksheet #2

... 2) *The design process generally flows from:*

- (a) conceptual design, to design development, to schematic design
- (b) design development, to conceptual design, to schematic design
- (c) conceptual design, to schematic design, to design development
- (d) guidelines compliance, to standards compliance,
to code compliance

Last Week: Introductory Concepts

Worksheet #2

... 3) *Design intent is best described as:*

- (a) a benchmark performance target for a design
- (b) a general statement describing expected outcomes
- (c) a specific statement of how a design problem will be solved
- (d) a statement that outlines the design team's design process

Last Week: Introductory Concepts

Worksheet #2

... 4) *Design criteria are best described as:*

- (a) benchmark performance targets for a specific design intent
- (b) a general statement describing expected design outcomes
- (c) the means and methods by which design intent will be accomplished
- (d) the governing code requirements for a given building issue

Last Week: Introductory Concepts

Worksheet #2

... 5) *The difference between a code and a standard is essentially:*

- (a) a code is not legally mandated
- (b) a code is enforced by the government
- (c) a standard is enforced by the government
- (d) more weight is given to standard requirements than to code requirements

Last Week: Introductory Concepts

Worksheet #2

... 6) *Without validation, design solutions are:*

- (a) assumed, but not proven, to be valid
- (b) more likely to avoid scrutiny by code officials
- (c) easier to implement on a project with building commissioning
- (d) always cheaper in the long run

Last Week: Introductory Concepts

Worksheet #2

... 7) *Green design and design for sustainability are differentiated by their:*

- (a) design methods
- (b) applicable building codes
- (c) intended outcomes (relative to performance)
- (d) degree of design validation

Last Week: Introductory Concepts

Worksheet #2

- ... 8) The design philosophy of “letting nature do the work” relates to:
- (a) a preference for unenclosed building spaces
 - (b) a preference for passive versus active system
 - (c) a preference for green versus sustainable buildings
 - (d) a preference for building on rural sites rather than on urban sites

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Eco-Effectiveness

McDonough's Rhetorical Flourish: **A Tale of Three Books**

(Apologies to Dickens and A Tale of Two Cities: “It was the Best of times, it was the Worst of Times...”)

- > **Book 1: “What happens when it is discarded?”**
Waste by-products include potentially toxic materials.

- > **Book 2: “Good thing it’s eco-friendly. Or is it?”**
Poor readability combined with “lesser of two evils” decisions concerning durability.

- > **Book 3: “Imagine we were to rethink the entire concept of the book”**
Design Intent: Consider both Practicalities *and* Pleasures concerning durability.

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Eco-Effectiveness

Book Three: Design Intent, Design Criteria, Validation

> (Is) paper itself is a proper vehicle for reading matter?

It can be made “of plastics developed around a completely different paradigm for materials, polymers that are infinitely recyclable at the same level of quality -- that have been designed with their future life foremost in mind...

“Inks are non-toxic and can be washed off the polymer with a simple and safe chemical process or an extremely hot water bath, from either of which they can be recovered and reused.”

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Eco-Effectiveness

Book Three: Design Intent, Design Criteria, Validation

> Nor is the reader's pleasure and convenience an after-thought to environmentally responsible design...

“Ink won't rub off... durable enough to last for many generations...”

“It celebrates its materials rather than apologizing for them.”

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Eco-Effectiveness

Consider the Cherry Tree: *The tree makes copious blossoms and fruit without depleting its environment.*

> “What would the human-built world look like if a cherry tree had produced it?”

- * During the daytime, light pours in
- * Views of the outdoors... are plentiful
- * Delicious, affordable food is available
- * Each office worker controls the flow of fresh air
- * &c.

> *The key to achieving important goals is the clear articulation of design intent.*

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Eco-Effectiveness

Case Studies in Improving Your Design Intent

> Herman Miller Factory



> Emphasis on Daylight
(Daylit “street”
(Introduction of Skylights)
(Exceptional Views out)

> Storm and waste water
abatement on-site

*Unvalidated Results: Excellent energy
performance & worker productivity.*

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Eco-Effectiveness

> The importance of Doing Things Right;

- or -

> The Importance of Doing the Right Things;

The concept of efficiency is a tool for achieving results, not a goal in itself. “If nature adhered to the human model of efficiency, there would be fewer cherry blossoms, and fewer nutrients.”

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: What is Growth?

- > A child's perspective:
Getting bigger, healthier, and stronger
- > Environmentalists' perspective:
The rapacious use of resources, &c.

The key is not to make human industries and systems smaller, as efficiency advocates propound, but to design them to get bigger and better in a way which replenishes, restores, and nourishes the rest of the world... Thus the "right things" ... to do are those that lead to good growth -- more niches, health, nourishment, diversity, intelligence, and abundance.

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Once Upon a Roof

- > How to reconceive each distinct building system by conceiving an integrated design for all components.



Chicago City Hall: An Extensive Green Roof (A light layer of soil a growing matrix, covered with plants.)

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Beyond Control

... An eco-effective approach to design might result in an innovation so extreme that it resembles nothing we know, or it might merely show us how to optimize a system already in place. It's not the solution itself that is necessarily radical, but the shift in perspective with which we begin, from the old view of nature as something to be controlled to a stance of engagement.

This week... Resources (Physical, Geographic, and Mental)

Cradle to Cradle: Our New Design Assignment

- > *Buildings that, like trees, produce more energy than they consume and purify their own waste water*
- > *Factories that produce effluents that are drinking water*
- > *Products that, when their useful life is over, do not become useless waste but can be tossed onto the ground to decompose and become food for plants and animals and nutrients for soil...*

This week... Resources (Physical, Geographic, and Mental)

With what palette do we implement these new design criteria?

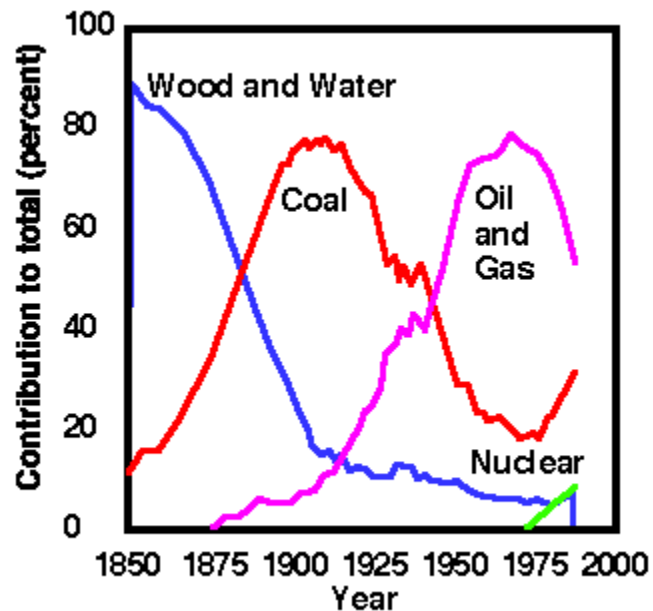
MEEB: Environmental Resources

“The building design process plays an active role in deciding... how much of what kinds of resources (we) will use. The mechanical and electrical systems that support our new buildings can be part of a growing problem or an important start to a solution.” p.25

This week... Resources (Physical, Geographic, and Mental)

MEEB: Environmental Resources

- > Until our time, the energy which shaped our planet and our environment has come regularly and uniformly from the Sun.



- > Our use of a large, but finite, source of fossil fuel energy has long blinded us towards the necessity of a strategic concept concerning the use of those resources.
- > Population growth is both the underlying source of increased energy usage and source of most architectural work!

This week... Resources (Physical, Geographic, and Mental)

MEEB: Environmental Resources

- > Buildings are physical objects and obey physical laws.

Conservation of Energy (First Law of Thermodynamics)

Increase of Entropy (Second Law of Thermodynamics)

...the tendency toward disorder that is part of the normal nature of things. Entropy is a measure of such disorder; as disorder increases, so does Entropy.

- > The design and construction of buildings is locally “anti-entropic”; but, to design and construct buildings requires the introduction of energy from outside the local environment.
- > The same is true for organic systems. The energy for these ordering processes (almost always) derives from the sun.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Environmental Resources

- > “Design process must consider various scales of concern relative to the impact of buildings upon the environment” p.26
- > ... and *vice versa*.

Geographic Scale : Micro-, Site-, and Macro-

Energy Efficiency Considerations	<>	Site Scale, (often neglects off-site/macro)
Renewable/Passive Systems	<>	Microscale
Non-renewable/Active Systems	<>	Scaleless in impact/consideration.

Time Scale : Now, Future, (and, sometimes, Past)

Adaptive Reuse	<>	Past
Energy Consumption	<>	Now
Lifecycle Costing	<>	Future
Sustainable Design	<>	Future Now Past at once...

This week... Resources (Physical, Geographic, and Mental)

MEEB: Energy (Renewable | Nonrenewable)

- > Renewable: Available indefinitely; but...
Availability typically determined by natural processes.

Examples: Solar Energy, wood supply, ... other examples?

- > Non-renewable: Once exhausted cannot be replaced.
Availability is immediate, but finite.

Examples: Coal, oil, natural gas, ... other examples?

- > Since the 1800's, the USA and other industrialized societies have transitioned from predominant use of renewable energy sources for non-renewable.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Energy (Renewable | Nonrenewable)

- > Contrasting impact/effects of the two types of energy sources, based on historical examples:

Renewable: Obtained locally; low-grade work; animal- or human-powered; combustion of energy sources in direct proximity to its use.

Non-renewable: Obtained and exchanged in a global market; high-energy-intensive processes, based on the combustion of fossile fuels; production of energy often separate (and even distant) from consumption.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Energy (Renewable | Nonrenewable)

- > Contemporary energy use in buildings relies heavily upon electricity, with serious implications for resource depletion:
 1. Consumption of Electricity is expected to rise; its proportion among energy types is expected to rise. For many kinds of energy production (coal, heavy fuel, nuclear), the only reasonable distribution method is electrical.
 2. Besides daylight, electricity is the only source of energy for lighting. Heating from lighting loads only adds to cooling requirements.

Continued...

This week... Resources (Physical, Geographic, and Mental)

MEEB: Energy (Renewable | Nonrenewable)

- > Contemporary energy use in buildings relies heavily upon electricity, with serious implications for resource depletion:
- 3. Electricity is convenient to use, for high-grade (lighting & power) or low-grade tasks (cooking, heating). *Examples?*
- 4. Electricity delivers to users less than 1/3rd of the energy used in its production. [!!!]

This week... Resources (Physical, Geographic, and Mental)

MEEB: Energy (Renewable | Nonrenewable)

> Alternatives for the near-future:

- A return to renewable sources:
Solar (photovoltaics; water heating)
- High-grade fuel (hydrogen) for local consumption.
- Bio-mass conversion (wood and waste)

Up to this time, most efforts towards addressing energy scarcity has emphasized efficiency; green and sustainable efforts look both to reduction and renewable resources.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Water

Although most efforts towards resource-efficient design emphasizes the use of energy, water resource management is at a crisis point in most parts of the world.

Water use, rather than energy use, may more severely affect growth contemporary development.

- > Increased domestic usage;
 - increase in intensive usage (agriculture, irrigation.)
- > Depletion of underground water stocks;
- > Increasing salinization of aquifers;
- > Pollution of above- and below-ground sources;
- > Misdirection of local sources (rainwater or groundwater)

This week... Resources (Physical, Geographic, and Mental)

MEEB: Materials (Renewable | Nonrenewable)

- > Structural and finish systems include both renewable and non-renewable materials. *Examples?*
- > Mechanical and electrical systems make use primarily of non-renewable materials. *Examples?*

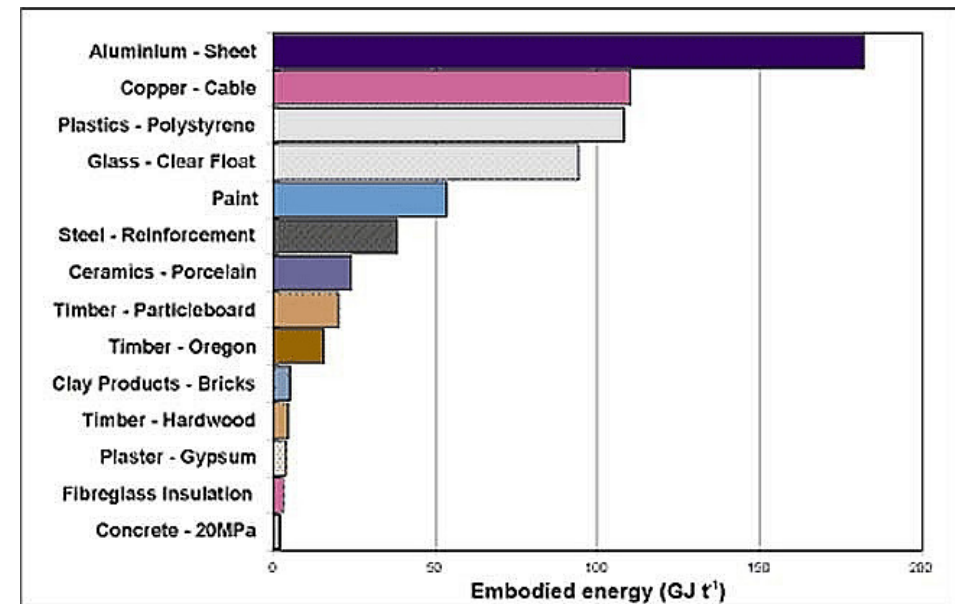
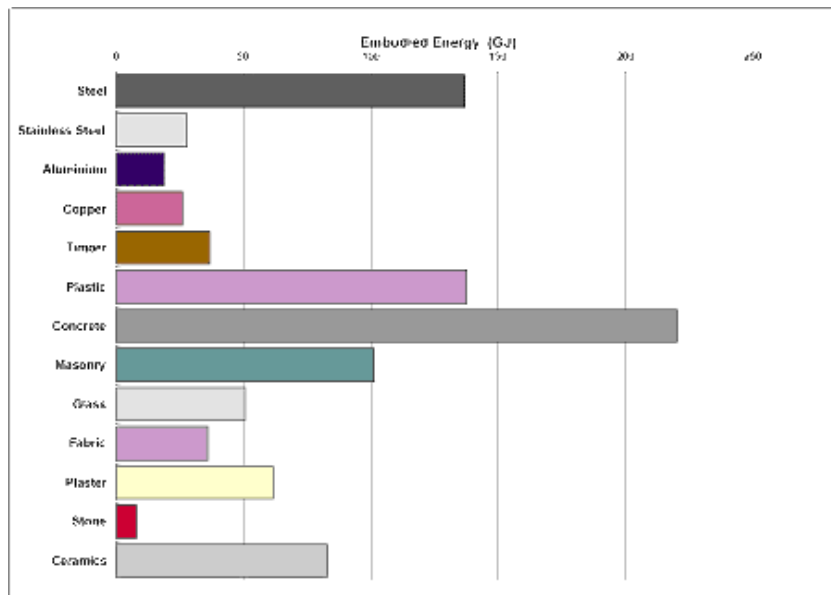
Furthermore, and analogously to energy production itself, contemporary construction looks mostly to resources produced off-site and “imported.” Doing so involves enormous energy resources to implement.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Materials

> **Embodied Energy:** How much Energy must be invested to mine/harvest/produce, fabricate, and transport a unit of building material. *Examples?*

> *Compare the following charts with Table 2.4...*



This week... Resources (Physical, Geographic, and Mental)

MEEB: Materials, Recycled or Virgin

> Building Construction, Renovation, and Demolition provide many opportunities for reuse and recycling; but, typically, these opportunities are ignored.

Most “green” certification programs, such as LEED, emphasize the importance of controlling the waste stream.

Examples of salvage and re-use? Of recycling materials?

Caveat: *Since labor costs have risen even more than material costs, recycling (a labor-intensive activity) may remain more costly than continued use of virgin material.*

This week... Resources (Physical, Geographic, and Mental)

MEEB: Design Challenges

Buildings and their systems are likely to be used differently over time. Societal value on resources are also likely to change.

“This poses some overall challenges to the designer.” p. 37

Is this true?

What are examples of changes over time? Counter-examples?

This week... Resources (Physical, Geographic, and Mental)

MEEB: Design Challenges - *Design for Building Recycling*

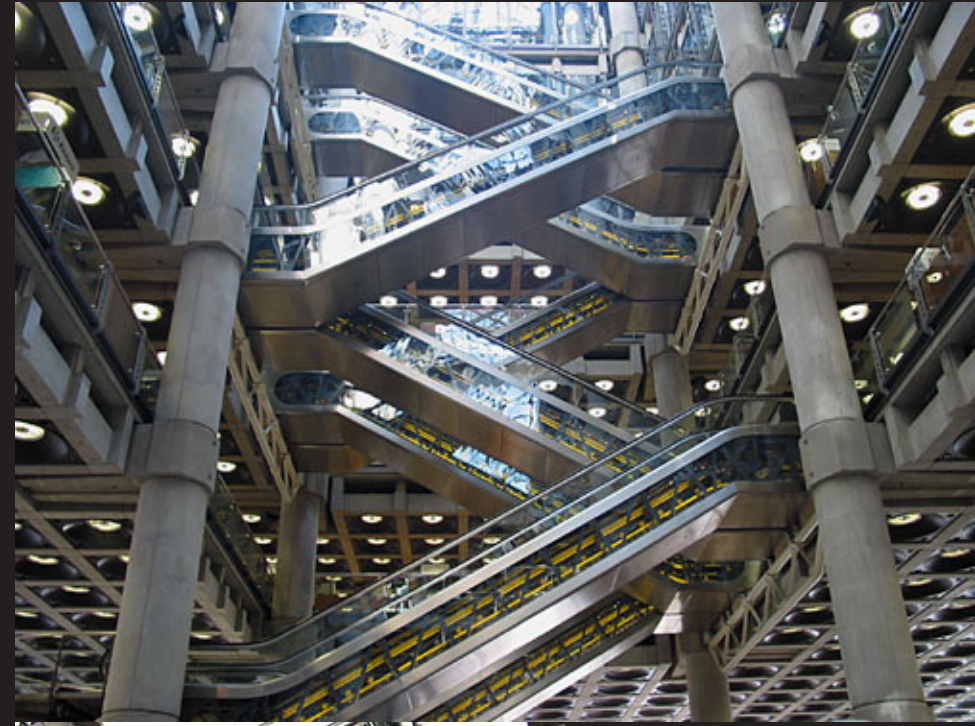
> A two-fold balance:

*Introduce flexibility into the spatial definition of the building;
Configure the building with “demountable” parts.*

1. Independant Structure, with the possibility of disassembly;
2. Design for potential expansion;
3. Maximize use of on-site forces, including Wind and Sun;
(These never becom obsolete...)
4. Use materials and components discretely; avoid combinations which make re-use or re-cycling difficult.
(Remember McDonogh’s first Book Example.)

But even a conscious effort can backfire...

Rogers, **Lloyds of London**
Circa 1985



This week... Resources (Physical, Geographic, and Mental)

MEEB: Design Challenges - *Design for Energy Transition*

> Two More Challenges:

1. Design not only to save energy, but also to anticipate future use of different energy sources, including renewable energy. *Examples?*
2. Anticipate equitable allocation of local resources, including sun and rainwater.

The concept of Solar Envelope will be introduced to evaluate each building or site's "fair" share of solar energy.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Design Challenges - *Design for the Information Age*

> Energy control is cheaper than energy use!

Buzz Words: *Smart houses, Intelligent buildings,
Smart appliances, Material memory...*

- > *Regulate an array of building resources automatically;*
- > *Dynamic and responsive systems allow appropriate energy use at appropriate places (micro-scale) and hours (time-scale).*

This week... Resources (Physical, Geographic, and Mental)

MEEB: Design Challenges - *Design for the Information Age*

> **Distribution Tree:** A hierarchical map of energy resource consumption within a building.

MEEB's description is extremely confusing.

Most “distribution” configurations for HVAC or related systems are very space-consuming; but the introduction of “intelligent” control -- either wired or wireless! -- suggest that the previous, typical distribution trees (big trunk, many short branches) might be replaced by a more efficient model: Smaller, parallel trunks, each with its own control and, possibly, its own power consumption devices.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Design Challenges - *Design for Transportation*

“There is clearly a link between design decisions at regional and neighborhood scales (urban planning and subdivision design), transportation, and resulting energy use for commuting, shopping, and recreation.” p. 39.

The design of systems for cars (as opposed to transit-oriented systems) impose heavy and inflexible demands on the design both of building structure and building systems. *Examples: Sloped decks for ramps and high-volume intake/exhaust systems for parking tiers.*

How might we design for a future in which human movement is achieved differently?

This week... Resources (Physical, Geographic, and Mental)

MEEB: How are we doing?

- > Concern is growing... per capita use is stable or falling;
- > New designs and equipment are more efficient than before;
- > Awareness seems to be effecting greater sensitivity towards the use of resources.

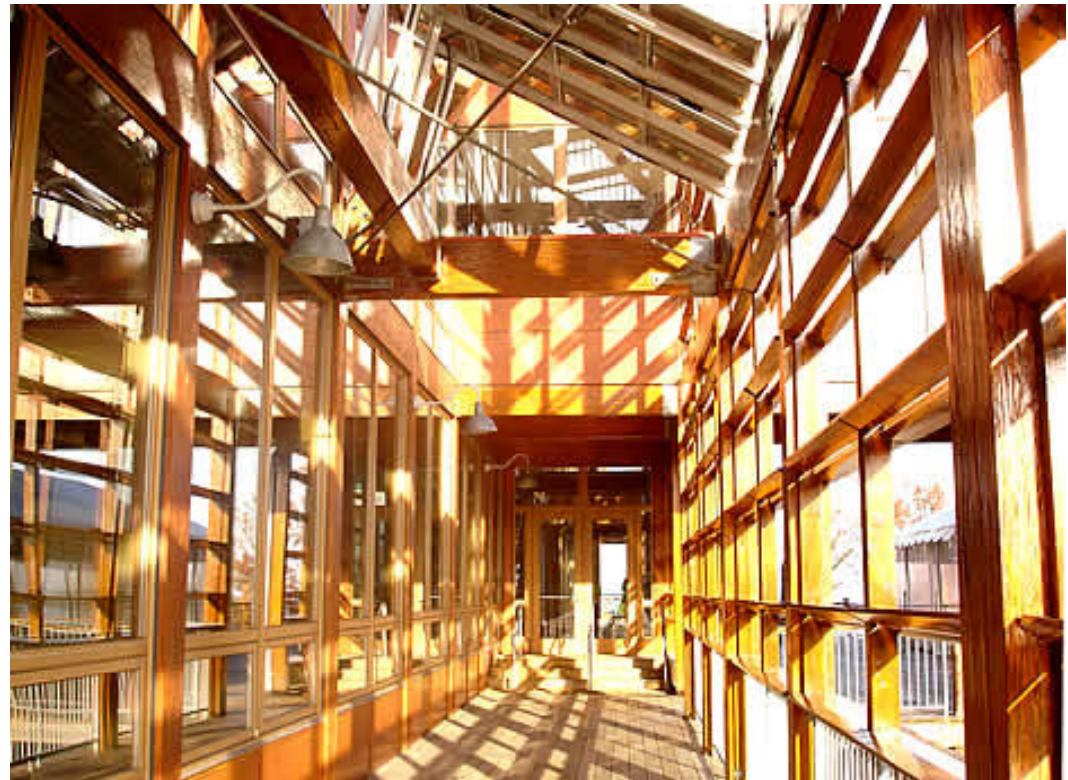
Yes, BUT...

Evaluations of concepts such as **Environment Footprint** suggest that we are, most of us, still living beyond our means.
[Consider Tables 2.6 and 2.7]

“Sustainability is essentially keeping the Earth’s footprint on the planet.” p. 41.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Case Study -- Chesapeake Bay Foundation Philip Merrill Center



(Smith Group Architects)

This week... Resources (Physical, Geographic, and Mental)

Worksheet #3a: Environmental Resources

Micro and Macro

PBS Video Series: *Design E²*

This week's showing: Green Machine

This week... Resources (Physical, Geographic, and Mental)

MEEB: Sites and Resources

Analysis Precedes Planning: Understanding Precedes Action.

Site analysis includes: Utility Availability, noise sources, zoning, views, solar access, traffic, pedestrian patterns, climate, etc.

Site analysis challenges the designer to locate appropriate and reliable information sources.

Remember: Analysis will provide the raw data upon which the Designer must impose judgements about the relative importance of that data...

This week... Resources (Physical, Geographic, and Mental)

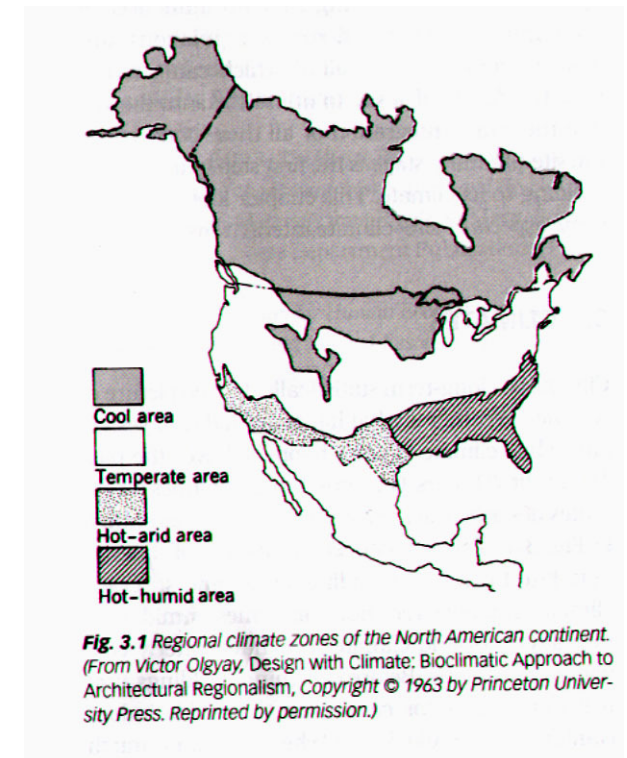
MEEB: Climates

“Climate is a long-term, statistically-derived picture of weather.”
10, 15, 20 or 100 year trends!

> Most verbal shorthand for a climate describes its most extreme condition, not its variation or its mean.

*Cold (northern) climates can be hot;
Hot-arid (desert) climates can be cold,
even every night!*

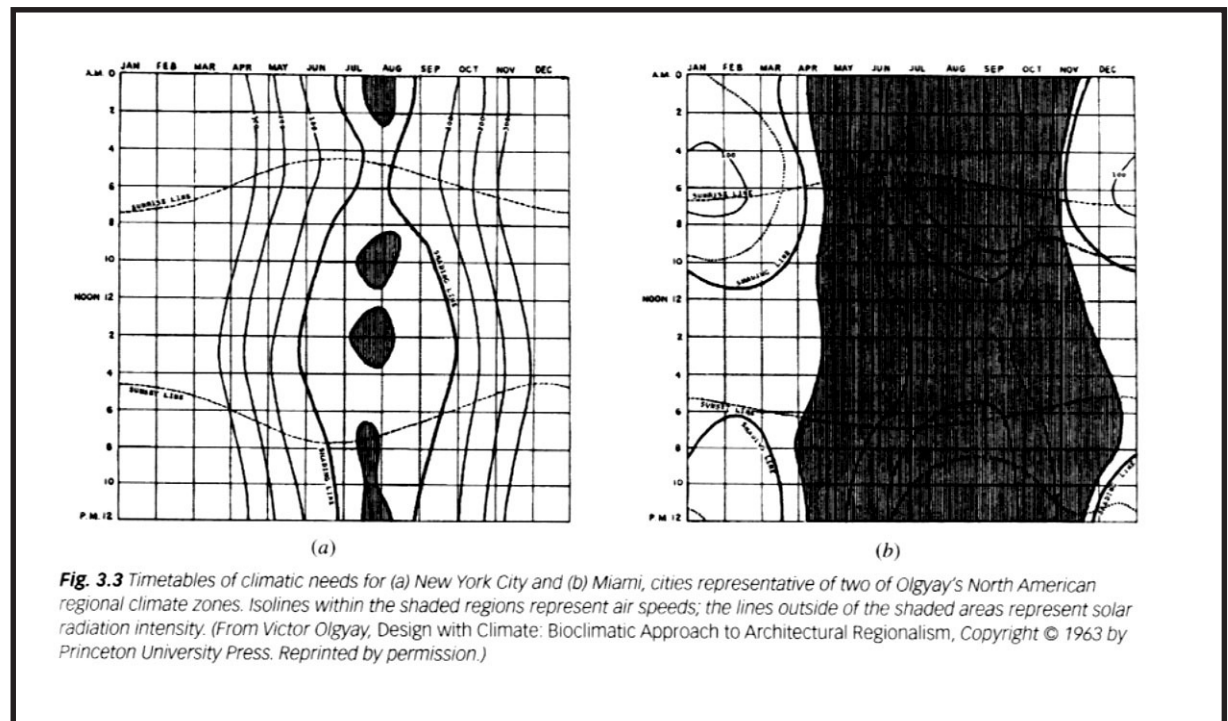
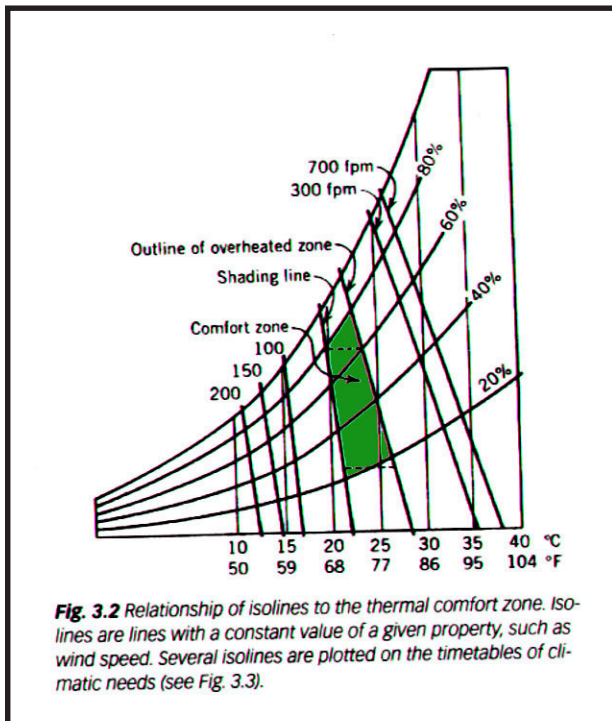
> Graphic representation is often useful, since multiple variables and data points may be illustrated.



This week... Resources (Physical, Geographic, and Mental)

MEEB: Climates - Bioclimate Design (Olgay, 1963)

- > “Bioclimate Design,” for instance, represents the connection between comfort and climate



This week... Resources (Physical, Geographic, and Mental)

MEEB: Climates within Climates - Microclimates

- > Climate at a Site might be different than that which is described by published data for a region. *Why?*
- > Characteristics of a microclimate and its influences:

Site: Soil type, ground surface, topography, vegetation, water bodies/flows, views, human effects.

Climate: Sun, air temperature, humidity, precipitation, air motion, air quality.

This week... Resources (Physical, Geographic, and Mental)

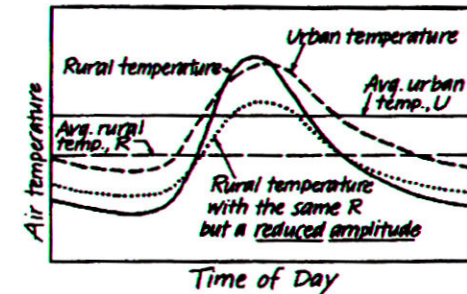
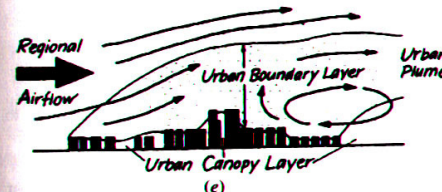
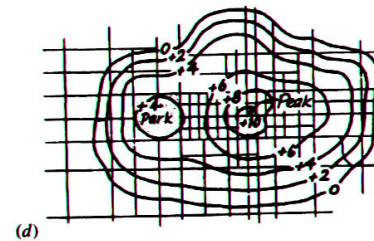
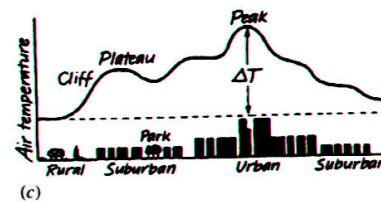
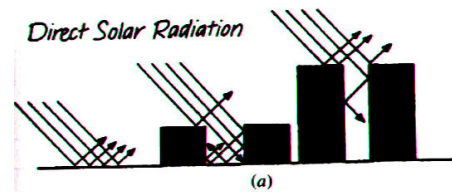
MEEB: Climates within Climates - Microclimates

> Urban sub-climates are distinct from surrounding areas.

Heat Island Effects

TABLE 3.1 Average Changes in Climate Effects Caused by Urbanization^a

Effect	Comparison with Rural Environment
Contaminants	
Condensation nuclei and particulates	10 times more
Gaseous admixtures	5 to 25 times more
Cloudiness	
Cover	5 to 10% more
Fog, winter	100% more
Fog, summer	30% more
Precipitation ^b	
Totals	5 to 10% more
Days with less than 2 in. (5 mm)	10% more
Snowfall	5% less
Relative humidity	
Winter	2% less
Summer	8% less
Radiation	
Global	15 to 20% less
Ultraviolet, winter	30% less
Ultraviolet, summer	5% less
Sunshine duration	5 to 15% less
Temperature	
Annual mean	0.9 to 1.8°F (0.5 to 1.0°C) higher
Winter minima (average)	1.8 to 2.6°F (1 to 2°C) higher
Heating degree days	10% less
Wind speed	
Annual mean	20 to 30% less
Extreme gusts	10 to 20% less
Calms	5 to 20% more



This week... Resources (Physical, Geographic, and Mental)

MEEB: Buildings and Sites

“Buildings are guests, sites are hosts; a fundamental design question is, how can the two most productively coexist?” p52.

- > Natural Sites Offer a Building: Support
Potential Heat Source / Sink
Plant Growth, Respiration

- > Building Construction Offers the Site: Electric light at night
Heat Flow
Change in Water Flow
Liquid and Solid Waste/Nutrient

Most often these elements are encapsulated for removal.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Buildings and Sites

- > Site Larger than the Building: Use of Vegetation, Wind, & Light
Use of Earth for filtering
& distribution.
- > Building Fills Its Site: Less possibility for Wind capture;
Less ability for Earth-
based absorption

The roof becomes THE significant player among environmental surfaces for interaction with the climate.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Analyzing the Site

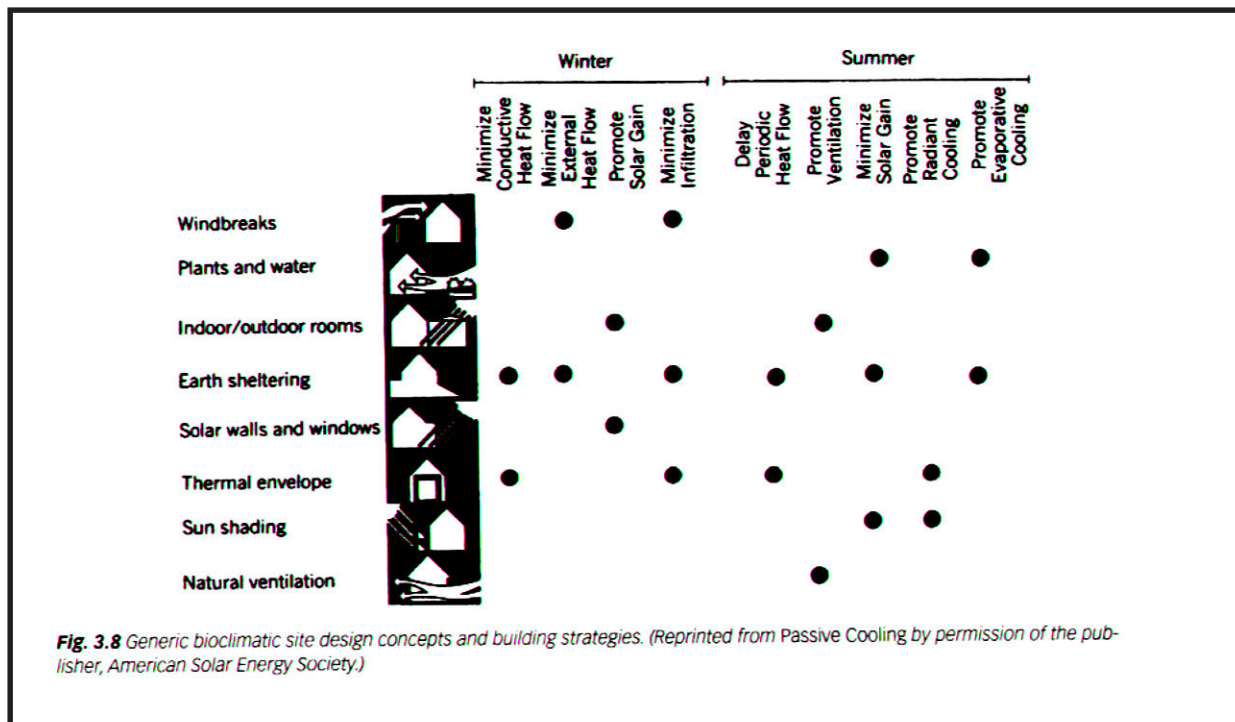
- > “Schematic Site Plans are typically used as a kind of inventory; ... (s)un and wind conditions (in both summer and winter), noise sources, and water runoff patterns are often included in a schematic plan.” p.53
- > Identify significant Microclimates! (To expand comfort zones.)
- > Microclimates are not limited to those visible above-ground.

Surface <> Subsurface

This week... Resources (Physical, Geographic, and Mental)

MEEB: Site Design Strategies

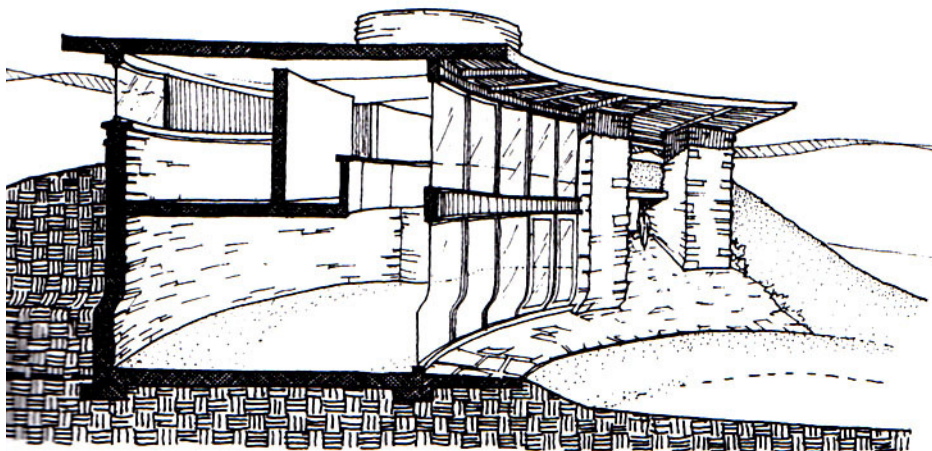
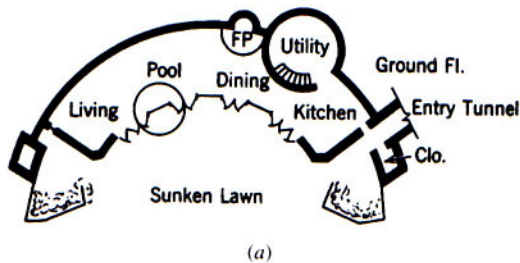
> Common Site Strategies may differ from season to season.



This week... Resources (Physical, Geographic, and Mental)

MEEB: Site Design Strategies

- > Application of these concepts may be seen in Wright's Hemicycle House, circa 1948.



- Windbreaks
- Plants and water
- Earth Sheltering
- Solar Walls and Windows
- Thermal Envelope
- Sun Shading
- Natural Ventilation

This week... Resources (Physical, Geographic, and Mental)

MEEB: Direct Sun and Daylight

- > Available solar energy at any given site varies seasonally and daily.
- > Light *quality*, as well as *quantity*, varies due to climate.

Access to Light and Sun: In urban settings, access to daylight is ensured by legislated setbacks for a given height...

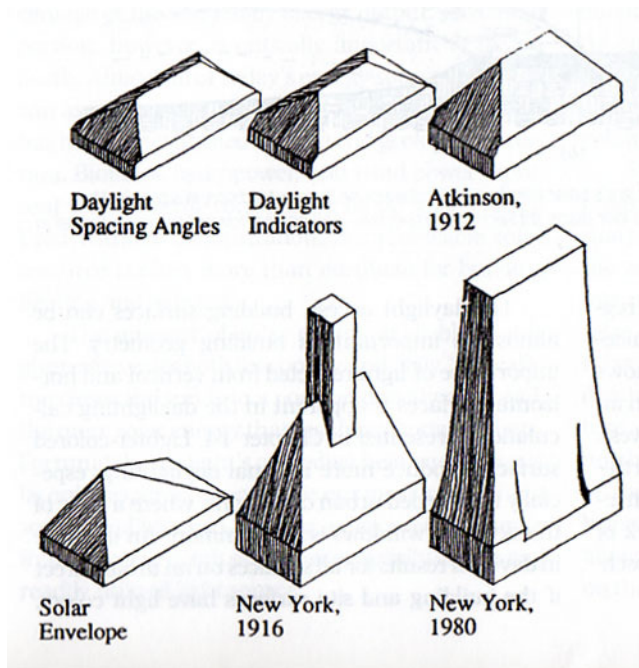
On all sites, the “Solar Envelope” is defined by the optimum height/depth bulk which assures daylight’s reaching the ground floor throughout the day.

The bulk defined by the Solar Envelope may be affected by surrounding landscape elements, including trees, topography, or other buildings.

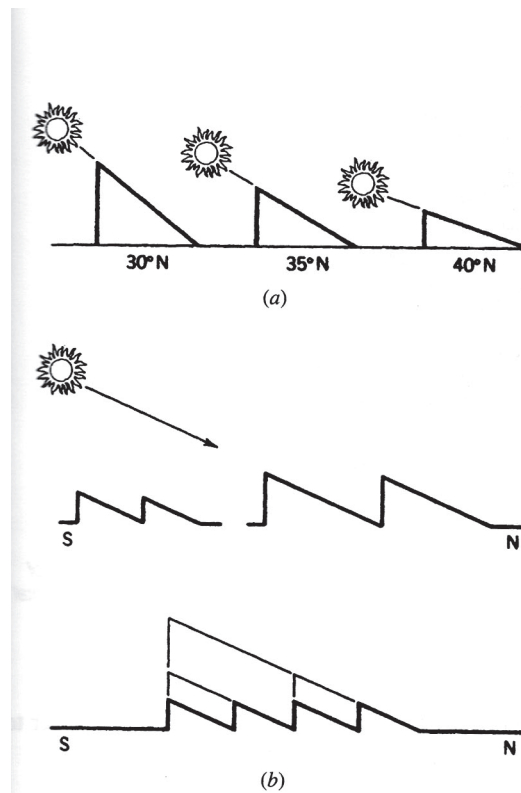
This week... Resources (Physical, Geographic, and Mental)

MEEB: Direct Sun and Daylight

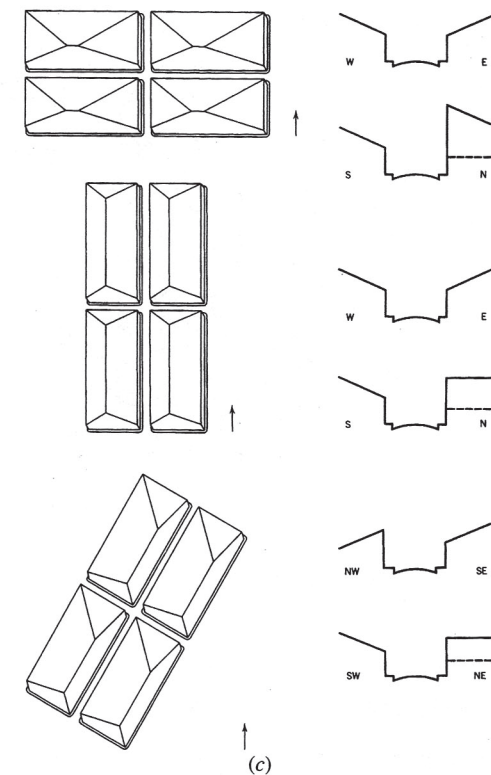
Access to Light and Sun: Sample Setback Definitions & Codes



Historical Examples



Changes with Latitude



Different Site Orientations

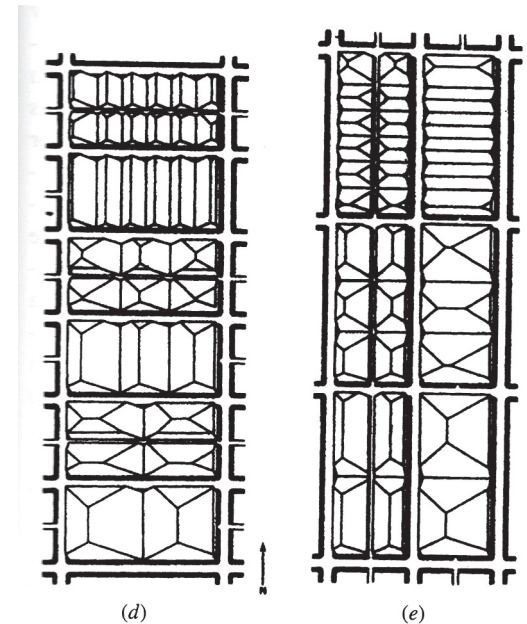
This week... Resources (Physical, Geographic, and Mental)

MEEB: Direct Sun and Daylight

Access to Light and Sun: Urban Topography

East-west elongated Blocks (Left)

North-south elongated blocks (Right)



This week... Resources (Physical, Geographic, and Mental)

MEEB: Direct Sun and Daylight | Charting the Sun

> Sun Chart Example

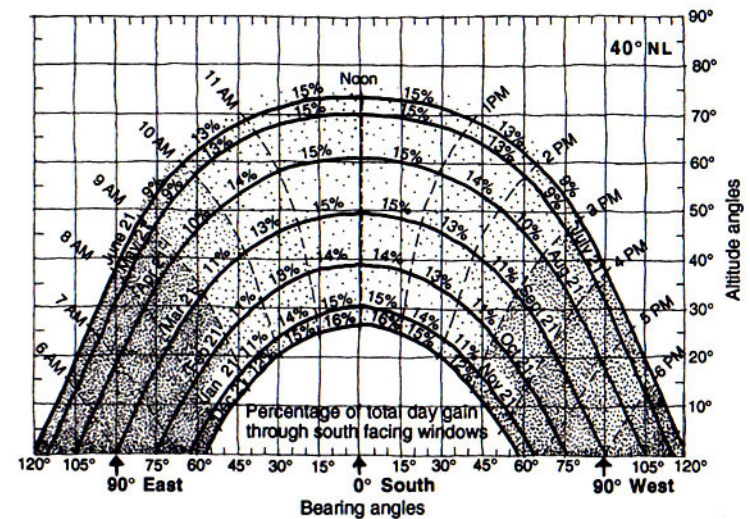
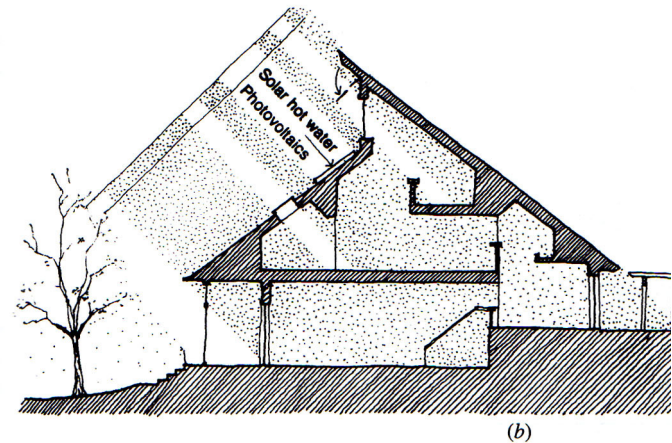
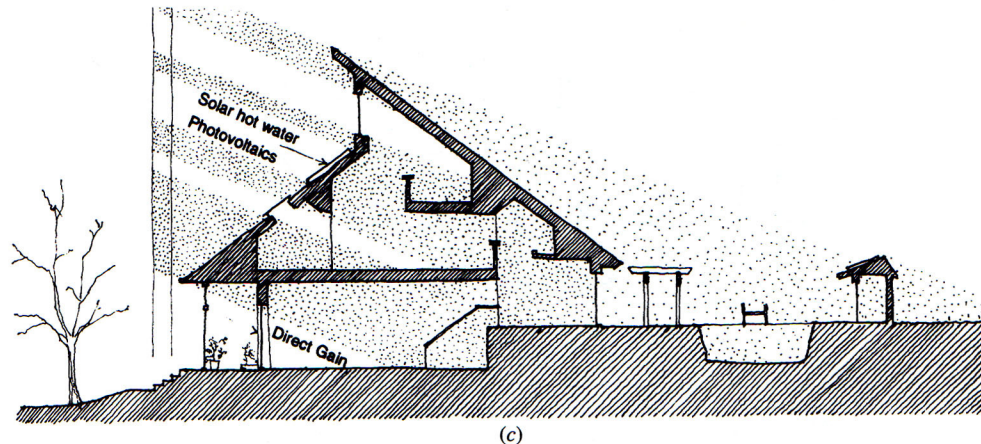
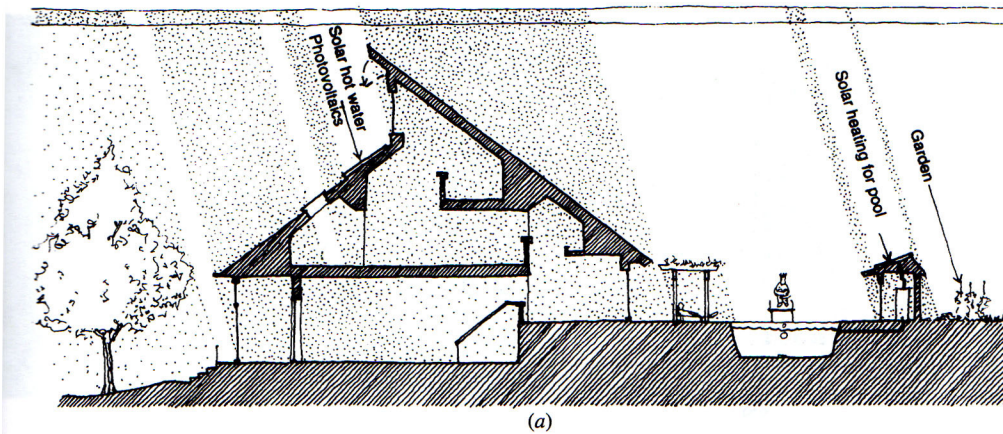


Fig. 3.13 Sun chart for 40° N latitude showing the approximate percentage of clear day insolation for south-facing windows for each of the 6 maximum hours of sun each month. (From Edward Mazria and David Winitsky, Solar Guide and Calculator, Center for Environmental Research, University of Oregon, 1976.)

Key Terms: *Clear-Day Insolation; Bearing Angle; Altitude Angle*

This week... Resources (Physical, Geographic, and Mental)

MEEB: Direct Sun and Daylight | The Band of Sun



- > Building Sections, showing sunlight entry based on 12-noon, adjusted for season (time of year). *Key Term: Tilt-angle*

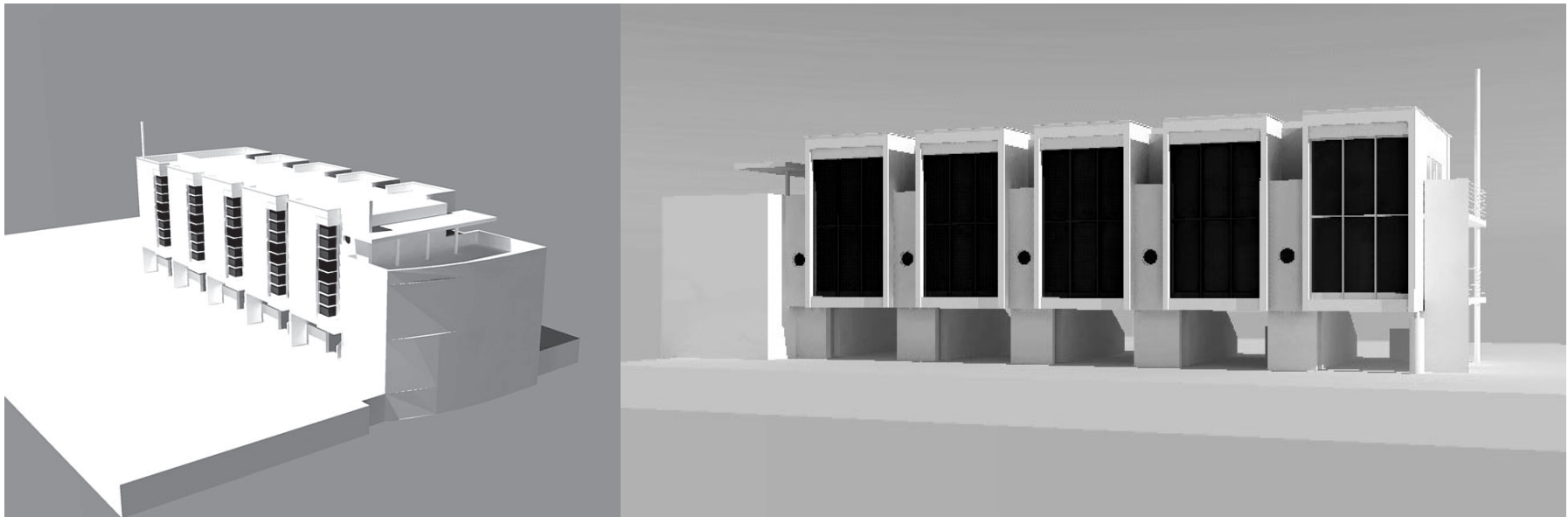
This week... Resources (Physical, Geographic, and Mental)

MEEB: Direct Sun and Daylight

Skylines and Winter Sun: Figure 3.15

Sun and Shadows, Model Techniques: Figure 3.16

Model Techniques are mostly simulated by computer models...



Key Terms: Seasonal Obstructions, Sunpeg Chart (see p.155),

This week... Resources (Physical, Geographic, and Mental)

MEEB: Direct Sun and Daylight | Controlling Solar Reflections

The use of mirror glass for aesthetic or energy-control reasons has introduced a new climactic impact: **Reflection**.

Control may be introduced by local landscape elements, including foliage, or architectural elements such as *brise soleil* or *light-shelves*, which can direct some of the energy as light into the building for interior illumination.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Sound and Airflow

These environmental factors, so different for us to experience, are themselves difficult to separate physically for individual control.

Noise

Air Pollution

Wind Control

Ventilation and Cooling

Wind, Daylight, and Sun

This week... Resources (Physical, Geographic, and Mental)

MEEB: Rain and Groundwater

A building typically interacts with 4 kinds of water:

- Lightly-controlled, exterior-source elements:
 - > Rainwater
 - > Groundwater

- Tightly-controlled, interior services:
 - > Potable Water
 - > Waste Water

This week... Resources (Physical, Geographic, and Mental)

MEEB: Rain and Groundwater | Rainwater Characteristics

- > *Diffuse, intermittent, and (often) seasonal;*
- > *Can be source of other kinds of water systems;*
- > *Strongly influences architectural form;*
- > *Rainwater / Building interaction affects other
Climate / Building interaction sources, including
Sunlight and Wind.*

Rainwater Diversion: *Rain runs downhill, but may also be introduced under pressure, and can result in secondary pathways, such as capillary movement.*

This week... Resources (Physical, Geographic, and Mental)

MEEB: Rain and Groundwater | Surface Water

Surface-collected water, whether from rainwater or groundwater sources, may make a rich contribution to the architectural character of buildings, as well as their environmental behavior.



Cooling and humidifying in hot, dry climates; reflection of daylight for low-altitude sunlight.

Ando's *Modern* in Fort Worth

This week... Resources (Physical, Geographic, and Mental)

MEEB: Groundwater Characteristics

Typically avoided by Architects -- seen as a threat to other systems:

- > *Structural Stability*
- > *Human Habitation, especially at below-grade or at-grade spaces*

In site planning, too, marshes and wetlands have traditionally been avoided due to potential health risks and, more recently, awareness of these ecosystems fragility.

Groundwater may be a significant source of heat or heat discharge, depending upon the ecological character of the site.

Geothermal systems, using groundwater, are becoming common.

Ecological impact remains uncertain, and may need to be considered.

This week... Resources (Physical, Geographic, and Mental)

MEEB: Plants

- > Affect the absorptivity and emissivity of the Earth's surface;
- > Participate in both food and water cycles;
- > Participate in free-Oxygen-producing cycle;
- > Provide Raw Materials for building and other human uses;
- > Provide, in some climates, a psychological measure of time.

Deciduous trees, in climates such as ours, are useful variable-shutters for control both of unwanted sun and heat. Additional human-factor parameters, such as privacy- and noise-control, are also affected beneficially by the strategic placement of foliage.

What can be better for climate control in the summer than a wet umbrella directly over-head?

This week... Resources (Physical, Geographic, and Mental)

Worksheet #3b: Sites and Resources

Next week...

Comfort and Design Strategies Indoor Air Quality

C+C, Chapter 4; MEEB, Chapters 4 & 5