Principles for forming the relationship between Comfort (Delight) <-> Environmental Forces / Climate

- Design Intent, Design criteria, Design tools, Design methods
  - Importance of SITE
  - Examples and Outlook
  - State of the Art (HighTech/LowTech) Europe and the U.S.

- Passive / Active / Integrative
- Physics and Physiology principle
- Regulations, Codes, Intuition

- Simulation, Hand Calculation, Rules of thumb
- Design process and concepts
- Level of detail

**Important: What to know when?**
schematische Darstellung
Alvar Aalto experimental summer house
Alvar Aalto experimental summer house

Environmental behaviour of a tent.
1. Tent membrane deflects wind and excludes rain
2. Reflects most radiation, retaining internal heat, excluding solar heat, maintaining privacy

Source: Reyner Banham: The architecture of the well-tempered environment
Design process

Design intent: (What do I want to achieve?)
• Program, project brief, occupants requirements
• Outstanding comfort (question: what is that?) versus delight?
• ‘Green building’ / use of passive systems
• Flexibility
• Spatial delight / beauty
• qualitative and quantitative aspects!

Design Criteria (benchmarks to evaluate success):
How do I want to achieve it?
• ASHRAE 55 (‘Code climatica’: for Comfort)
• LEED, European Solar Charta, Energy Saving Regulation etc

Design Tools:
• physical models, calculation, simulations
• (how do I get there?)

Methods:
• passive climate control, daylighting, envelope strategies......

Environmental Forces - Comfort

Thermal Environment: Heat, Coolth- Humidity - Thermal comfort
Wind / Air / Ventilation Pollution - Indoor Air quality / well-being performance
Water / Rain / - Stay dry

Light / Darkness - Visual comfort: I can read, work without glare
Sound / Noise - Acoustical comfort: I can hear (little background sound level)

Fire - Safety
### Passive system active Systems

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<th>Energy Source</th>
<th>System Components</th>
<th>System integration</th>
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<tr>
<td><strong>Energy Source</strong></td>
<td>No purchased energy: daylighting</td>
<td>Concrete floor as thermal storage/solar gain</td>
<td>Natural ventilation through operable windows</td>
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<tr>
<td><strong>System Components</strong></td>
<td></td>
<td>Gas furnace</td>
<td>Window air condition unit</td>
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<td><strong>System integration</strong></td>
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Passive Systems: Wind Towers in hot arid climate

Active means

MVRDV: Expo Pavilion for the Netherlands
Renzo Piano Workshop
Cultural Center
New Caledonia
3.3 Apartment building, Innsbruck (A)

The new apartment blocks in Innsbruck are an example of the integration of traditional and modern architectural elements. The buildings are constructed using local materials and have a distinct regional character.

The design of the apartment blocks is characterized by a combination of brick and wood, which not only provides thermal insulation but also enhances the aesthetic appeal. The layout of the apartments is designed to maximize natural light and views of the surrounding landscape.

Innovative systems for heating and cooling are integrated into the buildings, ensuring a comfortable living environment while also promoting energy efficiency. The apartment blocks are designed to meet contemporary standards for sustainable living, incorporating features such as solar panels and rainwater harvesting systems.
3.5 Law Courts, Bordeaux (F)

Richard Rogers Partnership

One of the largest and most innovative projects in the history of modern architecture, the Law Courts of Bordeaux is a landmark in the development of postmodern architecture. The building is characterized by its use of glass and steel, as well as its intricate roof structure, which is designed to reflect the city's historical heritage.

The building's design is inspired by the traditional French law courts, with a tower and domed roof serving as a symbol of justice. The use of glass and steel allows for maximum natural light, creating a bright and airy interior. The structure's roof is a complex network of curves and angles, designed to create a sense of movement and energy.

The Law Courts of Bordeaux is not only a symbol of justice but also a work of art, with its unique design and aesthetic appeal. It is a testament to the power of architecture to create a sense of place and identity.
Codes and Standards
Why do we need codes? Accidents, disasters (fires) crisis, costs? Public safety/ comfort / prevention

• **Codes are government-mandated**
  - Prescriptive approach (Minimum thermal properties for a roof insulation)
  - Performance approach (maximum energy use of a building)

• **Standards are set by recognized authorities**
  - ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers STANDARD 55 (Human comfort) or 90.1 (Energy efficiency)
  - the U.S. Green Building Council (USGBC),
  - the U.S. Department of Energy (DOE)
  - National Fire Protection Association

• **Guidelines and handbooks**
  - Advanced Lighting guidelines Illuminating Engineering Society of North America (IESNA),
  - LEED Certification brings an order and acceptance to green design issues

• **General practice, intuition, experience**

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Energy efficiency requirements

• **Minimum envelope and mechanical equipment performance for the ‘running’ of the building**

• **Efficiency: System input ratio to output**

• **Extended energy efficiency**
  – Construction energy
  Reduce energy use esp. nonrenewable energy sources
Green Building Design Strategies

• Minimize environmental impact
• Concerns with health and well-being of people
• Local and global
• Reduce environmental impact
• Certification now possible: LEED
  • (Leadership in Energy and Environmental Design)
    – Energy
    – Water
    – Materials
    – AIR Pollution

Design Strategies for  Sustainability

• Sustainability involves meeting the needs of today’s generation without detracting from the abilities of future generations to meet their needs.

• Long-term SURVIVAL
• Zero net use of nonrenewable sources
• NO net environmental impact
• Sustainability can ONLY be achieved on community level, it is essentially a broader issue than a single building
Regenerative Design Strategies

- Energy
- Water
- Material resources
- Air quality

- Produce POSITIVE environmental impact
- Example: the EDEN project in the UK

Physical laws as basis for design

- Heat flow
- Water flow
- Electricity
- Light properties
- Sound
- Air quality

-> Follow rules described by physics and understand their concepts and impact on the human metabolism
Design philosophy
The architect as moderator and consultant

- Natural and passive principle
OR / AND Active mechanical processes

Nature as MODEL i.e. living machine as a way to treat sewage water (integrative with landscape)
Use the right level of technology
  - heat hot water with solar panels instead of electricity
Design of spaces
- Shape the form to guide the flow
- Shape the form to manifest the process
- Educate the USER

Examples: Alvar Aalto: Viipuri Library

- Hybrid system:
  - > a combination of active and passive environmental control systems