During the conceptual design phase of urban areas, the designer deals with different geometrical characteristics of the project.

**Orientation**
- Height
- Width
- Open spaces
- Sidewalks
- Proportions

**Daylight Access**
- Wind regime
- Daylight access
- Shading
- Solar rights

Early stages of this process characterize themselves by a constant search for a design direction. Decisions taken in those moments can determine the success or failure of the proposed project.

**Outline**
- The need
- The gap
- The tools

**1. Passive Solar Design**

**Solar Rights**
- Passive Solar Heating of Buildings
- Comfort conditions in open spaces, Insolation and Shading

**2. Active Solar Systems**
- Solar water heating
- Compulsory in Israel for residential buildings
- MUST protect solar rights
- Photovoltaic panels (BIPV) part of the building envelope
- Roofs
- Facades
3. Daylight Access

availability of daylight in certain areas of the city can be difficult

Sky View – Sky Solid Angle SSA avoid glare

Energy demands per hour in an office building by end-uses on a summer day (left) and annual electricity production in Israel by type of fuel (right).

Source: Israel Electric Company, 1994 and 2001

Global horizontal solar illuminance (lux) in Tel Aviv (Lat: 32 deg N, Long: 35 deg E)

Design Tools:

Generation: aid to define the proper geometry (space of solutions) to achieve a certain performance

Evaluation: analyze the performance of a given design alternative

Evaluation +: (support generation)

disadvantages:

Input of evaluation models needs detailed information and precision not known and not relevant at the beginning. Tools can also have complex interfaces that require much time to learn and use. Both factors can distract from the design activity itself.

Early design decisions are based on vague “ideas” that cannot be evaluated with tools that rely on exact data. They require complex input procedures, together with translations from one format type to another.

Most tools are dedicated to evaluate a certain finished alternative, not to suggest and evaluate different design options and directions. This implies fitting an idea to the modeling tool, thus filtering out information that could be useful or distorting the process. Trial and error approach.

Most evaluation programs are designed for use by consultants, generally engineering companies that enter the design field very late, when main geometric characteristics of the building are already fixed.

For complex projects on the boundary of his or her expertise, the designer has few criteria about which design direction to develop in order to pass from idea to design concept.

How design tools can support the design process?

help to generate new set of questions… what if…? what to do next…?

support architects from the beginning of the design process; one 3D model

suggest solutions

present evaluations that help to generate design solutions

help architects making informed design decisions towards high-performance urban design
DESIGNING AN URBAN BLOCK

The Solar Volume for a new area
SRE = SV

INSOLATION PERIOD:
November-March
10:00AM – 2:00PM
SOUTHERN FAÇADE & SUN DECK
EXPOSED TO SUN
SUNNY SIDEWALKS
A simple method for considering solar rights based on Solar Envelopes

It presents the use of solar section lines as a simple tool for solar rights design.

Designing according to these section lines ensures the solar rights of the surrounding buildings and open spaces, without the need to demonstrate further requirements.

Solar rights regulations

According to the insolation hours which meet the radiation requirements. The designer has to present the proof of keeping the surrounding buildings exposed to the sun during that time.

**REQUIRED HOURS OF INSOLATION FOR MOUNTAIN AREA (JERUSALEM)**

<table>
<thead>
<tr>
<th>Month/Area</th>
<th>Dec. 21st</th>
<th>Jan. 21st</th>
<th>Feb. 21st</th>
<th>March</th>
<th>April</th>
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<th>Sept.</th>
<th>Oct. 21st</th>
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<tbody>
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The section lines defined for the descriptive method are based on solar envelopes that were created according to the required hours of insolation for each orientation for the four different climatic zones in Israel and for both central and peripheral areas.

1. Keeping Solar Rights of Residential Buildings

In central areas, where lower floors may be used for commercial purposes the base point of the section lines will rise up.

2. Keeping Solar Rights of Sidewalks

The requirement for sidewalk insolation is that at least 1 to 2 meters of its width will be insolated. The demand is for only one sidewalk to be exposed at a time.

Evaluation +

SunTools plugin for SketchUp
presenting information with new meaning valuable for design generation

sun_path sun_position

sun_penetration/solar_access
The external obstructions and the visible sky patch as viewed by Radiance from a window located at floors 2, 4, 8 and 12

The sky solid angle (SSA) as calculated by Sustarc from a window located at floors 2, 4, 8 and 12, in a building facing an irregular obstruction pattern

Dependence of average daylight factor (DFave) for office spaces on the solid angle subtended by the visible patch of sky (SSA) from the center of the window
"We have not succeeded in answering all our problems. The answers we have found only serve to raise a whole set of new questions. In some ways we feel we are as confused as ever, but we believe we are confused on a higher level and about more important things...".

Posted outside the mathematics reading room, Tromsø University (via Bernt Øksendal, Stochastic Differential Equations).

Thank you....!!

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