Natural Light in Design
Using simulation tools to explore realistic daylight-responsive solutions

Daylight Factor

Visual Comfort

Daylight Autonomy

Avoidance of Direct Sunlight

Radiance Materials
Christoph Reinhart, Ph.D.
# Overview – Radiance Materials

<table>
<thead>
<tr>
<th>Time Slot</th>
<th>Content</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tue 9.30</td>
<td>MISC: announcements, design project teams organization</td>
<td>MA</td>
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<tr>
<td>Tue 10.00</td>
<td>▪ Hands-on exercises: Review yesterday’s content (CR)</td>
<td>MA, CR, all</td>
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<td></td>
<td>- Building &amp; Technologies (inc. advanced materials) (MA)</td>
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<td></td>
<td>- Introduction to advanced Radiance materials, Ecotect’s BAOTOOL (CR)</td>
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<td>Tue 11.00</td>
<td>coffee break</td>
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<tr>
<td>Tue 11.15</td>
<td>▪ Hands-on exercises: Import Geometries and Materials from other</td>
<td>CR, all</td>
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<td></td>
<td>programs (SketchUp, AutoCAD)</td>
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<tr>
<td>Tue 12.15</td>
<td>▪ Specialty topics (to be suggested by participants before the workshop)</td>
<td>MA, CR, all</td>
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<td>Tue 13.00</td>
<td>lunch (on your own &amp; design teams should discuss their projects)</td>
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<tr>
<td>Tue 14.00</td>
<td>▪ Hands-on exercises: Participants start working on their own models</td>
<td>all</td>
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<td>(Participants will have the opportunity to discuss their project ideas</td>
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<td>with the instructors)</td>
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<td>Tue 15.45</td>
<td>coffee break</td>
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<tr>
<td>Tue 16.00</td>
<td>▪ Continue previous activities</td>
<td>all</td>
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<td>Tue 17.30</td>
<td>end second day</td>
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Plastic Material I

For a perfectly diffuse surface (Lambert surface) holds:

\[ L = \frac{E \rho}{\pi} \]

E.g. paper, drywall
Plastic Material II

Only internal properties used for Radiance.

Red/Green/Blue: $(246/255)=0.965$

$\text{Specularity}_{\text{Radiance}} = 0.2 \times \text{Specularity}_{\text{Ecotect}}$
Plastic Material III

Typical reflectance values:
- floors 30%
- wall 50%
- ceiling 60 - 80%

Typical specularity values:
- matt 0
- glossy 0.02

Simple measurement to estimate reflectance values:
- Luminance meter + reference sample + overcast sky
Mirror Material I

Virtual light sources
Mirror Material II

```c
void mirror PlasterCeiling
0
0
3 0.965 0.965 0.965
```

If Specularity_{Ecotect} > 0.75 => mirror material

Red/Green/Blue: (246/255)=0.965
Material Glass

void glass ClearFloat_6mm_MF
0
0
3 0.661 0.742 0.742

Red: \( \frac{227}{255} \times TN(0.88) \)
Material Trans I

```c
void trans PANEL
0
0
7 0.48913 0.48913 0.48913 0.08 0 0.5333 0
# A1 A2 A3 A4 A5 A6 A7
```

>> material database
Material Trans II

Energy & Buildings
Reinhart, Andersen 2005 (in review)

Need for a quality controlled material database.