High quality – low impact lighting

Alexandra Troi, EURAC research
Daylight (redirection)
Principles of daylighting

Visual comfort, daylight redirecting, sun shading
A screen made of textile or PVC is able to reduce glare if the visible transmittance is low.

- Solar control capacities depend on the position of the screen: generally, an internal system has weak solar control abilities.
- The need for artificial light is high, because if lowered the daylight transmittance is low and the room is badly illuminated.
Lamella systems

Good potential for exploiting daylight:

- Depending on the shape (konvex or koncav) the lamellas redirect daylight into the rooms.
- If split into two or more subsystems: lower part provides glare protection (by closing the lamellas) the upper parts controls daylight distribution and solar gains in winter and summer times (i.e. by closing, opening the lamellas).
- The magnitude of Solar heat gains coefficient depends on the position of the system: generally the more outside the smaller the SHGC.
Static overhangs (or brise soleil) are thought to be the simplest measure to control solar gains. Their functionality is limited to summer times (highest sun elevation). For glare protection additional internal systems has to installed. The need for artificial lighting is then comparable to screen systems.
Example: CS5 Höttinger School

Daylight factor in room 010

Bartenbach research & development

EURAC research
Example:
CS5 Höttinger School
<table>
<thead>
<tr>
<th>System 1</th>
<th>System 2</th>
<th>System 3</th>
<th>System 3 mit rho-80%</th>
<th>System 4</th>
<th>System 5</th>
<th>System 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>140mm bei 1500 / 155 bei 2000mm</td>
<td>217 bei 1800 / 223 bei 1900mm</td>
<td>165 bei 1800 / 169 bei 1900mm</td>
<td>165 bei 1800 / 169 bei 1900mm</td>
<td>———</td>
<td>ca. 250 bei 1900</td>
<td>143 bei 1800 / 149 bei 1900 mm</td>
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Example: CS5 Höttinger School

<table>
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<tr>
<th>IF50</th>
<th>E 50/80 Genius</th>
<th>Duobehang E 80LD</th>
<th>E50 L BAP</th>
<th>TAGESLICHT-RAFFSTORE RETROLu</th>
<th>Naturaff</th>
<th>RETRO Flex 25</th>
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<tr>
<td>HELLA</td>
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<td>Schlotterer</td>
<td>SUN-KONTOR GmbH</td>
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System 1

140 mm bei 1500 / 155 bei 2000 mm

System 2

217 bei 1800 / 223 bei 1900 mm

DF (no mirror ceiling)

Results are specific to CS5 classroom
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#### DF (no mirror ceiling)

- **warema E80LD south-east-western**
- **Warema E80 L northwestern**
- **Warema E50 L BAP**
- **Hella IF 50 tageslichtoptimiert**
- **Sun-Kontor NaturRaff**

Results are specific to CS5 classroom.

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**3encult**

ELECTRIC ENERGY FOR EU CULTURAL HERITAGE
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CS5 Höttinger School

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System 1
140 mm bei 1500 / 155 bei 2000 mm

System 2
217 bei 1800 / 223 bei 1900 mm

System 6
143 bei 1800 / 149 bei 1900 mm

DF (with mirror ceiling)
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- **Warema E80LD** (south-east-western)
- **Warema E80 L** (northwestern)
- **Warema E50 L BAP**
- **Hella IF 50** (tageslichtoptimiert)
- **Sun-Kontor NaturRaff**

**Graph:**
- Axis: room depth [m] vs. DF [%]
- Curves for different systems (e.g., Ohne System, System Jalousie, System Genius, System 30° Lamelle, System Schlotterer, System Ebene Lamelle, System RetroFlex)
- Graph shows the relationship between room depth and DF for various systems.
Example:
Idea developed by Bartenbach students
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Example: Idea developed by Bartenbach students

Fensterschnitt

Sowohl das direkte Licht der Sonne als auch das diffuse Tageslicht wird aus seinen verschiedenen Richtungen über die Lamellen in den Raum geleitet.

Eine Blendung ist aufgrund des steilen Winkels von mind. 45° fast ausgeschlossen, selbst beim direkten Herantreten an das Fenster.

Rückreflexion des Tageslichteintrags von der weißen Decke in den Raum.
Example:
Idea developed by Bartenbach students

Versuchsaufbau

Strahlengang:
Product development
Task

- develop an efficient artificial lighting component
- that can be **installed** in a **non-invasive way**
- should provide an **optimal visual scenery**
- should **slow down** the **deterioration** process (that any material undergoes in its natural/artificial environment)

The specific development followed the bottom-up approach starting from CS2 (Palazzo d’Accursio in Bologna): The lighting concept based on the idea of illuminating a room where the walls are the demonstrated objects.
Task: visual comfort

→ Luminance
→ Ratio
→ magnitudes
→ Colour rendering
→ Modelling/shadow
→ Brilliance
→ Etc…
Task: efficiency

coplayers
→ Lamp
→ Controller
→ Luminaire
→ Room
CS2 Palazzo d’Accursio
Sala degli Stemmi
Applicability of concepts

CHANDELIERS

WALLWASHER
Chandeliers

Glare problem!
Wallwasher

EXISTING PRODUCTS
projektleuchten

Patterns!

Lm = 30-50 cd/m²

Em ~ 200 lx

Lm = 15-25 cd/m²
EXISITING PRODUCTS – MORE EXAMPLES

artluce  XAL  iguzzini
3encult Wallwasher

3ENCULT WALLWASHER

artluce

XAL

3encult
3encult Wallwasher

VERTICAL & HORIZONTAL CUT-OFF
wallwasher - perfect glare control

mounting options

ceiling mounted - ceiling and floor mounted
minimum mounting impact

floor mounted - floor positioned
without any/ with little impact on architecture

placed on a cornice

to enlighten ceiling artwork - fresco painting without any impact on architecture
wallwasher - perfect glare control

mounting options

wall mounted
minimum mounting impact

stand mounted
without any impact on architecture
**wallwasher - perfect glare control**

**qualities**

- **little invasive**
  - minimal to non intervention into existing architecture for positioning/mounting of lightsource.

- **precise cut off**
  - lightbeam is precisely calculated and defined – no glare.

- **dynamic white (cw/nw/ww)**
  - two different colour temperatures out of the same lightsource [optional].

- **high uniformity**
  - highest consistency of constant illuminance within defined field.

- **optimized conservation - LED**
  - non harmful for historical/sensitive environment by emitting no UV – rays.