Daylighting Design: A Daylight Glare Probability based analysis tool

<p>| | | | | |</p>
<table>
<thead>
<tr>
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<td>0.36</td>
<td>1</td>
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<td>0.91</td>
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</tbody>
</table>

0 0 0 0 0 0 0 0 0

D. Bakker Msc.
B.M. Mpauli BAS (PJC (SA))
Dr. ir. M.B.C. Aries (TU/e (NL))
Overview

- Theoretical Background
- Method
- Tool demonstration: MetaForum
- Conclusions and Future development
Theoretical Background
Theoretical Background

- Theoretical Background
  - Daylighting Design
  - Glare analysis
- Method
- Tool demonstration
- Conclusions and Future development

Daylighting Design

- Availability of daylight for task performance
Theoretical Background

- **Daylighting Design**
  - Availability of daylight for task performance
  - Avoidance of visual discomfort

Theoretical Background

- Daylighting Design
- Glare analysis

Method

Tool demonstration

Conclusions and Future development
Theoretical Background

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Glare analysis

- Maximum Useful Daylight Illuminance
- Daylight Glare Probability


Theoretical Background

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  • Glare analysis

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UDI_{max}

- Floor space
- % of Time
Theoretical Background

- Theoretical Background
  - Daylighting Design
  - Glare analysis
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- $UDI_{max}$
  - Floor space
  - % of Time

- DGP
  - Brightness and contrast
Theoretical Background

• Theoretical Background
  - Daylighting Design
  - Glare analysis

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- UDI_{max}
  - Floor space
  - % of Time

- DGP
  - Brightness and contrast
Method

- Theoretical Background
- Method
  - Grid
  - % of Time
  - Result presentation
  - Tool
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Future development

**Method**

- Theoretical Background
- **Method**
  - Grid
  - % of Time
  - Result presentation
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- Use DGP in grid- and time-based approach
  - Grid
Method

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Use DGP in grid- and time-based approach

Time

![Graph showing DGP over time](image)

- Calculated DGP
- DGP set point
Method

- Theoretical Background
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Result Presentation

<table>
<thead>
<tr>
<th>DGP</th>
<th>Sensor 1</th>
<th>Sensor 2</th>
<th>Sensor 3</th>
<th>Sensor 4</th>
<th>Sensor 5</th>
<th>Sensor 6</th>
</tr>
</thead>
<tbody>
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<td>0.248367</td>
<td>0.246052</td>
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<td>0.280247</td>
<td>0.261182</td>
<td>0.25379</td>
<td>0.244906</td>
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<tr>
<td>10:00</td>
<td>0.367384</td>
<td>0.335964</td>
<td>0.296979</td>
<td>0.272847</td>
<td>0.259299</td>
<td>0.249434</td>
</tr>
<tr>
<td>11:00</td>
<td>0.379443</td>
<td>0.329023</td>
<td>0.318449</td>
<td>0.284569</td>
<td>0.262797</td>
<td>0.253094</td>
</tr>
<tr>
<td>12:00</td>
<td>0.390982</td>
<td>0.332575</td>
<td>0.311157</td>
<td>0.291873</td>
<td>0.265985</td>
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<tr>
<td>13:00</td>
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<td>14:00</td>
<td>0.421127</td>
<td>0.342045</td>
<td>0.311948</td>
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<td>15:00</td>
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<td>0.360717</td>
<td>0.31473</td>
<td>0.286954</td>
<td>0.260403</td>
<td>0.252871</td>
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<td>16:00</td>
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<td>0.264874</td>
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<td>0.448965</td>
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<td>0.36349</td>
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<td>0.336662</td>
<td>0.29863</td>
<td>0.266267</td>
</tr>
</tbody>
</table>
Method

- Theoretical Background
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Result Presentation
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Result Presentation

Daylight Glare Probability based analysis tool

<table>
<thead>
<tr>
<th>View 1: towards windows</th>
<th>View 2: away from the windows</th>
</tr>
</thead>
<tbody>
<tr>
<td>43% 10% 38% 38% 10% 43%</td>
<td>100% 100% 100% 100% 100% 100%</td>
</tr>
<tr>
<td>61% 45% 57% 62% 48% 81%</td>
<td>100% 100% 100% 100% 100% 100%</td>
</tr>
<tr>
<td>100% 81% 81% 81% 74% 100%</td>
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<tr>
<td>100% 100% 100% 100% 100% 100%</td>
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<tr>
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<td>100% 100% 100% 100% 100% 100%</td>
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<tr>
<td>100% 100% 100% 100% 100% 100%</td>
<td>100% 100% 100% 100% 100% 100%</td>
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</table>

Daylighting Design: A Daylight Glare Probability based analysis tool
Method

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Tool for Windows

- Radiance for Windows
- DAYSIM
  - Evalglare

Daylighting Design: A Daylight Glare Probability based analysis tool

Welcome!

This is the DGP-Tool, for calculating the glare probability for design of daylit space.
The tool uses the Daylight Glare Probability implemented in the Evalglare command.
The DGP tool calculates the glare probability for a percentage of time over a grid placed in the space.

For using the tool:
Go through the several tabs (e.g. “File Selection”, “Location”). And select / insert the required input.
Next to this, please save your definition file named “poyel.rad” in the destination folder! (Important!)
Once all this is set, press calculate DGP and wait. The DGP calculation process is time consuming!
When using a large grid and a large number of view directions the calculation can take hours/day(s).
Future development of this tool might reduce this calculation time.

Once the calculation is finished, the results for the various views and defined DGP-cell points can be
found under the “Results” tab. Each item in the dropdown represents one view direction.
The DGP-cell point analysis results are given for all view directions. Each row gives the results for one view direction. Select and copy the data and paste it into a spreadsheet software (e.g. Microsoft Excel).
The spreadsheet software in combination with conditional formatting can be used for the generation of false-colour floor planes.
For more info on how to use the tool, visit www.dolfakker.com/DGTool

Although the tool can be used for the glare analysis of a daylit space, the tool is still in a developing
stage. For questions, suggestions, bug reports, etc. please contact DGPTool@gmail.com.

When applying the tool for consultancy purposes, you are responsible for your own generated data/results.

DGPTool@gmail.com
Tool demonstration: MetaForum
Tool demonstration: MetaForum

- Theoretical Background
- Method
- Tool demonstration
  - MetaForum
  - Input
  - Preparation / DGP
  - Post-processing
  - Results
- Conclusions and Future development

Input ➔ Prepare ➔ DGP calculations ➔ Post-processing
Tool demonstration: MetaForum

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MetaForum

Technical University of Eindhoven

Flex-Desks for students

Ector Hoogstad Architects
Tool demonstration: MetaForum

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*Rad file
Including material information

C.E. Laudij
Master student Architecture & Building Physics
Tool demonstration: MetaForum

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Input → Prepare → DGP calculations → Post-processing

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![Diagram of Tool Flow](image)

Daylighting Design: A Daylight Glare Probability based analysis tool

[Map of Europe with United Kingdom highlighted]

[Image of Daylight Glare Probability Tool interface]
Tool demonstration: MetaForum

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Grid-points file
X[space]Y[space]Z

View-directions file
X[space]Y

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![Diagram of the tool demonstration process]
Tool demonstration: MetaForum

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Gensky +s based on location and date

Octrees From model and sky files
Tool demonstration: MetaForum

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Input ➔ Prepare ➔ DGP calculations ➔ Post-processing

Generate skies 08:00 – 18:00 ➔ Generate Octrees ➔ DGP Each Hour Each Sensor Each View ➔ Daily DGP analysis

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<td>6:00</td>
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<td>0.275822</td>
<td>0.249626</td>
<td>0.249267</td>
<td>0.249092</td>
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<td>0.262541</td>
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<td>0.261182</td>
<td>0.262779</td>
<td>0.264906</td>
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<tr>
<td>10:00</td>
<td>0.367304</td>
<td>0.339404</td>
<td>0.269679</td>
<td>0.272647</td>
<td>0.259299</td>
<td>0.244346</td>
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<td>11:00</td>
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<td>0.284546</td>
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<td>0.253094</td>
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<td>16:00</td>
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<td>0.448963</td>
<td>0.395139</td>
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<td>0.354937</td>
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<td>18:00</td>
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<td>0.395002</td>
<td>0.367441</td>
<td>0.236662</td>
<td>0.290603</td>
<td>0.264207</td>
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UDI$_{max}$
Next...

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Interior design?
Conclusions and future development
Conclusions

- Theoretical Background
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- Easy applicable glare analysis tool for Microsoft Windows
- Easy production of false-colour floor plans
- The results differ from $UDI_{\text{max}}$ results
- Approach includes view direction
Future development

- Tool is in development
- Time consuming
- Small number of test cases
The End

- Questions?

- [www.dolfbakker.com/dgptool](http://www.dolfbakker.com/dgptool)
- [dolfbakker@gmail.com](mailto:dolfbakker@gmail.com)