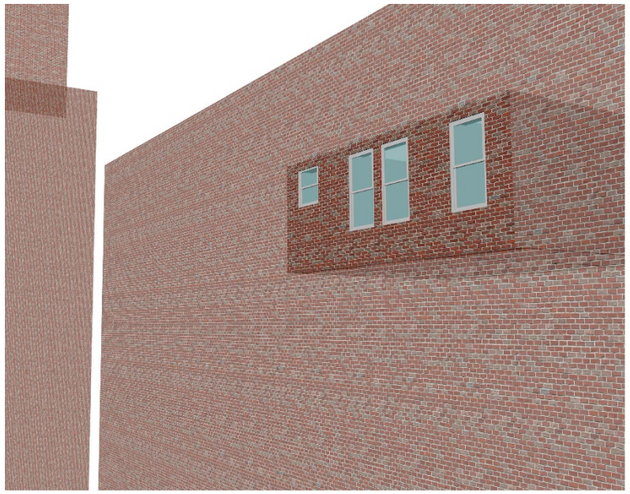
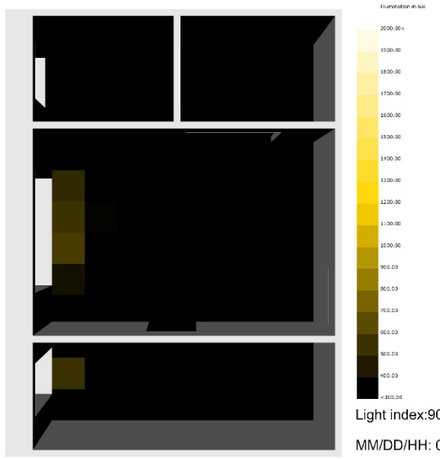


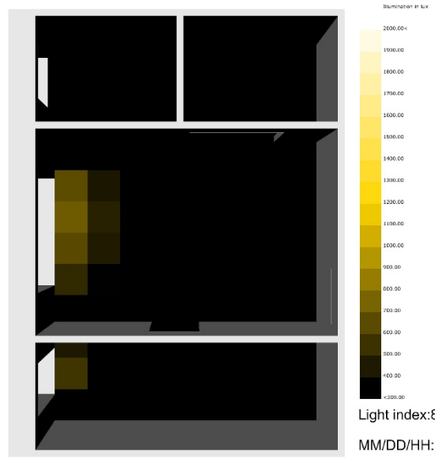
Nine-Grid Analysis Summary

The existing windows on this 3rd floor, west-facing apartment with a four storey neighbouring building provide insufficient daylight.



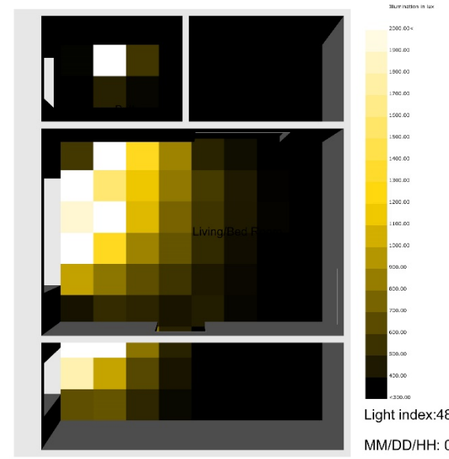
Light index:90.0

MM/DD/HH: 032109



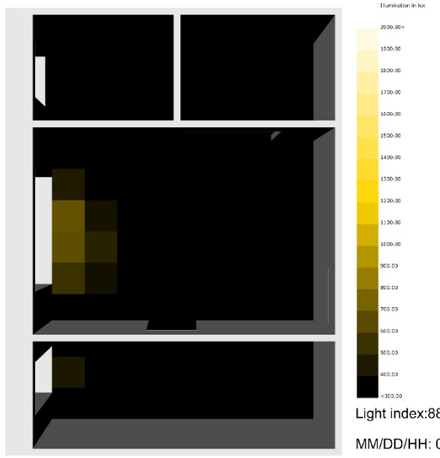
Light index:86.0

MM/DD/HH: 032112



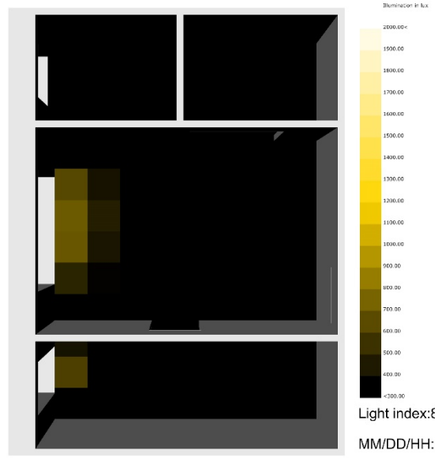
Light index:48.0

MM/DD/HH: 032115



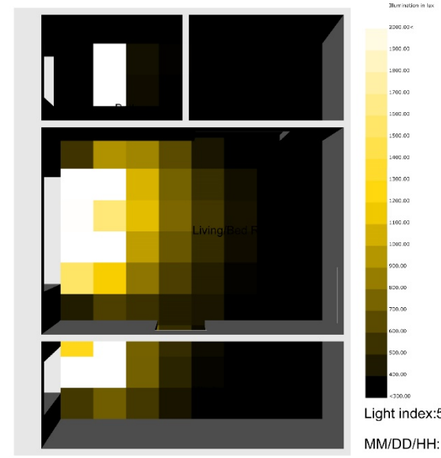
Light index:88.0

MM/DD/HH: 062109



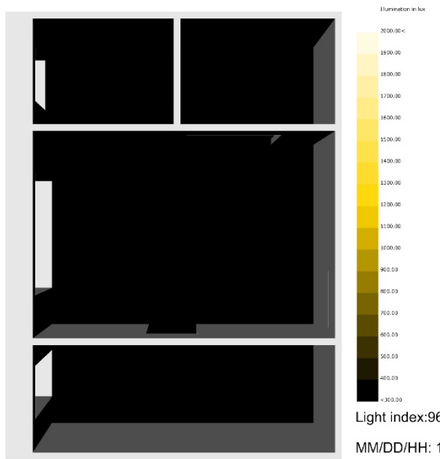
Light index:86.0

MM/DD/HH: 062112



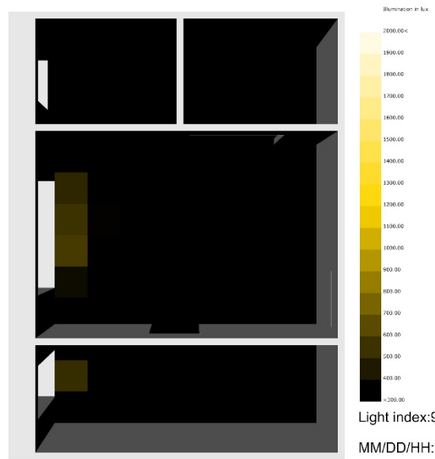
Light index:52.0

MM/DD/HH: 062115



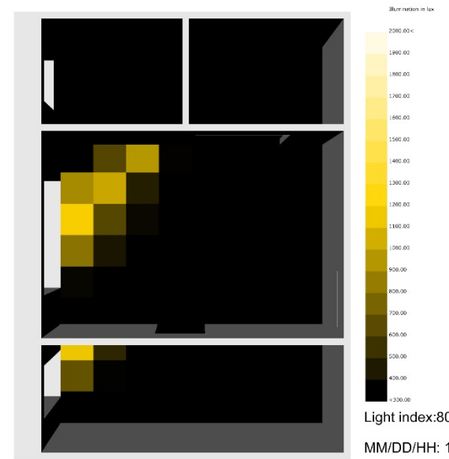
Light index:96.0

MM/DD/HH: 122109



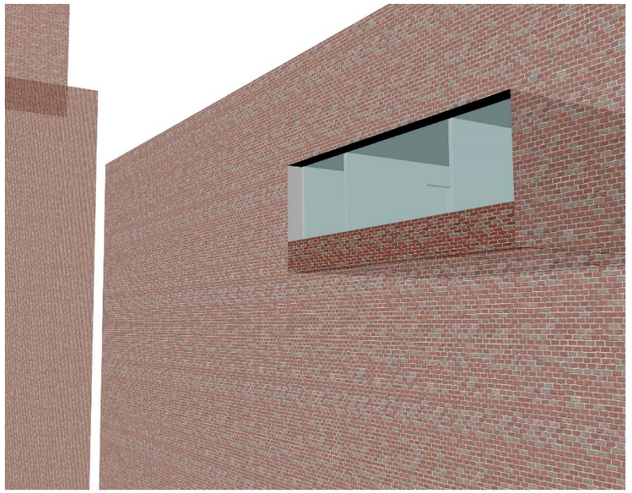
Light index:90.0

MM/DD/HH: 122112



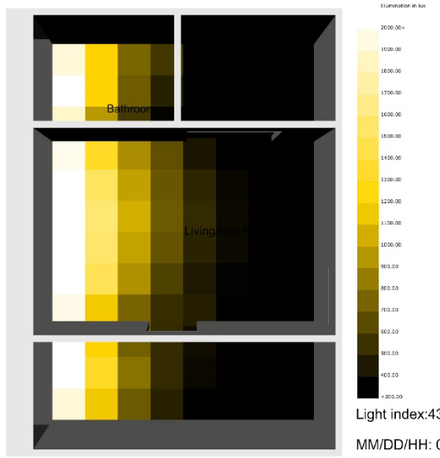
Light index:80.0

MM/DD/HH: 122115



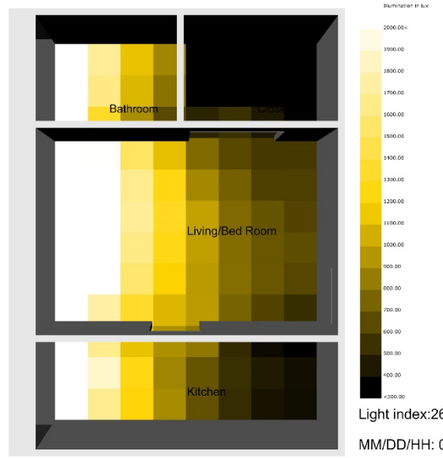
Nine-Grid Analysis Summary

Replacing the existing windows with west-facing glazing creates extreme glare.



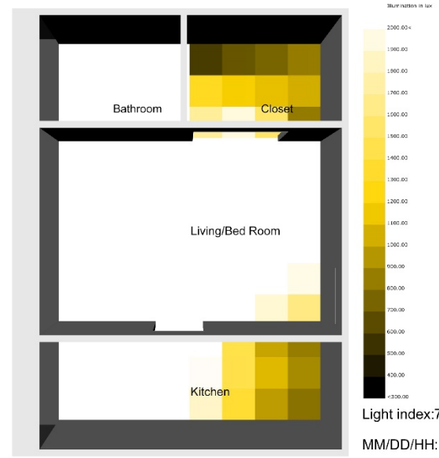
Light index:43.0

MM/DD/HH: 032109



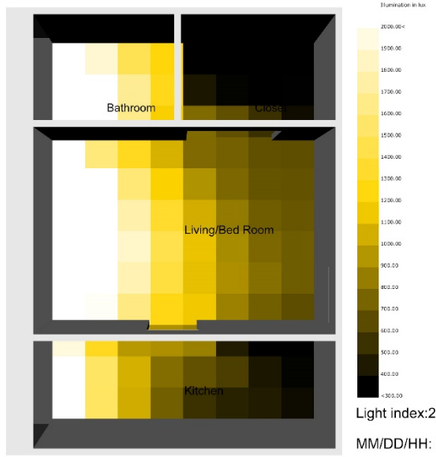
Light index:26.0

MM/DD/HH: 032112



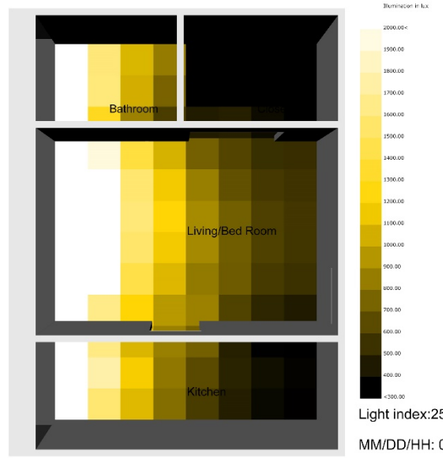
Light index:70.0

MM/DD/HH: 032115



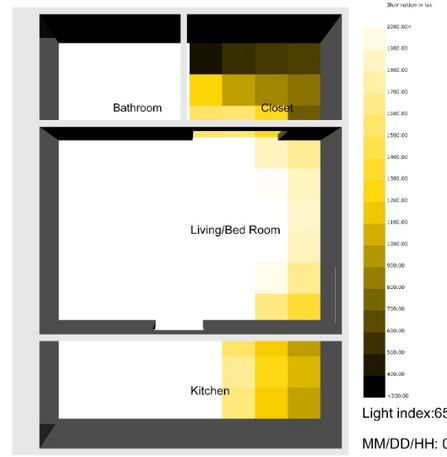
Light index:23.0

MM/DD/HH: 062109



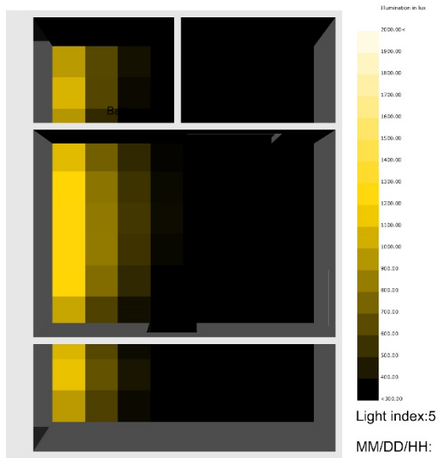
Light index:25.0

MM/DD/HH: 062112



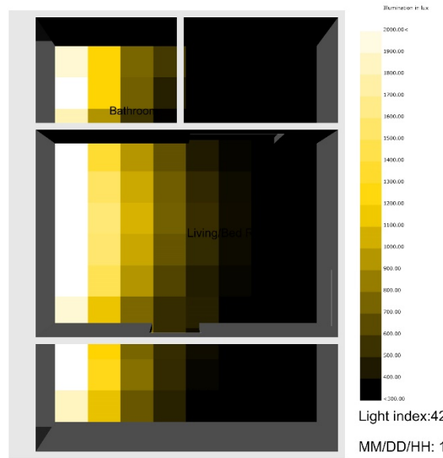
Light index:65.0

MM/DD/HH: 062115



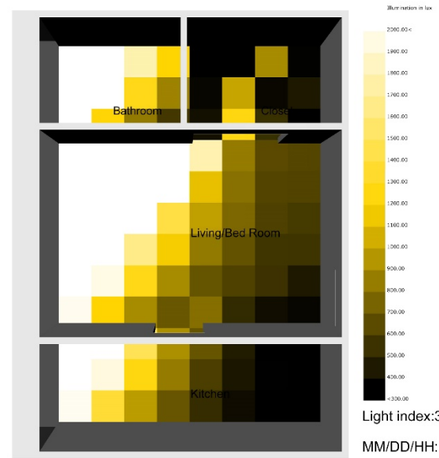
Light index:56.0

MM/DD/HH: 122109



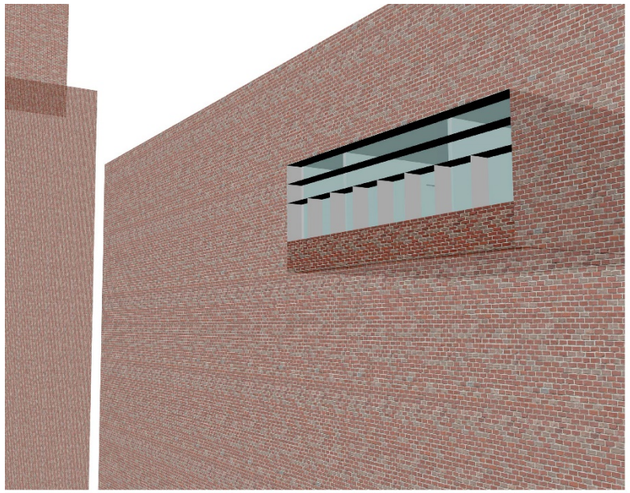
Light index:42.0

MM/DD/HH: 122112



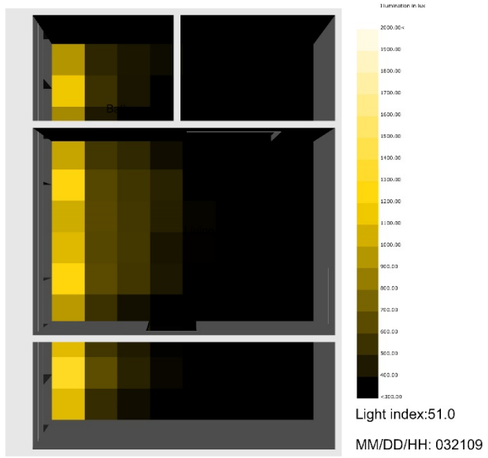
Light index:30.0

MM/DD/HH: 122115



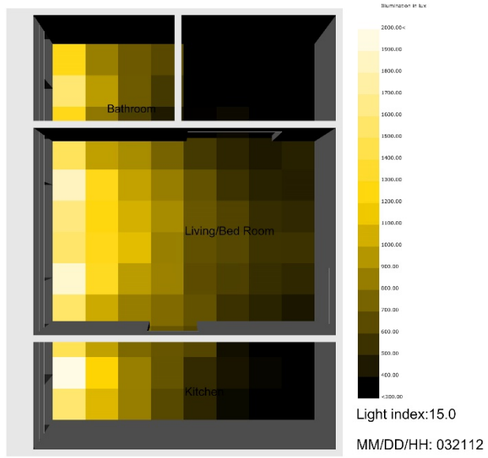
Nine-Grid Analysis Summary

Vertical louvers in the lower-half of the window cut horizontal light from the West, and horizontal louvers on the upper-half of the window act as light shelves that bounce diffuse light on to the ceiling to brighten the room.



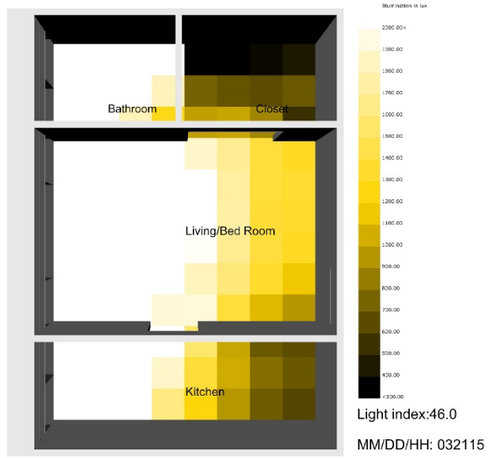
Light index:51.0

MM/DD/HH: 032109



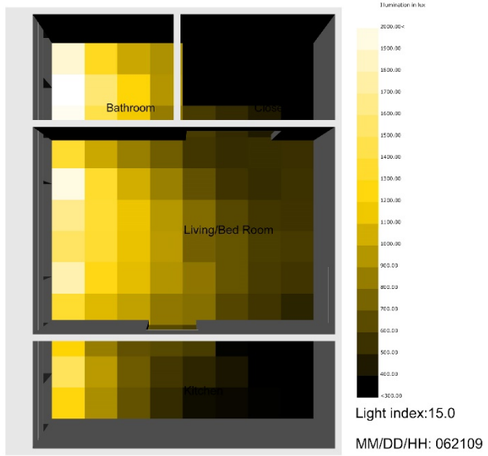
Light index:15.0

MM/DD/HH: 032112



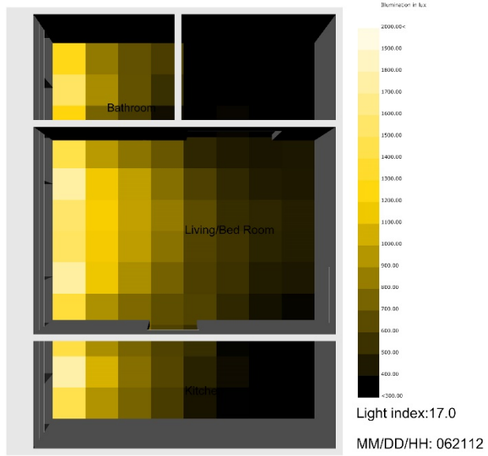
Light index:46.0

MM/DD/HH: 032115



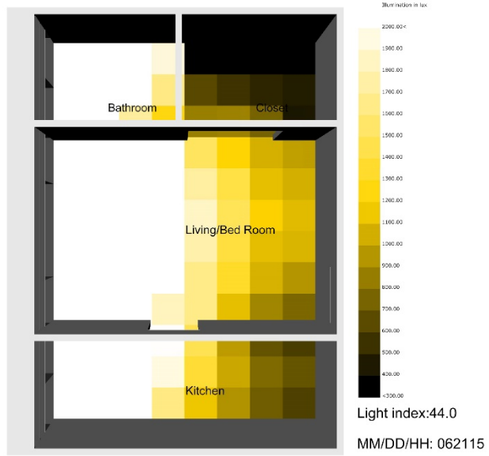
Light index:15.0

MM/DD/HH: 062109



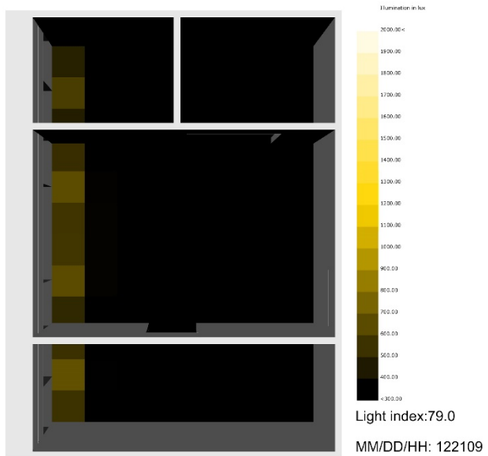
Light index:17.0

MM/DD/HH: 062112



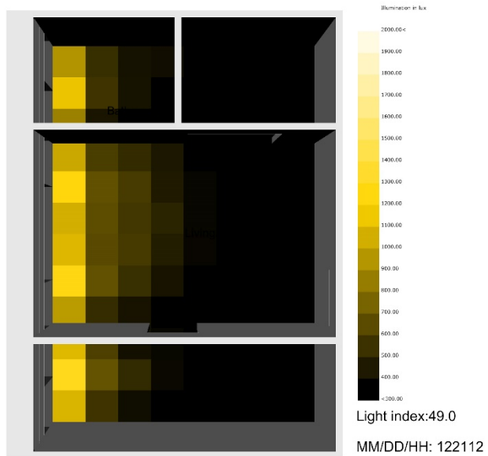
Light index:44.0

MM/DD/HH: 062115



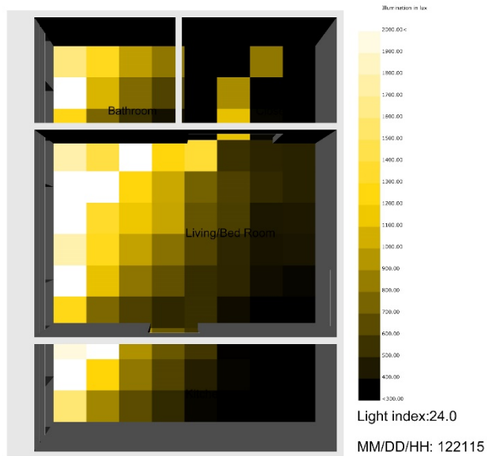
Light index:79.0

MM/DD/HH: 122109



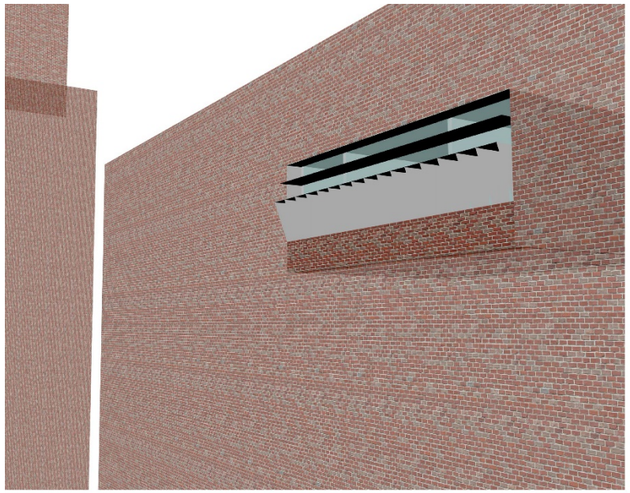
Light index:49.0

MM/DD/HH: 122112



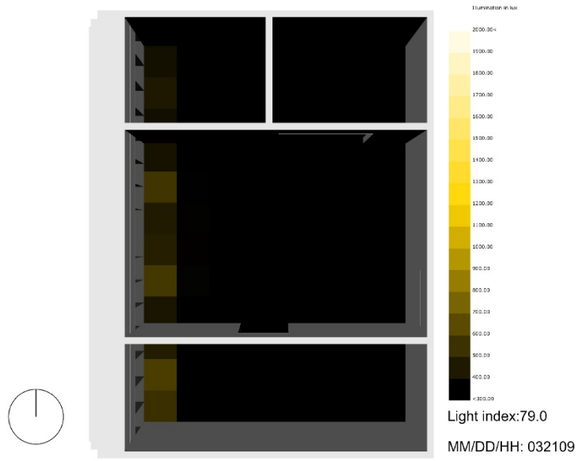
Light index:24.0

MM/DD/HH: 122115



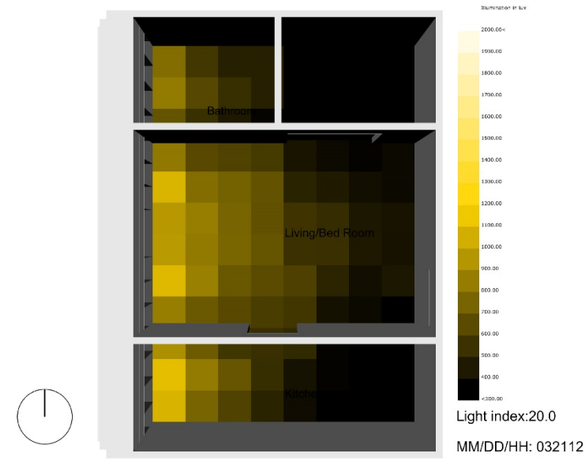
Nine-Grid Analysis Summary

While increasing the depth of the vertical louvers decreases glare in the summer evenings, increasing the depth of the horizontal louvers begins to cut light more than bounce it on to the ceiling leading to a lower cumulative performance in the nine-grid daylighting analysis.



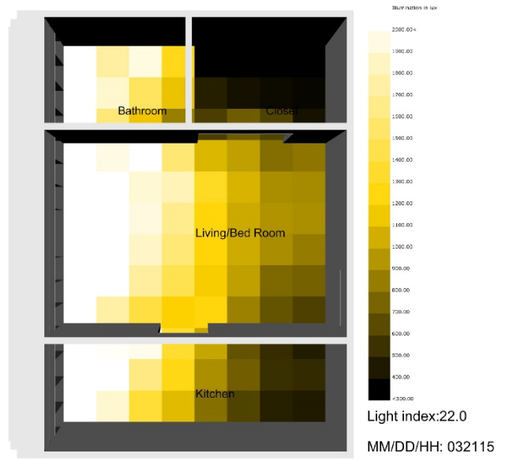
Light index:79.0

MM/DD/HH: 032109



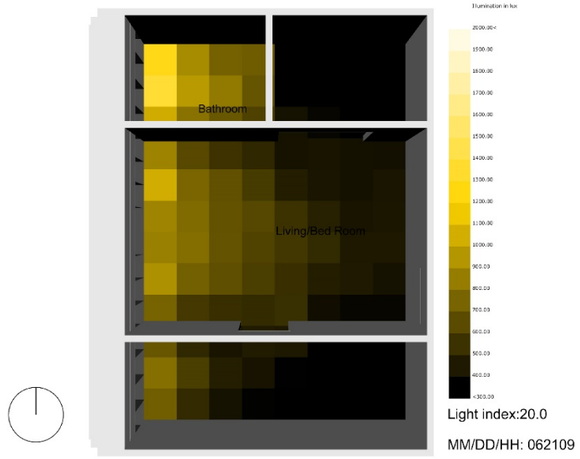
Light index:20.0

MM/DD/HH: 032112



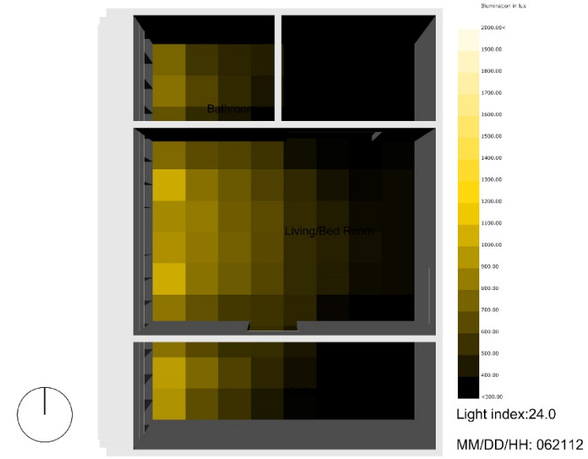
Light index:22.0

MM/DD/HH: 032115



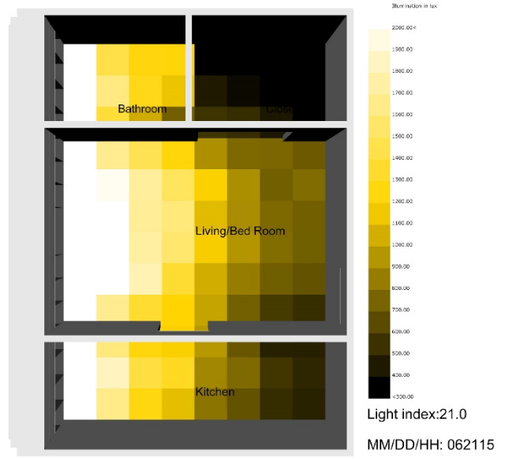
Light index:20.0

MM/DD/HH: 062109



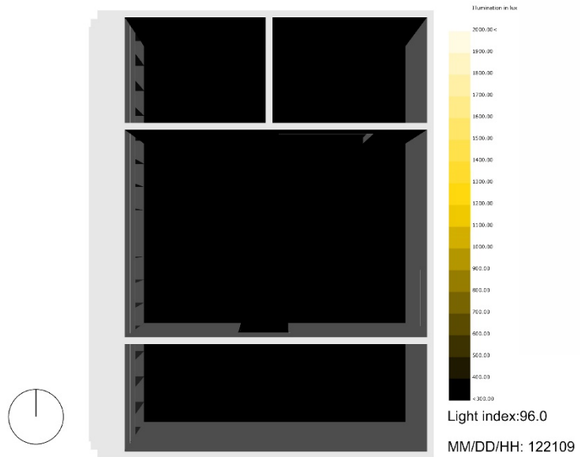
Light index:24.0

MM/DD/HH: 062112



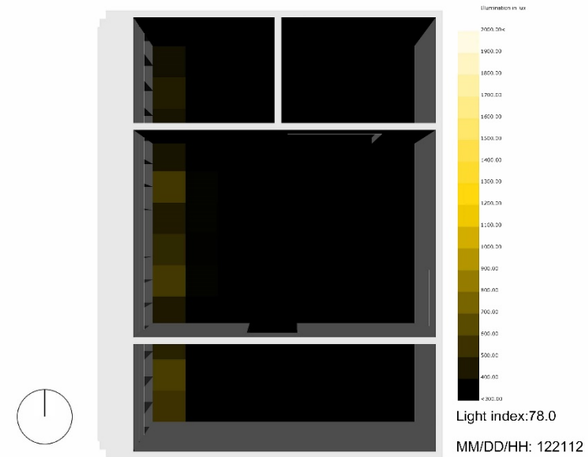
Light index:21.0

MM/DD/HH: 062115



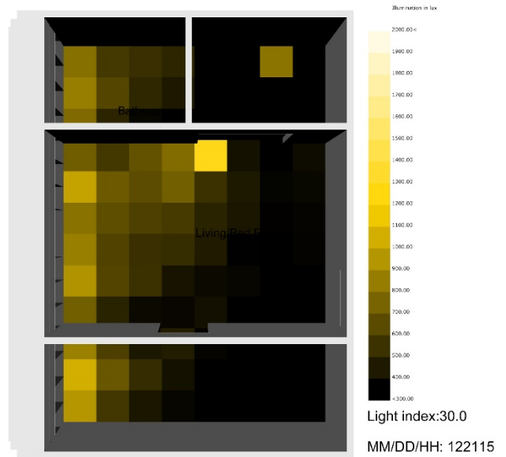
Light index:96.0

MM/DD/HH: 122109



Light index:78.0

MM/DD/HH: 122112



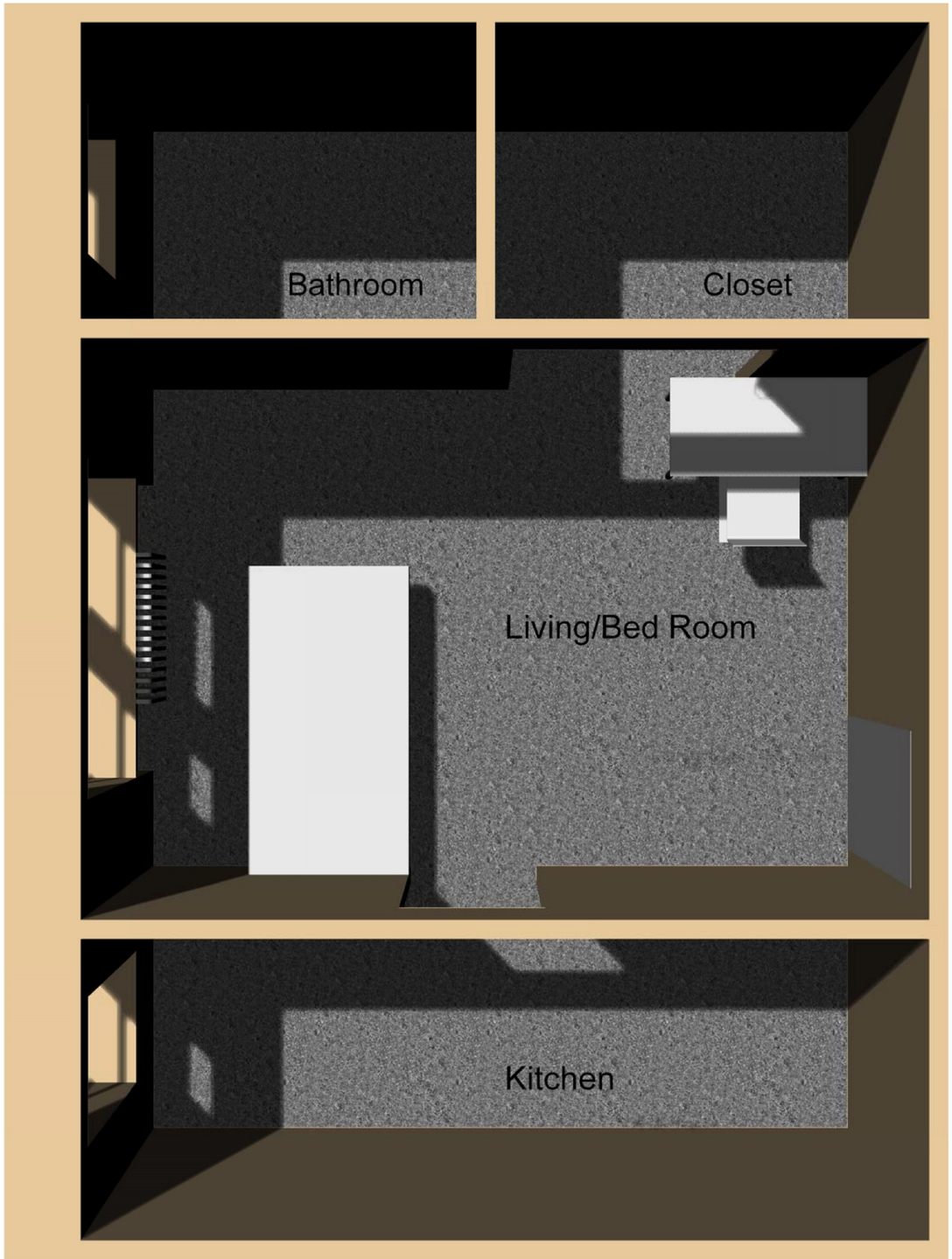
Light index:30.0

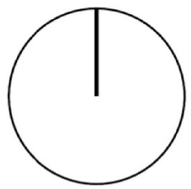
MM/DD/HH: 122115

Annual Analysis Setup

While the nine-grid analysis was done for the entire studio apartment, the focus of the annual analysis is the main living/bedroom space of the studio apartment as it is the most used space that will benefit most from daylighting design.

No significant improvements to the results of the annual analysis were observed on changing the ‘Number of Bounces: ab’ and the ‘Ambient Resolution: ar’ in the ‘Radiance parameters’ (see the Grasshopper file for details).





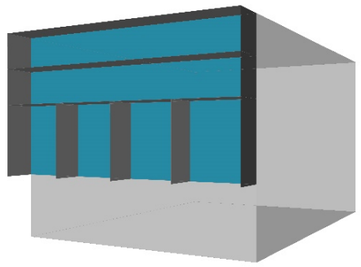
Annual Analysis Development

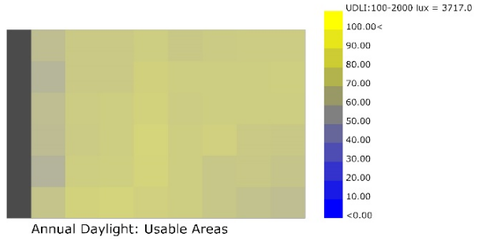
The best performing shading design from the nine-grid analysis has been taken as the starting point of this annual daylight analysis. This design received a cumulative UDLI (100-2000 lux) of 3717 (based on a ‘Mass Addition’ of percentage annual values on a 0.5x0.5 meter grid).

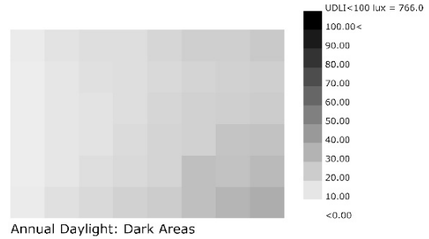
However, since the nine-grid analysis showed that deeper vertical louvers in the lower-half of the window reduced glare in the summer evenings, a parametric louver design has been developed to test more options.

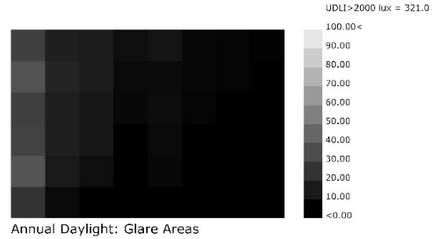
Performing an annual daylight study on manually adjusted input parameters for the louver design shows that is possible to improve on the best performing design of the nine-grid analysis.

Therefore Galapagos has been used to maximize the UDLI (100-2000 lux) of the parametric shading design to a value of 3759. The optimized design is shown on the right –

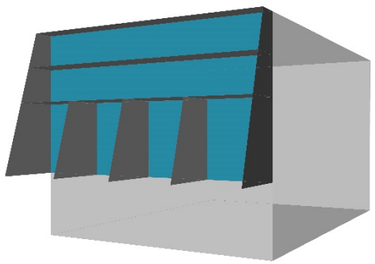


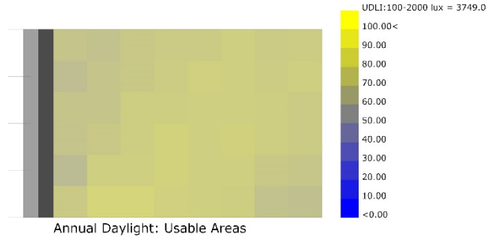


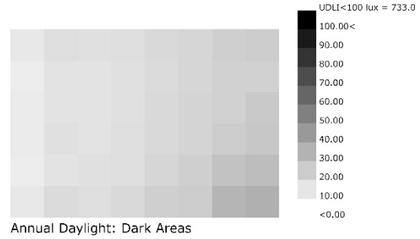


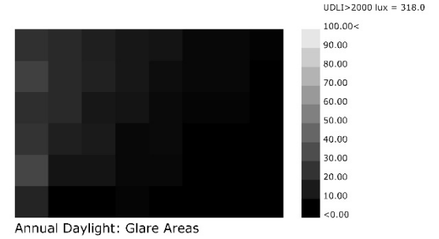


1. The best performing design from the nine-grid analysis.

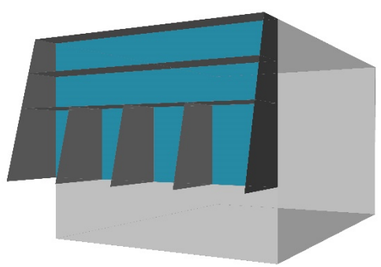


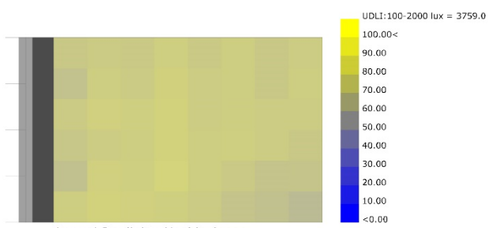


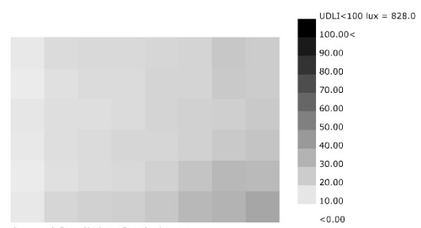


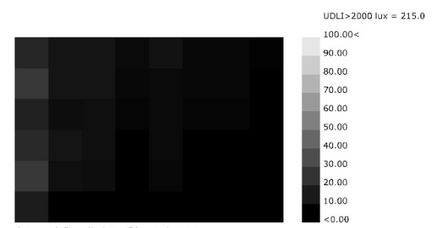


2. Manual input adjustments showing improved performance.









3. Shading design optimized to maximize UDLI.