

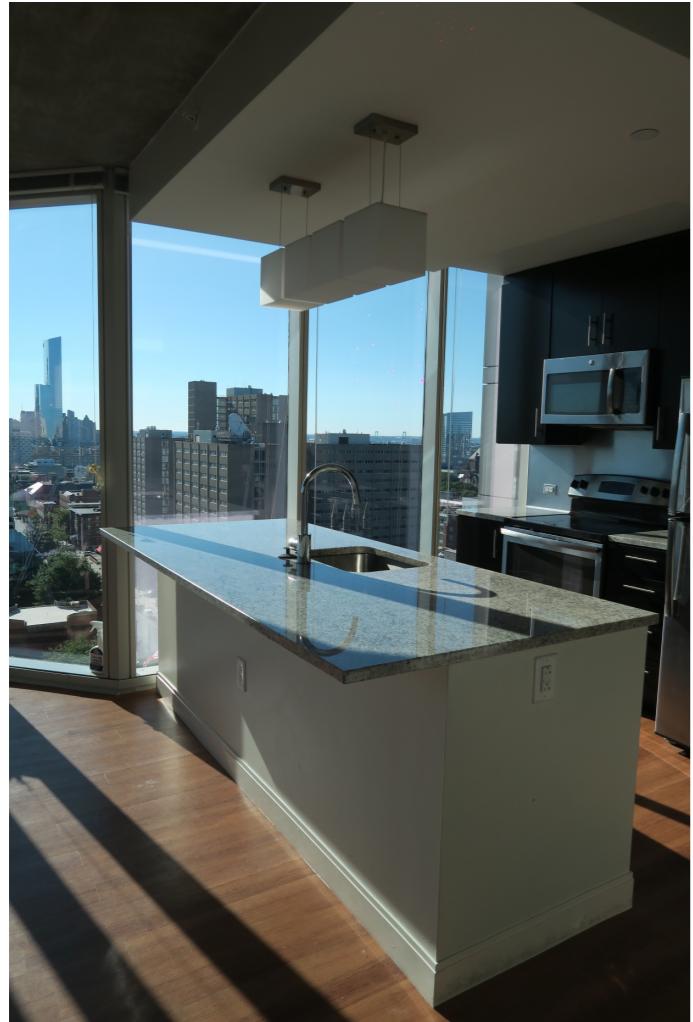
SHADING DESIGN

WESTON HUANG

WITHOUT SHADING

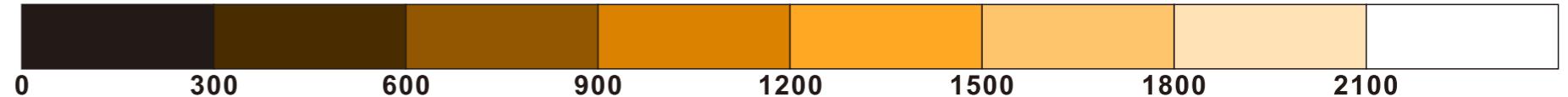
The apartment has a issue of glare. Since there is no shading when surrounding with glass window, it is illuminated by sunlight in the morning too much.

It is uncomfortable to stay in the living space that faces East. From the simulation, almost everyday in a year is too bright. Even though the apartment adopts LOW-E glass in reality, the daylighting quality is not reasonable.



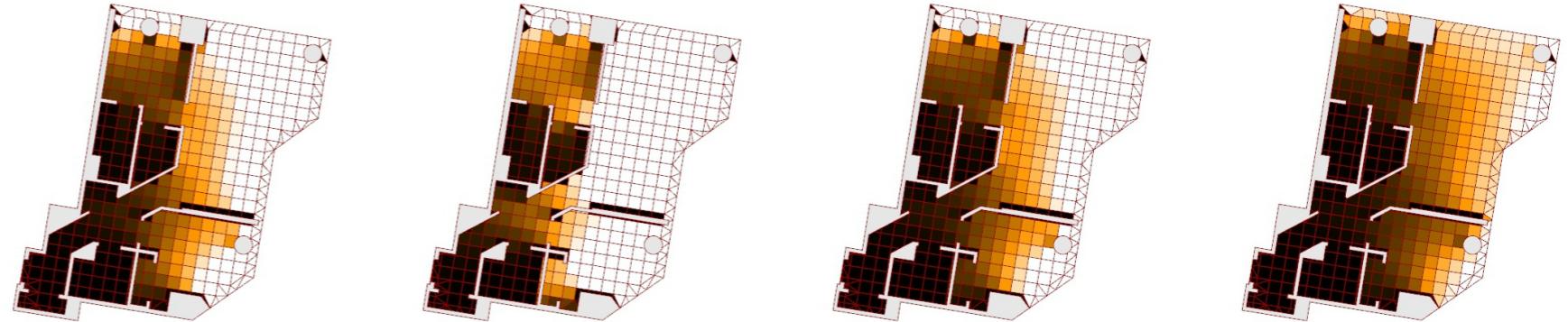
ORIGINAL RADIANCE IN THE APARTMENT

LUX

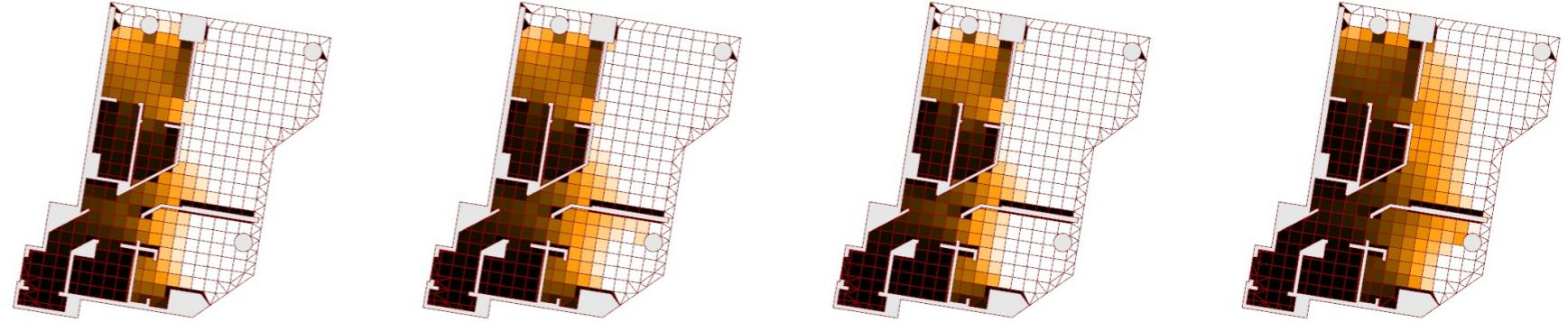


03/21 06/21 09/21 12/21

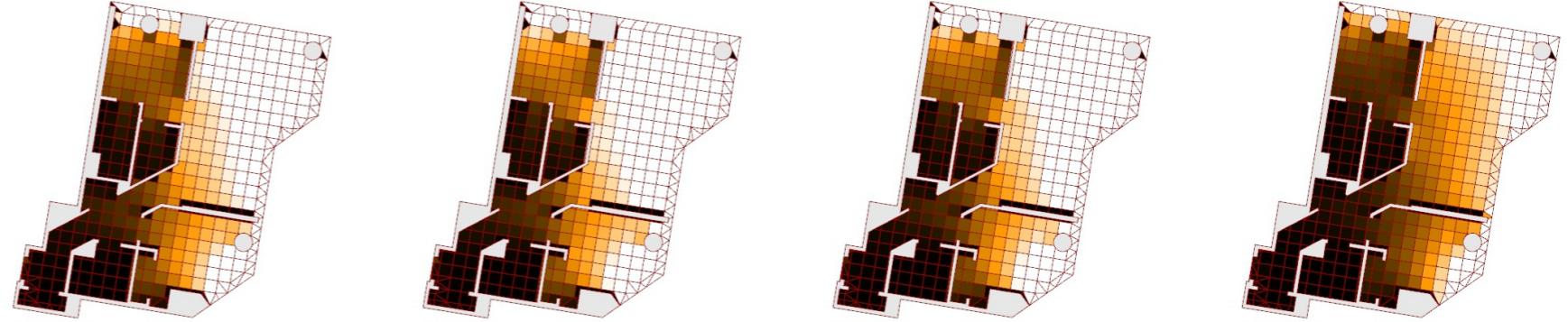
09:00



12:00



15:00



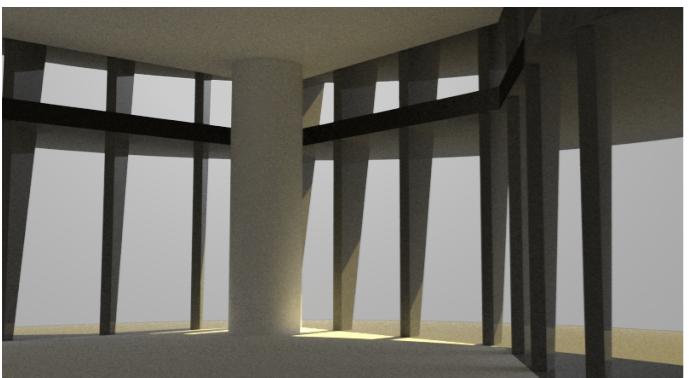
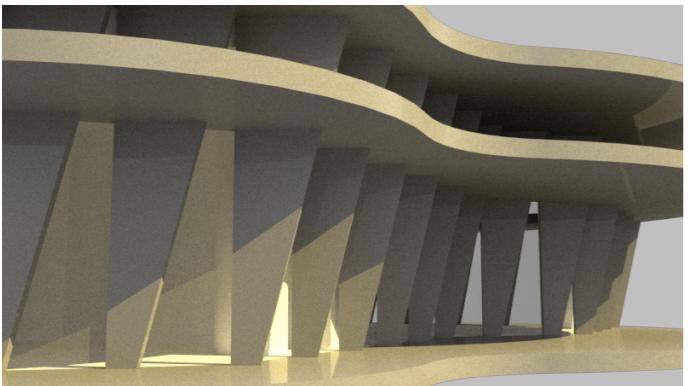
SHADING DESIGN

WESTON HUANG

WITH SHADING

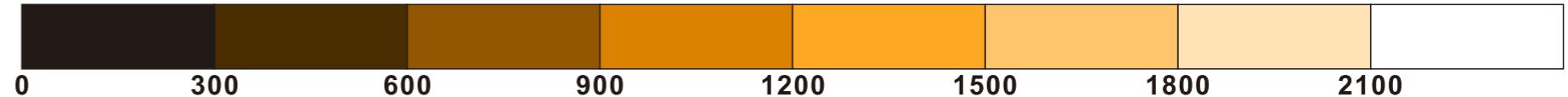
The target illuminance range is from 300 lux to 2000 lux. The goal is blocking some solar radiation but retaining the ability of daylighting from natural sun light.

In order to maintain the condition that the place originally illuminated by sun will still get natural light, and block the light that has the illuminance bigger than 2000, Both vertical and horizontal shading devices are applied here.

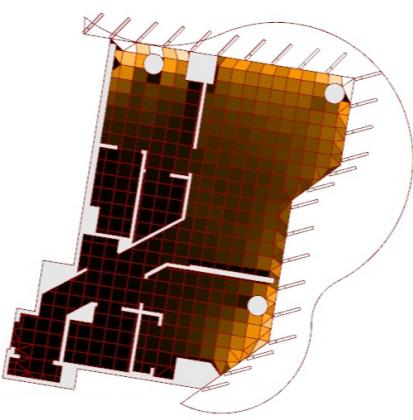


IMPROVED RADIANCE IN THE APARTMENT

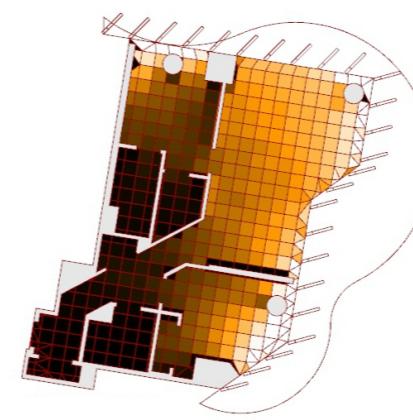
LUX



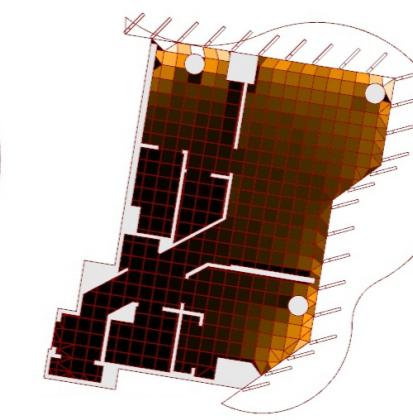
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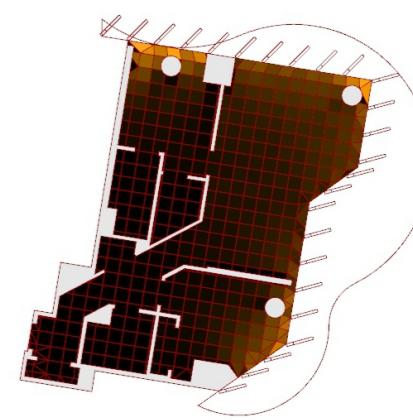
06/21



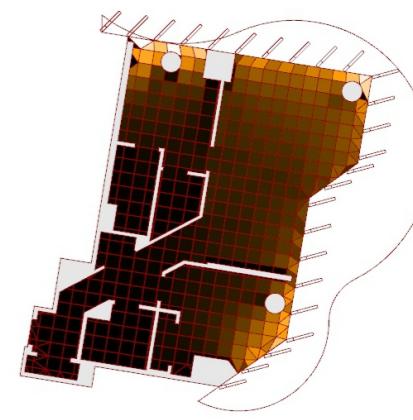
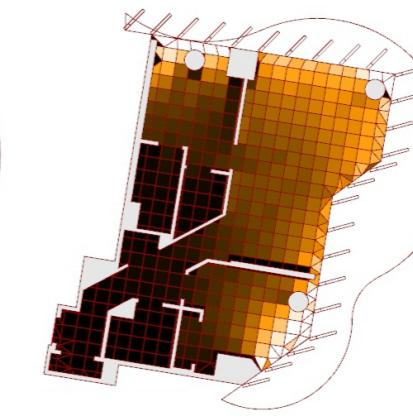
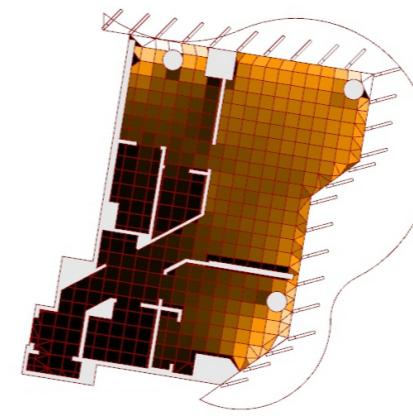
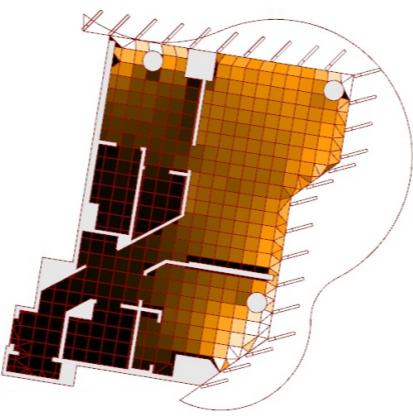
09/21



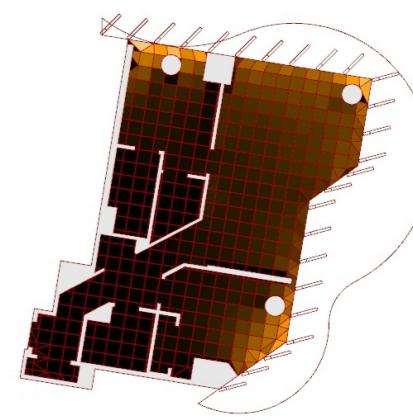
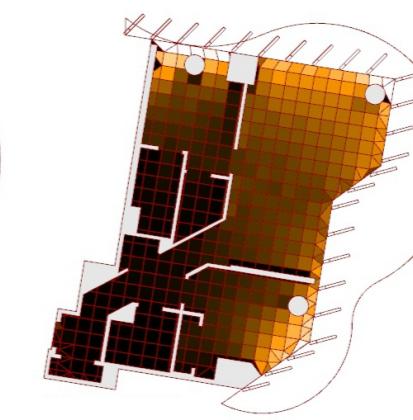
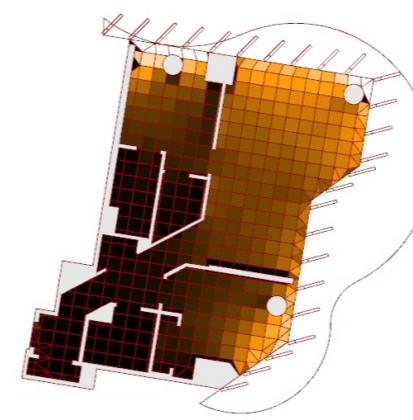
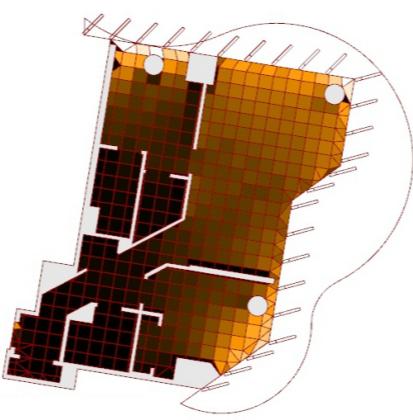
12/21



12:00



15:00



SHADING DESIGN

WESTON HUANG

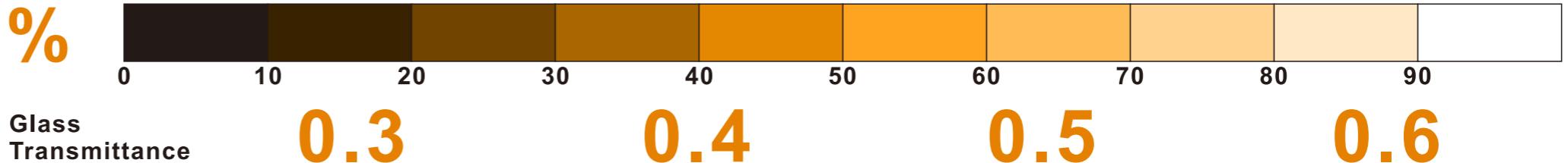
ADJUSTMENT

For getting the most efficient UDI, choosing the option that uses the glass with transmittance of 0.6 and the shading with vertical and horizontal side can guarantee the area with opening in the house to have more than 90 percent of UDI in a year. However, since the shading system is extremely effective, the transmittance of glass with too low value may decrease the percentage of UDI slightly. As a result, under this conditions, the glass performance may not be the critical point.

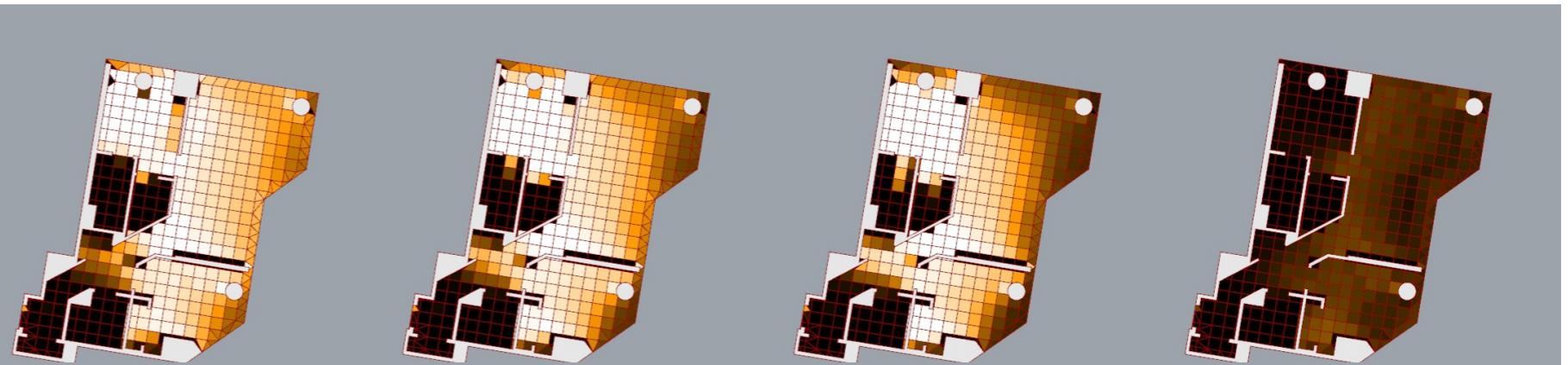
Nevertheless, choosing the option that uses the glass with transmittance of 0.4 and the horizontal shading is recommended. For one thing, in reality, the house now use the glass with transmittance around 0.4, which means that the cost of changing glass can be saved. Even though it blocks unusable sun light unsuccessfully now, with the horizontal shading, the area with window in the house will achieve almost 90 percent of UDI. Moreover, adding the deep horizontal shading is not practical. Since the depth of the proposed shading will violate the building code and the safety of structure, it will need a lot of efforts to construct it. That is to say, this combination of the original glass and the vertical shading is quite more efficient.

In conclusion, using high performance glass sometimes may diminish the effect of UDI. Besides, constructing the horizontal shading is not always practical. With the effective design of vertical shading, it can still provide the excellent performance on UDI when the window facing East or West, which is usually a huge challenge.

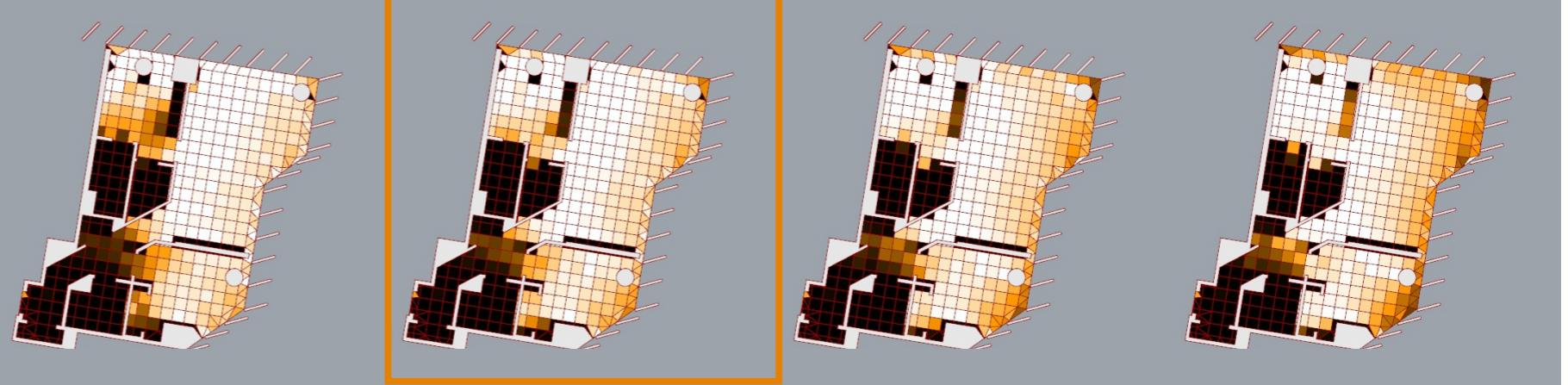
PERCENTAGE OF TIME RECEIVES UDI 100 ~ 2000 LUX



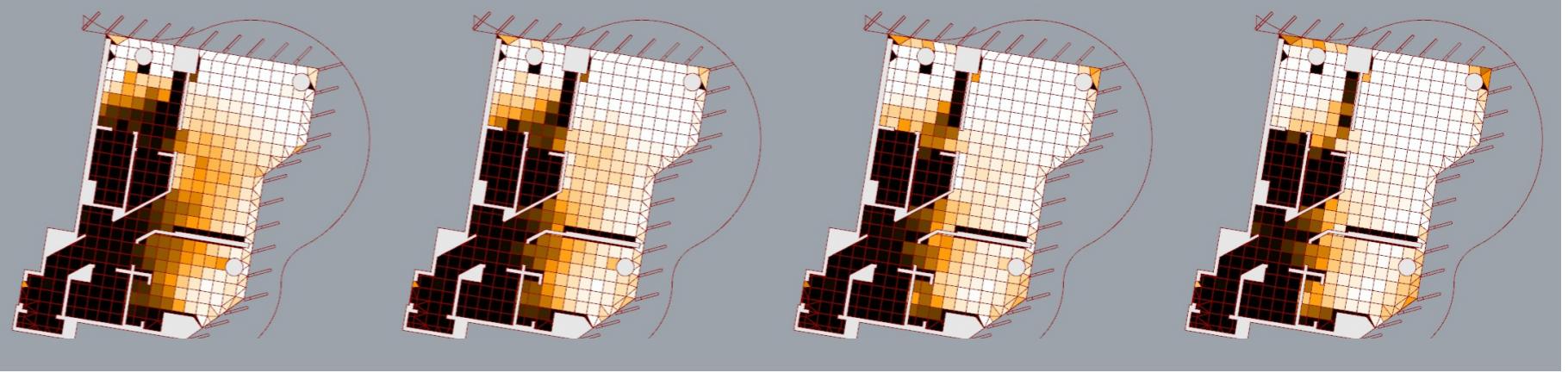
NO
SHADING



ONLY
VERTICAL
SHADING



VERTICAL &
HORIZONTAL
SHADING



SHADING DESIGN

WESTON HUANG

MERELY NO GLARE

With the shading system, the values of daylight glare probability in the house are all lower than 0.35 nearly whole year. That is to say, people stay in the house can hardly be aware of glare, which provides a better daylight quality and indoor comfort.

However, without the shading system, the value of daylight glare probability reaches the status of intolerable glare. For example, in June, 21st, 9 AM, the value soars to almost 0.5, which makes people hard to work in the house. Therefore, the shading system is effective and vital.



GLARE ANALYSIS

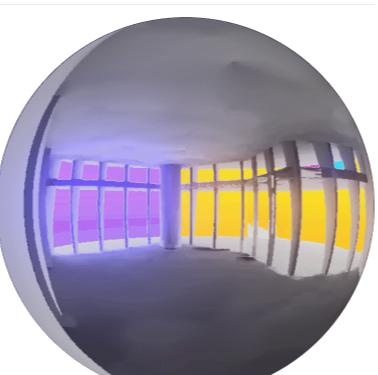
$DGP \geq 0.45$
Intolerable Glare

$0.45 > DGP \geq 0.40$
Disturbing Glare

$0.40 > DGP \geq 0.35$
Perceptible Glare

$0.35 > DGP \geq 0.00$
Imperceptible Glare

09:00



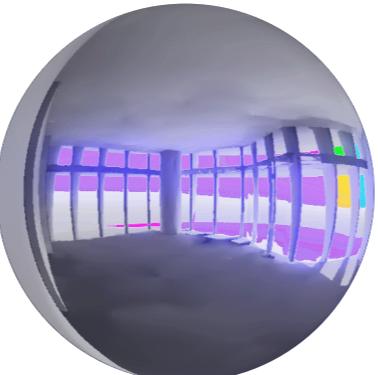
DGP = 0.259727

12:00

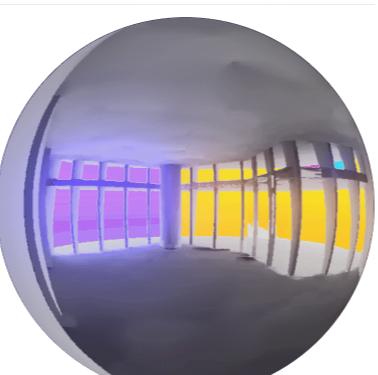


DGP = 0.275323

15:00



DGP = 0.282464

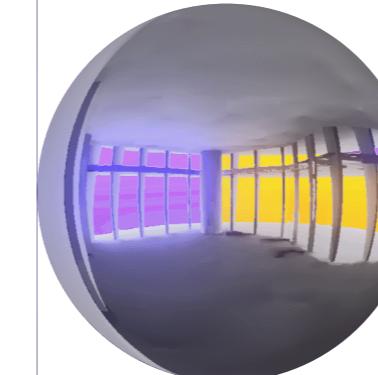


06/21

DGP = 0.300988



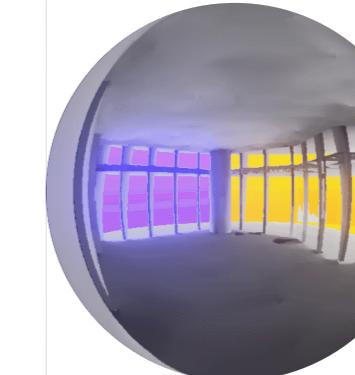
DGP = 0.283277



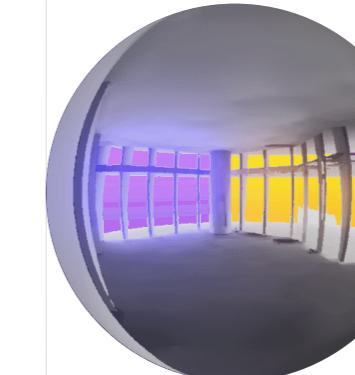
DGP = 0.270491

09/21

DGP = 0.286419



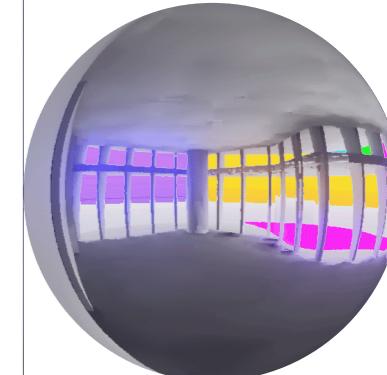
DGP = 0.277288



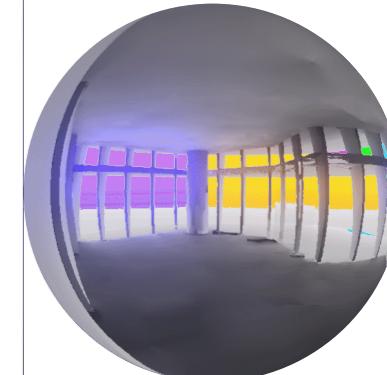
DGP = 0.260566

12/21

DGP = 0.239502



DGP = 0.259911



DGP = 0.237718

SHADING DESIGN

WESTON HUANG

ABOUT RESULT

Without assigning the material for each construction, the house now is not comfortable to live. Even though by adding the shading system can ease the hot feeling slightly, half of the time in this house is still not comfortable.

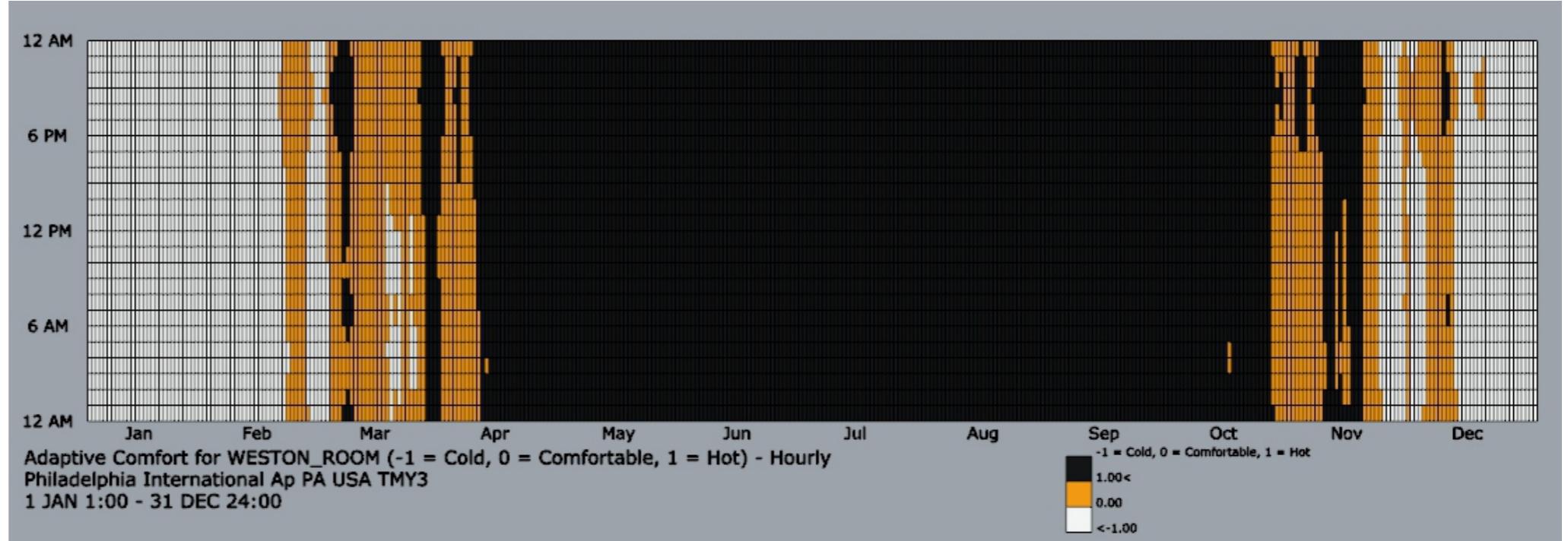
However, it is not the reality in this house. In fact, even without the shading system, the uncomfortable time is not as much as the analysis. That is to say, the correct material of each construction is the key point of the accuracy when doing the simulation.

PERCENT OF TIME COMFORTABLE

Shading	NO	YES
Comfortable	16.5%	19.2%
Hot	59.9%	53.6%
Cold	23.6%	27.2%

ENERGY PLUS ANALYSIS

Without shading



With shading

