SHADING DESIGN

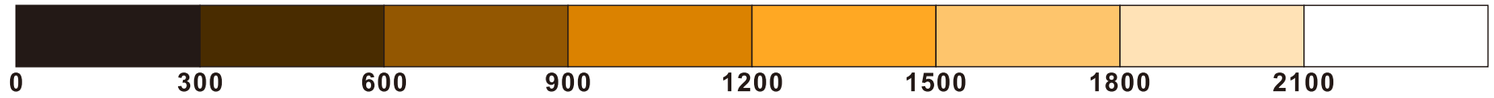
WESTON HUANG

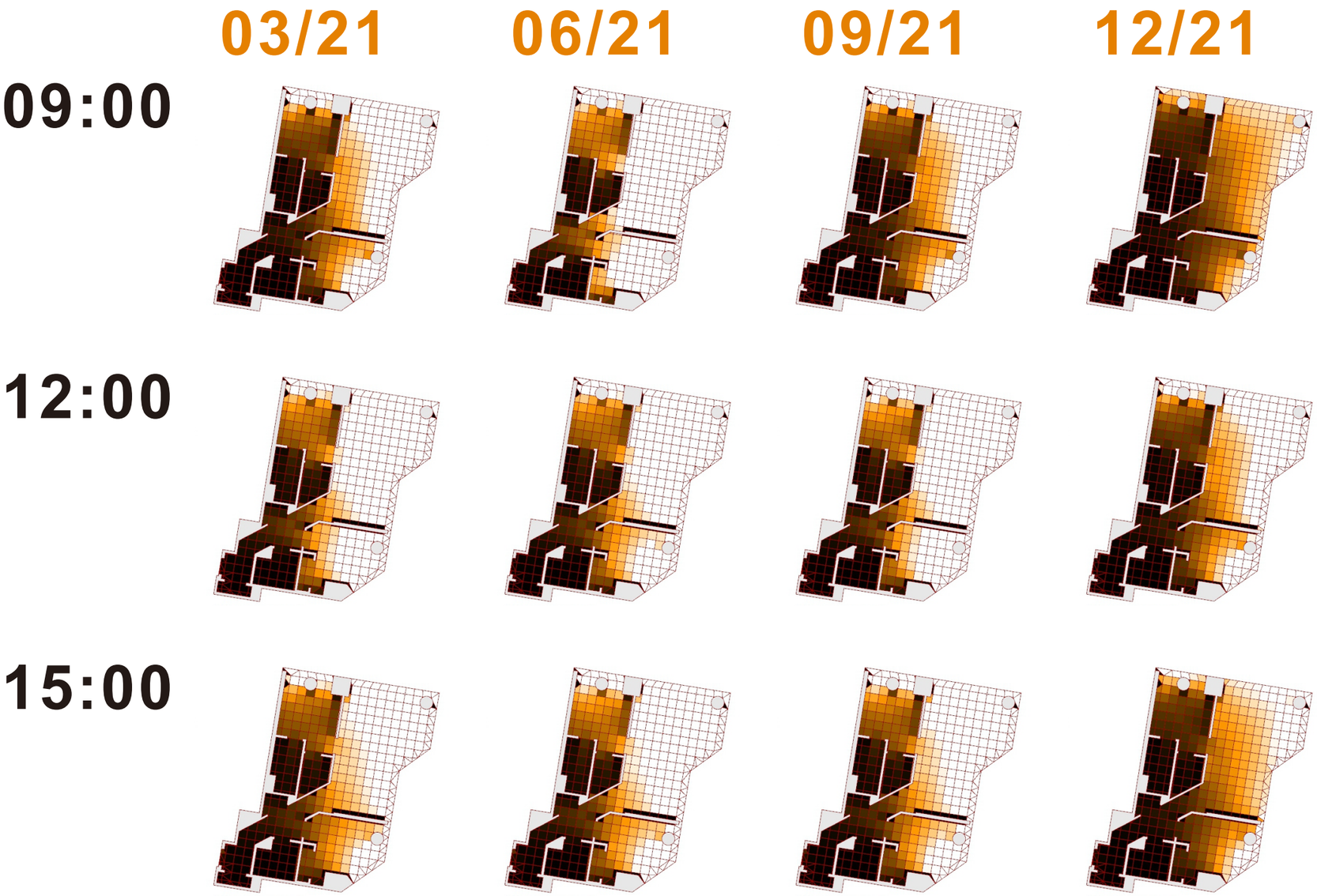
WITHOUT SHADING

The apartment has a issue of glare. Sine 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





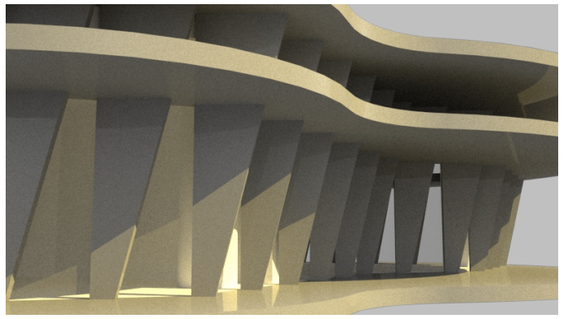
SHADING DESIGN

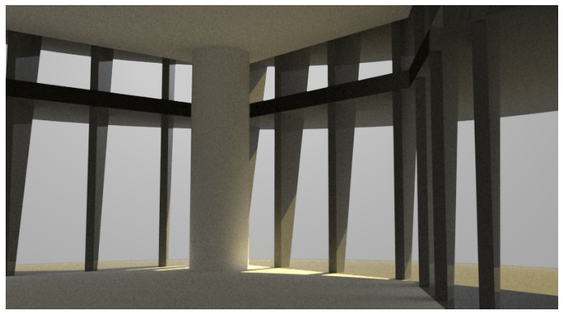
WESTON HUANG

WITH SHADING

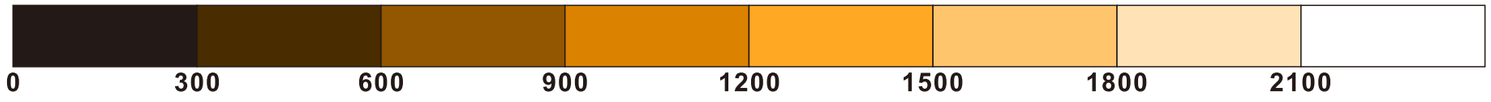
The target illuminance range is from 300 lux to 2000 lux. The goal is blocking some solar radiation but retaining the ability of daylighting from natural sun light.

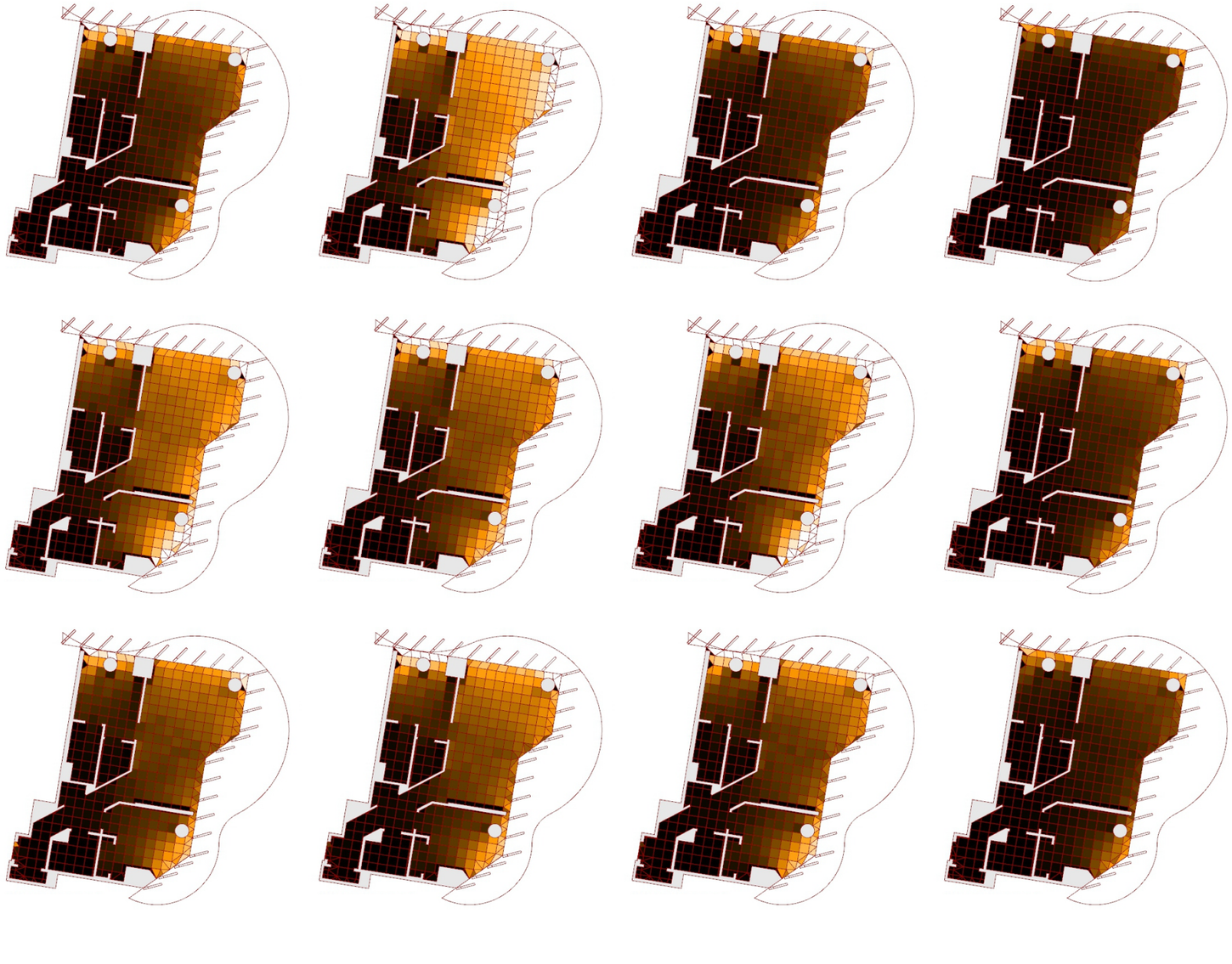
In order to maintain the condition that the place originally illuminated by sun will still get natural light, and block the light that has the illuminance bigger than 2000, Both vertical and horizontal shading devices are applied here.





IMPROVED RADIANCE IN THE APARTMENT





SHADING DESIGN

WESTON HUANG

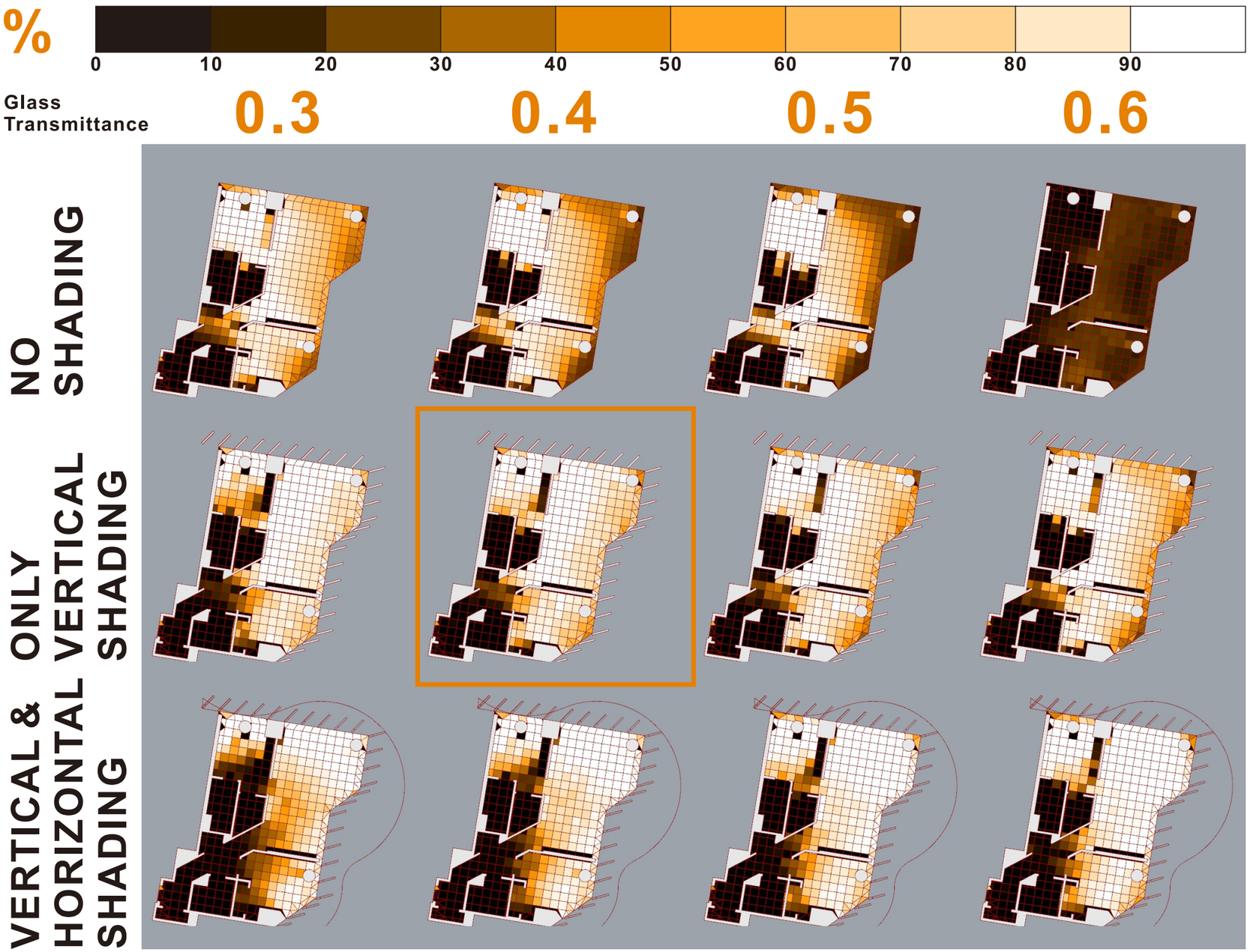
ADJUSTMENT

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



SHADING DESIGN

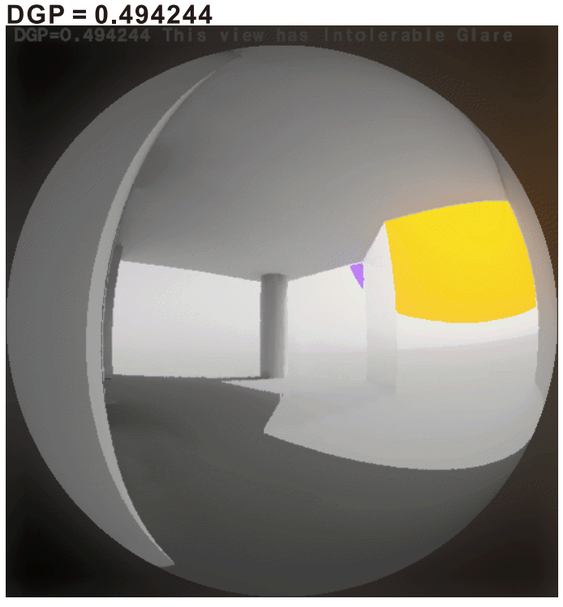
WESTON HUANG

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.

DGP = 0.494244



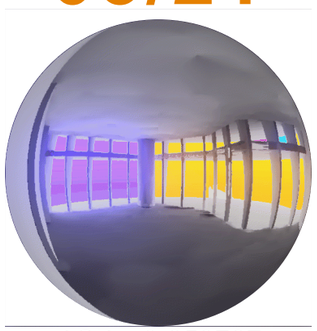
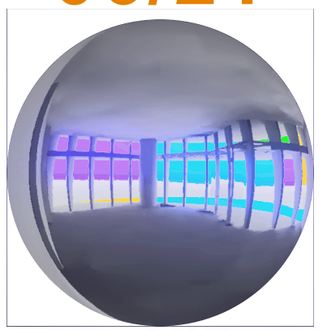
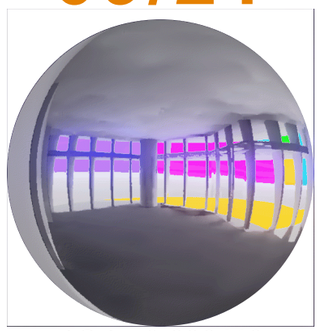
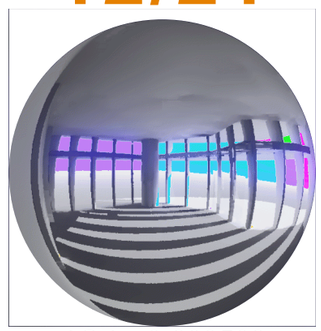
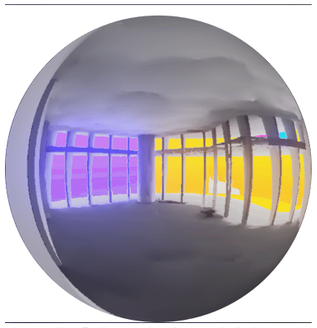
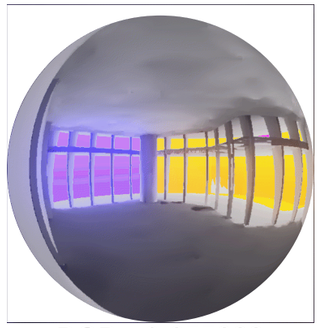
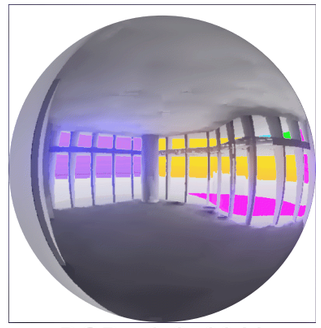
GLARE ANALYSIS

DGP ≧ 0.45
Intolerable Glare

0.45＞DGP ≧ 0.40
Disturbing Glare

0.40＞DGP ≧ 0.35
Perceptible Glare

0.35＞DGP ≧ 0.00
Imperceptible Glare

	03/21	06/21	09/21	12/21
09:00	 DGP = 0.259727	 DGP = 0.300988	 DGP = 0.286419	 DGP = 0.239502
12:00	 DGP = 0.275323	 DGP = 0.283277	 DGP = 0.277288	 DGP = 0.259911
15:00	 DGP = 0.282464	 DGP = 0.270491	 DGP = 0.260566	 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.

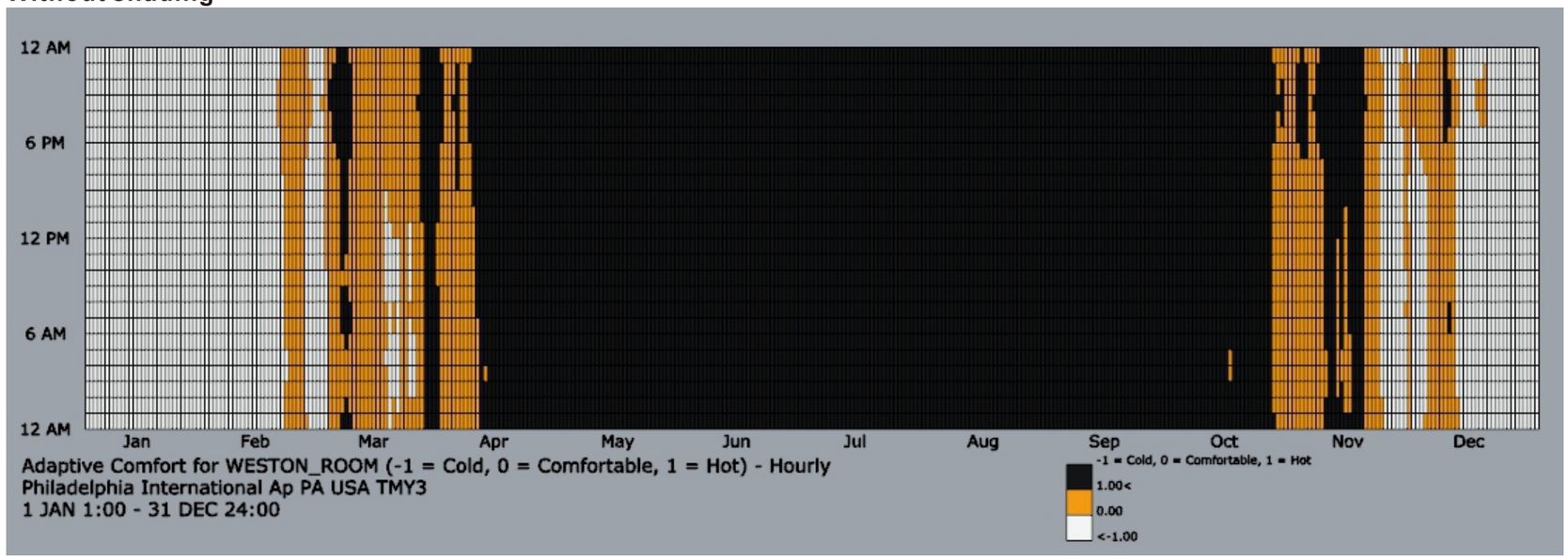
However, it is not the reality in this house. In fact, even without the shading system, the uncomfortable time is not as much as the analysis. That is to say, the correct material of each construction is the key point of the accuracy when doing the simulation.

PERCENT OF TIME COMFORTABLE

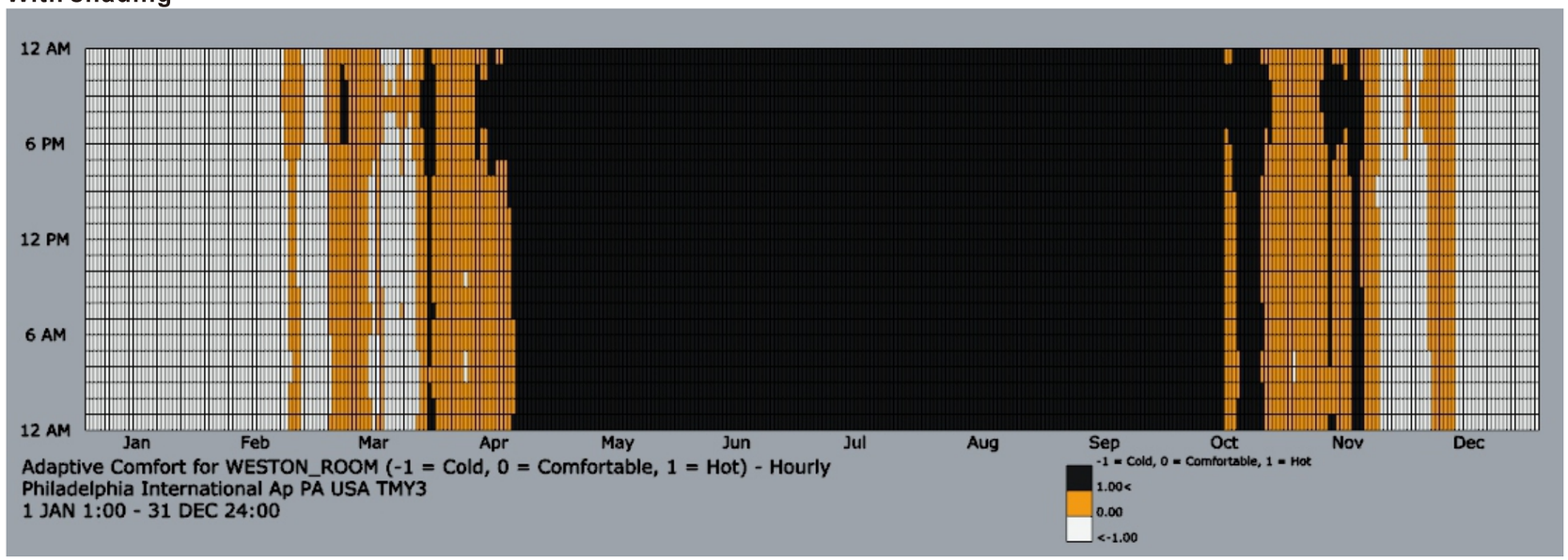
Shading	NO	YES
Comfortable	16.5%	19.2%
Hot	59.9%	53.6%
Cold	23.6%	27.2%

ENERGY PLUS ANALYSIS

Without shading



With shading



SHADING DESIGN

WESTON HUANG

ADJUSTED RESULT

After assigning the materials for constructions and letting the windows open for natural ventilation, the house now is more comfortable. The value of indoor jumps from 16.5% to 36.2%. On the other words, the comfortable days in the house double. As a result, the adjustment has been effective.

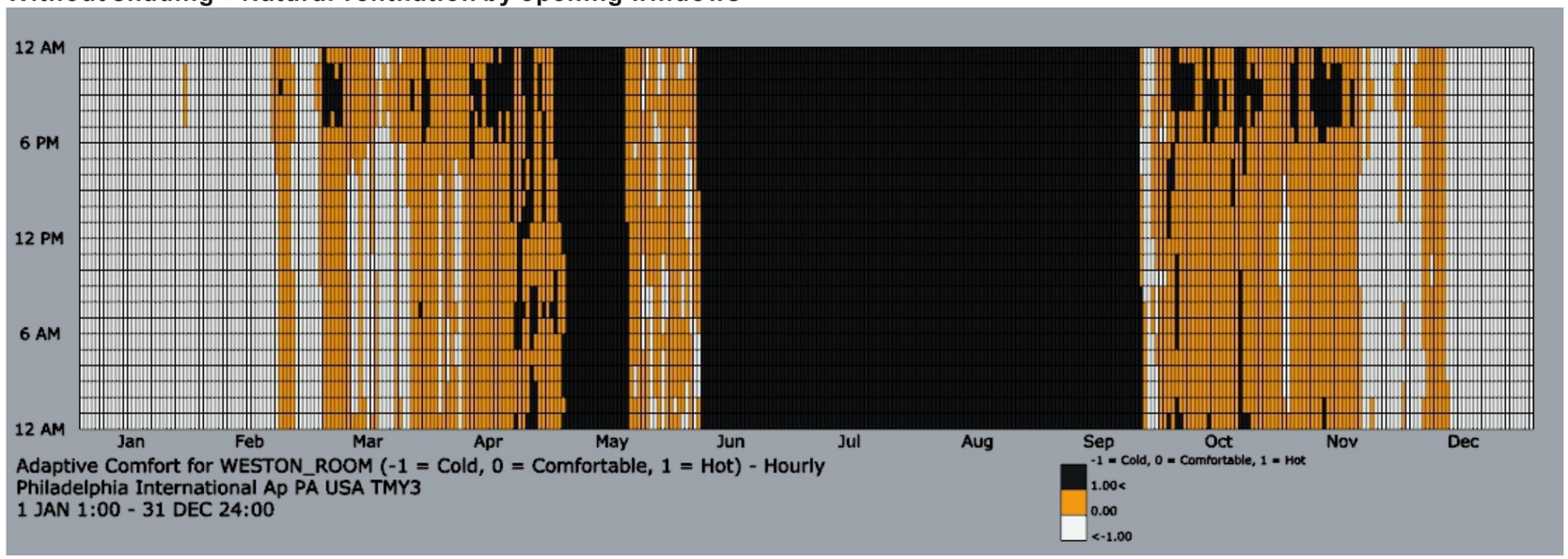
Conditions of opening windows for natural ventilation:
Indoor temperature: 20 C - 28 C
Outdoor temperature: 16 C - 32 C

NATURAL VENTILATION
BY OPENING WINDOW
PERCENT OF TIME
COMFORTABLE

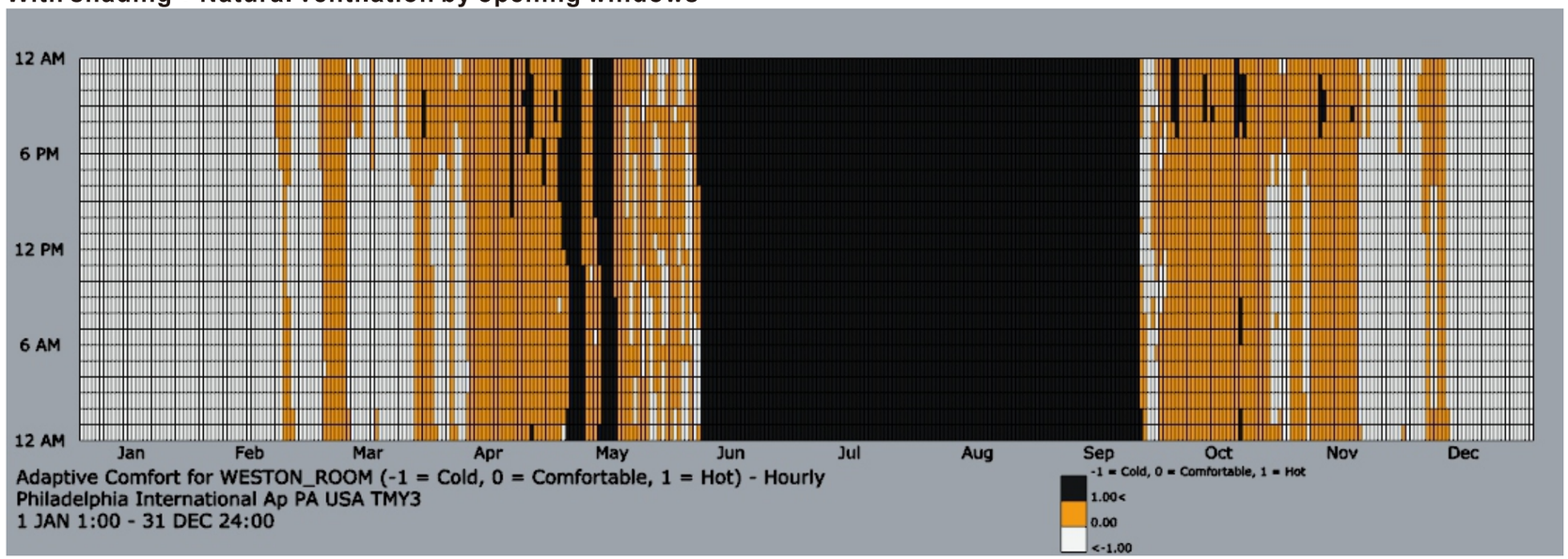
Shading	NO	YES
Comfortable	31.2%	30.2%
Hot	38.5%	33.5%
Cold	30.3%	36.3%

ENERGY PLUS ANALYSIS

Without shading + Natural ventilation by opening windows



With shading + Natural ventilation by opening windows



SHADING DESIGN

WESTON HUANG

ABOUT RESULT

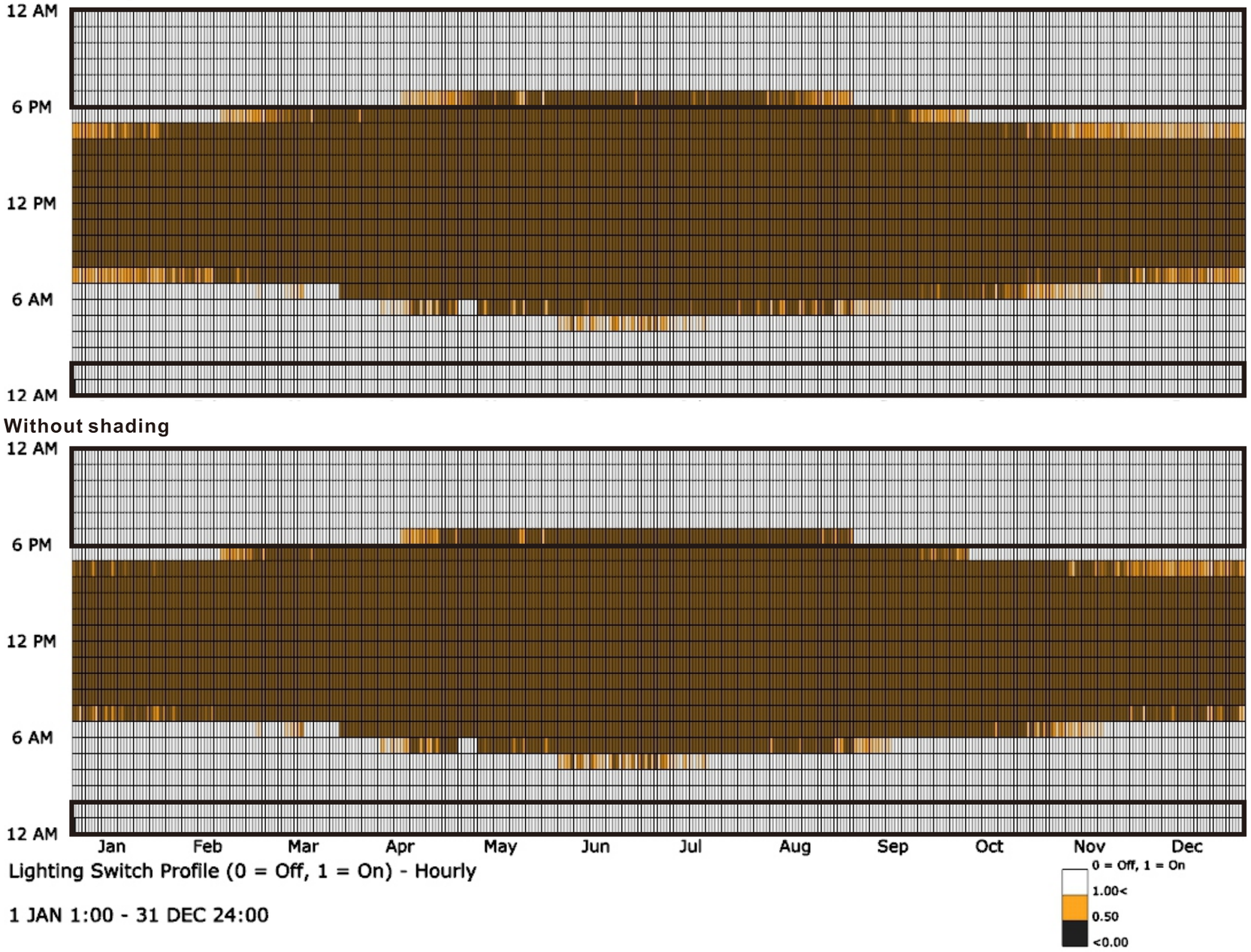
In order to understand the actual hours that need electronic light in this apartment, the setting time of occupancy is 8760 hours. In the chart of lighting schedule, the black color means the time having natural daylight and turn off the electronic light is acceptable. On the other hand, the white color implies the need of turning on the light. Then, the yellow color is optional to turn on or turn off the light.

In summer there are more hours for turning off the light than in winter. Usually, people can save the energy of lighting for nearly 14 hours daily in summer, while in winter merely 8 to 10 hours. Nevertheless, when accounting the 8 hours of sleeping time, the amount of time needing turning on the light will be from 4 to 6 hours, which is one sixth to a quarter of day. All these advantages should be contributed to the well-performed daylighting design, which has provided enough lighting to the house.

For making sure that the shading devices will not affect the lighting schedule too much, the simulation of it also applied to the condition which is without shading devices. In fact, from the comparison, the results of lighting schedule are similar. Therefore, it proved that the shading devices will not influence the effect of getting daylight when it protected the house from glaring and over-heating. So now we can say the design of the shading devices is helpful and effective.

Lighting Schedule

With shading



Without shading