BUILDING PERFORMANCE SIMULATION
ARCH-753 Fall 2017

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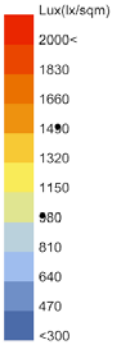
ASSIGNMENT 5

Hwang, Youngjin

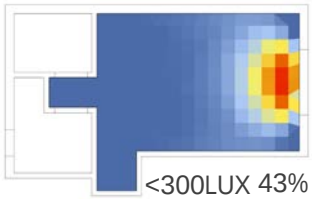
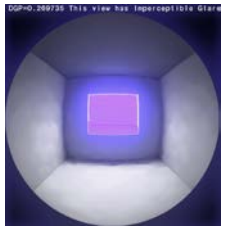
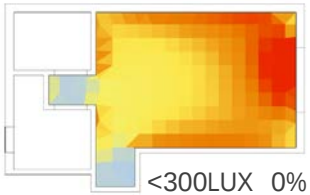
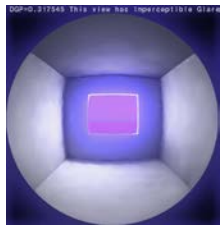
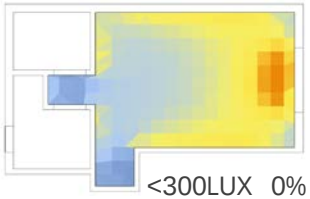
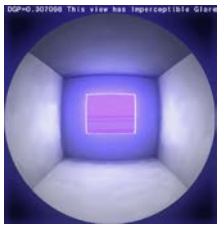
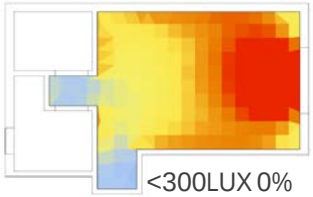
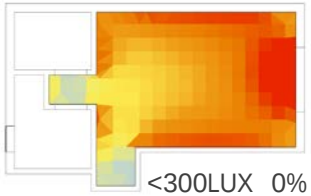
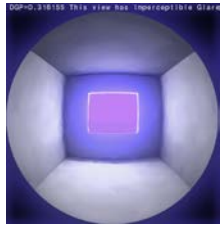
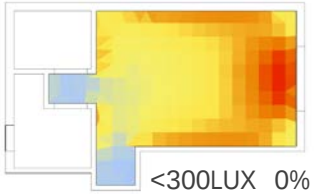
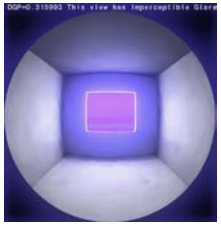
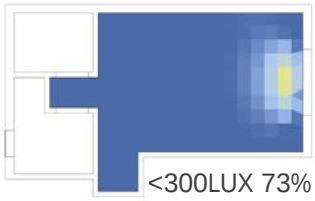
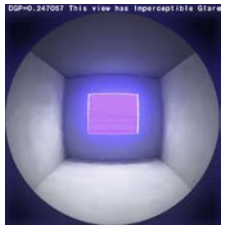
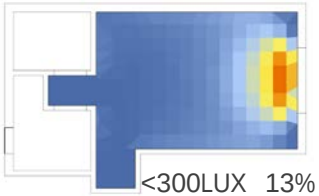
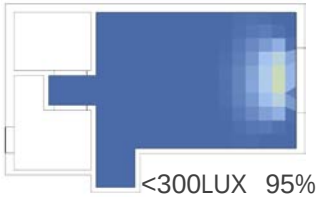
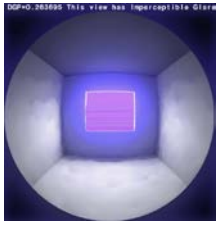
Glare Analysis / Glare Probability (1)



Point-in-time Illuminance Analysis & Glare Probability Analysis of Original Room

The room is deep, and there is only one window on the east side. As analysis results are shown below, sufficient sun light do not come inside through this window. Except June, the room does not provide enough daylight during the day, and glare probability is also imperceptible during most of days.

Floor Plan (Unit: m)

	9AM		12PM		3PM	
21stMAR	 <300LUX 43% >2000LUX 1%	 DGP=0.27	 <300LUX 0% >2000LUX 4%	 DGP=0.32	 <300LUX 0% >2000LUX 0%	 DGP=0.31
21stJUN	 <300LUX 0% >2000LUX 16%	 DGP=0.47	 <300LUX 0% >2000LUX 8%	 DGP=0.32	 <300LUX 0% >2000LUX 2%	 DGP=0.32
21stDEC	 <300LUX 73% >2000LUX 0%	 DGP=0.25	 <300LUX 13% >2000LUX 0%	 DGP=0.26	 <300LUX 95% >2000LUX 0%	 DGP=0.26

Re-Evaluation through Annual Daylight Analysis 1

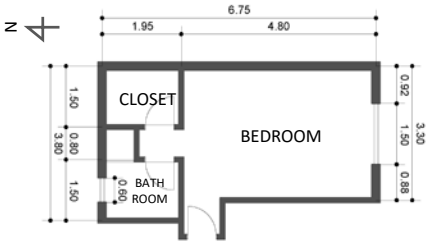
Daylight Autonomy & Continuous Daylight Autonomy Analysis

*lux threshold: 300lux

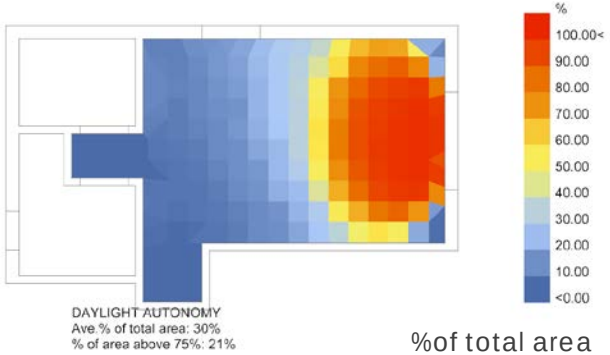
Different from point-in-time analysis, DA and CDA are annual based daylight analysis. These analysis methods are useful and easy to check average daylight value during a year while point-in-time is also a critical method to check specific daylight value during a season. Proposed design improves indoor daylight environment; however, these both results do not show how many over-lit occurs in the room since the results only indicate whether each analyzed node is above specific designated lux value(300lux) or not.

DAYLIGHT AUTONOMY

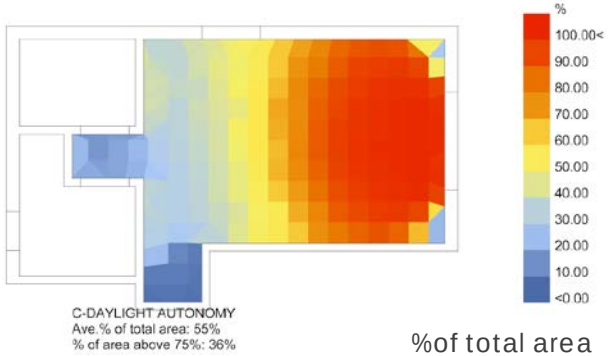
Continuous DAYLIGHT AUTONOMY



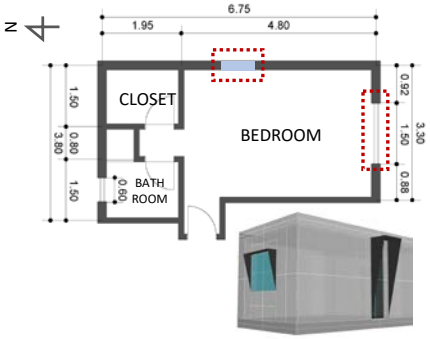
Original Room



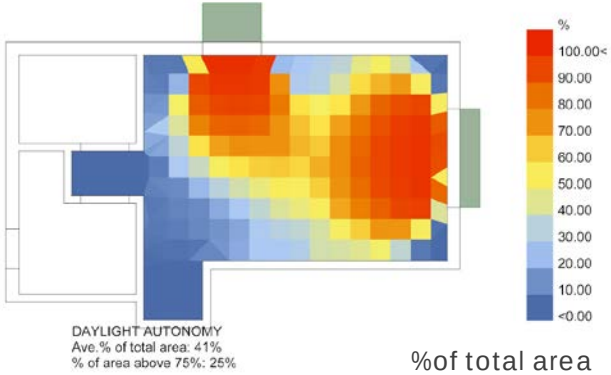
%of total area
30%



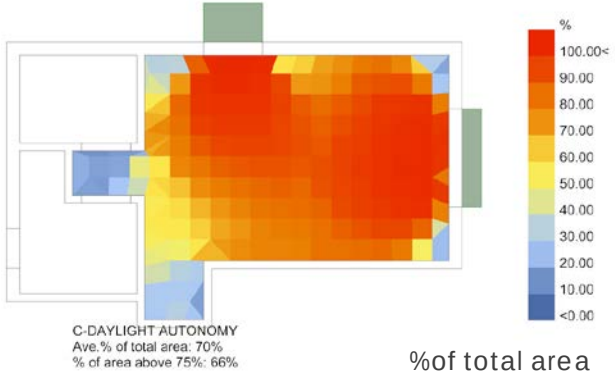
%of total area
55%



New Proposed Room



%of total area
41%

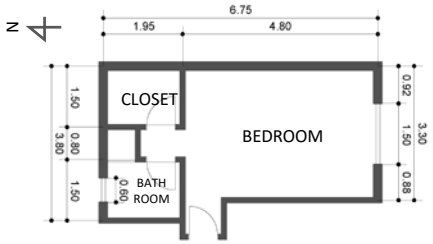


%of total area
70%

Re-Evaluation through Annual Daylight Analysis 2

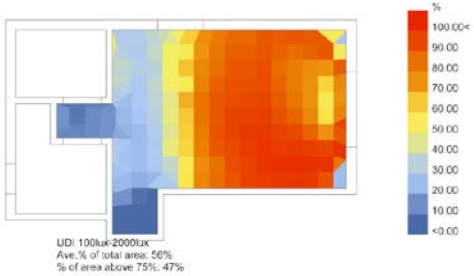
Useful Daylight Illuminance(UDI) Analysis |

Since Useful Daylight Illuminance(UDI) can analyze over-lit ratio, it would be easier to evaluate the design with the method than using DA or CDA. Metric of UDI is hourly time values based upon three illumination ranges, 0-100lux, 100-2000lux, and over 2000lux. For evaluating the results, the minimum UDI criteria was set at least 75% of the time. The UDI results shown below represent that newly proposed design has better UDI than original room.



Original Room

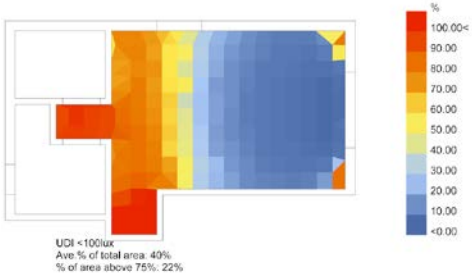
UDI (100lux<=a<=2000lux)



%of total area **30%**

% of area achieving above 75% **47%**

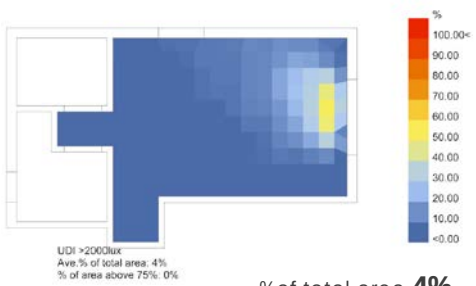
UDI (a<100lux)



%of total area **40%**

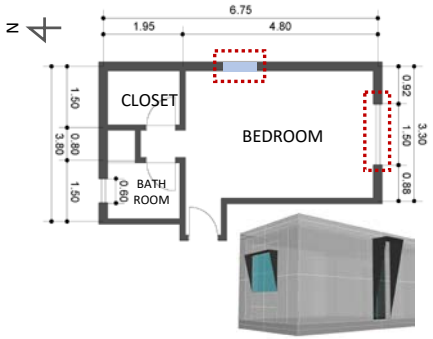
% of area achieving above 75% **22%**

UDI (a>2000lux)

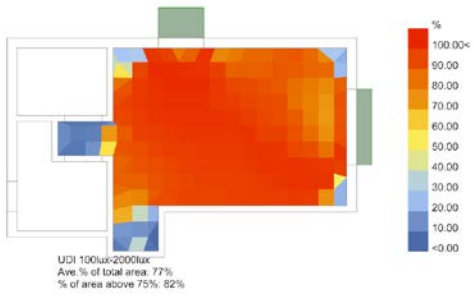


%of total area **4%**

% of area achieving above 75% **0%**

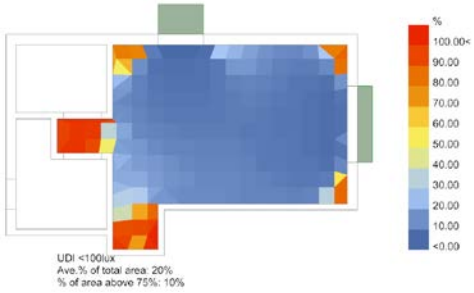


Newly Proposed Room



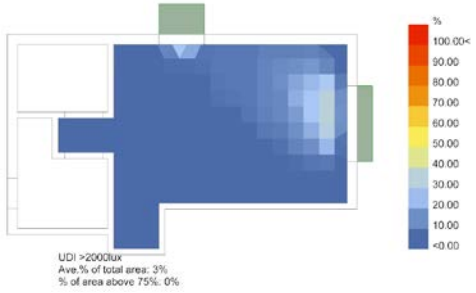
%of total area **77%**

% of area achieving above 75% **82%**



%of total area **20%**

% of area achieving above 75% **10%**



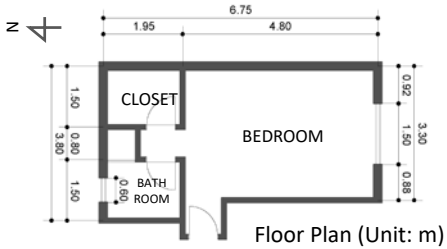
%of total area **3%**

% of area achieving above 75% **0%**

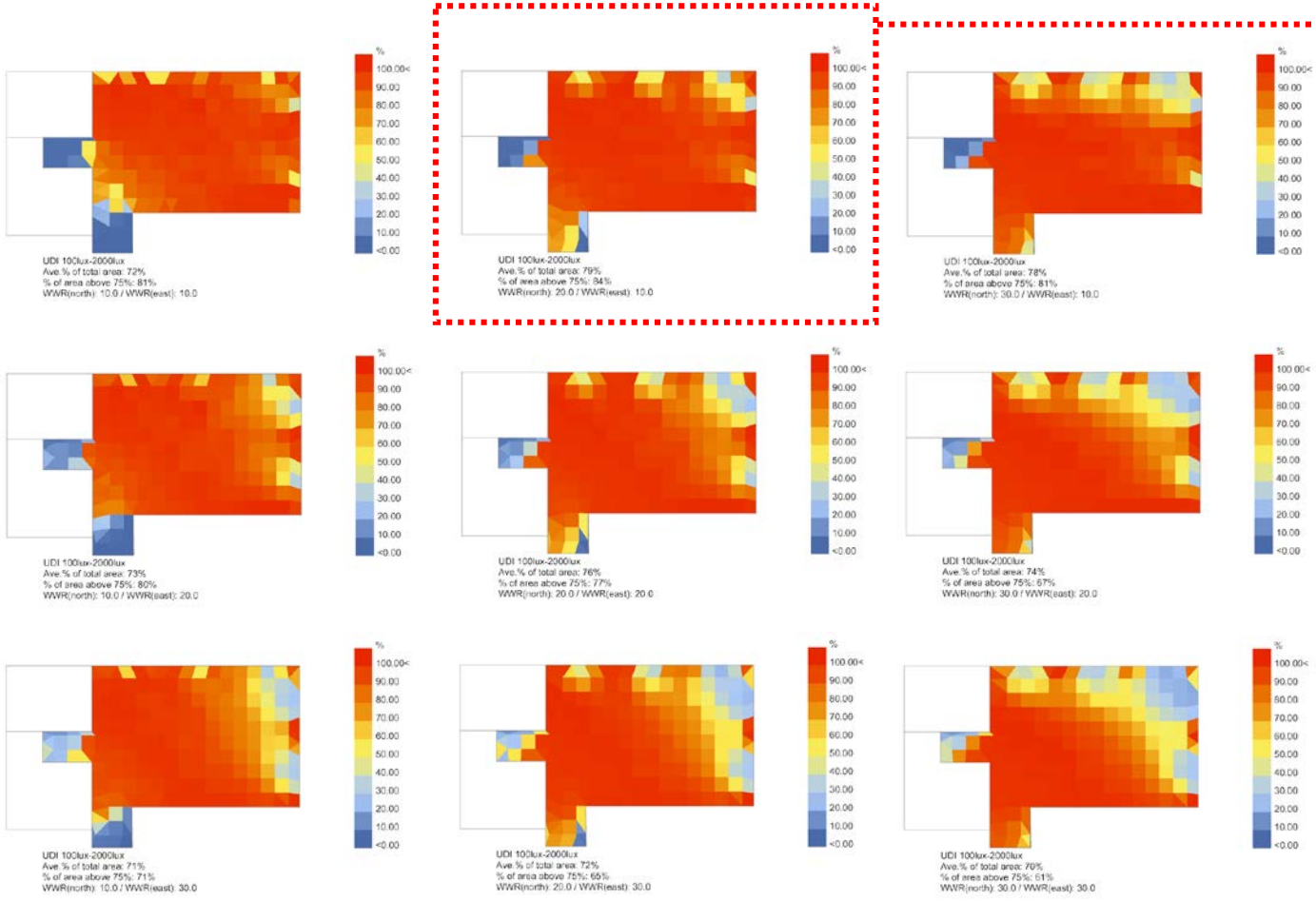
Re-Design for UDI Optimization 1

Evaluation of UDI upon WWR on North and East Facade

The room has both east and north façades. To optimize UDI from the previous proposed design, geometry of the room has been changed. WWR of north and east façade has a specific range, 10%-30%, since the WWR of the original window facing the east is around 30%. If the WWR is above 30%, there would be over-lit, and daylight will not be provided evenly due to the depth of the room. For these reasons, UDI is evaluated upon the WWR of the north side and the east.

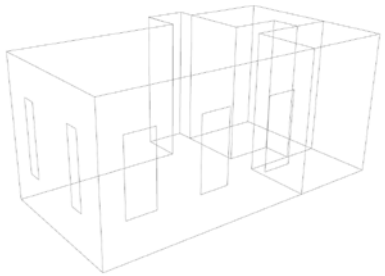


Floor Plan (Unit: m)



BEST RESULT
WWR(north): 20%
WWR(east): 10%

% of total area **79%**
% of area achieving above 75% **84%**



Re-Design for UDI Optimization 2

Change Radiance Parameters

To improve the result, some radiance parameter has been changed. As AB and AD value increased, the result is slightly improved than the previous one.

Base Radiance Parameter: ab-2 ad-512

% of total area **79%**

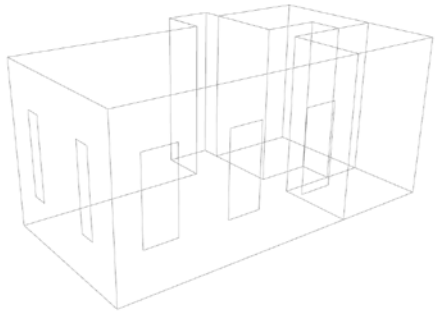
% of area achieving above 75% **84%**

Changed Radiance Parameter: ab-5 ad-1000

% of total area **80%**

% of area achieving above 75% **86%**

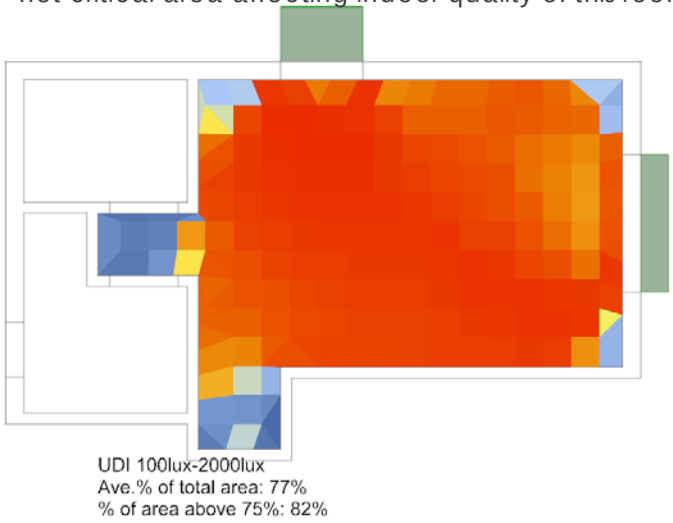
(without shading devices)

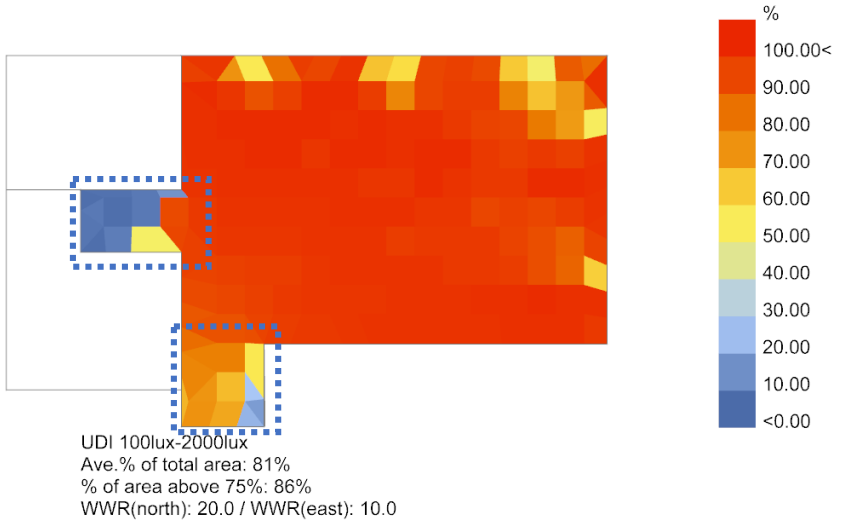


Re-Design for UDI Optimization 3

Add Shading Devices and Comparing the Result

Newly optimized UDI design shows the better result than the previous proposed design. If the result excludes the blue box area, which is not critical area affecting indoor quality of this room, it would have been more developed result than others.





Previous Proposed Design

% of total area **77%**

% of area achieving above 75% **82%**

Newly Proposed Design

% of total area **81%**

% of area achieving above 75% **86%**

(with shading devices)