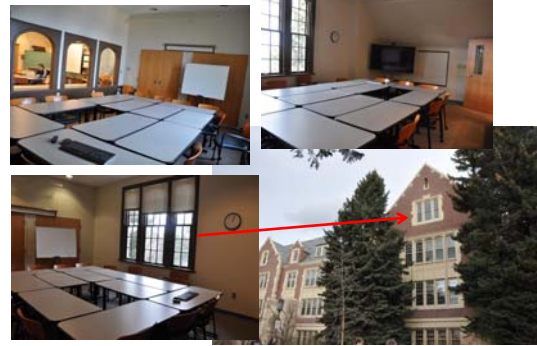




Case Study: A Daylighted Room

Karin Settles
Nan Wang
Rachael Smith

Our Case Study

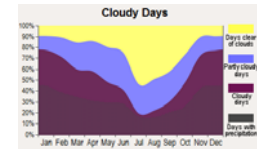
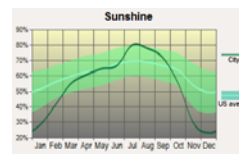


Our Case Study



- **Room Description**
 - LLS 447C, top floor of Life Science, with windows facing west
 - Small classroom
 - Primarily used for meetings
 - Windows connect the room to the larger "reading room," which only has one small window
 - Eight electric lights in the room

Climate Data



Annual chance of sunshine: %

Months	% Sunny	Clear Days	Partly Cloudy Days	Cloudy Days
January	22.5%	1	4	24
February	21.5%	1	5	23
March	32.5%	4	6	21
April	34.5%	1	6	19
May	48.2%	6	9	16
June	54.5%	8	9	13
July	60.6%	18	7	8
August	77.4%	16	8	7
September	48.1%	13	7	9
October	11.4%	9	7	15
November	11.4%	1	6	23
December	22.5%	1	4	24

- Moscow is sunny 196 days of the year, on average, which is lower than the national average (205).

<http://www.bestplaces.net/climate/city/idaho/moscow>
<http://www.homefacts.com/weather/idaho/Jatah-County/Moscow.html>

Performance Analysis

- **Daylight**
 - Outside a few minutes later and under the same weather conditions, there were 9300 footcandles of daylight.
 - The corners of the room were much darker than the center.
 - The average daylight factor in the room is 1.51%
 - The lowest value is 22 footcandles
 - The highest value is 491 footcandles



Performance Analysis

Glare

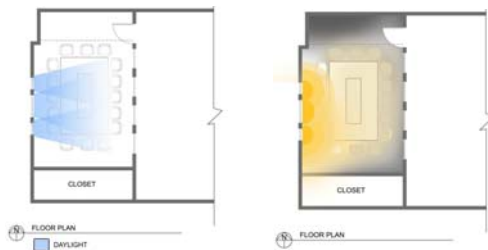


Glare Metric	Value	Individual Point Commenting
Max Glare	88.83	120
Avg Glare	10.83	240
Min Glare	0.83	120
Background Metric	0.83	120
Low End Point Value	0.83	120
High End Point Value	88.83	120
Background Metric Value	0.83	120
Number of Background Points	4000	0.00
Background Percentage of View	12.12 %	0.00 %

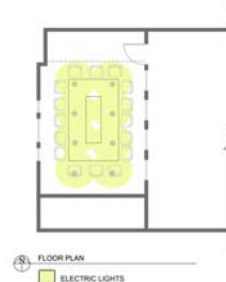
Ratio to Background Ratio: 10.83 to 0.83 = 13.05

Performance Analysis

- **Daylight**
 - Because of the large side window, the room was fairly well lit, but there was a lot of glare. On sunny days, especially in the summer, the glare from direct sunlight around sunset will be much worse.



Performance Analysis



- **Current Electric Lighting**
 - 8 Recessed Can Light Fixtures
 - Each fixture has 2 lamps
 - Compact Fluorescent Lightbulbs, Quad Tube, 18 watts
 - All of the lights in the room are on dimmer switches
 - There are 3 lighting schemes

Performance Analysis

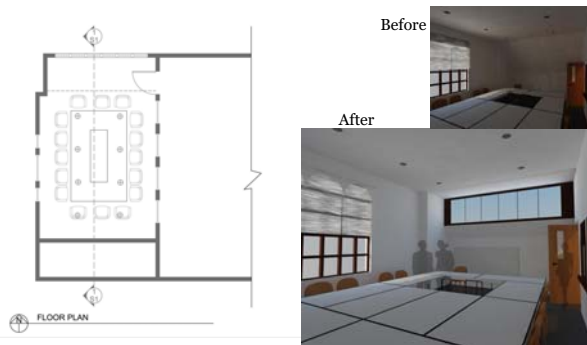


- **Does the daylighting have the potential to save energy?**
 - 2 lamps per fixture
 - 18 watts per lamp
 - 2920 hours per year
 - **840.96 kw/y**
 - \$3.79 per lamp
 - 12000 hours per lamp
 - **\$14.76 per year** for electric lighting

Room Redesign (February)



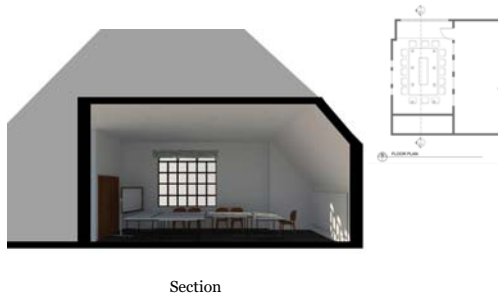
Room Redesign



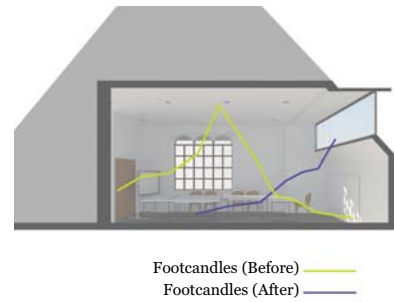
Room Redesign (August)



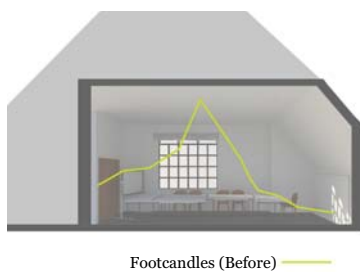
Redesign Performance Analysis



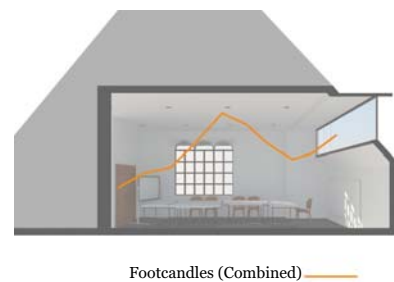
Redesign Performance Analysis



Redesign Performance Analysis



Redesign Performance Analysis

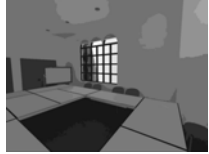


Redesign Performance Analysis

Before



After



- **Glare**
 - The new apertures reduce the amount of glare at desk height and don't contribute more glare because they face north.

Conclusion

- Increase the daylight levels in the room by adding north glazing from a dormer window or skylight.
- By adding a northern window the light will be distributed more evenly throughout the room.



ENERGY SAVINGS DUE TO DAYLIGHTING
Based on: GreenGlaze, G. and GreenGlaze, G. (2008). "Daylighting Performance".
 U.S. report 1000A, Berkeley, CA: Lawrence Berkeley Laboratory.
 Sponsored by: Fuller House, Architecture Department, Miami University, Oxford OH 45308-0000 (fuller@fuller.com)

	Before	Current	Redesign
1. Enter LA Floor of building location	LAT	38.9	38.9
2. Enter Daylighting Strategy (from the table 2.1.1)	DAYSTR	10	10
3. Enter Typical Floor Width (ft)	FW	30	30
4. Enter Typical Floor Length (ft)	FL	30	30
5. Enter Lighting Control Type (1 = control, 2 = dimming)	LCT	1	1
6. Enter Design Roomwork Level (0.0, 0.5, or 1.0 ft-cm)	RL	0.5	0.5
7. Enter window area per floor above the workspace (ft ²)	WAA	15	15
8. Enter window height above floor (ft)	WH	7	7
9. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
10. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
11. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
12. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
13. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
14. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
15. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
16. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
17. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
18. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
19. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
20. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
21. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
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48. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
49. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
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97. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
98. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
99. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0
100. Enter daylighting control system (0 = OFF, 1 = ON)	DCS	0	0

Energy Savings

- Current Annual Savings: 47%
- Redesign Annual Savings: 49.2%

Conclusion



- In addition adding an aperture on a second wall will decrease the amount of glare in the room by increasing illumination and contrast reduction.
- With apertures on the northern wall, this will increase the amount of hours per day the room is illuminated by daylight since the existing western windows allow sun penetration in the afternoon and blinds are closed.