

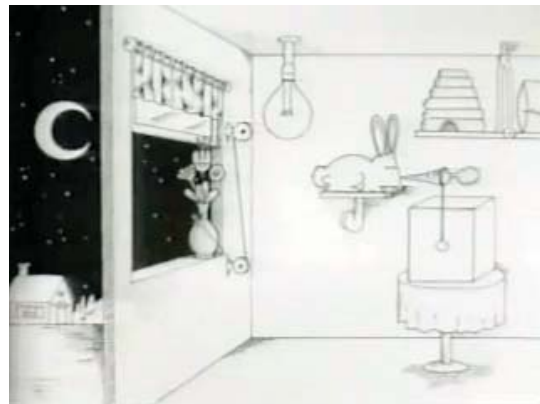
DIVA and Design

Jeff Niemasz & Jon Sargent
DIVA Day
October 19th, 2012

Thursday, November 8, 12

Multi-Platform Workflows

- Can stifle design, collaboration, and integration.
- Prone to Errors.
- More software to learn.



Sesame Street Rube Goldberg Alphabet Contraption

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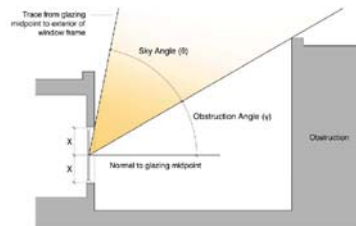
Generative Form



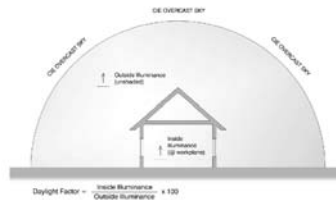
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Environmental Relationships

Step 1: Site Conditions



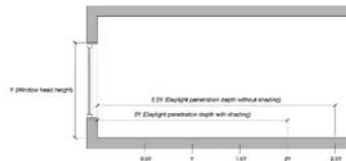
Step 2: Program needs



Step 3: Window to Wall Ratio

$$WWR > \frac{0.088 \cdot DF}{\tau_{vis}} \cdot \frac{90^\circ}{\theta}$$

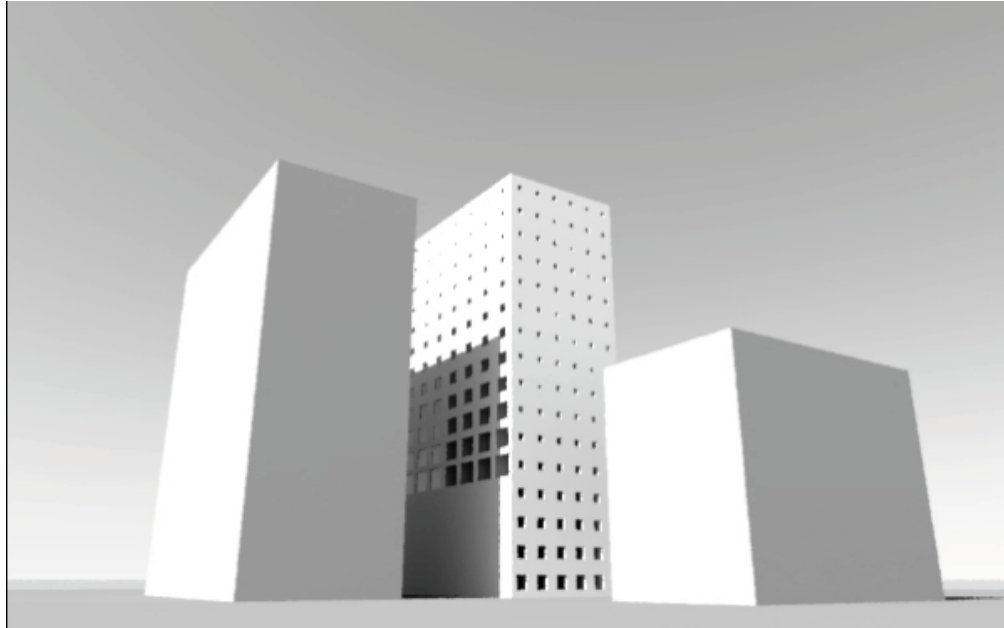
Step 4: Daylight Depth



CF Reinhart and VRM LoVerso, "A design sequence for diffuse daylight", Lighting Res. Technol, 2010; 42: 7-31

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Visualizing Relationships



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Rules of Thumb and Simulations



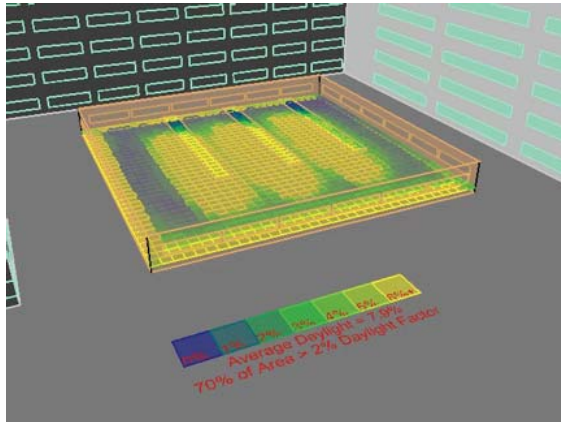
Diffuse Daylight Sequence **Rule of Thumb**



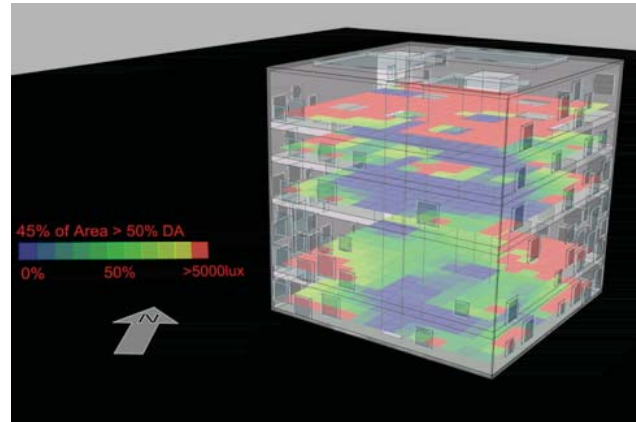
Daylight Factor **Simulation**

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Proof of Concept Rhino/Grasshopper & Radiance and Daysim



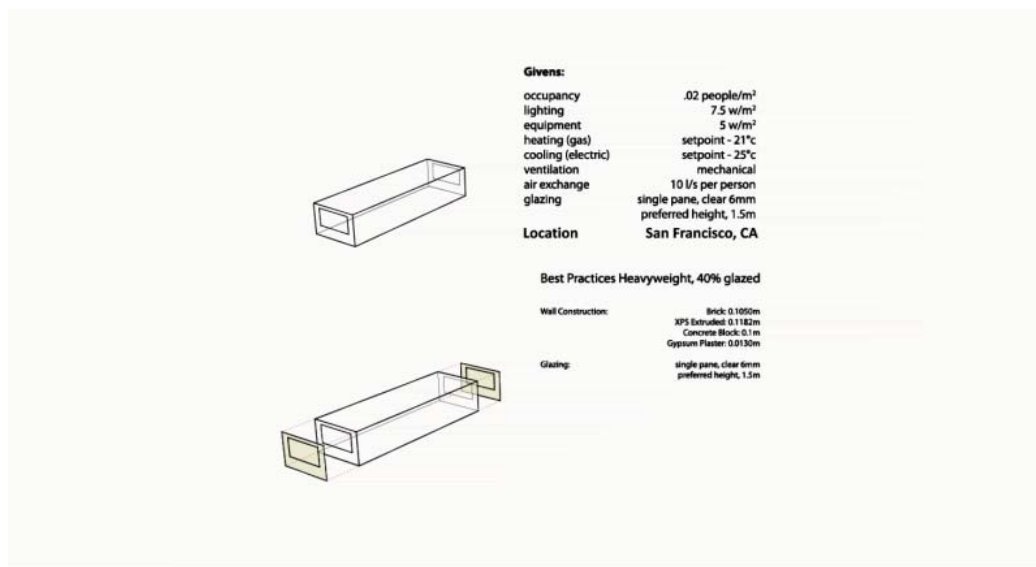
Skylight and Daylight Factor
2009 International Radiance Conference



Daylight Autonomy Demonstration
2010

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Proof of Concept Rhino/Grasshopper & EnergyPlus



Linking Grasshopper with Energy Plus
Spring 2010 class "Thermal Performance of Buildings"
J Niemasz, J Sargent, L Viklund

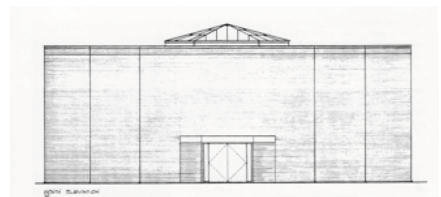
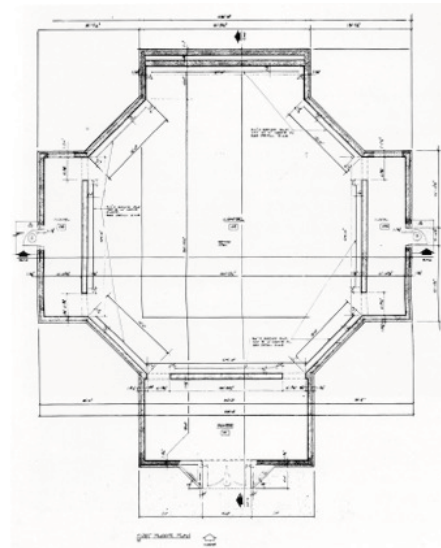
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DIVA Thermal Analysis + Galapagos

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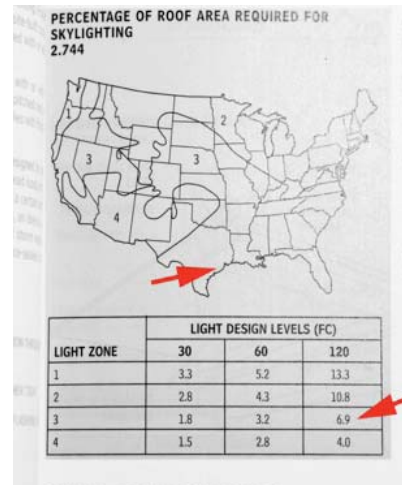
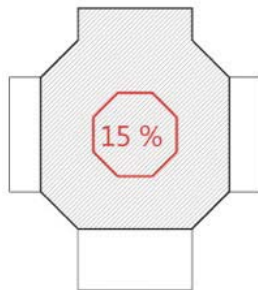
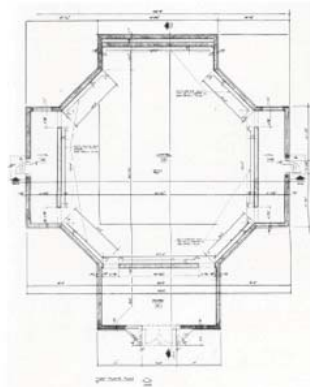
Example: Size a Skylight

- Location: Houston, TX
- Program: Museum
- 1500 sf
- No windows



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Skylight Rules of Thumb



DOE rule of thumb for windowless space recommends between 5 and 15% skylight to floor area percentage.

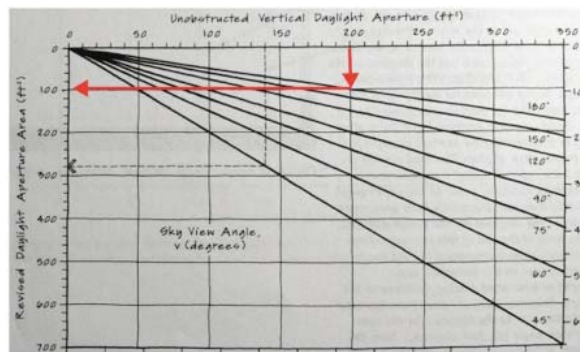
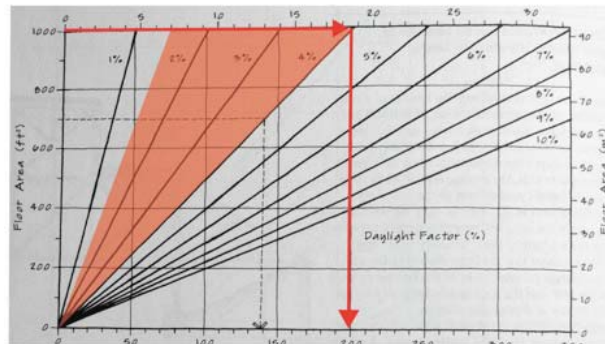
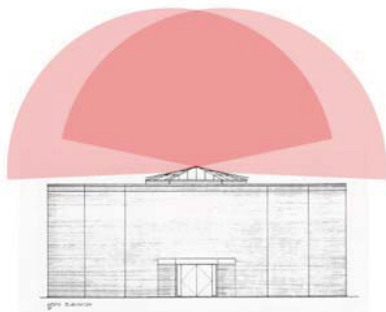
US Dept. of Energy website: <http://www.energysavers.gov>

AIA graphic standards uses a climate zone and recommends a 7% skylight.

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Skylight Rules of Thumb cont.

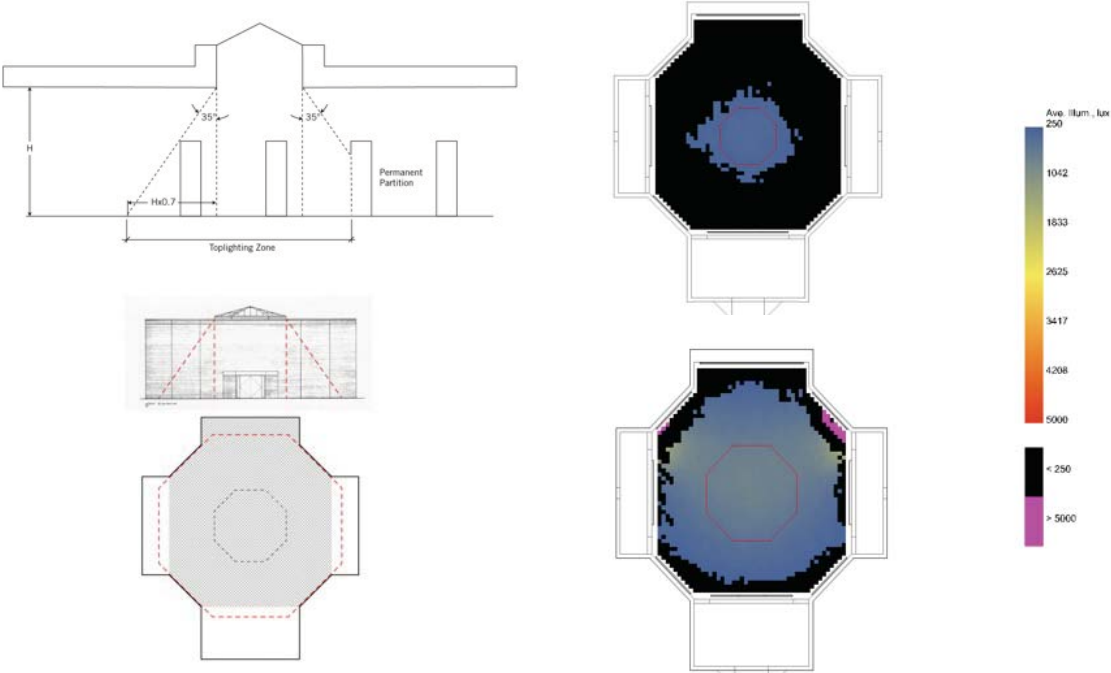
TASK/USE	fc (Lux)	Latitude		
		10°-20°	30°	40°
Assembly Tanks, simple	20-50 (215-536)	1.5-3	1.4	2.6
moderately difficult	50-100 (536-1070)	3-6.5	4	5.5-14.5
Air Terminals	10-20 (108-215)	0.5-1	1.5	1-3.5
Bank, lobby	10-20 (108-215)	0.5-1	1.5	1-2.5
bar	50-100 (536-1070)	3-6.5	4	5.5-14.5
Casuarium, general	20-50 (215-536)	1.5-3	1.4	2.6
reading	50-100 (536-1070)	3-6.5	4	5.5-14.5
Conference Room	20-50 (215-536)	1.5-3	1.4	2.6
Corridor, stairs	5-10 (54-108)	0.5-1	0.5-1	0.5-1
Dining Hall	5-10 (54-108)	0.5-1	0.5-1	0.5-1
Drafting	50-100 (536-1070)	3-6.5	4	5.5-14.5
Exhibition, general	10-20 (108-215)	0.5-1	1.3	1-2.5
display	20-50 (215-536)	1.5-3	1.4	2.6
Hotel Rooms	20-50 (215-536)	1.5-3	1.4	2.6
Lobby, lounge, reception	10-20 (108-215)	0.5-1	1.3	1-2.5
Library stacks, active	20-50 (215-536)	1.5-3	1.4	2.6
inactive	5-10 (54-108)	0.5-1	0.5-1	0.5-1
Locker Rooms	10-20 (108-215)	0.5-1	1.3	1-2.5
Museum Display	20-50 (215-536)	1.5-3	1.5-4	2.6
Office, general	10-20 (108-215)	0.5-1	1-1.5	1-2.5
Reading, normal	20-50 (215-536)	1.5-3	1.5-4	2.6



Sun, Wind & Light, Architectural Design Strategies second edition
GZ Brown and Mark DeKay

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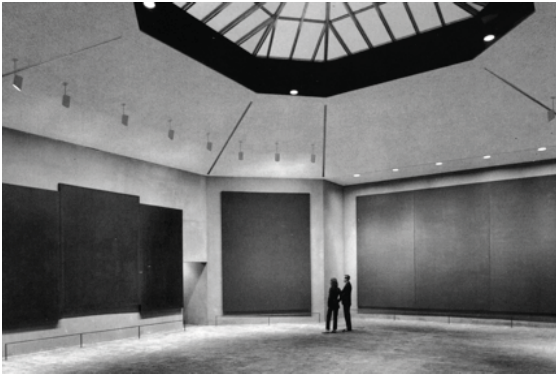
LEED IEQ 8.1



Prescriptive and Performance Guidelines give daylighting credit for the 15% skylight but not for the 7%.

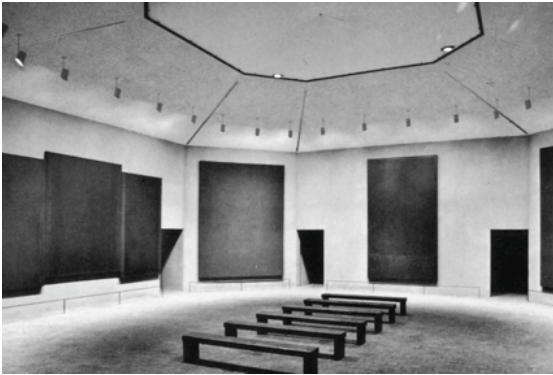
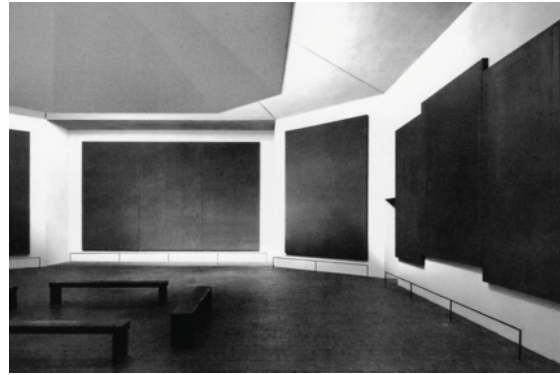
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Full scale prototype is the gold standard for daylight assessment.



Photos from "The Roktho Chapel", by Susan J. Barnes

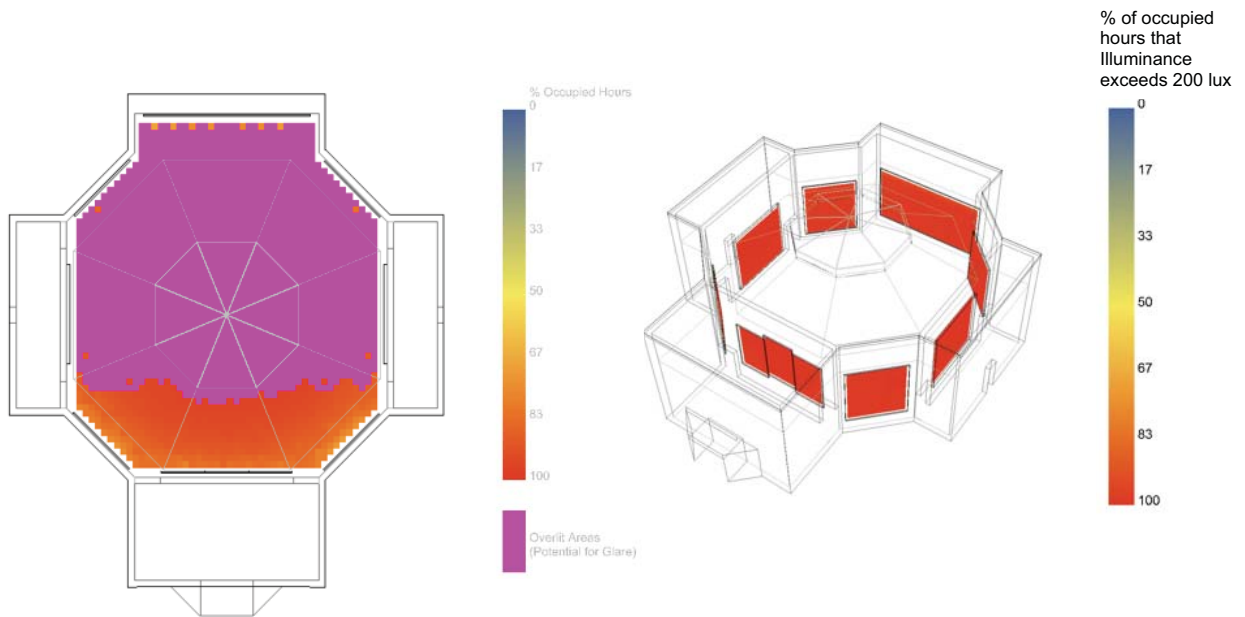
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Photos from "The Roktho Chapel", by Susan J. Barnes

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Climate Based Metrics in DIVA



Daylight Availability (pink is over-lit)

Daylight Autonomy. Red means artwork exceeds 200 lx for 100% of the occupied hours

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"A Meditative Mecca- in Oil Country"
Michael Hailey GQ Dec 2010