ABPS

Animated Building Performance Simulation

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Harvard University
Graduate School of Design

version: 11/2/2009

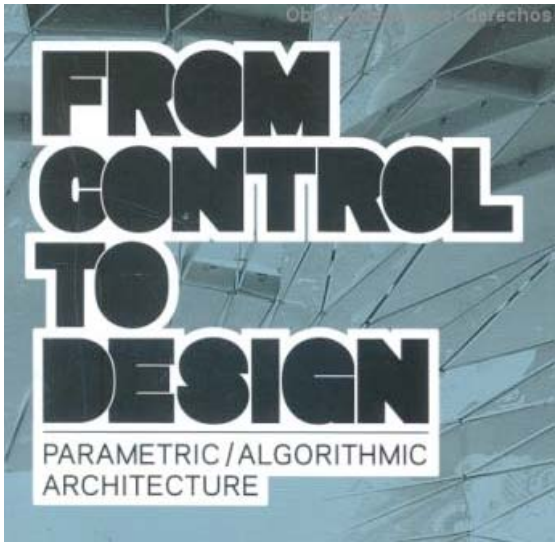
CONTEXT

SOFTWARE: NURBS based modeling

Radiance

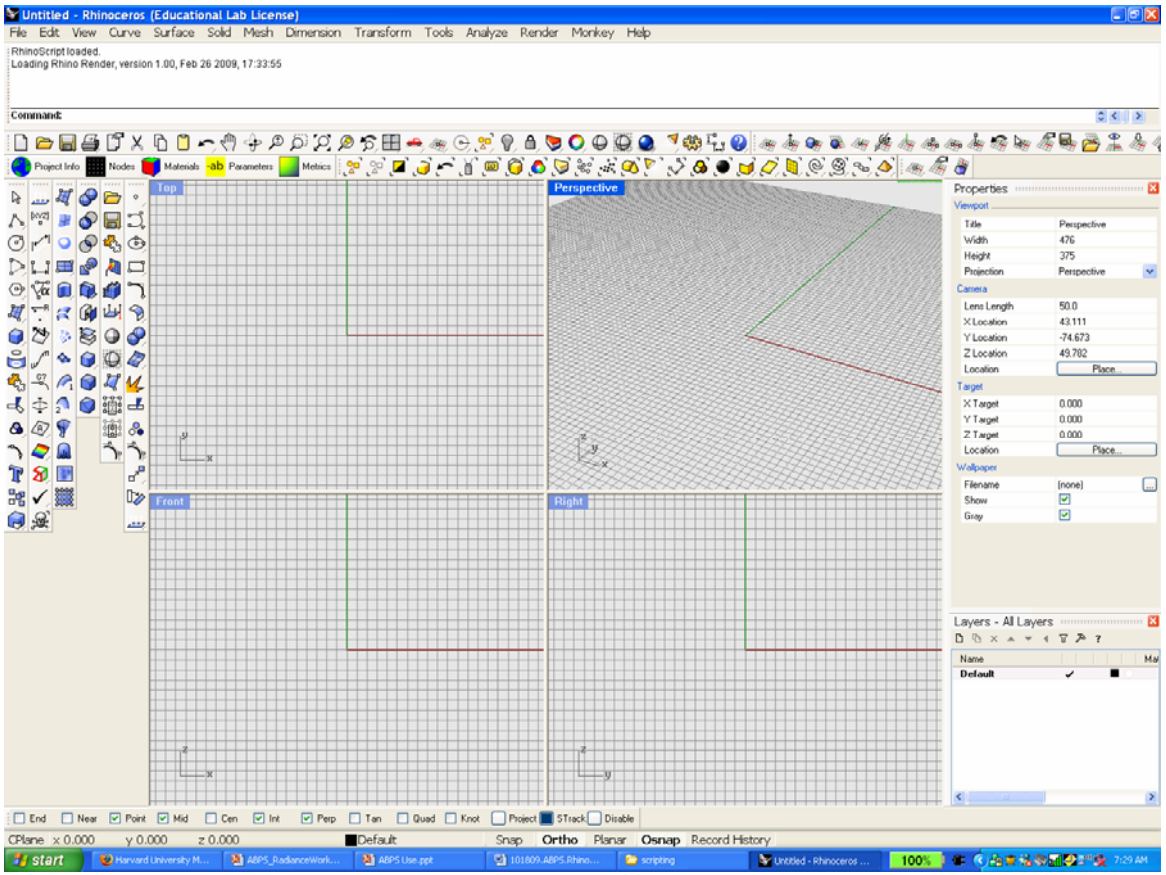
CONTEXT

PARAMETRICS



CONTEXT

TOOLBAR: For Rhinoceros 4.0 and Grasshopper 6.0
PLATFORM: Rhinoscripting (a language based on VBScript)



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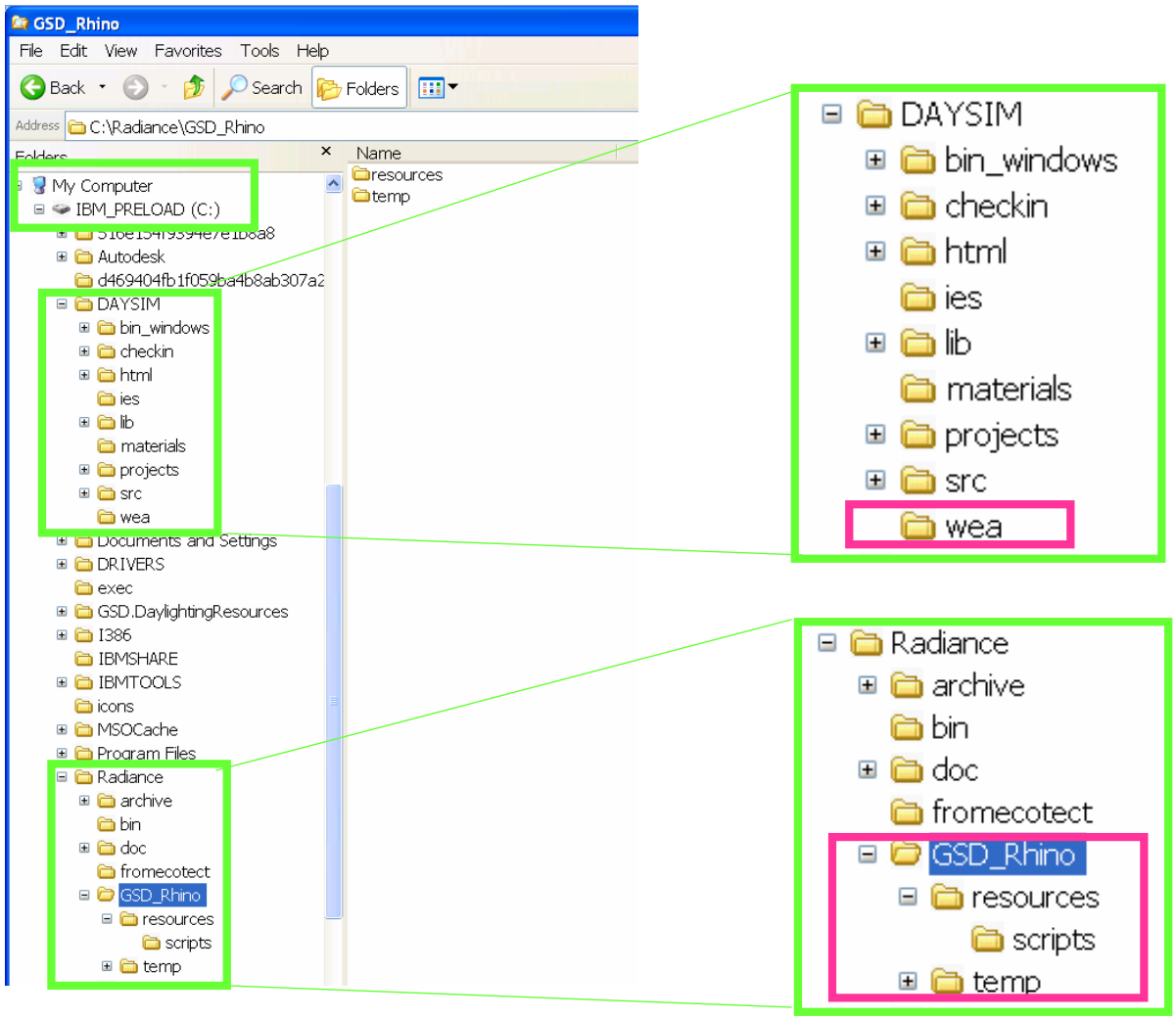
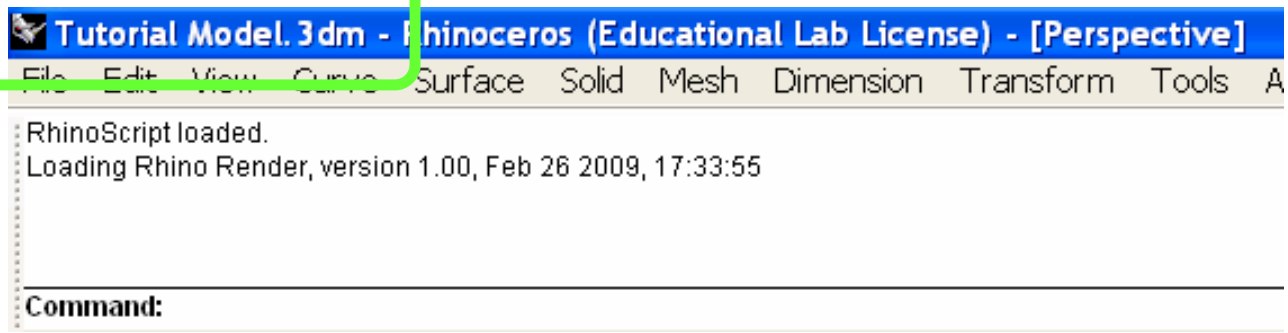
CONTEXT

NECESSARY FILES: Skies, .epw, .map, material.rad, .rvb



PROCESS

CHALLENGE 1: Naming Convention
INTENT: Maintain function given “spaces”



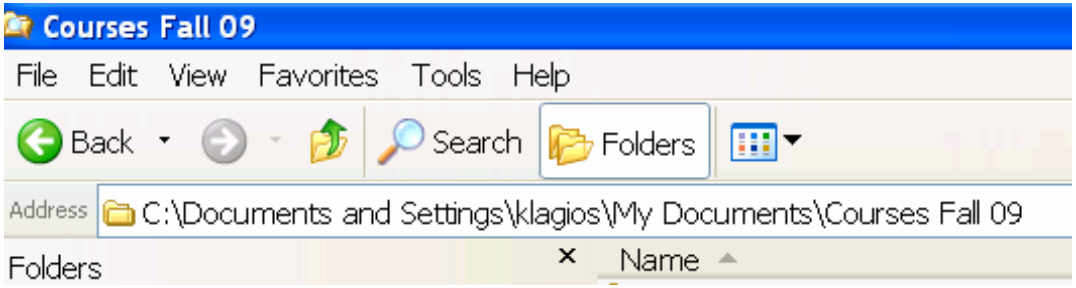
The “tag” is part of your filename, up to the first [space].
The rest of the name is truncated.

Example 1: Tutorial Model.3dm >> Tutorial
Example 2: trial 1.3dm >> trial 1.3dm >> trial
Example 3: trial 2.3dm >> trial 2.3dm >> trial

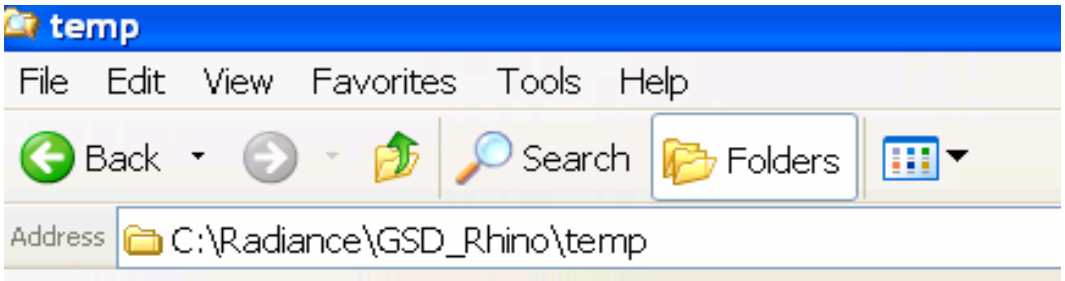
PROCESS

CHALLENGE 2: Directory Convention
INTENT: Maintain freedom of user storage

User Folder



Storage Folder Default



OK C:\Radiance\GSD_Rhino\trial1

NOT OK C:\Documents and Settings\user\My Documents\trial 1

NOTE:Files are overwritten

PROCESS

CHALLENGE 3: Materials
INTENT: Allow user layer-conventions

1. Assigning materials by layer
2. Rhino's material index
   a. Not standardized
   b. Inability to recall reliably
3. Use color instead
4. Material names are for user identification and export

PROCESS

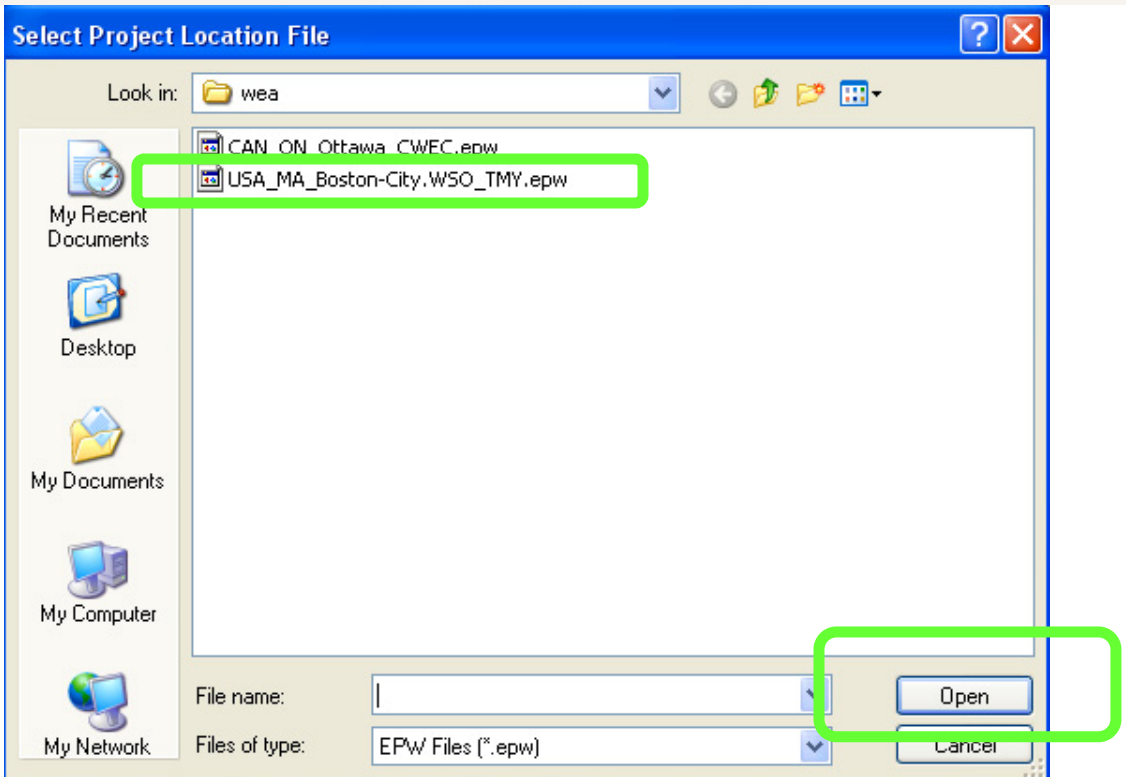
CHALLENGE 4: Geometry → obj2rad, .map file
INTENT: ACCURACY

1. **Point ordering for geometry output**
2. **Material association**

1 PROJECT INFO

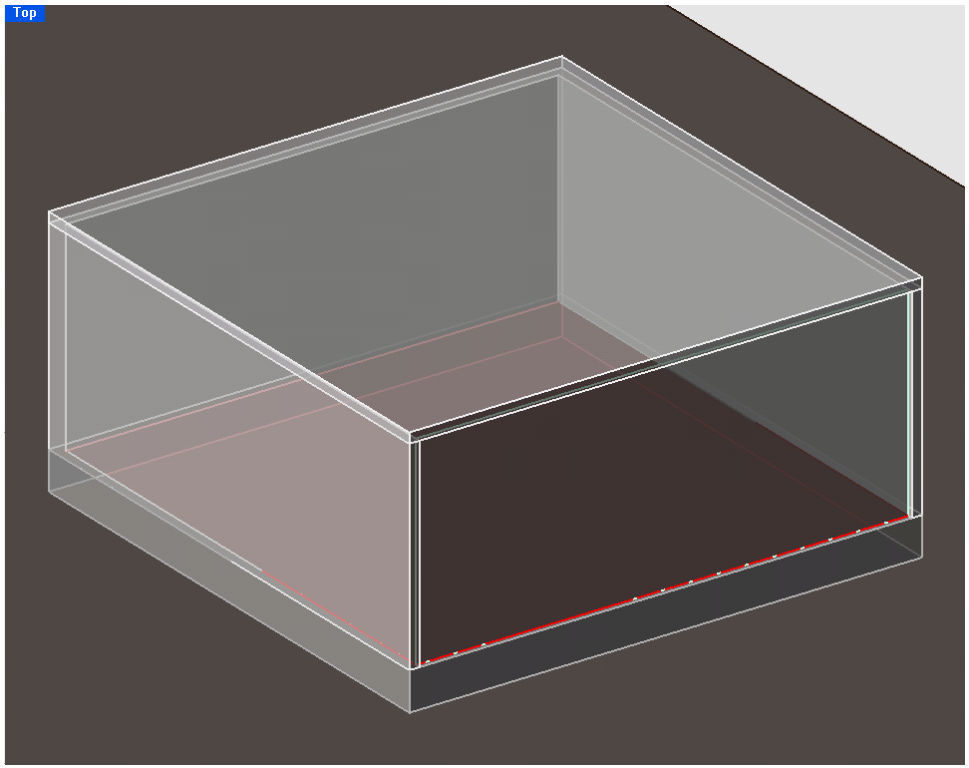
FUNCTION: name, directory, location
FILES: xyzinfo.dat file, .wea file

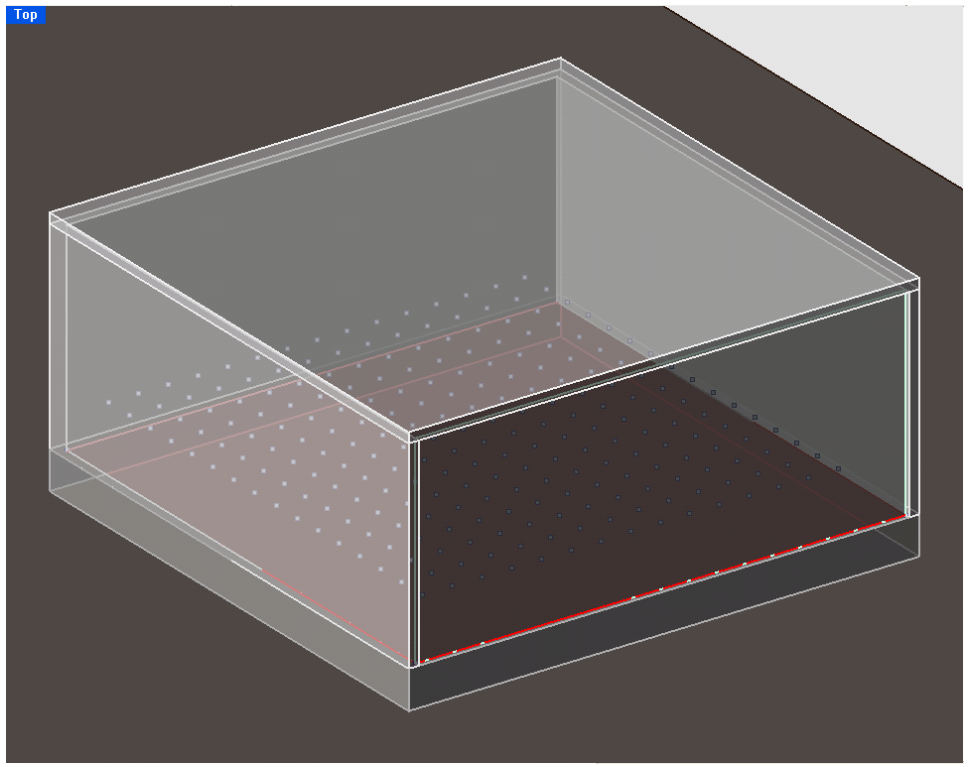
Would you like to use a Default folder and name? <Default> (Default UserDefined):



2 NODES

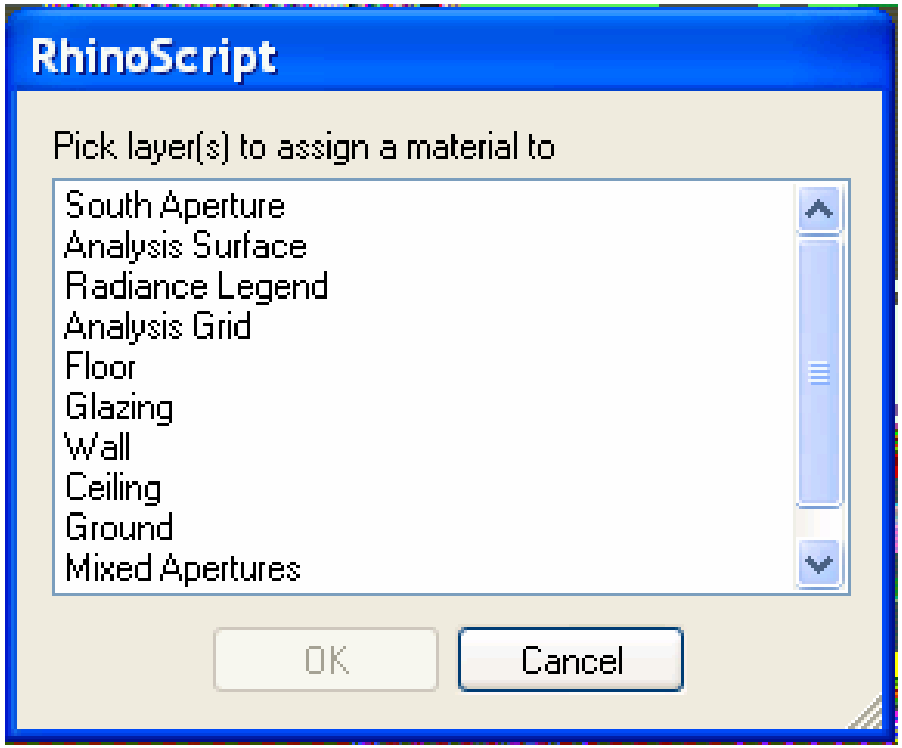
FUNCTION: Create point grid
FILES: xyz.pts

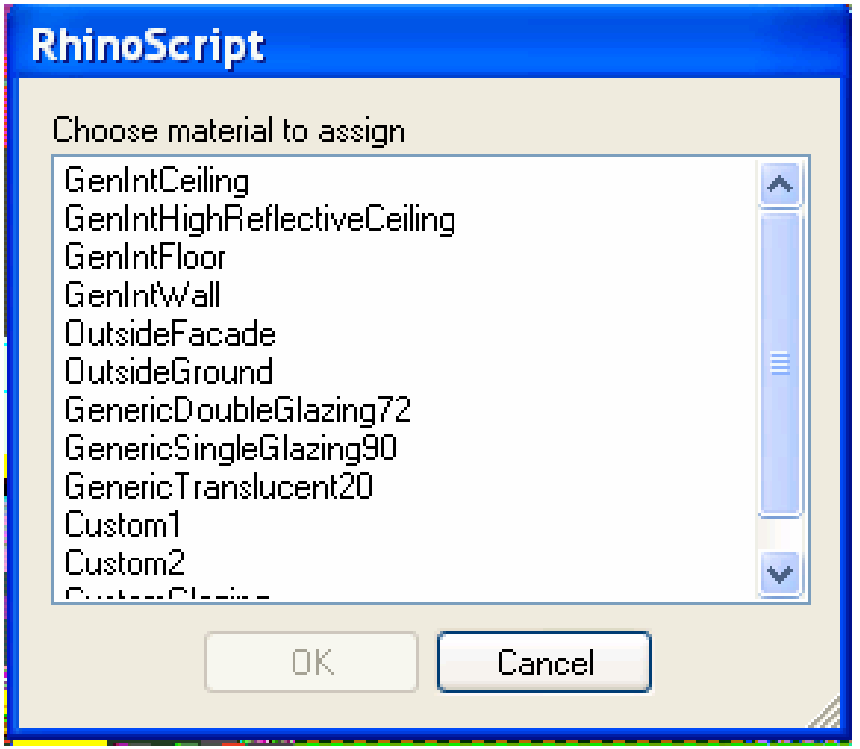




3 MATERIALS

FUNCTION: Assign materials to Layers
FILE: material.rad (copied)





4 PARAMETERS

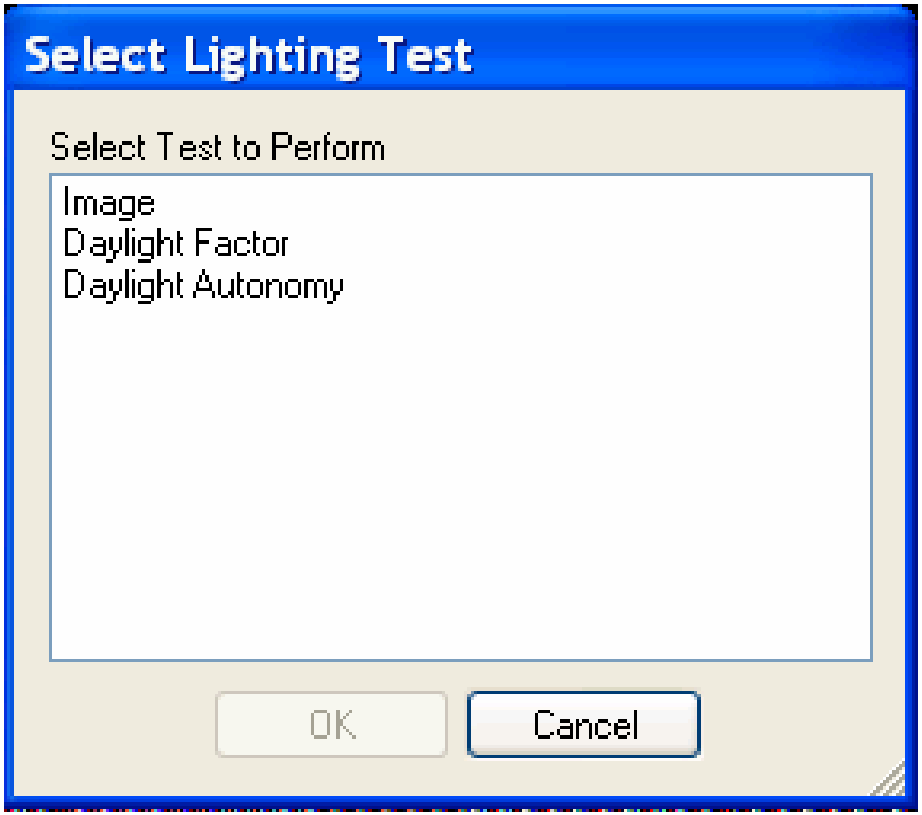
FUNCTION: Sets Radiance parameters
FILE: parameters.dat

Select a parameter to change and Exit to accept defaults or finish (ab ad as ar aa Exit): ab

Enter new -ab value <5>:

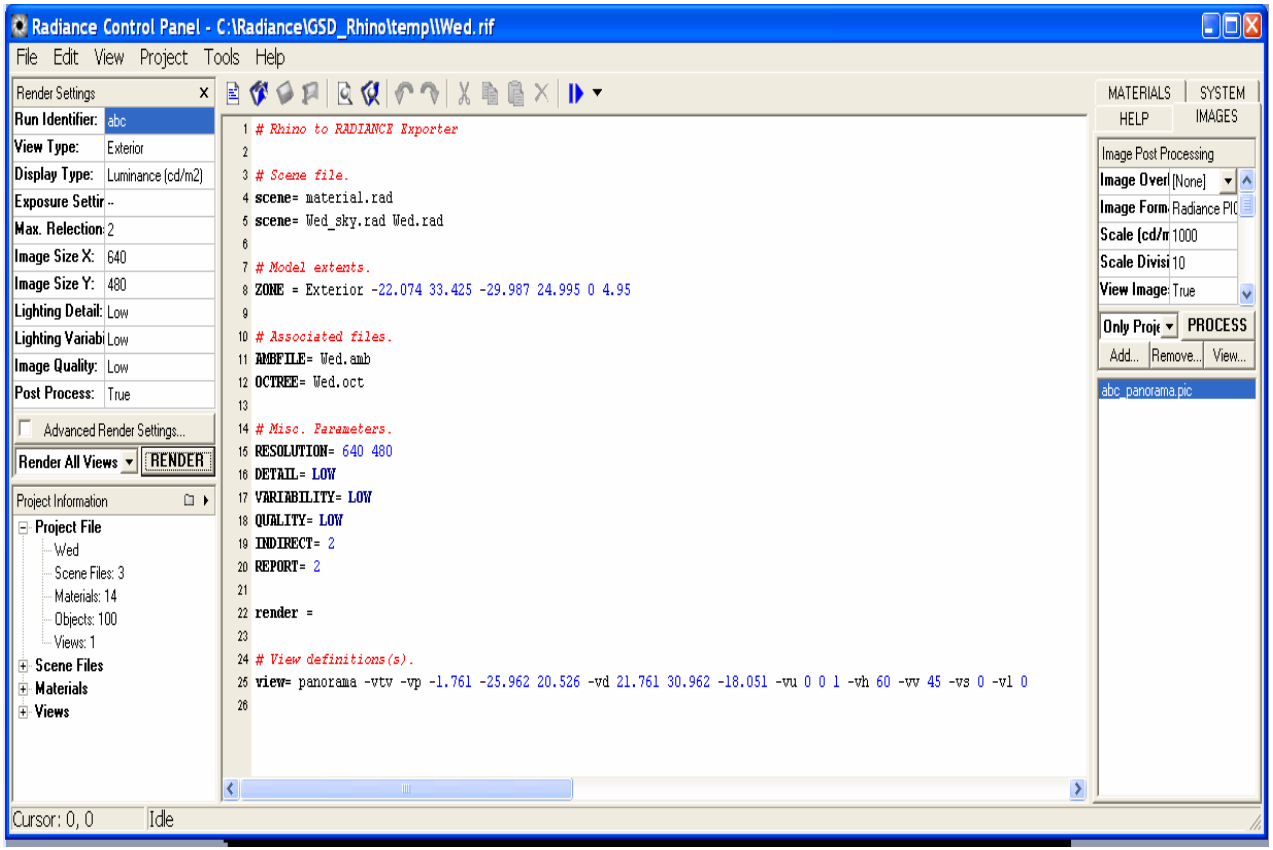
5 METRICS

IMAGE, DF, DA
FILES: Test-dependent



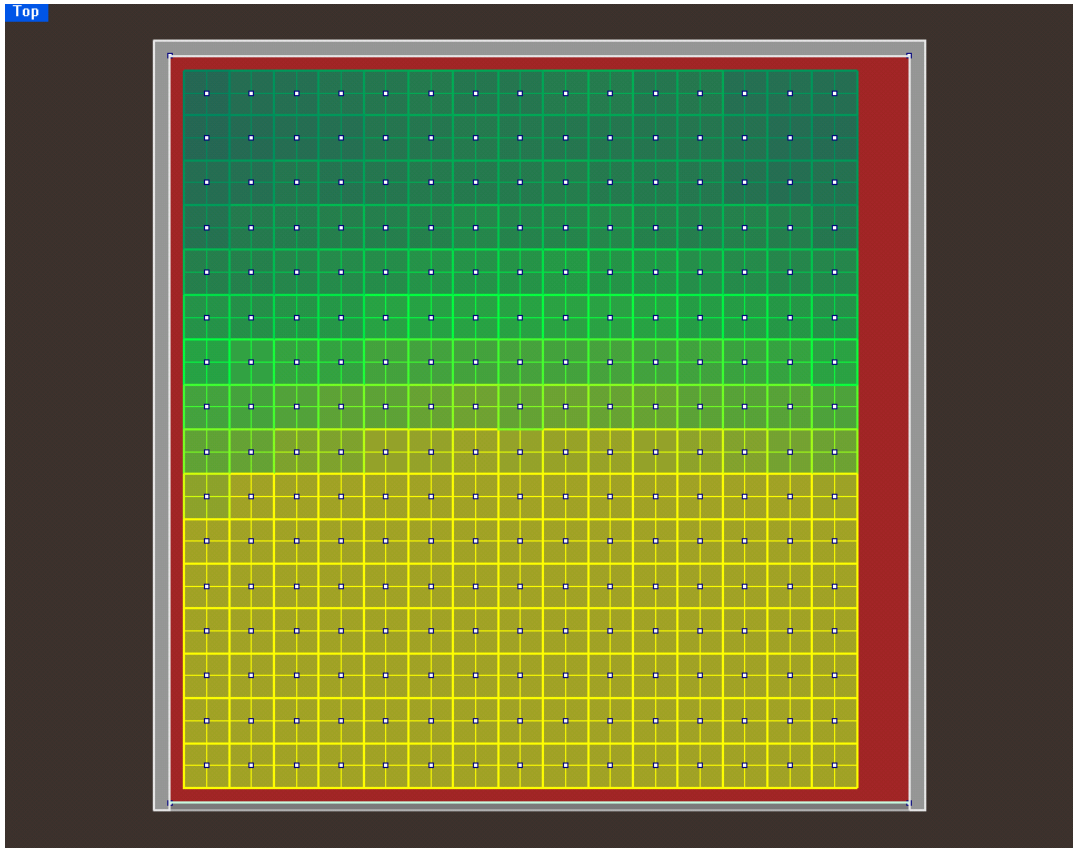
5 METRICS

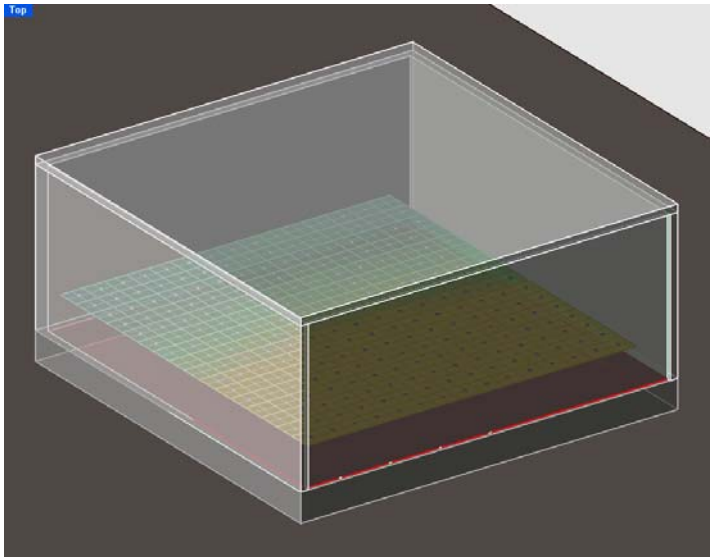
IMAGE
FILE: xyzimg.bat, xyz.rif…

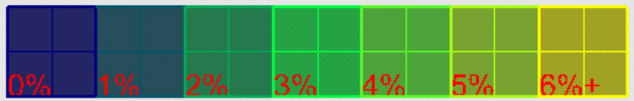


5 METRICS

DAYLIGHT FACTOR: Performs DF
FILES: xyz.bat, xyz.dat, xyz.rad, etc.



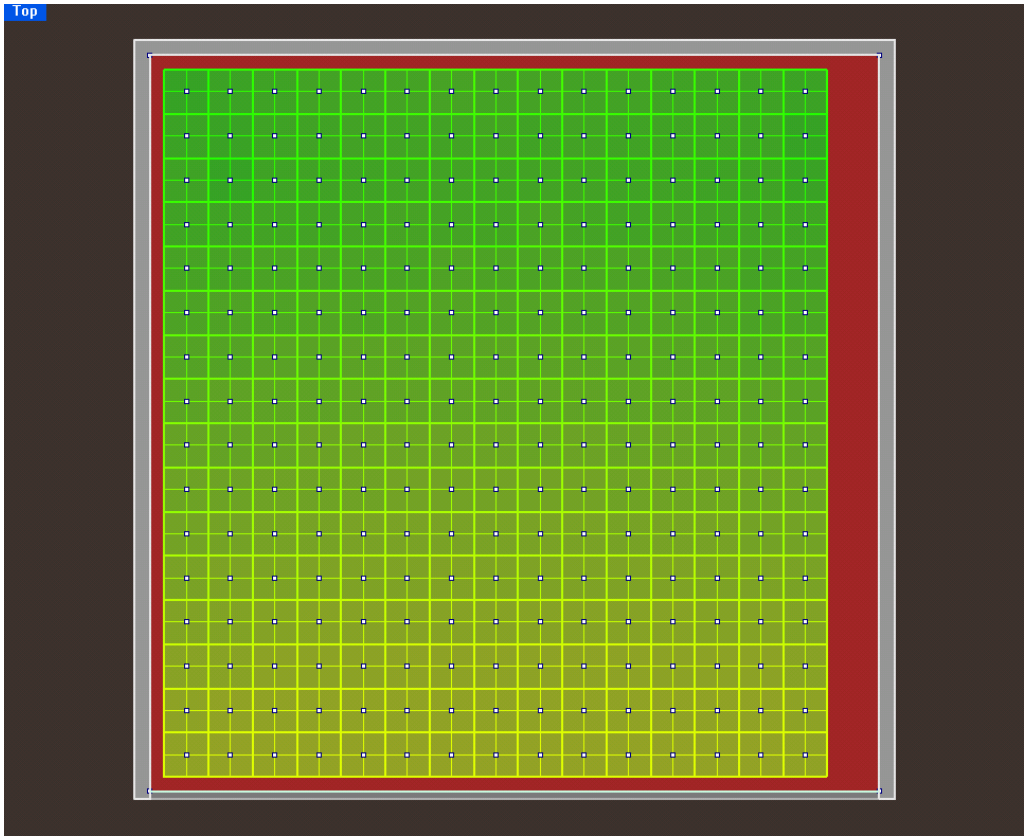


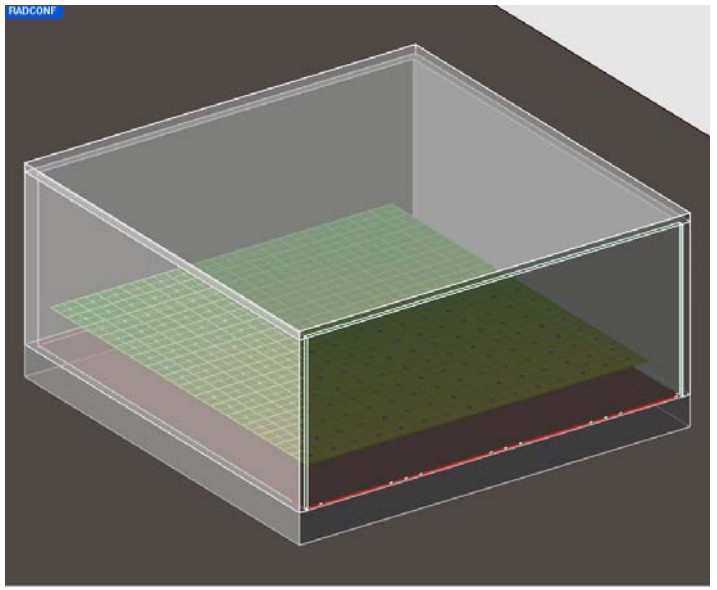


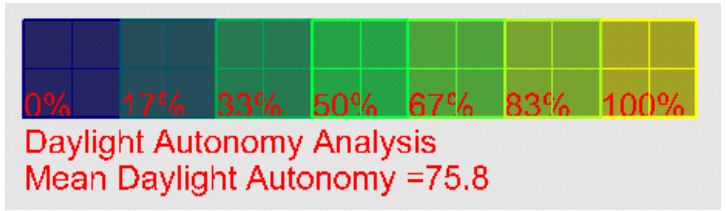
Daylight Factor Analysis
Mean Daylight Factor =8.98
84.9% of Area > 2% Daylight Factor

5 METRICS

DAYLIGHT AUTONOMY: Performs DA
FILES: xyz.bat, xyz.rad, xyz.da, etc.





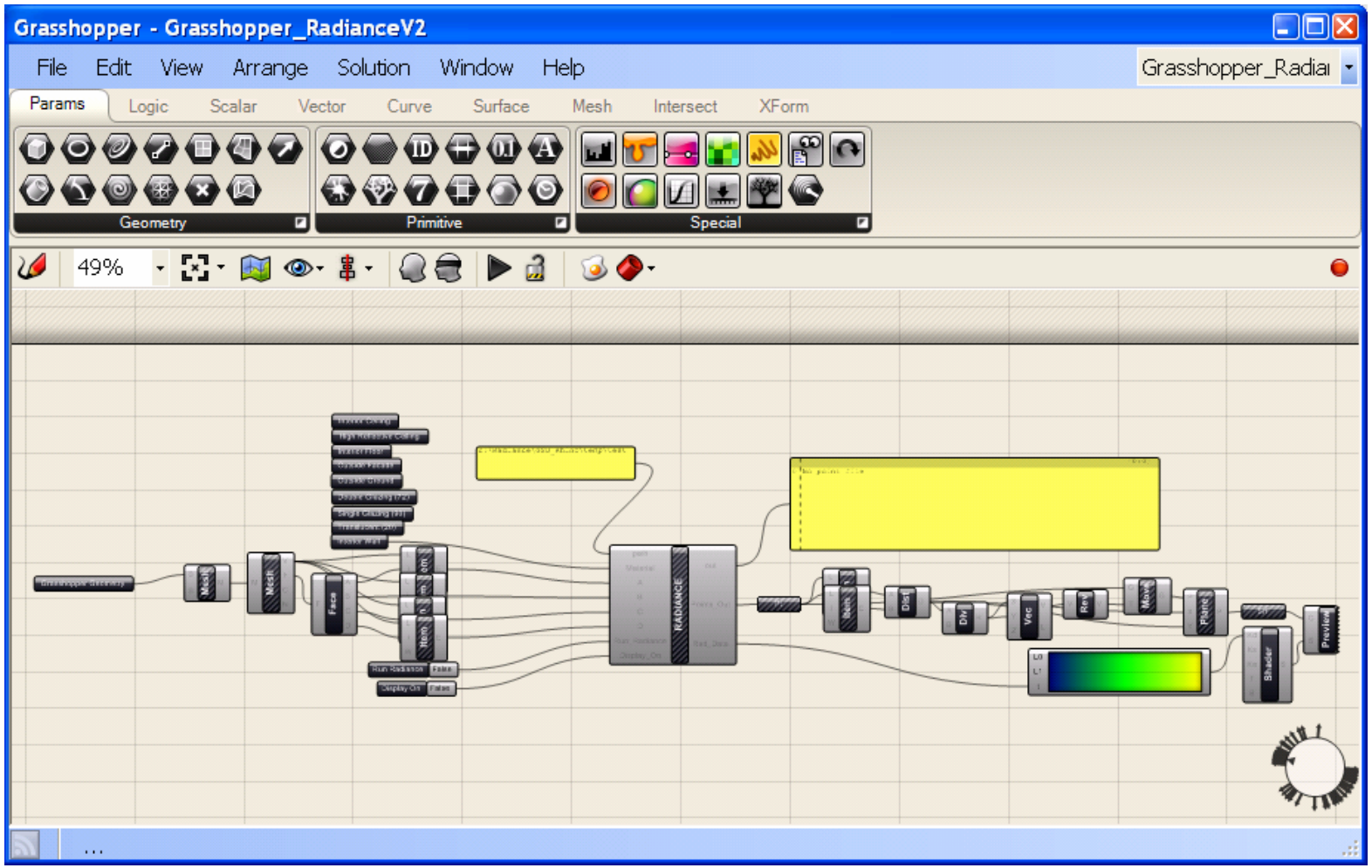


DEMO

USING RAD CONF.3DM

GRASSHOPPER

INTERFACE AND DEMO



ANIMATION

WHY?

APPLICATIONS/APPLICABILITY

1. Design Validation
2. Design Evaluation / Optimization
3. Rapid Iterations at all phases of design

FUTURE

ADDITIONAL FUNCTIONALITY

1. Materials Management
2. Additional Metrics
3. Vertical Surfaces
4. Loading of saved results
5. Sky Options

REFERENCES

The scientific basis of the daylighting design sequence as described in this document is provided under:
http://isites.harvard.edu/fs/docs/icb.topic466783.files/Daylighting%20design%20sequence.v1.pdf

Free online references:

Tips for Daylighting with Windows: http://windows.lbl.gov/pub/designguide/default.html

Daylighting Guide for Canadian Commercial Buildings:
www.enermodal.com/Canadian/pdf/DaylightingGuideforCanadianBuildingsFinal6.pdf

Daylighting Schools:
http://www.innovativedesign.net/pdf/daylightguide_8511.pdf

ACKNOWLEDGEMENTS

The development of this document has been supported by the following organizations:

Harvard Graduate School of Design:
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The Presidential Instructional Technology Fellows (PITFs) program was established to recruit and train fellows in conjunction with the Schools to work with faculty to develop digital course materials with immediate educational benefits. PITFs leverage existing software tools developed here at Harvard and provide outreach. www.provost.harvard.edu/funding