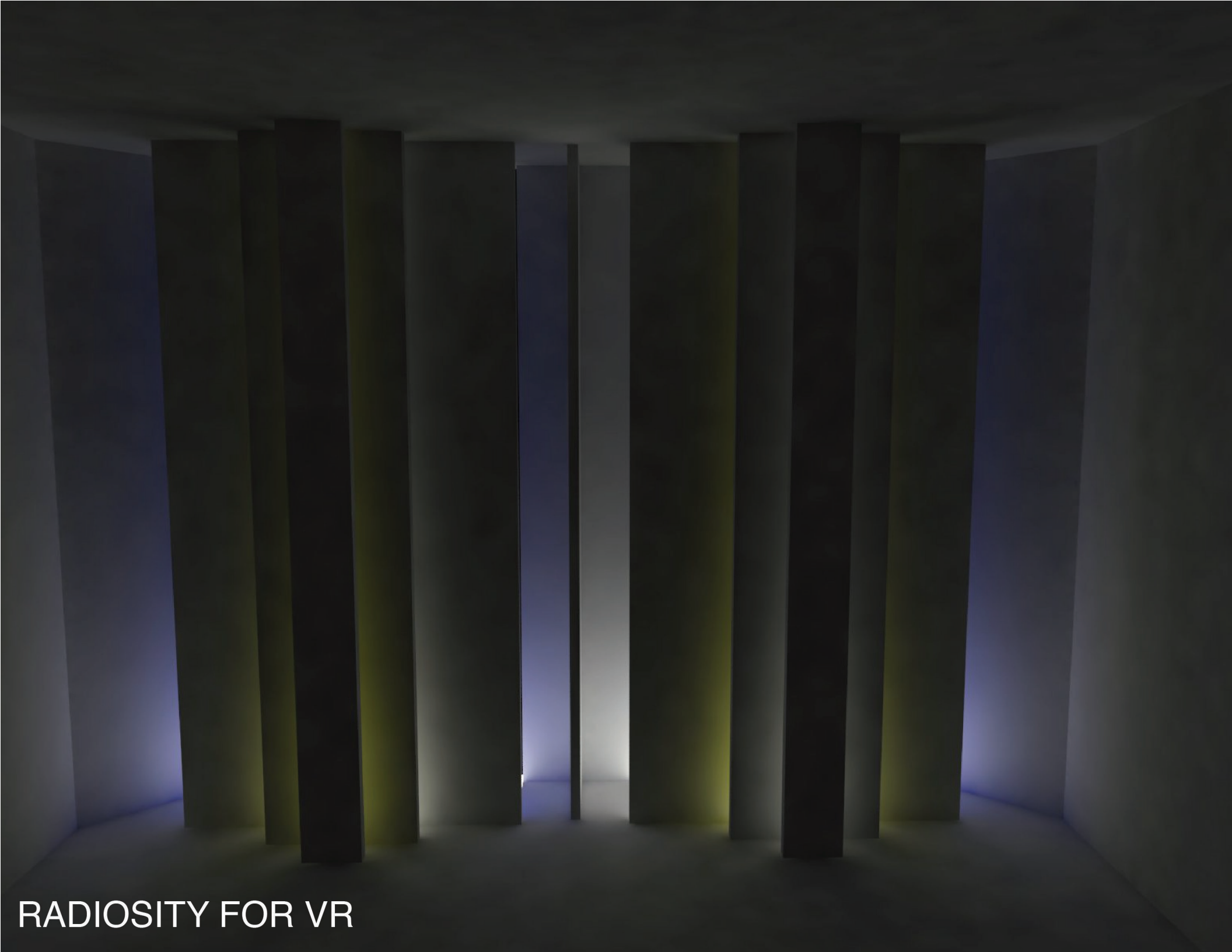
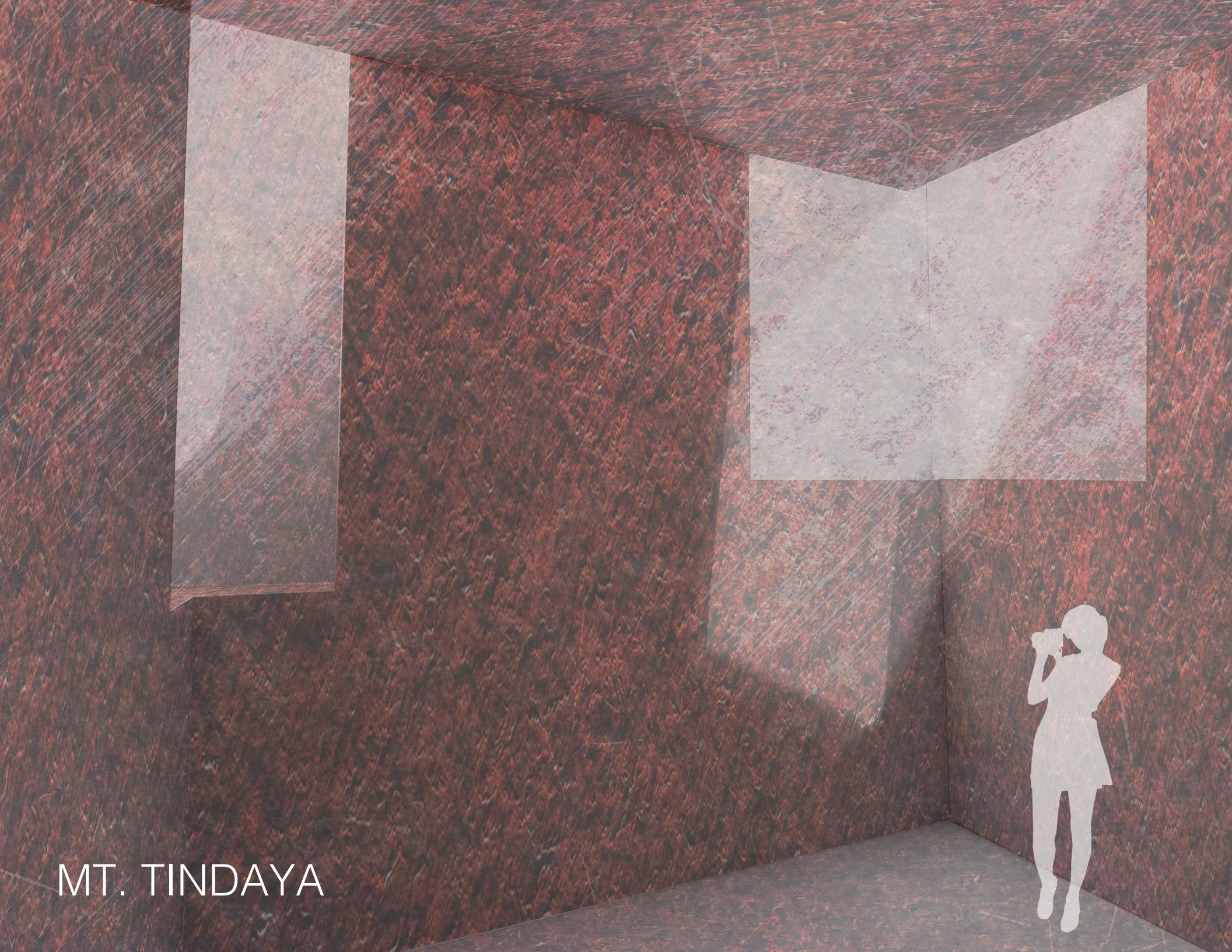
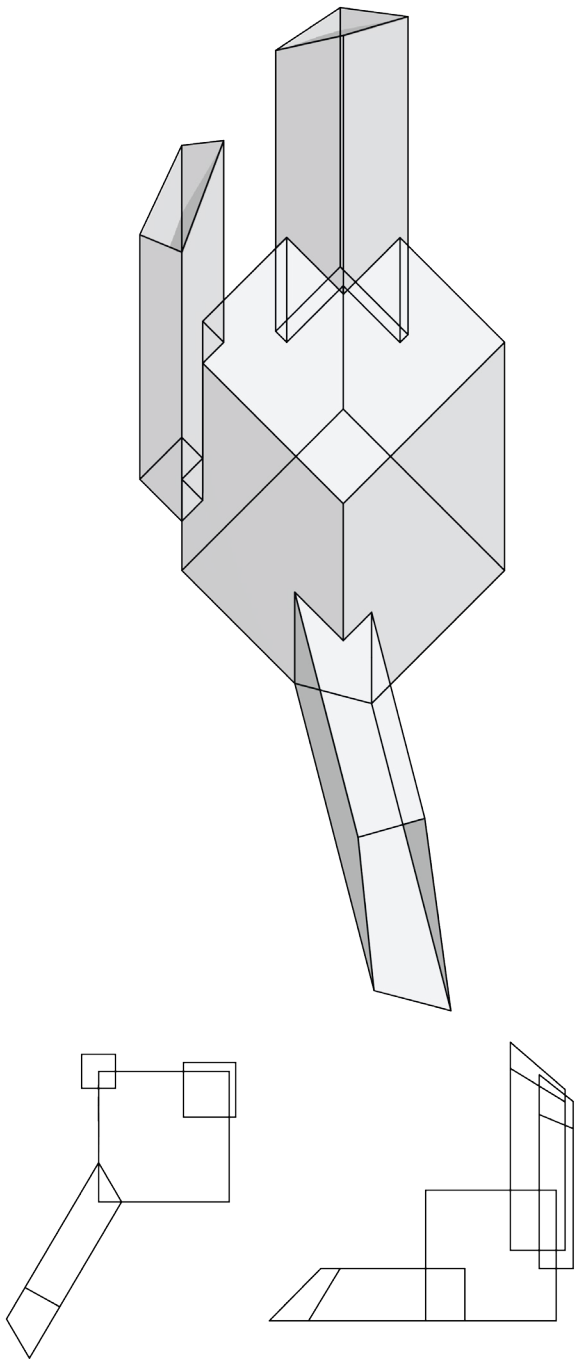

RADIOSITY FOR VR


MT. TINDAYA

PROJECT: MT. TINDAYA



PURPOSE OF STUDY:

-Perfect testing ground for exploring the lighting capabilities of current game engines

-Allowing us to choose the platform that would become the foundation for our further studies

- -long narrow light shafts
- -large space that is lit by only light well

-God rays created by the intense direct light and particulate in the space created additional rigor

RESULTS:

-UNREAL engine became the prefered

- -immense number of options and configurations

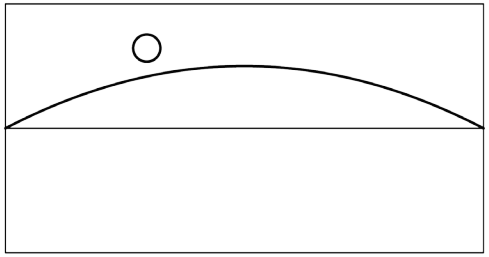
-Able to create similar lighting to that found in pictures of Mt. Tindaya

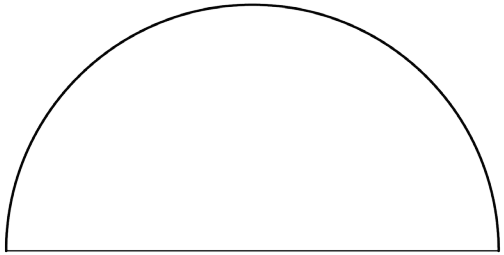
- -The lighting had to be created using additional staged lights

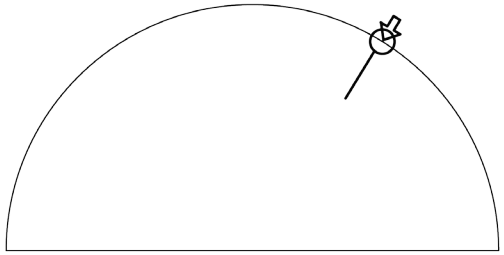
- Never able to achieve the original god rays after resting with both environmental fog and particle effects.


ENVIRONMENT EMITTER

PROJECT: ENVIRONMENT EMITTER







PURPOSE OF STUDY:

-Create a better environment in UNREAL that is capable of displaying different times of day

-Prove the ability to render an image of sky with previously collected data using mitsuba

-Place the environment map into unreal and allow for interpolation between sun angles

- -Required loading dynamically loading hundreds of textures into UNREAL

-Create a platform to test effects of lighting throughout the day on different models

- -Study models for areas that might have problems due to glare at times of day

-Gives us an emission vector that we will need later

RESULTS:

-Didn't have enough of an effect alone to be the only light source in the model

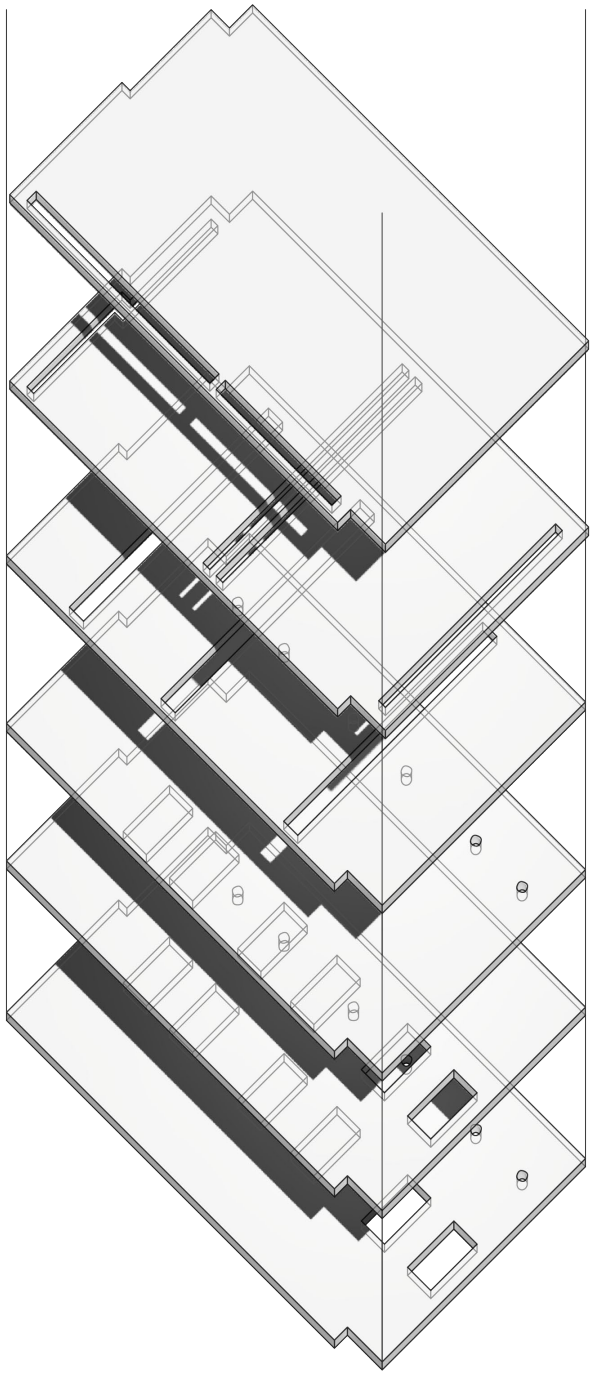
-Successful progression of the sun throughout the day in UNREAL

- -Even with success the results weren't accurate representations of sunlight in our test spaces
- -Proven by comparing images from unreal with photographs of existing spaces

VIDEO

LIGHT DESIGN: WAR ROOM

PROJECT: LIGHT CONFIGURATION



PURPOSE OF STUDY:

-Exploring the potential of being able to dynamically configure lighting while in Virtual Reality.

-Optimise the natural lighting influence in an unbuilt space

-Experience any angle of the room

-Ability to inspect for problems with glare or interaction of materials

-Give the user full control over the lighting parameters inside the space

RESULTS:

-Extremely challenging to solve with any solution other than hard coding

-Pre-made models significantly limit the options of the user

-Lighting conditions in UNREAL aren't accurate enough to closely examine the finer changes created by certain types of lights

-Pointed out a bigger problem of working with the conditions in unreal

-Lead to the exploration of OpenVR and Radiosity

PROJECT: NEWTONS WHEEL

PURPOSE OF STUDY:

-Attempt to understand how color and movement are affected by Virtual Reality

-When spun fast enough the colors blend together to form white to the human eye

-Different patterns can be used as long as all colors are represented

-Two different test cases used

-Use adjustable speed controls to understand the threshold for white in Virtual Reality

RESULTS:

-Test never converges to white in virtual reality, regardless of speed of rotation

-Theorized explanations

-Frequency of the refresh of the display

-Ghosting of color due to time required to turn each pixel on and off

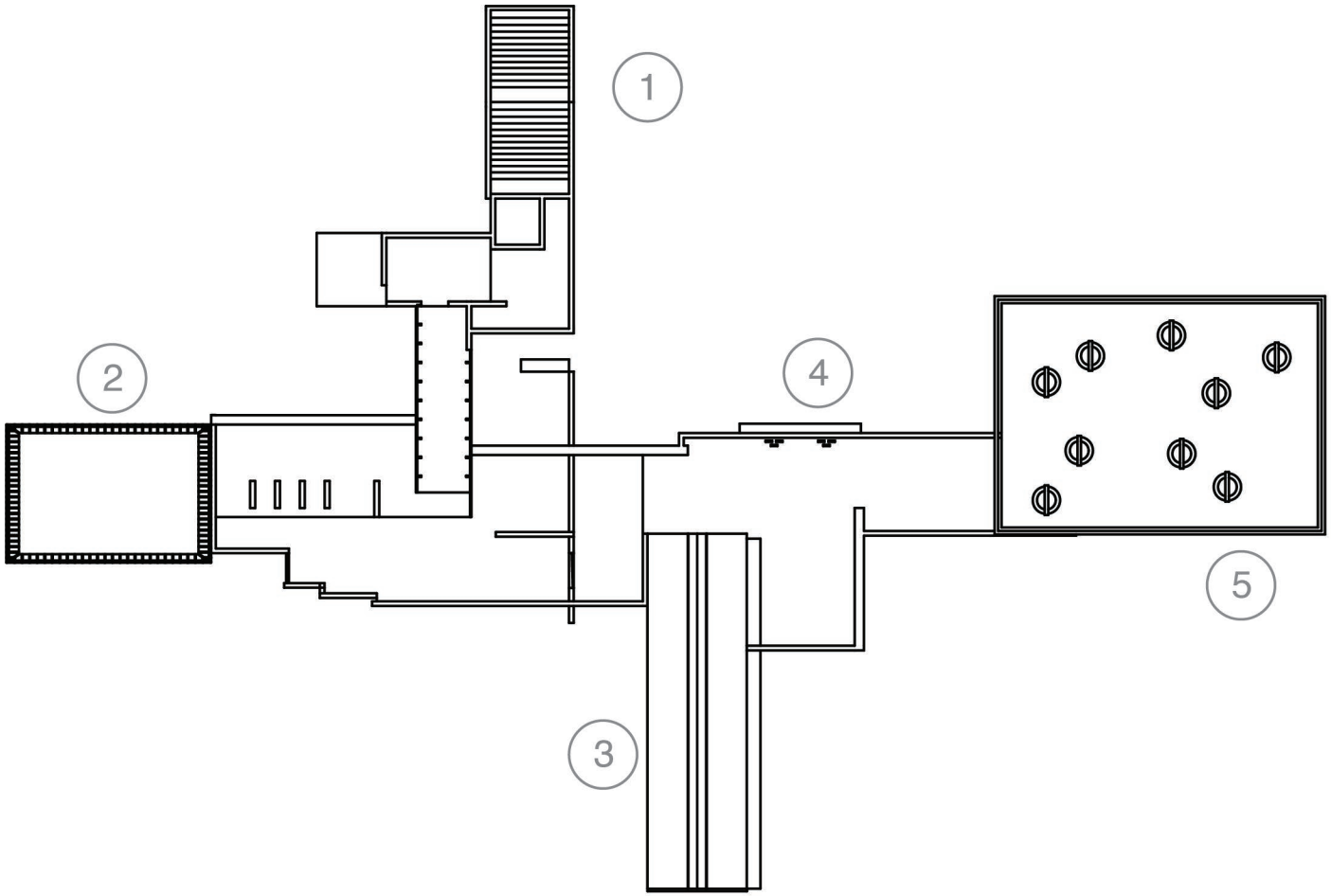
-Both wheels appear to be white when spun on a device in person

-Suggests that there might be other elements of perception that could be contributing

PROJECT: LIGHT MUSEUM

Summary

A lighting model designed to capture challenging lighting conditions that will eventually be used to push the limits of Stephens work with the radiosity solver. The model incorporates multiple different rooms that each focus on specific elements of light.



Room List

Room 1 -Reducing glare with reflectors that face away from the direction of the sun to use indirect lighting

Room 2 - Focuses on many finite elements to inspect the shadows the rendered is creating

Room 3- Based on the kimball museam in Texas. Uses inderct lighting to create a gradient

Room 4 - Uses light refraction to illuminate the members with color

Room 5 - Massive exposer holes that flood the colomn shaft with lighting with a tall enough roof that lighting should fade

PROJECT: RADIOSITY VR STEP 1

$$B = (\mathbb{I} - \rho F)^{-1} E$$

B	:	radiosity
ρ	:	surface reflectance(k_d)
F	:	form factor
E	:	emission

CALCULATING THE FORM FACTOR AND ITS INVERSE

-Done using a single mesh that represents the entire scene along with a bounding sphere

-Utilizes stochastic sampling to get the relationship between all the triangles

-Currently we have a default R of 1

RADIOSITY

$$F_{ij} = \frac{1}{A_i} \int_{A_i} \int_{A_j} \frac{\cos(\phi_i) \cdot \cos(\theta_i)}{\pi r^2} dA_j dA_i$$

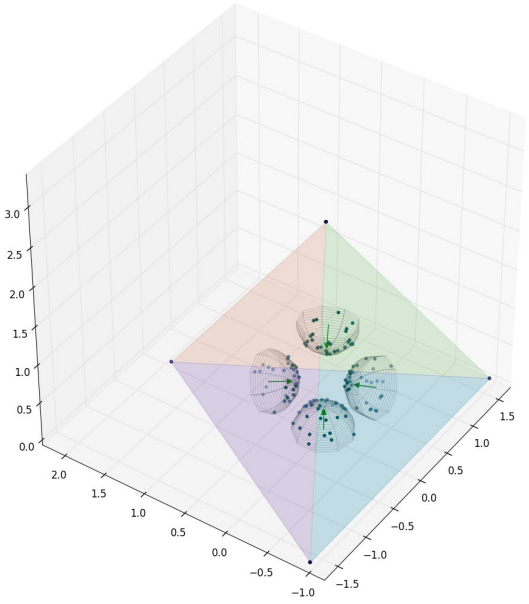
-Generate a scene using the same mesh
-Use the same bounding sphere from before to get the effect of sky lighting for each triangle

Currently:
using an open mesh directly, as its lighting will bounce inside the scene

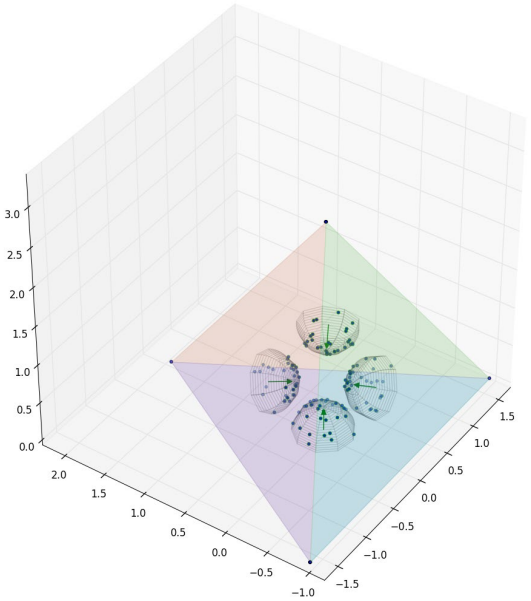
Ideally:
Calculate the weight of window triangles based on the bounding sphere

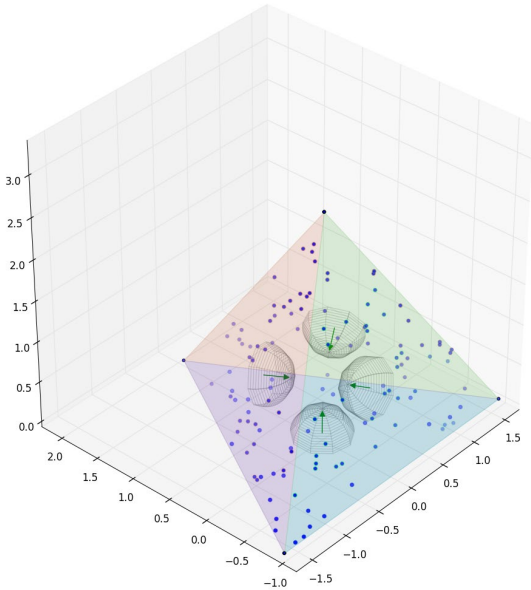
$$\begin{bmatrix} B_1 \\ B_2 \\ \vdots \\ B_n \end{bmatrix} = \begin{bmatrix} 1-\rho_1 F_{11} & -\rho_1 F_{21} & \dots & -\rho_1 F_{n1} \\ -\rho_2 F_{12} & 1-\rho_2 F_{22} & \dots & -\rho_2 F_{n2} \\ \vdots & \vdots & \ddots & \vdots \\ -\rho_n F_{1n} & -\rho_n F_{2n} & \dots & 1-\rho_n F_{nn} \end{bmatrix}^{-1} \begin{bmatrix} E_1 \\ E_2 \\ \vdots \\ E_n \end{bmatrix}$$

PROJECT: VISUALIZING THE FORM FACTOR

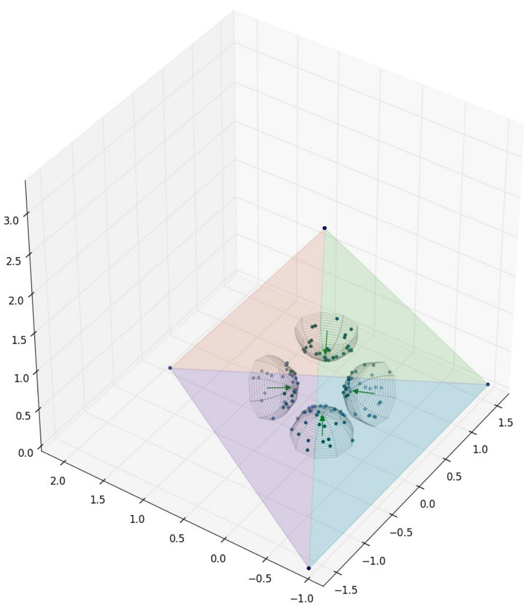


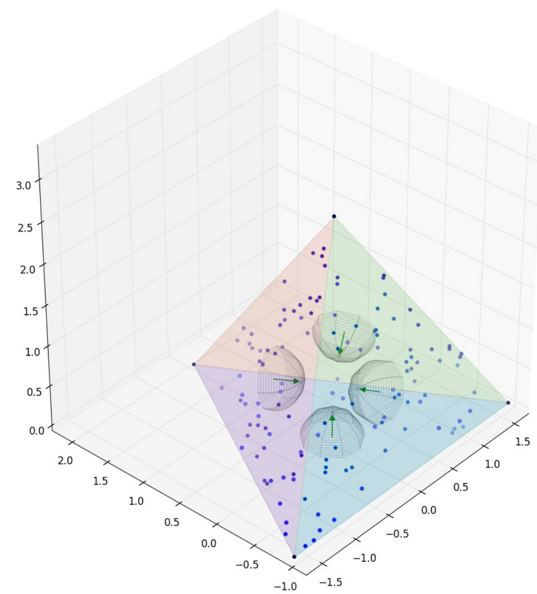
PROJECT: VISUALIZING THE FORM FACTOR

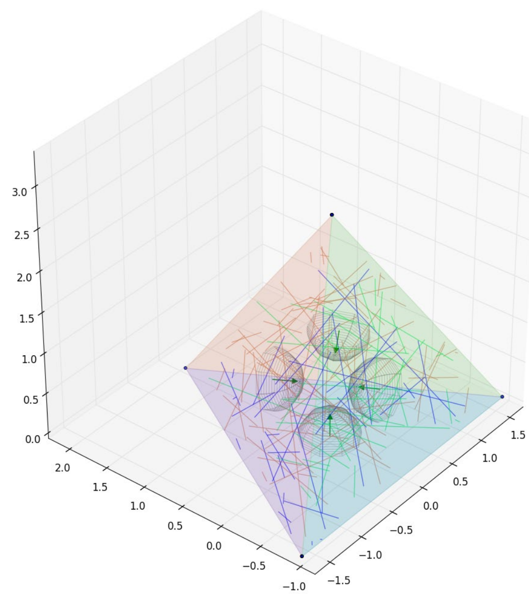




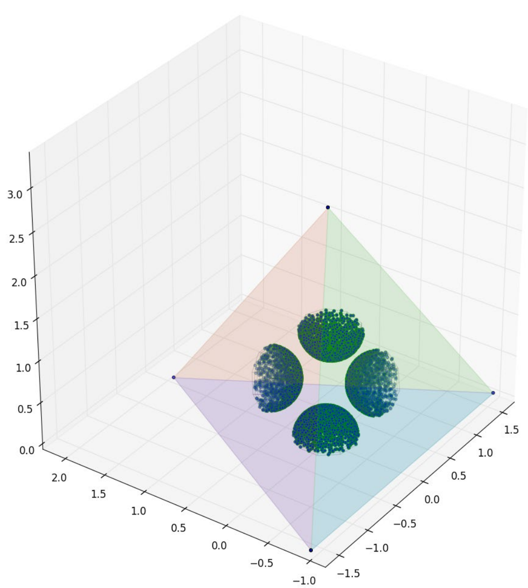
PROJECT: VISUALIZING THE FORM FACTOR

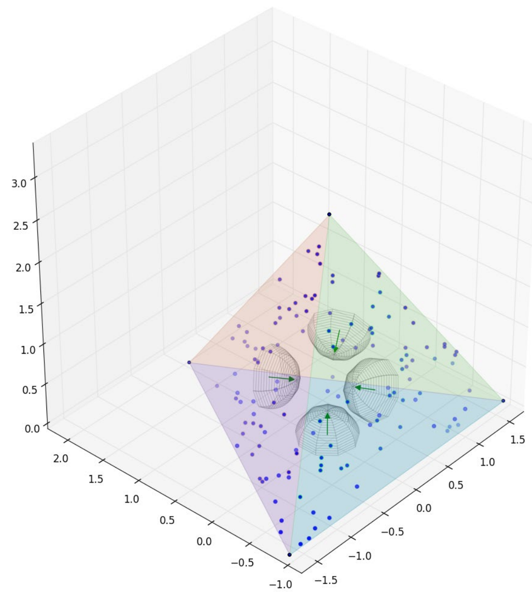


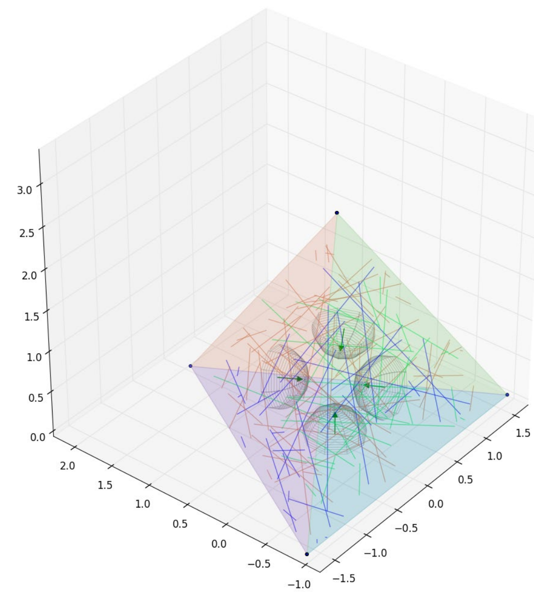




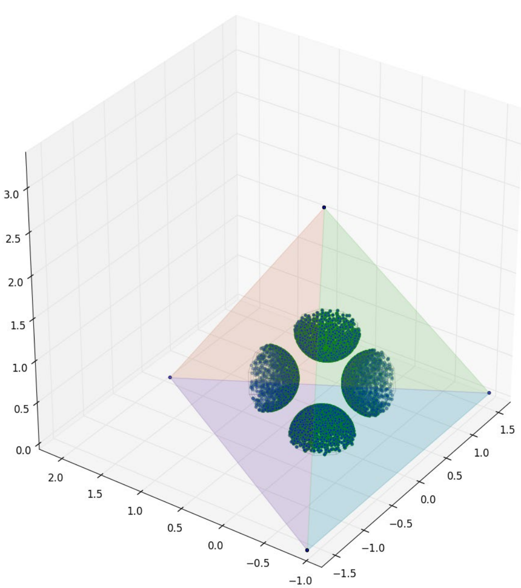
PROJECT: VISUALIZING THE FORM FACTOR

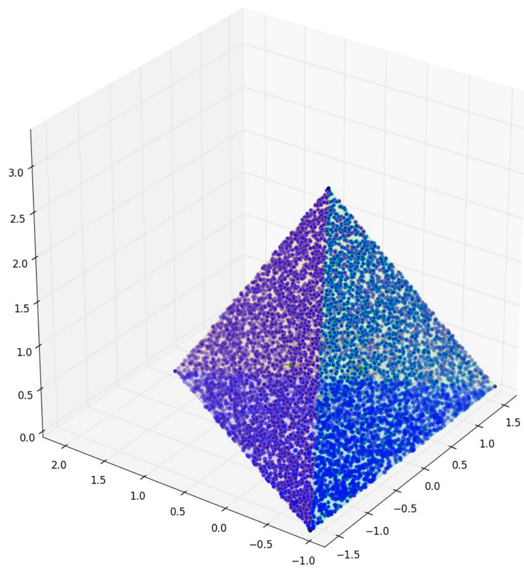


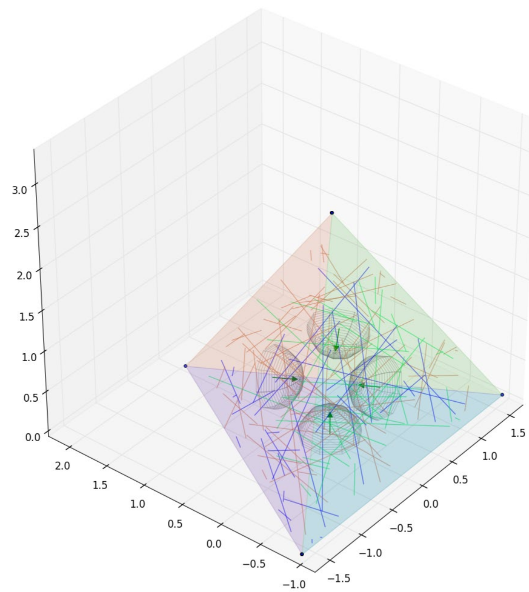




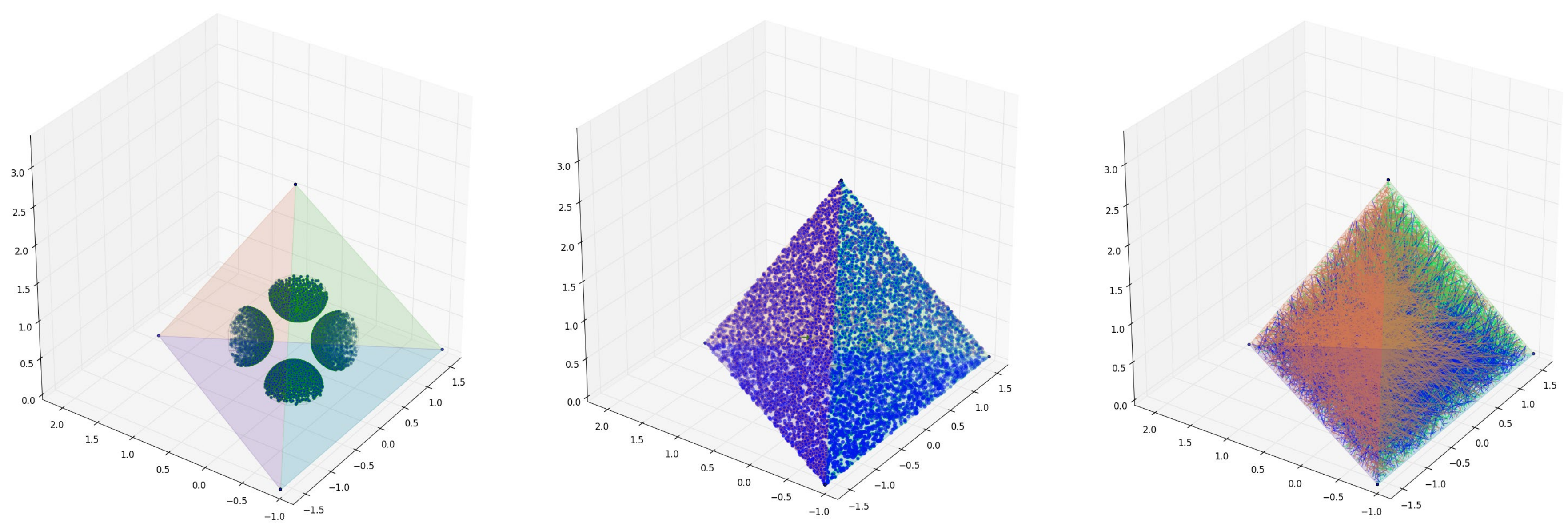
PROJECT: VISUALIZING THE FORM FACTOR

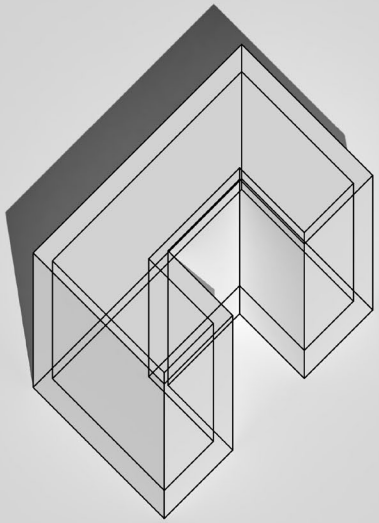


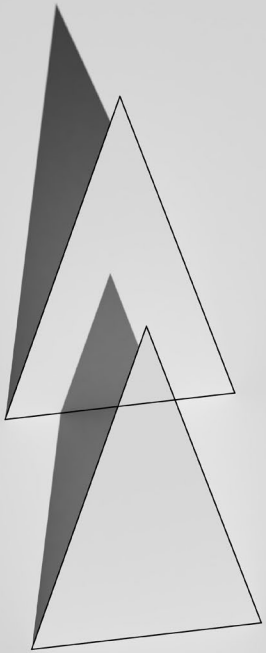


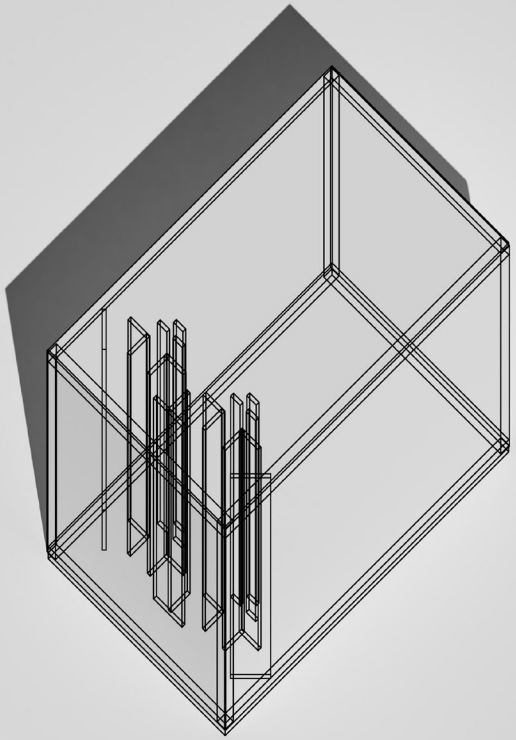


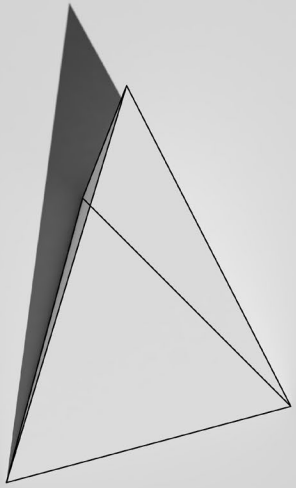
PROJECT: VISUALIZING THE FORM FACTOR

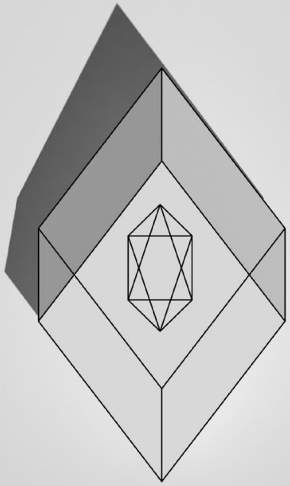


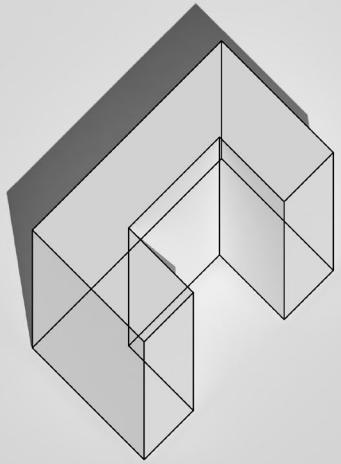




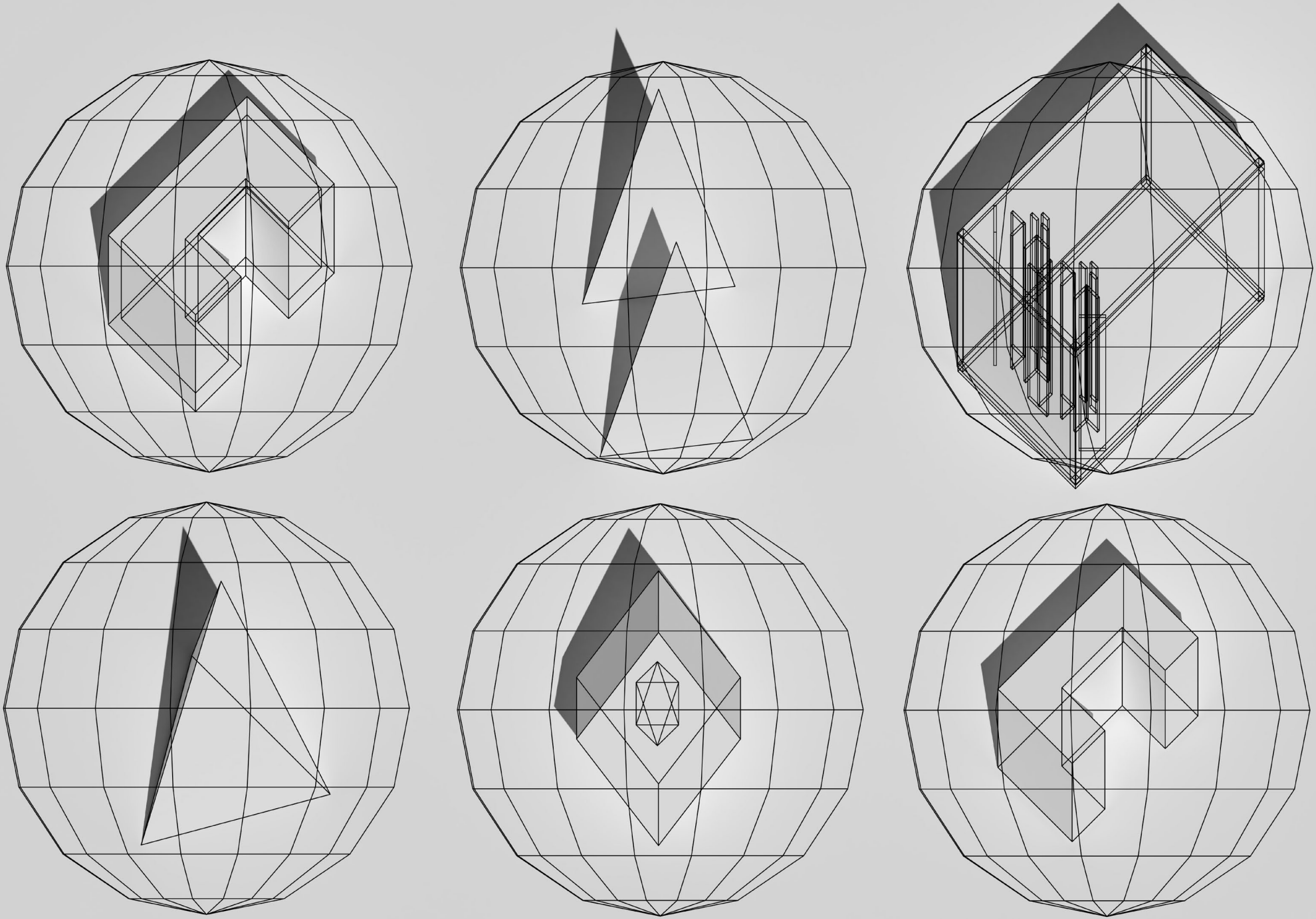








TEST CASE: SAMPLE MODELS



TEST CASE: THE MISSING LINK


RADIOSITY: TEST SPACE 1

PROJECT: TEST SPACES