03. 3D Visualization of Design

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CAD & Graphics II | HOM2027 | Fall 2014 | Every Wednesday 2:00 pm – 5:50 pm

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What to do today

1. **Brief Review**: 2015 Graduation Exhibition

2. **Lecture**: 3d Visualization of Design

3. **Technical Note & Setup**: Accessing local area network in Rm #504

4. Lab exercise: Rendering scenes in SketchUP + Vray (Review) + **installing 3ds Max Design**
   - Setting up your Lab Exercise environment
   - SketchUP + Vray: Recall your skill
   - Installing 3ds Max Design and first run

5. Requirements: All lab exercises outcome files should be submitted in “Shared Folder”
   → **At least 4 images in JPG format (Max 8 JPGs)**. Try to get your best render shots!
Installing 3ds Max Design 2015
What is the essence of design?
What is Design?

“structured arrangement of design units (elements)”

design units are:
1) a physical element that forms a design
2) an element of design that a designer can cognitively deal with


What is “Designing”?

“Designing is an act of creating and elaborating a design.”
To make computational models for your design, what’s NEXT?

Your Design & ideas → Computational Models → Design Visualizations, Representations & Presentations

Something unknown → Revit file, 3ds Max file... → Plan drawings, design slides, renderings, videos...
To make computational models for your design, what’s NEXT?

Your Design & ideas

Computational Models

Design Visualizations, Representations & Presentations

On-site Construction

Realization of Design

Shop Fabrication, Pre-fab, Rapid Prototyping...
However, we are dealing with “geometric modeling & visualization” in this course.

→ CAD & Graphics II

→ Geometry-oriented approach to the design
Geometry-oriented approach to the design

- Conventionally CAD systems only deal with “geometry”
- Because people believed that geometric shape is all about design, at that time.
- Geometry is important, but it is a subset of a design.
Architectural Design “versus” Construction

- **2000 years ago** Marcus Vitruvius Pollio (born c. 80–70 BC, died after c. 15 BC)
  - the author of De architectura, (The Ten Books on Architecture)
  → discussed the value inherent in using plans, elevations, and perspectives to convey design intent.

- **Renaissance** Leon Battista Alberti (February 14, 1404 – April 20, 1472)
  - the author of De Re Aedificatoria (1452, On the Art of Building)
  → distinguished architectural “design” from “construction” by proposing that the essence of design lay in the thought processes associated with conveying lines on paper. His goal was to differentiate the intellectual task of design from the craft of construction.

- **Modern Architecture** Form follows function
  - coined by Louis Sullivan, in his article “The Tall Office Building Artistically Considered” in 1896. referring to Vitruvius.

- **Contemporary** 2D CAD (AKA CAAD, CADD…), 3D Graphics
- **Cutting-edge** BIM – the most advanced CAD system so far
Conceptual modeling of a building – for both human and computer
Information is important. Geometry is one part of information.
Building Data Model: a bit more elaborated model
CAD evolves into 3d BIM → Not just evolving from 2d to 3d

“Rectangular Shape” in a CAD model

“Space Object” in a BIM model

“Office” Labeled Polygon

Label Text: “Office”
Layer Label Text: “Level 1”
2D or 3D Dummy Geometry

Space Object Instance contains “information”
GUID (Globally Unique ID)
Name: “Office”
Zone Name: “Leasing Spaces”
Space Number: 250
Floor, Spatial Topology
NET Area, Height, Volume...
Relations, Topology Data
3D Geometry Data
Standard Names, Standard Area, Required Area
Basic Rentable Area
ANSI/BOMA Category
Occupants Code
Energy Zone Type
Cost Estimate Data
Security Information
......
Why CAD & Graphics?

Especially, why 3D Computer Graphics?

- For enhancing your design visualization skills
- For moving forward to advanced design computing issues such as BIM

Our course title:
CAD & Graphics II
History of computer-aided design is a history of understanding what is design

- The design is a drawing of the product
  → e.g. Geometric drafting in 2D

- The design is a surface model of the product
  → e.g. Geometric surface modeling in 3D

- The design is a 3D model of the product
  → e.g. Solid modeling

- The design is an editable 3D model of the product
  → e.g. Parametric modeling

- The design is the integrated representation of all the compositional, analytical and fabrication representations of the product
  (Geometry is just one part of the model)
  → e.g. Product Data Modeling, Building Information Modeling
Design Modes

Design is a plan or framework of linking ideas together into a system of meaning. It can also be an end in itself, an abstraction which generates ideas and concepts.

Design is also a way of taking thought systems and applying them to visual equivalents — usually defined by exploiting a medium’s unique qualities to maximize meaning.

Design is finally a way of making artifacts — limited by the way media is structured and exploiting its inherent qualities — by what is expected, or by the unexpected.

(Digital) Design Media

- Design by pencil to computing (computer hardware + software)
- The pencil is one of the most basic media of design (graphic design tool).
- Proliferation of IT ➔ What’s new media for design? ➔ Digital Design Media

Design by hand.  

Design by computing.
Example: Hotel Expo
Example: Jewish Museum
Example: Sleepbox
You’re already well-known to design visualization especially using AutoCAD and SketchUP + Vray.

In this semester, it’s 3ds Max Design-based class for advanced visualization and representation of your design.
What you have to learn are:

- Fundamentals of Computer Science & Engineering Theory
- Computer Hardware
- Network & Internet
- Computer Software – OS: Windows

- Fundamentals of Design Computing theories

- Computer Software – Specific Applications: CAD & Graphics tool: “3ds Max Design” for this semester + Mental Ray, Vray, Photoshop, etc.

- Even more things about Design Computing!
3d Visualization of Design
Photo-realistic visualizations using current/common CG tools

SketchUP + Vray (download a model from Google 3d warehouse and edit lights, in 5 min)
Photo-realistic visualizations using current/common CG tools

SketchUP + Vray
Photo-realistic visualizations using current/common CG tools
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Photo-realistic visualizations using current/common CG tools
Is Photo-realistic visualization always top-priority?
Modeling: Geometric shape is just one part of the model

Your Design & idea → Computational Model

+ More Information

→ BIM

“Shareable”

Digital Design Presentation
- Plan, exported by model
- 3D, exported by model
- Sketch, exported by model
- Pictures from model
- Animation from model
- Anything from model

One source, multi use
Semantic Integrity

Your Design & idea → Computational Model → Real Object

Are they semantically same?

Your mini world UoD (Universe of Discourse) → Real World
Semantics

- Is your CAD model photo-realistic?

- Does it have Semantic Integrity?
  
  → Photo-realistic visualization is NOT always the solution.
  → Architecturally “effective” visualization which has semantic integrity is of importance.
Review: 3d Visualization by Computers: Rendering
Rendering basics – all about lights

- Lighting Source
  - Direct Illumination (e.g. Sunlight)
  - Indirect Illumination
  - Environment

- Target Objects
  - Diffuse
    - Intensity
    - Texture Map
    - Shadow casting
    - Ambient Occlusion ...
  - Reflection
    - Refraction
    - Caustics

- Camera
  - Source, Target
  - Field of View
Photo-realistic Rendering: Global illumination, Ray tracing...

- To “compute” the interactions between light rays and all target objects in the given environment
- “Rendering” usually refers to the “control” such interactions with amount of options
Rendering Overview

- Rendering
  - Target Object
    - Object Surface
      - Diffuse
      - Reflection
      - Refraction
      - Self-Illumination (Emissive)
      - Special Effects
    - Objects Interaction
      - Caustics
      - Ambient occlusion
    - Standard Views (Orthogonal Views)
      - Camera (Perspective Views)
    - Observer
  - Shadow casting
  - Camera (Perspective Views)
    - Observer

- Lighting Source
  - Direct Illumination
    - Sunlight
    - Spotlight
    - Omni, free light
  - Indirect Illumination
    - Diffuse/reflection from objects
    - Global Illumination (GI), Final Gather (FG)
    - Background (BG)
  - Environment setup
    - Color
      - Intensity
      - U/V/W mapping
      - Bump mapping
      - Displacement
    - Diffuse
      - Texture (Bitmap Image)
      - Transparency
      - ...
Graduate Exhibition
나눔생산소
권슬기, 이정화, 김현진
청소년 보호관찰소

김다혜, 정성재, 박종찬
세운 트라이브

이다훈, 권오준
TRANSFORMAKING SPACE
정영택, 박가영
THE DREAM ISLAND_노들섬
전유진, 정승재, 김지원
서울시 삼선동 장수마을 환경개선 프로젝트
문창현, 정인선, 김다솜
담 더머로
최동성, 김하얀, 이은영
READING & COMMUNICATION AREA: 서로(路)
PRIVATE READING AREA
CHILD AISLE
BUS PLATFORM
SCALE: 1/50
혼용
정강의, 오청실, 방성빈
비움채
허은미, 김민주, 이서연
서울시 폐쇄된 김포가압장 리모델링 프로젝트

왕쓰지, 진자양, 사문청
책 읽어주는 한옥

이다혜, 조의진, 이원재
무화과는 없다
이아영, 현은지, 한예은
에움길_979
박종빈, 홍석민, 이슬
과거와 오늘, 대한민국의 빛을 잇다
정유준, 최련단, 이정우
창고
송민건
공공터
김도경, 전달리, 전세희
문화 예_ 한국관광홍보센터
방해연, 이지영
이어,울림
진가율, 박수진, 송지희
Course Web

https://sites.google.com/site/jkleecourses/

https://sites.google.com/site/cadgraphicsiia2015
Lab Exercises

- Install: 3ds Max Design 2015

- Recall: SketchUP + Vray

Recall your render skill!
Lab Exercise 1. Installing 3ds Max Design 2015
Lab Exercise 2. Review

SketchUP + Vray

Panton Chairs

- **Lighting Source**
  - Sunlight setup in SketchUP + Vray
  - GI setup
  - BG setup
  - Environment HDRI

- **Target Objects**
  - Chairs
  - Diffuse
  - Reflection
  - Bitmap texture mapping on the floor
**Vray Setup Roll-outs**

**Environment**
- Brightness
- Gi, BG
- Background, HDRI

**Output**
- Rendering image size
Vray Setup Roll-outs

Change Environment from “TexSky” to “TexBitmap” or “None”
- Choose TexBitmap, UVW Type is UVWGenEnvironment
- Load the HDR image
Create Layers: Emissive, Reflection, Refraction
Lab Exercises 03: Preview

3ds Max + Mental Ray (based on V-ray experiences)
Lab Exercise 03

- Render a scene in 3ds Max using Mental Ray

- Create a new Max file:
  - Set a MR Sun
  - Make primitive objects such as a box and a teapot
  - Assign MR materials presets, without any experiences
  - And so on

- Render your final scene → Store under your named folder
Next Class

- 3d Graphics Fundamentals
- 3ds Max Design + Mental Ray