

3D Curriculum Project

Curriculum Project Researched and Designed by Joel and Ruth McKinney, as part of the Master of Fine Arts Degree Program at the University of South Dakota.

Class Title: "Sculptural Modeling on the Computer"

This is a three-dimensional computer design class that will function to allow sculptors to bring computer assisted design to their pallet of skills, to add a deep element of organization and design strategy to the generally intuitive 3D design of much contemporary sculpture, and to provide a foundation in 3D design to animation students.

Goals:

To integrate computer technology into the Sculpture program, and thereby:

- a.) Offer sculpture students an additional visualization and production tool,
- b.) Offer serious art students a critical presentation and promotion tool,
- c.) Offer a visual and intellectual three-dimensional approach to computer modeling for animation students,
- d.) And offer an additional intellectual ingress to sculpture and fine arts for computer science students,
- e.) Stress the importance of planning and preparation for the serious sculptor,
- f.) Prepare students for presentations involving sculptural (and other 3D) proposals.

Notes:

1.) Because modeling software varies in interface style and tools/commands this curriculum will focus on specific projects, which are designed to teach specific lessons. Following the model set by Graphic Design classes, where the students are lectured in design theory but are responsible for studying software tutorials in lab or on their own, this curriculum will not go into details on specific software usage. Exceptions may be used to illustrate specific points, but an effort will be made to generalize rather than adhere to any one modeling program.

The instructor will decide what program or programs will best suit the needs of the students as well as those of the department.

2.) Curriculum is based on a 3 credit, 16-week semester.

3.) Prerequisites for this class include Design 1 & 2, and Drawing 1

4.) In general, half of the units will utilize computers, while the remaining units will focus on actual hand-drawn or hand-built projects.

Unit 1. Visualization in Three Dimensions

3D and Illusion [Introductory Lecture]

Basic Form Generation [Computer]

Primitive vs. Procedural Objects

Basic Commands

Types of Working Render (Wire Frame, Shaded, Bounding Box, etc.)

Objectives: Introduce the concepts of Primitive Forms, Spatial Relationships, Scaling, 2D and 3D, Illusion of third dimension vs. reality of third dimension. Familiarize students with computer basics such as opening programs, setting up basic workspaces, and basic modeling tools.

Unit 2. Orthographic and Isometric Drawing [Hand Exercises]

Drawing Basic Forms and Relationships

Types of Perspectives used in Drawing and Rendering (One point, multi-point, Isometric, orthographic, etc.) [Hand Exercises]

Objectives: Introduce the various "views" used in both 3D modeling and orthographic drawing.

Familiarize students with visualization in three axes from various drawings (images) showing specific views (i.e. "top view," "front view," "side view"). Review basic shapes, forms, and types of perspective rendering. Get students used to working both on and off computers in the same class.

Unit 3. Visualization and Planning [Hand Exercises]

Plan Project #3 Still Life of Primitives on Paper (with spatial relationships dimensioned)

Produce "Working Drawings" of Still Life (Arranged Primitives)

Objectives: Practice thinking and working on three axes. Practice careful planning and rendering of objects in preparation for continued work. Introduce the concepts of "maquettes" and Proposal Drawings.

Unit 4. Computer Simulation of Planned Objects [Computer]

Creation of Still Life on the Computer maintaining all Spatial Relationships, Cartesian Co-ordinates, and Euclidian Axes (and variations in labeling from program to program.)

Introduce Spline, B-spline, and Non-Rational B-Spline (NURBS) and Mesh objects, and the various alteration methods appropriate for each type.

Objectives: Students will learn how to create previously planned objects and arrange them in previously planned spatial relationships. This unit is important in order to overcome the student tendency to play on the computer and to accept any interesting result instead of working toward specific outcomes. The required planning and various limitations inherent in different processes will become apparent.

Unit 5. Disassembly of Complex Shapes into Primitives

Study Cézanne's Geometric Primitives [Slides and Exercises]

Drawing Project (involving reduction of complex objects to constituent primitives, and the building of complex objects utilizing primitives)

Objectives: To teach students to disassemble complex objects into their constituent primitives, and to build complex objects from primitive forms. As a fundamental part of creative problem solving this is perhaps the most important unit as far as "liberal arts education" is concerned.

Unit 6. Transformation of Primitives [Computer]

Generate Primitive Forms and Transform Using "Extrude," "Lathe," "Join," and "Difference" Commands

Cross Sectioning

Extrusion as a Modeling Tool (Single and Compound Shapes)

Lathe and Lathing Operations

Boolean Operations on Objects (Union, Subtraction, and Intersection)

Paths and Curves

Objectives: Introduce complex operations utilized in the creation of complex 3D objects. This is the next step beyond assembling multiple basic forms, but is fairly complicated and some time will be needed to bring student skills up to necessary levels.

Unit 7. Creation of 3D Objects From Computer Generated Plans [Sculpture Studio Project]

Assembly of 3D object Based on Computer Design. (Materials might include styrofoam, clay, wood, wax, or other materials. Project must be kept reasonably simple)

Objectives: (This is the technical inverse of Unit 4 when students built on the computer objects previously designed longhand.) In this Unit students will work in the sculpture studio to create objects they have previously designed on the computer. Again, the required planning and various limitations inherent in the different processes will become apparent.

Unit 8. Creation of Computer Generated Rendering Based Upon 3D Object [Computer]

Computer Rendering Basics

(This Unit might or might not involve an additional studio project, depending on the satisfactory completion of the previous studio project. [Studio])

Computer Modeling of Actual 3D object, or, at the discretion of the instructor, a "proposed" object. Rendering of the object. [Computer]

Objectives: Introduce computer-rendering techniques. Introduce various rendering perspectives, color, "views," surface treatments, lighting, backgrounds, bump maps, reflectivity, specularly, transparency, and refraction. Introduce Bit Maps, Vectors and Vector Based Graphics, and Bezièr Curves. Introduce printing specifications including resolution, size, output formats, printers and plotters. Familiarize students with printing techniques.

Unit 9. Rendering for Presentation

Rendering for Presentation

Integration of Additional Images (Scanner Demo, Web Capture Demo, Photoshop Demo) Animation overview ("Fly-overs" and "Walk-throughs")
[Computer]

Presentation for the Class [Presentation]

Objectives: Students will get the opportunity to organize, design, prepare, and give a presentation similar to those given when applying for grants or artistic commissions. Students will be introduced to CAD renderings, scanners, and web capture to obtain images to utilize in presentations. Students will use Photoshop to place rendered objects into imaged environments. While Animation is beyond the scope of this class students should be aware that the possibility exists and is fast becoming an industry standard.

Tests and Quizzes:

The above Units will each contain one or more vocabulary quizzes. Additionally, two tests, one mid-term and one final, will cover concepts, integration of vocabulary, integration of concepts, and skills. Each unit will have a finished "project."

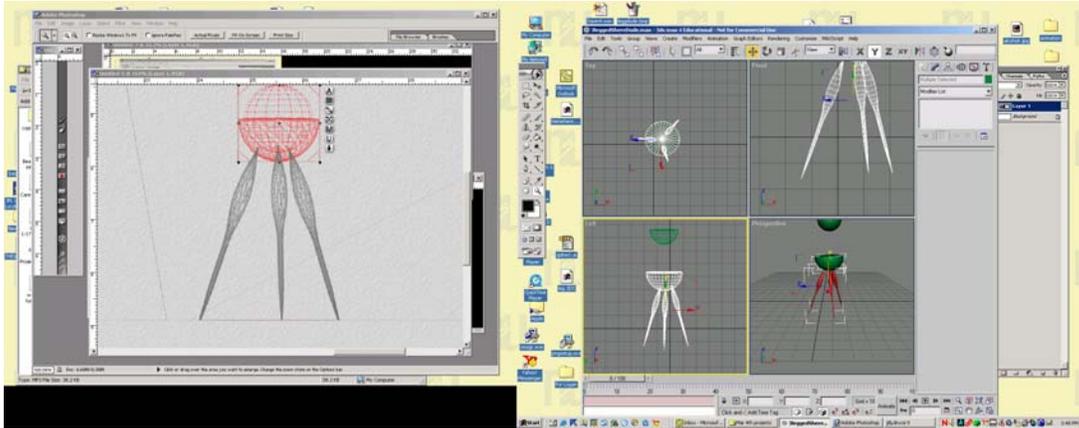
3D Curriculum project, Class Title: "Sculptural Modeling on the Computer"
Curriculum Project Researched and Designed by Joel and Ruth McKinney, as part of the Master of Fine Arts Degree Program at the University of South Dakota

Bibliography

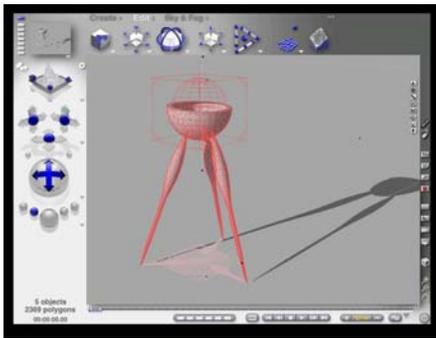
Ashford, Janet, and John Odam, *Getting Started with 3D: A designer's guide to 3D graphics and Illustration* Berkeley, CA, Peachpit Press 1998 (Chosen as text for class)
Janson, H. W. *History of Art* Englewood Cliffs, NJ Prentice-Hall 1974
Janson, H. W. and Anthony F. Janson *A Basic History of Art* Englewood Cliffs, NJ Prentice-Hall 1992
Kelly, James *The Sculptural Idea* Minneapolis, MN, Burgess Publishing Company 1974
Strata 3D Pro: Reference Manual St. George, UT 3D.Com 2000
Lightwave 3D Reference (No city given) New Tek Inc. 1996
Ocvirk, Stinson, Wigg, Bone and Cayton *Art Fundamentals Theory and Practice* Boston, MA, McGraw Hill 1998
Verhelst, Wilbert *Sculpture: Tools, Materials, and Techniques* Englewood Cliffs, NJ Prentice-Hall 1973

Modeling and animation software reviewed for this project included: "Lightwave," " Bryce 4 & 5," "Extreme 3D," "Rhino," "Vectorworks," "Maya," "3D Studio Max," and "Strata 3D." There are many more programs available at this time: "Ray Dream," "Infinit-D" "Form-Z," and others.

Submitted: December 15, 2000; Updated December 5, 2003



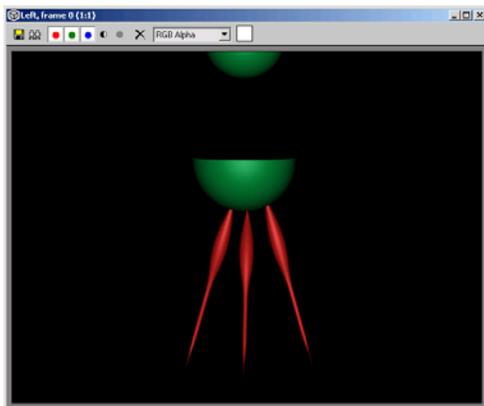
Left side: Typical wire-frame view of Boolean computation (Bryce)
 Right: Typical multi-pane view (3D Studio Max)



Shaded render of Boolean subtraction (Bryce)



Bronze object cast from modeled wax



Shaded render of primitive deformation and lathed spline (3D Studio Max)