## DRAWING FOR FURNITURE: 3D

Rhode Island School of Design
Department of Furniture Design
semester: Spring 2017
FURN-2511, Sections 01 & 02 (3 credits)
2nd Floor of Prov-Wash Building, Room 202 and 237B
Mondays, 1:10pm – 6:10pm
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**COURSE DESCRIPTION**

With its capacity for rapidly developing and realizing design concepts, 3D CAD modeling has become an indispensable part of the contemporary design process. The goal of this course is for students to develop competency with CAD modeling, and an increased sensitivity to the creative potential that this media presents to designers. Work in the class will center around learning to use the popular, powerful CAD modeling application Rhinoceros.

Many of the projects in this class will have a physical object as the deliverable. A primary concern of the course will be developing methods to deal with the disconnect between working on-screen and working with real materials in physical space. This will be facilitated through experiments with a variety of technologies, both sophisticated (such as CNC machining) and basic (drawing, printing). Ultimately, students should come away from the class equipped with a variety of processes and skills that will contribute to their productivity and creativity as designers and makers.

**LEARNING OUTCOMES**

Successful performance in this class will yield the following outcomes for students:
- intermediate level proficiency with Rhinoceros 3D modeling software, Keyshot rendering software, and MasterCAM CNC software
- a working knowledge of the underlying structure of NURBS surfaces and how to devise effective modeling strategies for a variety of forms
- an understanding of the core geometric concepts of curves, surfaces, and solids and how to control continuity between objects
- a solid foundation for future self directed growth with the various software introduced in the class
- experience developing strategies to mitigate the challenges associated with developing three dimensional objects in a two dimensional, screen-based work space
- practical experience with several digital fabrication technologies, including: plotting and CNC machining

**COURSE STRUCTURE**

Class time will be occupied by a balance of demonstrations, lectures, critiques, discussion, exercises, and work on projects. Many classes will begin with a short exercise intended to challenge the student's skills with the software and to encourage resourcefulness and problem solving. These exercises will raise important issues inherent to the software in an effort to develop awareness of the technology's limitations and sensitivity to its fundamental qualities.

**COURSE REQUIREMENTS**

There will be several projects throughout the semester, some of which will be completed in one week, others spanning multiple weeks. In addition to the weekly deadlines assigned for these projects, other skill building exercises will be assigned. Outside of class, participation in web-based activities conducted on the class website and shared Google Drive will be required, including posting progress and documentation of projects and contribution to discussions. In general, all students are expected to check the class website daily. Tutorial videos that demonstrate techniques with the software will be posted to the site throughout the semester and students are expected to watch these videos as they are posted. In addition to work on projects and exercises, quizzes will be given to assess the student's grasp of fundamental concepts.

Although a primary objective for this class is to learn software, this is not "just a computer class". Students will be expected to be invested in the design and execution of their projects, with an attitude that views the conceptual, theoretical, and technical aspects of the course content as mutually beneficial to the student's development. Significant off-screen work will be required to satisfactorily execute projects as physical objects - sketching, sanding, finishing, etc.

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**SUPPLIES & SOFTWARE**

Students in this class are expected to have their own laptop computer, as well as a three button mouse (right and left buttons + scroll wheel/button). A licensed installation of Rhinoceros 3D modeling software and Keyshot rendering software is required for all students - either the Windows or Mac versions of these applications are acceptable. Several projects will also require students to use MasterCAM. A "Home Learning Edition" of this software is available for students to use at home, for free. The Furniture Department Computer Lab also has a license of this software available for student use, but please note that this software only runs on the Windows OS. To run this software, it is strongly recommended that students create a virtual machine with the software Parallels Desktop.

Students will also be required to have other standard art and design tools and supplies for use in the class, such as rulers, utility knives, drawing implements, etc.

The class website will provide links for students to find the most economical purchasing options for the class's required software. The list below outlines the software that will be used in the class:
- Rhino (3D Modeling)
- Keyshot (Rendering)
- Windows 10 (Operating System)
- Parallels (Operating System Virtualization)
- MasterCAM Home Learning Edition (CAM)

**COURSE POLICIES**

This course will follow the Department of Furniture Design attendance and critique policy, which has been distributed separately and is available in the Department Office. It is of crucial importance that students adhere to departmental and school policies for shops, studios, labs, classrooms, and other facilities. All students are expected to clean up their workspace in the computer lab at the end of class and to arrange the chairs in an orderly fashion. Failure to use facilities safely and respectfully will be reflected in grading.

**GRADING CRITERIA**

In general, this course will follow the Department of Furniture Design grading and attendance policies, which have been distributed separately and are available in the Department Office as well as on the course website. Students will also be expected to actively participate in class discussions and be active contributors to a vibrant, engaged, critical, and supportive class community. In addition to work on assignments, performance in the class will be evaluated on the following criteria: engagement in one-on-one and group discussions; effort and ability to engage fully in the subject matter; timeliness in completing projects; respectful and safe use of facilities; and attendance and punctuality.

For the purposes of determining grades, "A" level performance will be characterized by the following:
- the student was punctual and attended all classes
- the student challenged themselves and grew significantly through their engagement with the content of the course
- the student was an active member of the class community who made genuine efforts to engage with and support the work of their peers
- the student completed all assignments and projects on time, with excellence
- the student's projects demonstrated increasing competency to build complex objects with Rhinoceros and to create realistic renderings with Keyshot
- the student demonstrated resourcefulness, problem solving, and creativity when faced with challenging modeling problems
- the student's work demonstrated competency with MasterCAM and an awareness of the limitations and capabilities of 3 axis CNC routing
- the student successfully translated their work from concept, to digital model, to a compelling physical object, using the various outputting tools covered in class sensitively and appropriately
- the student was a good citizen - outside of and within RISD and the Department of Furniture Design - following school and department policies and using facilities safely and respectfully

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**SCHEDULE**

Project schedules will overlap, and assignments for multiple projects may be due at the same time. This is done in an effort to provide adequate time for design development, modeling, execution on various digital fabrication equipment, assembly, and finishing. See the attached table for a detailed calendar of class activities and events.

Work in this class will be divided into five major modules, each focusing on a particular skill set or technology. Each module will include design briefs for projects with specific deadlines, deliverables, and evaluation criteria for assignments.

**Drinking Glasses**
basic drawing, modeling, editing, & rendering
**Chair Study**
Drawing in 3d, Plotting
**Paper Model**
Developable Surfaces, Digital Cutting
**Name Plate & Plywood Stool**
Nesting parts, Modeling Structure, Curve Driven CAM, 2D CNC Machining
**Advanced Tutorials**
Surface Continuity, 3D CNC Machining, Surface Driven CAM

| 3D 2016 | Week 1 2/20/2017 | Week 2 2/27/2017 | Week 3 3/6/2017 | Week 4 3/13/2017 | Week 5 3/20/2017 | Spring Break 3/27/2017 | Week 6 4/3/2017 | Week 7 4/10/2017 | Week 8 4/17/2017 | Week 9 4/24/2017 | Week 10 5/1/2017 | Week 11 5/8/2017 | Week 12 5/15/2017 | Week 13 date TBA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Uncategorized** | | | | | | | | | | | | | | |
| Assignments | Install Keyshot Buy Rhino Install Virtualization | Install Windows | Install MasterCAM Mustard Bottle Tutorial | | Bring Protective Eyewear | | | | | | Pay for Plywood | | | |
| In class | Intro to Rhino Demo Transform Challenge Draw + Revolve Challenge | Lego Challenge Trace Challenge 3D Drawing Challenge | Pencil Challenge Check Windows / MasterCAM Install Plotter / Cutter Demo | Boat Challenge Bring Protective Eyewear | Bring Protective Eyewear | | Bring Protective Eyewear | | 3D Printing Lecture | Torqued Ring Challenge Continuity Lecture | Y Branch Challenge NURBS Lecture | Steel Spoon Challenge | | |
| **Glasses** | | | | | | | | | | | | | | |
| Assignments | Model Rendering Description | Comment Revisions (optional) | | | | | | | | | | | | |
| In class | Quick Model + Render Demo | | | | | | | | | | | | | |
| **Chair Study** | | | | | | | | | | | | | | |
| Assignments | | Model Rendering | Plot Drawing | Plot Drawing | | | | | | | | | | |
| In class | | Texturing Demo | | | Collect Drawings | | | | | | | | | |
| **Paper Model** | | | | | | | | | | | | | | |
| Assignments | | Bring in Object to Model | Rough models Renderings | Final Models | | | | | | | | | | |
| In class | | Introduce project | Paper Model Lecture Unroll Demo Tabs / Assembly Demo | Review Rough Models | Critique | | | | | | | | | |
| **Name Plate** | | | | | Due 4/2/2017 | | | | | | | | | |
| Assignments | | | | | Draw Name Name Plate MasterCAM | | | | | | | | | |
| In Class | | | | | Intro to CNC Lecture Cat Face Cut Demo Cat Face CAM Demo Cat Face CAM Exercise | | Cut Names | | | | | | | |
| **Plywood Stool** | | | | | | | | | | | | | | |
| Assignments | | | | | | | Design 1:3 Scale Model Screenshot Nesting Pattern Print | Design Revisions 1:2 scale model Screenshot Nesting Pattern Print | Refine Design CAM Rendering Stepstool Demo CAM | Revise CAM Submit for approval Sign up for Cut Time Cut/Finish/Assembly | Cut Assembly Finish | Cut Assembly Finish | Cut Assembly Finish | |
| In class | | | | | | | Introduce Project In Class Work | review 1:3 models | review 1:2 models MasterCAM Demo work on project | Review CAM Cut projects | | | | Critique |
| **Surface CAM Tutorial** | | | | | | | | | | | | | | |
| Assignments | | | | | | | | | | | Model + Render Copy of Watering Can | CAM Watering Can | | |
| In class | | | | | | | | | | | Demo Introduction | | | |
| **Spoon Modeling Tutorial** | | | | | | | | | | | | | | |
| Assignments | | | | | | | | | | | | | Model Spoon | |
| In class | | | | | | | | | | | | | | |