

DSIS Studio II: Industrial Design

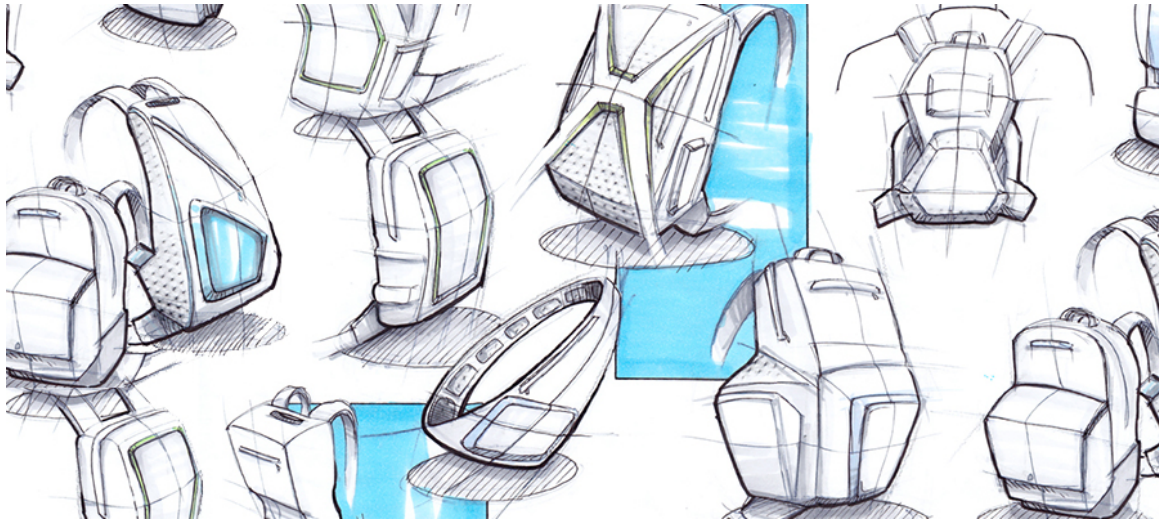
Syllabus, Spring 2020

Studios: Tuesday/Friday 9-12 AM, Sage 2211

Professor: Dr. Jim Malazita (malazj@rpi.edu)

Office: West 403, Office Hours: Tuesday 1-2

Introduction:



This course is the second in the DSIS studio series. It introduces students to general principles of user-experience design and industrial design as a set of approaches for attending broadly to matters of aesthetics and form, usability, and meaning-making. It considers industrial designers as a community of practice. Assignments require students to synthesize social, technical, and formal concerns in the design of innovative objects.

Industrial design encompasses the interests and needs of those impacted by designed artifacts. The emphasis of this course will be on product aesthetics and usability from the perspective of users; however, issues of fabrication and manufacturability, and design impacts on groups extending beyond a given product's immediate users will also be considered. According to the Industrial Designers' Society of America,

The industrial designer's unique contribution places emphasis on those aspects of the product or system that relate most directly to human characteristics, needs and interests. This contribution requires specialized understanding of visual, tactile, safety and convenience criteria, with concern for the user. Education and experience in anticipating psychological, physiological and sociological factors that influence and are perceived by the user are essential industrial design resources. (www.idsa.org; accessed 10Aug06)

Thus, industrial design can be understood as a disciplined approach—and accompanying methodologies—used to align product characteristics with human characteristics. In addition, industrial design is a community of practice. It has its own professional associations, codes of responsible practice, membership rules, priorities, and ways of understanding what “design” entails. As DSIS students, you are not expected to become industrial designers (though some of you may well do so). However, you are expected to understand industrial design's basic approach to design as well as how this community defines itself and how it is defined by others.

In other words, you must become competent in industrial design practice and conversant in its discourse.

As a studio course, class time is used for self-guided design investigations as well as structured group activities. Students will participate in individual and group research; discussions with potential users, researchers, and practitioners; project reviews; and formal presentations. The course includes time for hands-on exploration of design ideas. Overall, this is a labor-intensive course that requires a sustained effort throughout the semester. Students will need to start on their projects early, reach out to testers and their group members efficiently and empathetically, and dedicate adequate time to polish, iterate, and hone their design concepts throughout the course. In general, it is expected that you will spend between 10 to 12 hours every week outside of class time on your reading, prototyping, testing, and writing. Always be thinking about your portfolio.

Daily class times are generally broken into two 1.5 hour sections: a lecture/discussion, tutorial, or design activity for the first section of class, and open studio/table critique for the second section. In general, Tuesday classes will feature discussions/criticisms of assigned readings about User Experience design, the sociology/anthropology of consumer objects, and tutorials and discussions about user experience testing/general UX principles. Friday classes will feature tutorials and exercises about CAD modeling, rapid prototyping, and lighting-rendering-presenting product concepts.

The key component to this course is **attention to detail** across the social, aesthetic, and experience dimensions of the design of objects. This means that students will be held to a high standard of product concepting, user testing, and object prototyping/building. **A good concept that is executed poorly will result in a poor grade.**

Required Texts:

Harvey Molotch, *Where Stuff Comes From* (Routledge, 2003).

Donald Norman, *The Design of Everyday Things, Revised Edition* (BasicBooks, 2013).

Additional texts will be posted on LMS.

Required Software (Windows Version Highly Recommended):

Rhinoceros 3D (Version 5) <https://www.rhino3d.com/download/rhino/5/latest>

Epic Software's *Unreal Engine* (Version 4.1 and up) <https://www.unrealengine.com/en-US/download>

Required Materials:

Strathmore 300 Series Bristol Smooth Pad, 14"x17" Tape Bound, 20 Sheets
<https://www.amazon.com/Strathmore-Bristol-Smooth-Bound-Sheets/dp/B0027AAYLG>

Sakura Pigma 30062 Micron Blister Card Ink Pen Set, Black, Ass't Point Sizes 6CT Set
<https://www.amazon.com/Sakura-Pigma-30062-Micron-Blister/dp/B0008G8G8Y>

Prismacolor 3620 Premier Double-Ended Art Markers: Fine and Chisel Tip
<https://www.amazon.com/Prismacolor-3620-Premier-Double-Ended-Markers/dp/B00006IFGK>

Unlined sketchbook of your choice

Pencils, Colored Pencils, and other Prototyping/Sketching Materials as Needed

Strongly Recommended Materials:

Three-button USB mouse

USB Stick, min. 25 GB

Assignments and Grade Breakdown:

Design Briefs: (66 Points)

Studio Object Design – 17 points

- Pinup – 3 points
- Rough Prototype – 5 points
- Final Concept – 2 Points
- Report – 5 Points
- Final Presentation – 2 Points

Design History Redesign – 22 Points

- Moodboard and Pinup – 3 points
- Rough Prototype – 5 Points
- Detailed Prototype – 5 Points
- Final Concept – 2 Points
- Report – 5 Points
- Final Presentation – 2 Points

Open Design – 27 Points

- Pinup – 3 points
- Rough Prototype – 5 points
- Detailed Prototype – 5 Points
- Final Concept – 5 Points
- Report – 5 Points
- Final Presentation – 2 Points
- Poster – 2 points

Modeling Challenges: (35 Points)

Complex Curvature – 10 Points

Complex Texturing – 10 Points

Photorealistic Lighting and Texturing – 15 Points

Total: 101 points (Students begin with 1 Point of Extra Credit)

All text portions of projects (papers, write-ups, design documents) must be submitted to the course's Blackboard page before the start of class on the due date. Papers submitted must be in **.doc, .docx, or .rtf format.**

All projects will include:

- 1) A series of 3-D/material mockups and rough prototypes of your proposed design in suitable materials

2) A concept presentation. Your presentation should be from a User Experience point of view, and should include information about your design and research process, persuasive evidence for specific design decisions based on user feedback, and some key features of your object.

3) A design report accompanied by detailed mockups/build of the design, including appropriate 2-dimensional representations of 3-D models.

Thumbnails and Pinups:

For every Design Challenge Assignment, the student or group will be responsible for initial iterated thumbnail pages and polished pinup pages. The number of each of these pages will depend upon the project. Each iterated thumbnail page should have 10, relatively polished, 2 x 2" thumbnail sketches, showing multiple pivots and plusses of varying degrees of your potential concepts. Each polished pinup page should showcase a polished version of your concept, including 7 to 9 renderings that show the imagined product, communicate use case, highlight both broad strokes and details of the design, and demonstrate minor pivots. There should be minimal to NO text on each of these pages, and any text should be limited to design specifications that are difficult to capture on paper (for example, if a part of your product must be a specific kind of metal or plastic). Color and form should be used strategically to both communicate the goals of the product and to make it visually and rhetorically inviting (see the header image for one example of this).

The craft expectations for each page are very high. Students **must** use the assigned Bristol paper for their pinups, as well as the assigned markers to ink (and, if necessary, color), their design concept. Pencil sketches, tears in the paper, coffee stains, and/or generally undercrafted or sloppy work is unacceptable, and will result in a "0" for the thumbnail/pinup. Success on the thumbnails does not require that the student be an excellent artist. Rather, success will be judged through the time and craft put into the pinup, and the thoughtfulness of communication that the student has placed into the pinup. Doing rough sketches in your personal design notebook before preparing your thumbnails and concepts is highly recommended.

Design Reports:

For every Design Challenge Assignment, the student or group will turn in their final build and a Design Report that contains each of the following:

1. A title page that gives the name of the product, the names of each group member (or individual), and an "abstract" that describes the product in three or four sentences
2. A PDF of photos of the prototyping process, with image captions and descriptions under each image
3. A PDF of "beauty shots" of the final product, as well as the product being used, with image captions and descriptions under each image. **For the final two assignments, the beauty shots must be CAD renders using Rhino and Unreal. The expected craft of these renders will increase as students become more familiar with CAD and the rendering process.**
4. A design process statement: a 1000 word statement that describes the group's design process, the feedback from user testing sessions, and design iterations. The Design Process includes Problem Definition, Ideation, Prototyping, Building, and Testing. **The process section should demonstrate both what and why, materially and experientially, and the included user test feedback must be clear and specific.**

5. A user statement (1000 words):
 - a. You are to identify the user group(s) targeted in your project. **You should be as specific as possible in describing shared attributes of the targeted users**, focusing particularly on those dimensions that make this target user group distinct not only from dissimilar groups but also from apparently similar groups. Obvious but generalized attributes include demographic characteristics (e.g., age, gender, income), socioeconomic class, education level, geographic context, and physical and mental status as relevant. Less obvious generalized attributes may include orientation toward consumer product innovation, high tech, (formal) design, environmental sensibility, etc. Specific attributes may include stylistic preferences, popular (media, culture) reference points, work pattern preferences, etc.
 - b. **This is a “social analysis,” not analysis of a random group of people, so be sure to talk in terms of social groups and their needs, wants, desires, and expectations.** Remember that designing for “everybody” is not really possible and is rarely desirable. The instinct to broaden or rearrange priorities when targeting user groups is a good one, but if you don’t understand the boundaries of your audience, you won’t be effective in reaching new user groups. Design for “everybody” is usually a euphemism for designing for “people like me” or for “middle-class American consumers.” What are the strengths and benefits of attending to the chosen group? What trade-offs do you face as a designer having selected this target user group?
 - c. To be analytically robust, you must be mindful of stereotypes as you characterize user groups. Critical reflection on your initial assumptions about the user group you have selected early in your thinking and writing process will result in stronger and more insightful analysis.
 - d. As always, you must submit a *refined* paper for this assignment. **It should include a short introduction laying out the terrain to be covered, a logically organized body that develops a clear line of argument, and a brief conclusion statement summarizing your argument.** Papers should use gender-fair language and be free of typos and writing errors.
6. A 500 word section that should be technical in nature, which would allow a manufacturing team to build your design accurately. This should include both detailed descriptions of the product, as well as material and measurement diagrams, and low-fidelity exploded views where appropriate.

The report will be graded on both the strength of the analysis and also on the strength of concept. These elements are tightly wound together.

The report will be compiled as a single PDF, and submitted to the LMS site. For group assignments, each group need only submit one collective PDF.

Design Challenge 1: Studio Object Design/Redesign

Group Size: Individual

Concepting Requirements: 1 thumbnail page and 1 polished pinup page

This project entails the design (or redesign) of an object for use in the PDI studio. There is some flexibility in the type of object you choose to design, but it must be something that users *physically* interact with and it must be directly relevant to the use of the studio—by instructors, students, visitors, maintenance staff, etc.

This is an *individual* project, so the objects you select for (re)design should be simple enough that you have sufficient time for each of the following steps (informed by the design process reviewed in DSIS Studio 1):

- detailed design decision making, including appropriate iteration;
- background and mid-stream research;
- object representation including detailed sketches and modeling using 3-D software; and
- a series of progressively detailed mock-ups/prototypes representing innovative components/features of your concept.

You may collaborate with your classmates in the framing of problems and you may share your research and your design progress, but what you submit for grading at the end of the project must be the results of your own labor. All sketching/modeling, all reported research findings, all prototyping, etc. must be your own unless you note otherwise. (If you want to use someone else's research findings because they are relevant to your project, that's fine as long as the work in question is clearly attributed to its source.)

You should attend carefully and systematically to usability and the emotional experience created by both your proposed design and all its supporting components, including the prototype/mock-ups and within the presentation.

This project is intended to be narrow and deep. Keep in mind, the simpler the object being (re)designed, the more attention you can pay to all the required supporting work. Thus, you are strongly encouraged to select a simple object and pay careful attention to all the details rather than over-reaching by selecting a more complex object and paying insufficient attention to detail. (Project 3 will be a more complex project, developed in teams, to provide a broader experience.)

Your designed objects may employ any materials in any configuration as long as you can justify your decisions appropriately. Material choices in particular affect cost, environmental impact, and aesthetics in addition to functional performance.

Design Challenge 2: Design History Redesign Series

Group Size: 2 Members

Concepting Requirements: 1 Moodboard, 1 thumbnail page, and 2 polished pinup pages

This project entails the redesign of a product series through the lens of a notable designer, design group, or design company. Student Groups will be assigned a problem statement and designer, and will have to find solutions to that problem statement using the aesthetic, philosophical, social, and manufacturing priorities of their designer. For designers that have had a long and varied career, student groups must select a particular period of that designer's work to emulate.

The problem statement is both broad and specific. It will identify a particular user experience problem (e.g., "I am cold at night"), but will not identify the user themselves. The student groups must decide on an imagined user group for that problem statement. This decision is important, as it will direct their design decisions and user testing protocols (i.e., you must test your product with the chosen user demographic). However, students have wide latitude in interpreting the UX problem (there are many reasons why an individual may be cold at night, and there are infinitely more potential solutions to that problem).

A constraint of the project is that student groups must design a product series (of three objects) as the solution to the UX problem, and that series must be recognizable as products that are intended for home consumer use (think, “what would I find in an IKEA, or in the home goods section of a Target?”). Students are allowed a wide gamut of the variability of the individual objects in a product series. The three objects may be similarly-themed pivots off of a single concept (e.g., three kinds of forks); a continuum of related objects (e.g., a fork, a spoon, and a knife), or a set of three interrelated objects (e.g., a sugar spoon, a teapot, and a breakfast tray). Importantly, the objects must be recognizable as a set to users.

Often, that recognition will manifest through the interpretation of the assigned designer’s style and philosophy upon the object series (for example, what might a set of spoons designed by late-career Frank Lloyd Wright look like and operate like?). Though the assigned designers will have a wide array of product and architectural examples, they will not have developed many (if any) of the user problems assigned to the student. The student must be able to identify how the priorities of their designer have translated into a new medium. **The student should also take into account the designer’s audience when constructing the “who” of their project.** For example, if the students’ assigned designer is explicitly working in a decolonial way, the user prompt should reflect that, as should the design research.

Student groups must balance their designer values with their growing knowledge of user testing and experience—not all of the designer’s choices or styles will be good ones for the users of your product series. Through a combination of user testing, multiple iterations of design, and application of the principles covered in class, student groups must also continue to make the product useable for a target audience.

This project will entail:

- A mood board/historical research of your designer and their design philosophies and practices
- A **critical interpretation** of those practices
- Multiple physical prototypes
- A design report that includes a description of their assigned designer
- A formal presentation with prototypes and beauty shots

Design Challenge 3: Open Design

Group Size: 3 Members

Concepting Requirements: 1 thumbnail page and 2 polished pinup pages

This project entails the design (or redesign) of a *real-world* object of your choice. As with Project 1 and 2, you should pay particular attention to questions of user experience, usability, and formal/aesthetic dimensions of the design: How does the user interact with and psychologically/emotionally experience your designed object? How do the product’s form, surface, and details provide the user cues as to how it should be engaged? How have you improved user experience compared to existing products?

There is considerable flexibility in objects to be designed for this project, but the objects should be something you can prototype and actually *put in the world for detailed user interaction and testing* (for complex objects, you may prototype salient components of the larger object). Your designed objects may employ any materials in any configuration as long as you can systematically justify your decisions, though they must still fit under the broad category of “things you could find in a home goods store.” Material choices in particular effect cost, environmental impact, and aesthetics in addition to functional performance. Mechanical contraptions are allowed, but

strongly discouraged. I cannot stress enough: the more complicated the object is mechanically, the more complicated will be design and prototyping, the more difficult it will be to keep the form simple and elegant, and the less time you will have for user experience design.

This assignment entails:

1. A professional **design report** highlighting research findings and delineating relevant design specifications, including generous use of appropriate 3D visualizations of your design);
2. A series of **mockups and prototypes** of your proposed design in suitable materials and appropriate resolution for each stage of design, with a *high-res* prototype;
3. A **stand-alone poster** that communicates the design concept, the problem it solves, and its key features in terms of usability and aesthetics; and
3. A **formal presentation** with prototypes.

Attention to user experience, usability, and formal/aesthetic characteristics should be given to all components of this project, including supporting documentation. This project is intended to provide a broader design experience than Project 1 and 2, but you must also achieve considerable *depth* in your project's design. *User experience should be addressed explicitly and systematically across all facets of your project.*

Modeling Challenges

Group Size: Individual

Students will be presented with three Modeling Challenges throughout the semester—2-week, highly constrained modeling sprints that are designed to both students to push their modeling and texturing work beyond the foundational lectures covered in class, as well as to demonstrate their growing competence with Rhino and Unreal. Students will be assigned a particular object or scene to model, texture, and light, and must submit both renders of their assignments, as well as the Rhino or Unreal files used to construct the scene.

Grading will be based upon demonstration of the understanding of Rhino and Unreal toolsets, as well as on the aesthetic qualities of the final renders and attention to detail in modeling, texturing, and lighting. There are many ways to model and texture the same object or scene, so students should feel free to take a modeling or texturing approach that they feel will yield the best end results. For each assignment, students should be paying special attention to:

Challenge 1: Form and curvature, detail modeling, manufacturing seams, physically-real edges, internal form (where appropriate).

Challenge 2: Displacement, alpha, material properties, physically-real wear, fidelity in close-ups and distance shots.

Challenge 3: Shadow maps, appropriate lighting for chosen time of day, physically-real wear, non-duplicated appearing objects, volumetric effects, realistic lighting, shading, reflection, fidelity in close-ups and distance shots.

NOTE: Using software other than Rhino or Unreal to complete the modeling challenges is considered cheating and will result in a “0” for the project. The use of software like Photoshop, however, is permitted for the design of textures, orthogonal sketches, displacement maps, etc.

For **each assignment**, students will submit a Zipped folder to LMS that contains:

- 3 - 5 “Beauty shots” of your result

- 5 – 15 “In progress” screenshots of your modeling process, detailing the major steps you took to create the model.

Each image should follow the filename convention of:

Lastname_BeautyShot_#.PNG

Or

Lastname_ProcessShot_#.PNG

Schedule:

Week	Assignments Due	Tuesday Class (Discussions & Studio)	Friday Class (Lab & Studio)
Week 1, January 14th and 17th		Welcome & course overview Discuss: <i>What is good user experience?</i>	3D Modeling Basics Introduction to Rhino (Box, Hole, Glass)
Week 2, January 21st and 24th		Read: “On Placing Design,” by Robinson	Lofting simple surfaces, working off of reference images
Week 3, January 28th and 31st	Project 1 Pinups Due in Tuesday Class	Read: <i>DOET</i> Ch 1 & 2	Complex surfacing Rhino Challenge 1 Assigned
Week 4, February 4th and 7th	Project 1 Rough Prototype Due in Tuesday Class	Read: <i>DOET</i> Ch 3	Roughing out concepts in CAD, Subsurface modeling
Week 5, February 11th and 14th	Project 1 Final Report Due Monday Night	Read: <i>DOET</i> Ch 4 & 5 Project 1 Presentations	Read: <i>DOET</i> Ch 6 Project 1 Presentations
Week 6, February 18th and 21st	Makerspace Training Must be Completed	NO CLASS: President’s Day, Follow a Monday Schedule	Advanced modeling techniques (blocks, displacement, rendermesh)
Week 7, February 25th and 28th	Complex Curvature Rhino Challenge 1 Due Monday Night	Read: “Re-Enchanting the Commodity: Nazi Modernism Reconsidered,” by Betts	Texturing 1: Prepping UVs in Rhino, Importing to Unreal
Week 8, March 3rd and 6th	Project 2 Moodboard and Pinups Due in Tuesday Class	Read: “The Nierentisch Nemesis: The Promise and Peril of Organic Design,” by Betts	Texturing 2: PBR Basics Rhino Challenge 2 Assigned

Week 9, March 10th and 13th	Spring Break		
Week 10, March 17th and 20th	Project 2 Rough Prototype Due in Tuesday Class	Read: "Why Can't the US Decolonize its Design Education?," by Anderson	Texturing 3: Complex materials, animated/procedural materials
Week 11, March 24th and 27th	Project 2 Detailed Prototype Due in Tuesday Class	Read: "Probes, Toolkits, and Prototypes" by Sanders and Sappers	Lighting 1: Basic Lighting
Week 12, March 31st and April 3rd	Project 2 Final Report Due Monday Night	Project 2 Presentations	Lighting 2: HDR, environmental lighting
Week 13, April 7th and 10th	Complex Textures Rhino Challenge 2 Due Monday Night	<i>Stuff</i> Preface & Ch 1	Read: <i>Stuff</i> Ch 2 Final CAD Challenge Assigned
Week 14, April 14th and 17th	Project 3 Pinups Due in Tuesday Class	Read: <i>Stuff</i> Ch 3	Read: <i>Stuff</i> Ch 4
Week 15, April 21st and 24th	Project 3 Rough Prototype Due in Tuesday Class	Read: <i>Stuff</i> Ch 5 & 6	Read: <i>Stuff</i> Ch 7 & 8
Week 16, April 28th	Project 3 Detailed Prototype Due in Tuesday Class Presentation, and Tuesday's Class	Final Presentations	
Finals Week, First Week of May	Project 3 Final Report Due Monday Night, May 4 th Poster Due to Jim's office (West 403) by May 8 th	Final Report	CAD Challenge 3 Photorealistic Lighting Final Challenge Due May 8 th

Late Assignment Policy:

Pinups and Prototypes are due at the beginning of class. Writeups and Project Reports are due to LMS at the end of the day of their due date. Late assignments will suffer a penalty of one letter grade for each day late.

Attendance:

Students are expected always to be present during class and recitations. Attendance will be taken at the beginning of each class. Excellence in submitted work will not make up for delinquency in attendance. **More than three unexcused absences will result in a lowering of your final course grade by one mark for each unexcused absence after 3. More than seven absences will result in the failure of the course. Three late arrivals will equal one missed class.** If you must miss a class, assignments are due before the class period begins. Excusable absences include illness, family emergencies, and scheduled Rensselaer athletic events. All excused absences must be delivered to the professor via the Office of Student Life.

Academic Integrity:

Student-teacher relationships should be built on trust. Students should be able to trust that teachers have made responsible decisions about the structure and content of the courses they teach, and teachers must trust that the assignments students turn in are their own. Acts that violate this trust undermine the educational enterprise and contradict the very reason for your being at Rensselaer. *The Rensselaer Handbook of Student Rights and Responsibilities* defines various forms of academic dishonesty and procedures for responding to them. The policies laid out in the *Handbook* are intended to maintain a community of trust and will be strictly enforced. Please review these policies.

For this course, the following penalties will apply:

- Significant acts of plagiarism (e.g., text copied verbatim from an unidentified source): Failure of the course and a written judgment in the student's official record
- Minor acts of plagiarism (e.g., referencing the findings of others without appropriate citations): Failure of the assignment, plus reduction of final course grade by one letter grade

Other acts of academic dishonesty: Penalties range from a warning to reduction of final grade by one letter grade to failure of the course, depending on the severity of the violation as determined by the instructor. As is evident above, penalties for plagiarism are significant. All direct use of another person's words must be placed inside quotation marks. You must also indicate where you paraphrase another's work and where you borrow another's specific ideas or interpretations. If you have questions regarding proper citation practices, see the instructor for clarification *before* the assignment is submitted. While collaboration is encouraged throughout the course, others cannot do work for you. All assignment activities must be carried out by the individual or team members submitting the assignment for a grade. Other people may show you *how* to do something (say, when using computer software), but you must follow up by doing the work yourself. *The Rensselaer Handbook* provides specific procedures by which a student may appeal a grade. You should speak to the professor before initiating an appeal. If this does not lead to satisfactory resolution, you have the option of appealing your grade by writing to the head of the STS Department no later than 10 days after your grade has been posted.