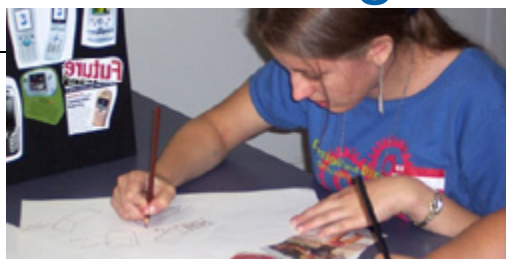
Session 11

Design Requirements and Drawings

Making, Modeling, and Materializing



In This Session:

A) Checking in on the Design Process (45 minutes)
- Student Handout

B) The Perfect Fit: Meeting Needs Through Design (45 Minutes)
- Student Handout
- Student Reading

C) Conceptual Drawing: Thinking on Paper (60 Minutes)
- Student Handout
- Student Reading

In *Design Requirements and Drawings,* you will refine your design efforts with product requirements and drawings. In *11A: Checking in on the Design Process*, look at a checklist of steps that follow the design process to determine how far you've come, and look ahead to the next steps. Next, in activity *11B: The Perfect Fit: Meeting Needs Through Design*, learn how a designer considers the needs of the user to define minimum requirements for a design, and then develop design requirements for your own project. In a third activity, *11C: Conceptual Drawing: Thinking on Paper*, learn how drawing helps the thinking process, then put pen to paper to make a series of conceptual drawings. By the end of the session, you should have a more fully developed project and are ready for the next steps, modeling and testing your ideas.

Checking in on the Design Process

Handout: Session 11, Activity A

The Design Process: Getting From "Think" To "Thing"
The checklist below is adapted from the design process steps. This is a tool to keep you organized and thinking about where you have been and where you want to go.

1. Identify a design opportunity. (Session 7)

- ☐ Identified many design opportunities (needs, problems, or cool things to design).
- ☐ Narrowed the list of opportunities to three for further research.

2. Research the design opportunity. (Session 7)

- ☐ Refined my design opportunities with interviews and other data-gathering research.
- ☐ Selected one design opportunity to address.
- ☐ Wrote a problem statement to clarify and explain to anyone what I will solve with a design solution.

3. Brainstorm possible solutions to the problem. (Session 7)

- ☐ Expanded my possible solutions using SCAMPER and other research.
- ☐ Evaluated my solutions using criteria that we determined.
- ☐ Narrowed my solutions to three possibilities.
- ☐ Began thinking about the types of materials I could use for my solutions.

4. Draft a Design brief. (Session 8)

- ☐ Wrote a design brief with a problem statement, a description of user needs, a proposed solution, and a sketch of the solution.

5. Research and refine your solution. (Session 9)

- ☐ Researched and refined my proposed solution using the U.S. Patent Office Web site and other resources.
- ☐ Took notes and wrote down information from my research.
- ☐ Interviewed experts and possible users to analyze my project for feasibility, safety, and other implications of my solution.
- ☐ Researched materials and methods that would be appropriate for constructing my project.
- ☐ Conducted a project analysis to consider any changes to my solution.

11A Handout: Checking in on the Design Process (continued)

6. Prepare design requirements and conceptual drawings. (Session 11)

- ☐ Developed design requirements that focused on the needs of the user.
- ☐ Completed conceptual drawings.

7. Build models and component parts. (Sessions 12, 13, and 14)

- ☐ Analyzed my project design for its systems, components, and parts.
- ☐ Planned models to build and what each model would test or be able to demonstrate.
- ☐ Built a model or models of components of my design.
- ☐ Developed a project plan for completing my design.

8. Build the solution prototype. (Session 15)

- ☐ Conducted further research, model building, and testing, as needed to complete a working prototype.
- ☐ Developed specifications.
- ☐ Completed first working prototype.
- ☐ Analyzed prototype for functional improvements.

9. Test, evaluate, and revise your solution. (Session 16)

- ☐ Prioritized improvements needed and built new or revised prototype to meet priorities.
- ☐ Evaluated prototype for function, feasibility, safety, aesthetics, and other criteria.

10. Communicate the solution (Session 18)

- ☐ Presented my solution to an audience.
- ☐ Gathered feedback and made appropriate changes to prototype.

The Perfect Fit: Meeting Needs Through Design

Handout: Session 11, Activity B

Your Design Requirements

Now consider the user of your product and what requirements might be necessary in order to meet the needs of the user. Refer back to the character identities and scenarios that you did in *8A Handout: User Profile*. Make a chart like the one below in your notebook and fill out the requirements.

User Needs	Design Requirements

The Perfect Fit: Meeting Needs Through Design

Reading: Session 11, Activity B

Many products have been improved when the needs of the user were given a closer look, including the Terry* bicycle. After looking at this design innovation based on the users' needs, you'll consider the needs of your intended users.

A Closer Look at Design Requirements: The Terry Bike Success Story
Georgina Terry, a bike racer, felt disadvantaged when she raced using a man's bike. She thought she could perform better if the bike fit her better. Even though she had a bicycle that was designed for a rider her height, and even though she had adjusted the seat and handlebars just so, it still didn't seem right. She realized that her bike might be designed perfectly for a man her height, but a woman is put together differently, and needs a different bike design.

She looked into the physical differences between men and women, and here's what she found out: When a woman and man of the same height are compared, the woman typically has longer legs, shorter arms, and a shorter torso than the man. She has smaller hands and feet, a wider pelvis, and less muscle mass as well. Design requirements for a women's bicycle emerged from her research:

User Needs	Design Requirements
Shorter arms and torso	Shorten the distance from the handlebars to the seat (the cockpit length) by making the top tube length shorter.
Smaller hands	Shorten reach to brake levers.
Narrower shoulders	Make narrower handlebars.
Shorter legs	Shorten crank arms for more efficient spin.
Smaller bicycle frame causes toe-wheel overlap	

The Problem
When a bike is sized more compactly for women, a new problem arises. The tight geometry of the racing bike doesn't work with regular racing wheels; you run into toe-wheel overlap, where the tips of your shoes hit the front wheel when turning and pedaling at the same time.

The Solution
How do you think she solved this problem? After studying pictures of a Terry bike, what was her solution? Add her solution to the design requirements chart above.

The Terry bicycle is popular with women, because, as she puts it, "a woman isn't just a smaller version of a man." In her first year, 1985, she sold 20 women's bikes; the following year, 1,300;then 5,000, and today it's a multimillion-dollar enterprise.

Conceptual Drawing: Thinking on Paper

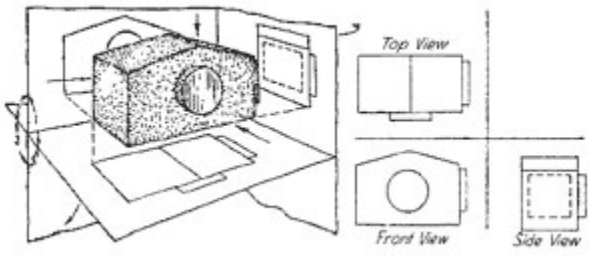
Handout: Session 11, Activity C

Drawing From All Sides

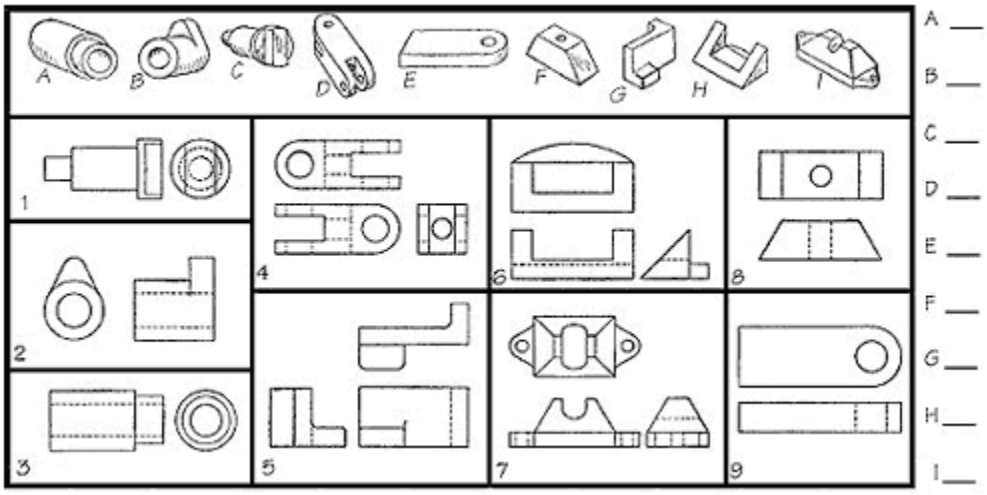
Drawing your ideas can help you visualize your plan and will be very useful when you make your model. You may find it helpful to draw the different components and parts of your project—from different perspectives. You will probably have several drawings of your project as your ideas evolve.

This activity begins by learning some basic mechanical drawing techniques. You'll learn how to draw a line and a circle on graph paper. You will then use these techniques to draw an object in the room. This should be done in your design notebook.

1. Compare the 3-D drawing of the object below to the three views of the object on the right. What do the three views show you about the object that you didn't know from the 3-D version?

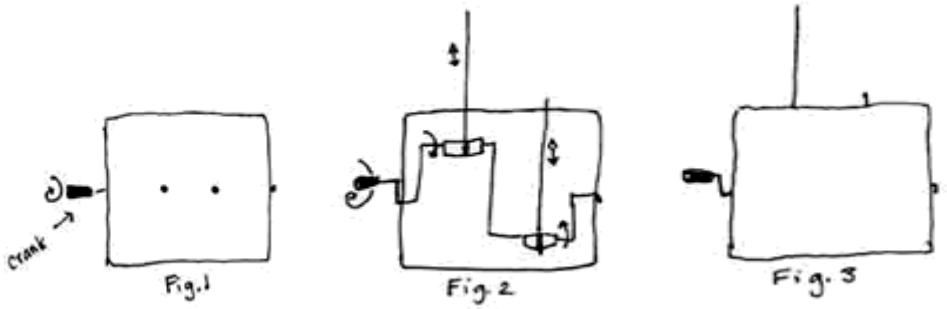


2. Match the object in the top row with its orthographic sketch.

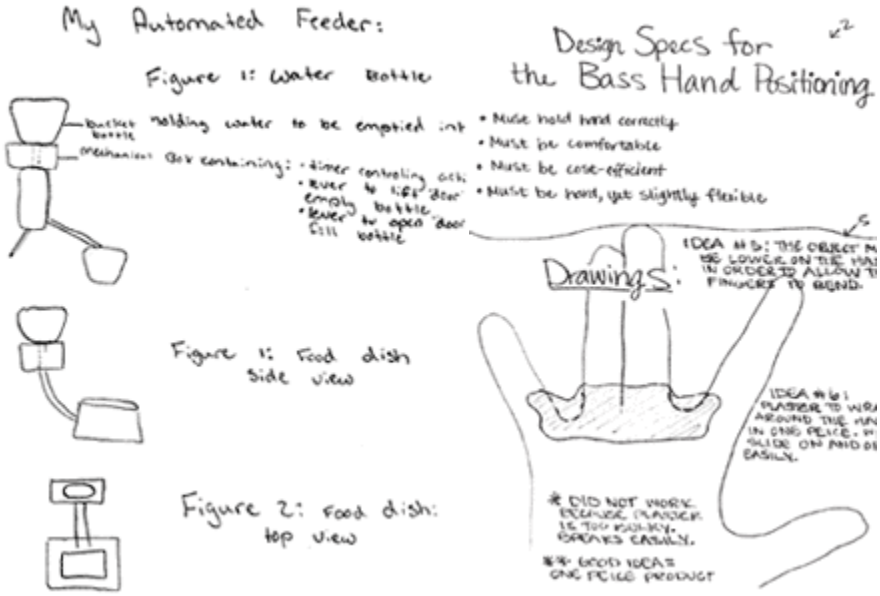


11C Handout: Conceptual Drawing: Thinking on Paper (continued)

3. What object is shown here? Label the different figures: interior, top and side.



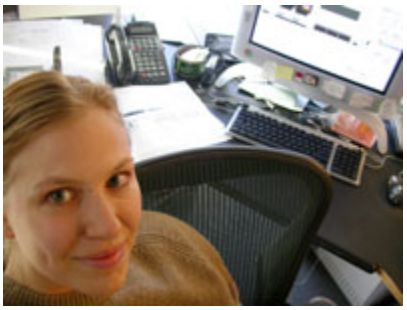
4. Here are some samples of past *Design and Discovery* students' drawings. Can you tell what they are?



5. Now, in your design notebook, try your hand at conceptual drawings for your project. Be sure to draw different views as well as individual drawings of the components and parts. Make many drawings. You can't have too many. Make your drawings large enough to label components and show the direction of any movement that may be appropriate to your design.

Meet a Communication Designer

Reading: Session 11, Activity C



Chelsea Vandiver
Senior Communication Designer
ZIBA Design

Introduction
Hello, my name is Chelsea Vandiver. I am a senior graphic designer at ZIBA Design. I studied graphic design at the University of Washington. After graduation, I worked as a conventional graphic designer, designing packaging, letterheads, and brochures that were destined for the recycling bin days after coming off the printing press. I didn't find the work satisfying. I knew that I wanted to add value, not clutter to people's lives. Fortunately, I found a job at a product development firm. Now, at ZIBA Design, I work on projects like signage systems, user interfaces, and products that improve people's day-to-day lives.

A Typical Day
I spend a large part of my day participating in collaborative brainstorms and work sessions with an inspiring group of product designers, environmental designers, brand specialists, and engineers. The beauty of working together on a multidisciplinary team is that the result is larger and greater than what any of us could have developed on our own.

Challenges
I've worked at ZIBA Design since 1997, and every day I learn something new. Each project has its own set of unique challenges that force me to continually grow and expand in new ways.

Advice
My advice to younger people entering the design or engineering field is to not be afraid to collaborate and share your work with your friends and teachers.

About ZIBA Design
ZIBA Design is an international design firm that has designed products for many global companies, including FedEx, Microsoft, Intel, Fujitsu, Black & Decker, Sony, Pioneer North America, Dial, and Clorox. www.ziba.com*