Session 12

Planning for Models and Tests

Making, Modeling, and Materializing

In This Session:

A) Thinking Again About Design (45 minutes)
- Student Handout

B) Materials and Modeling Plans (45 Minutes)
- Student Handout
- Student Reading

C) Structural Considerations (60 Minutes)
- Student Handout

Planning for Models and Tests prepares you for building models and testing systems or components of your design project. This is Step 7 of the design process. In an opening activity, *12A: Thinking Again About Design*, review your experience of the design process and think about your revisions up to now. You'll notice that the design process is not linear; there are cycles or iterations of review, testing, revision, and change. In the second activity, *12B: Materials and Modeling Plans*, survey available materials for constructing models and plan your first constructions. In the final activity *12C: Structural Considerations*, learn about collapsible objects and the principles of collapsibility related to storing, moving, and assembling their projects.

Checking in on the Design Process

Handout: Session 12, Activity A

The steps of the design process rarely happen one after another but often are repeated or revisited in many cycles (or iterations) of change that lead to improvements. For example, drawing your idea may have caused you to revise your requirements in some way. In fact, with each step in the process that makes your idea more real (moving from "think" to "thing"), revisions can get more comprehensive as you see new ways of looking at your idea—you might even throw out a solution and go back to an earlier idea.

It's time to make project ideas tangible—to go from what's in your mind to things in your hands. You are now at the stage of building models—a way to test, revise, and improve your design. Models allow you to see your idea as a "trial run." You might build a model to test dimensions and fit between components. Or you might build a model to test a mechanism or some system in your project. Eventually you will build a prototype—a model that works.

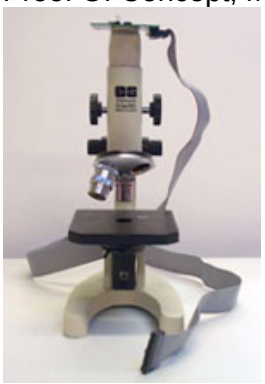
Model: A small but exact copy of something
Prototype: A working model of a machine or other object used to test it before producing the final version

Even your first working prototype will go through revisions. Follow the progression of prototypes that resulted in the Intel QX3 microscope:

QX3 Requirements

- Fun to use computer microscope
- Meet $99 retail cost target
- Must really work technically
- Must be mobile, capture images at the source
- Easy to use; plug-and-play simplicity
- Everything included ("just add specimen")
- No batteries, no AC adapter, no external lighting
- Fully exploit computer capabilities: capture, time lapse, collection, printing

Proof Of Concept, May 1998



This is the first model to test the concept of transferring a magnified image to a computer for viewing, saving, and manipulating. This is a demonstration or "works-like" prototype. It used a standard off-the-shelf microscope, external lighting, with circuitry and a ribbon cable for connection to the computer. It was tested with kids to see if they felt that a computer-connected microscope had "play value" (was fun). It also allowed the engineers to ask kids questions about what they would want to look at and what magnifications were interesting to them.

Microscope in a Box, May 1998

This version was an exciting breakthrough... in function. The box fit in your hand and included the necessary lighting and electronics for capturing the image. It proved that you could take the microscope to what you want to see instead of bringing the object to the microscope. Clearly, this version proved the function (with form to follow). The key was that this prototype had the light source on the top (as opposed to the bottom for conventional microscopes). It didn't have a base and could be pointed at just about anything in the environment. It allowed children to explore objects that were opaque or too large or heavy to fit under a traditional microscope. This was a major fun feature. Kids wanted to look inside their mouth, in their ears, and the weave on their sweaters, their pets, and so on. This later became the "handheld" mode of operation of the QX3 product, where the unit can be lifted out of the base and used exactly like that.

A First Look, June 1998

This version is all form and no functionality; it was the very first industrial design foam model to combine the traditional microscope mode (in the base) and handheld mode into a single design. The vertical piece is removable. This model represents desired form (without function). This version was developed prior to knowing the size and dimension specifications.

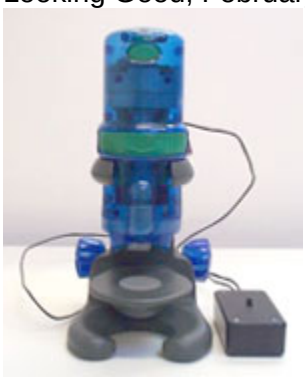
A Working Prototype, October 1998

Here is the first working prototype with full functionality. It works, but the wires on the outside belong inside. The ideal shape or color weren't right yet, and the designers didn't know yet what they should be.

Getting Closer, January 1999

This second working prototype has functionality, but the power supply is still on the outside. This one was called the "albino" model. The shape is very close to final. The engineers knew that everything inside (electronics, optics) would fit inside this shape; it also fit the size of kids' hands well, and looked good.

Looking Good, February 1999



This version tested a new look for a debut at a national toy tradeshow. It looks good with transparent plastic, but it wasn't fully functional—the power supply was still external.

Presenting QX3, September 1999

The final product—the QX3 is born!

Materials and Modeling Plans

Handout: Session 12, Activity B

In this activity, you will start to plan your model. Like anything, the more planning you do in advance, the better your chances of achieving what you want. It's best to put answers to the questions below in your design notebooks.

1. What do you want or need a model of? (List at least three possibilities.)

2. For each model possibility, consider the following questions and answer them in your design notebooks:

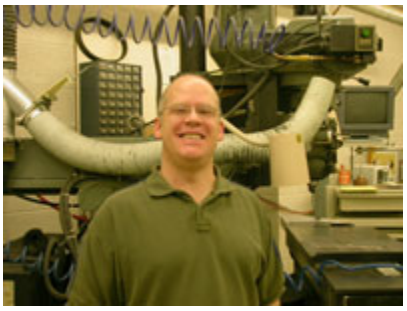
    - Is this a system or a component of your design project?
    - What will this model help you understand about your idea?
    - Will it be a small or full-scale version?
    - What will you need to build it?
    - What materials on hand will work for your model?
    - What is not on hand for building your model?

3. As you plan, you may select and manipulate different materials. Be sure to make notes about the materials that you study: their flexibility, strength, and suitability as a modeling material.

Tip: When planning your model, it is better to plan to build a bigger model so that the details can be seen, tested, and understood.

Meet a Modelshop Manager

Reading: Session 12, Activity B



Bruce Willey
Modelshop Manager
ZIBA Design

Background
I'm originally from St. Paul, Minnesota. I've worked at ZIBA Design for almost eight years. I decided to study modelmaking after I had graduated from college and taught English in Japan for two years. I enrolled at Bemidji State University in Minnesota and took Industrial Technology and modelmaking courses for two years. I performed a three-month internship at an architectural modelshop in Boston, Massachusetts. After that I got a job at the Industrial Design Center for NCR in Dayton, Ohio. I worked there for five years, then I visited Portland, got a job offer, and moved here. I became the manager of the modelshop about four years ago. In each case, my managers and co-workers have mentored me. Since a new person often brings new skills into a workplace, I sometimes have taught my manager and I've been taught by those who work for me.

A Typical Day
In a typical day I discuss the current and upcoming work schedule with the other modelshop staff and project managers and their team members who bring us the work to do. I will often order modelmaking supplies by phone or Internet from a variety of vendors, and I might have to arrange to have an outside modelshop do work for us if we don't have the time or resources. I have to fill out paper or electronic forms to order things or hire outside shops or schedule projects. There is a project meeting or a group meeting or a management meeting or a brainstorm meeting on almost any given day.

If there is still any time left or if there is a tight deadline, I will do model work too. Sometimes that is just spending a couple of hours painting things or using a table saw or band saw to cut material up and using hand tools like chisels and files and sandpaper to form it. Sometimes I work on very complicated models that take weeks to finish and involve planning, measuring, using computer aided design (CAD) and computer aided machining (CAM) software, sanding, polishing, painting, and careful assembly.

Favorite Thing About Job
I like having such a wide variety of different activities to do every day.

12B Reading: Meet a Modelshop Manager (continued)

Advice To Young People

You have to decide if you are interested in how things go together and work. You should be comfortable using tools and working with your hands. You will be using math and science and art skills. Any kind of commercial and industrial arts classes and art or craft classes or hobbies will help you a lot. All designers and engineers and almost all modelmakers use computers very frequently. Take computer classes and classes that expose you to advanced technology. Watch carpentry shows and similar programs to see if you are interested in solving problems by designing and making things.

About ZIBA Design

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

Structural Considerations

Handout: Session 12, Activity C

Have you ever noticed how many products change shape depending on their usage or non-usage? For example, an umbrella is quite different when in use and when not in use. In this activity you will study collapsible items and make structural considerations for your project.

1. In your notebook, fill in the "Examples" for each Collapsible Principle like chart below. These may be items that are in your class or items that you discuss.

Collapsible Principles	**Definition**	**Examples**
Stress	Something that is stressed (compressed) for storage and relaxed for action Something that is stressed (stretched) for action while relaxed for storage	
Folding	Soft materials that are flexible and directionless can be folded to create new direction	
Creasing	Something that can be folded along preset lines or creases giving an object (folded and unfolded) a neater appearance; may also facilitate the act of folding and unfolding	
Bellows	Used where a flexible and sealed connection is needed	
Assembling	Something whole is separated into parts for storage	
Hinging	Objects with flexible joints	
Rolling	Objects that are rolled and unrolled repeatedly	

12C Handout: Structural Considerations (continued)

Collapsible Principles	Definition	Examples
Sliding	Collapsibles that expand and contract as their parts slide open or closed	
Nesting	Two or more objects that fit together to occupy less space than they do individually	
Inflation	Something that blows up to expand	
Fanning	An object that has a pivot that holds its leaves together to allow multiple leaves to be viewed at the same time	
Concertina	Collapsibles that have a number of equal rods connected by pivots to form a string of Xs which can be expanded and retracted	

2. What structural principles would improve your project? Consider the following questions:

   - How will your project be stored?
   - How will your product be moved?
   - Will your product need to be disassembled? If so, how?