Rochester Institute of Technology

A thesis submitted to the faculty of the

College of Imaging Arts and Sciences

in candidacy for the degree of

Master of Fine Arts, Industrial Design

Form and Visual Cues:

A Workshop for Graduate Design Students

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July 19, 2010

Form and Visual Cues: A Workshop for Graduate Design Students

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_____ Date: _____

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Abstract

Product development timelines are shrinking and simultaneously, products are becoming more complicated. Designers have little time to allow products to iteratively evolve into their most intuitive forms. The result for the consumer is often a steep learning curve via thick instruction manuals, cheat sheets and "quick-start" guides. In contrast, an object such as a water pitcher contains virtually all the information needed to successfully use it right away- everything is either communicated by the form itself or quickly discovered through simple explorations.

In 2001-2003, when I attended RIT, the graduate industrial design curriculum did not include a class solely based on design principles. Many graduate ID students at RIT come from other disciplines with limited exposure to design principles or theories of cognitive psychology. So after research into the work of Christopher Alexander, Irving Biederman, JJ Gibson, Rudolph Arnhiem, and Donald Norman, etc. I created a one-day graduate workshop to teach a number of related design principles and cognitive psychology theories towards more effectively using physical form to improve a product's semantics.

This paper describes the workshop material as well as student work created in the workshop. Successful application of the workshop material by the students who attended suggests that RIT ID graduate students would benefit from a full quarter class based on these theories and principles.

Introduction

I'm not sure when I started to perceive a "hole" in the graduate ID program. At times, I felt somewhat like the dog ate various pieces of my new jigsaw puzzle but it was too early to tell which ones! Resolving those feelings led to this project.

When I decided to change careers and earn a Master's in Industrial Design at RIT, I imagined I would learn how to create products that look nice and actually work too. That happened, but we spent a lot of time in seminars, some of which didn't offer much to the study of ID.

I never previously studied ID so many other required studies built practical skills such as concept sketching and technical drawing. Most of my graduate classes emphasized user-centered design and green design. After a while, I felt I was learning very important things towards becoming a good designer but not everything. Yes, being able to sketch well in order to communicate a concept is important, but there must be more to creating a good product than that? Certainly some excellent products start with a sketch in very poor perspective and many terrible products start with a sketch that belongs in a frame.

I thought maybe whatever I was looking for was so basic that it seemed unnecessary to speak it, and so it remained unspoken. Maybe I needed some combination of things caught sooner or later through "osmosis," which is the way I imagine most undergraduates learn how to be a designer. That is, some concepts don't have a specific class; rather those concepts are difficult to define and instead picked up little by little throughout the entire program and each student picks out the pieces they need most.

As a graduate student, I didn't have the luxury of time and repetition that most undergraduates do. Many graduate students can probably utilize theoretical concepts efficiently, but theory seemed to take a back seat to the seminars and practical skills. Much of the best ID work is initially felt, or responsive. That didn't help my situation- I felt a lot of things. How could I put my various feelings into the right context? As the time came to choose a thesis topic, few of my classes answered my still unarticulated questions or developed certain sensitivities regarding form, function, and aesthetics.

I continued and focused on why some products seem more inviting, and others less so. Why are some products easier to use and understand than others with similar features? Does a cell phone really need to be so complicated, with all those features buried in forgotten menus? Is it too complicated if you need a "quick start" guide or sticker on the backside? How do you know where the handle is without consciously thinking about it? What makes a product so cool that you have to have it? Surely knowing how to manipulate the *perception* of products and their uses is valuable to a designer?

I didn't know how to turn my questions into a project that could be displayed in the gallery. I'm sure that absolute answers to my questions don't exist, but why shouldn't we study things that relate to them? Other students suggested that maybe I could turn my research into a published book or magazine article, or teach a class instead of a gallery showing.

Teaching a class didn't seem possible due to time constraints involved with taking eighteen credits per quarter, two part time jobs, and maintaining some small semblance of a social life. So I leaned towards getting something published! Ha! However, I later felt that a class would be extremely beneficial to RIT's graduate students, especially those who came from another discipline. I decided to prove it out by developing a workshop, but I still needed to define my topic a little better.

I did a literature review. I soon realized that one of the most influential things that an industrial designer can directly control is the form or shape of an object. Arguably, form carries the most widely understood information than any other single characteristic. I focused on how in theory designers can use form to make things easier to use, more intuitive, and therefore more useful and desirable. Yes, color and graphics help in understanding a product and its intended use, but form is the thing that industrial designers have the most control over, at least initially in the process.

When deciding what form a product should have the ID mantra is "form follows function." I certainly believe this to be useful and mostly true. I also believe that it's crucial for designers to go beyond this. Yes, the form should follow the function, but one can do this and end with an ugly product, or worse, create one that is difficult to understand or remember properly. What if the user isn't familiar with that particular function? Would the product's form, based solely on an intended function, lead them to figure it out? Further, even the most purely functional form has its own aesthetic, though some will not consider it beautiful. Likewise, even the most purely aesthetic object has a function, and some will argue that it's not very useful. Where those lines fall is a highly individual experience, and such research might lead to a number of thesis topics.

Additionally, everyone has unique needs, experiences, and abilities. There are no "universal people," and consequently, there is no such thing as a "universal design" in today's world. However, *almost* universal meanings, such as relative sizes, do exist. That said, it's critical to understand that all characteristics of a product's form are relative to all other characteristics of its form. So, the goal of my workshop was not to focus on finding a "universal design," but to help graduate students better understand how a form can effectively communicate function.

The principles of design were not really taught as such in the grad program when I attended. Further, like me, many of my classmates come from a background outside of industrial design. Consequently, the principles of design were not firmly imbedded in our processes yet, and defining how those principles can contribute to understanding the function of a form was an important part of my workshop. Becoming more familiar with the principles of design alone is almost enough justification for a workshop like mine in the grad curriculum.

There were other difficulties: The amount of information not directly related to my topic and the time required getting what I needed gave me trouble. Over two quarters, I accumulated thousands of images, and without a good system to keep track of why I selected them.

Many of the graduate students do not speak English as a first language so I needed to keep my sentences very simple. Distilling such complex ideas for simplicity and clarity challenged me. The lessons needed a strong tactile component so I created a number of exercises. For example, a bump on the head generally provides a more profound experience than someone does telling you about it. Hopefully my exercises were more pleasant than those scenarios! Dealing with language problems allowed me to create a much stronger presentation and make the most of my limited time.

Unfortunately, proving that we created easier to use products because of the workshop is not possible without putting those products out to market. Extensive comparisons to competing products over the products' life span would be necessary, and consequently falls outside of our abilities.

Subsequently, proving that RIT needs a class like this one depends on comparisons of designs created by the students before participation in the workshop and during. If their latter work shows application of the material, I succeeded. Students critiqued their own work as a group at the end of the workshop. At the end, they submitted an evaluation containing their opinions about the workshop and its value to RIT's curriculum. The core concepts, students' work, and evaluation surveys are summarized in this document.

The Proposal:
Visual Directives & Product Semantics

Beyond a product's immediate functional needs, the form of that product is traditionally left to the designer, the client, and/or various constraints based on some combination of technology, marketing, human factors, price, or materials. This process is typically referred to as the "art" or perhaps the "compromise" of design.

People have various responses to visual stimuli. Some responses are learned, and some seem to be innate. Similarly, most people will create associations based on past experience or their culture to help identify and understand a new stimulus. There have been extensive scientific studies concerning such behavior.

A generalized study of human response to form should allow the designer to achieve a deeper understanding of design principles such as visual metaphors and symbolism, and manipulation of elements such as proportion, balance, patterns, and repetition and their use in product design.

Although there are various attributes that can help a person understand how to use a product, such as color or texture variation, I would like to concentrate mostly on the influence of form. Further, understanding these concepts should improve visual literacy, for the designer and through subsequent exposure, the user as well.

Any creative person who truly understands their medium will be able to communicate through it more effectively. RIT does not currently offer any type of class based on form study, aesthetics, or product semantics. The student usually learns through trial and error. I would like to show how the student of Industrial Design could apply an understanding of human responses to form to help improve product semantics.

I will begin my thesis with research regarding previous studies of product semantics, design methods, existing products, and branch into other disciplines such as cognitive psychology, anthropology, architecture, and classical thought. Essential ideas and concepts based on my research will be outlined according to their relevance to product design and product semantics. I will create a workshop to better illustrate these essential concepts to students of industrial design with the end goal of improving product semantics.

The Short Story Proposal

•Do research and reading.
•Find out how the form of a product can give us visual cues to its use.
•Create a workshop.
•Show how visual cues can lead us in ways that are very basic and easy to remember resulting in better products that are easier to use and understand.

Main Issues Regarding This Topic

•Lots of things can influence peoples' perception: culture, age, past experience, physical abilities, etc.
•Therefore, we can't always send the same message to everybody.
•Can't prove products are easier to use without valid user testing.

Issues Regarding the Workshop

•Time! End of quarter, mutual free time, etc.
•Lots of complex material and concepts, how to distill in a clear way?
•Few native English speakers present.
•Need a way to show students learned something.
•How to compete with a nice, sunny Saturday afternoon after a long, bitter-cold winter?

My Major Goals

•Prove RIT needs a form theory class
•Create a fun class that illustrates form and visual cues in a useful and memorable way.
•Teach the class
•Everyone should get something more to think about than we do in some of our seminars.

Development Of The Workshop

My preliminary work consisted mostly of reading books identified in my literature review. During this period, I tried to identify the most important theories and principles, and then understand them well enough to distill them into something I could teach. I also collected various images to help illustrate ideas discussed in my reading.

Examining the curriculums of other design schools helped. These concepts and their relevance to the workshop will be discussed in more detail below. Throughout my class work, I witnessed many student presentations and critiques. I became certain that sharing the research I was doing would be very valuable to my classmates, if only to help them articulate their issues more effectively.

The workshop developed into its own entity towards the end of my research, and around images that I had stockpiled during my reading. Over time, I had collected over 2500 different images. I forgot why I initially chose certain images, which made weeding those out quite easy; if I couldn't remember why or figure it out immediately then I decided it was not a good example. Others however, took quite a while to weed out, and a six-hour slideshow would bore even the most dedicated student. My committee helped me through comments made over a brief show during one of my later meetings.

I also needed a way to provide hands on training, which led me to develop the exercises described later in this document. The feedback of my committee in this area was very helpful. The exercises were arguably the most valuable part of the workshop because they helped show the importance and application of the concepts to the practice of industrial design. Similar learning opportunities were rarely, if ever, present in several of the graduate seminars.

Once I had the main points of the workshop in place, it became easier to narrow things down a little further. I studied different approaches to creating lesson plans as well as various learning and teaching styles. A proofread by one of my international graduate student friends helped me understand that the sentences needed to be very simple and clear, because most of the students in the graduate design group are not native English speakers. I was also surprised that Times New Roman needed to be used for clarity because that's what international students are used to.

I then created a PowerPoint presentation to create the outline of the workshop and act as visual support. It was the easiest way to not only show the images but also highlight important points as I spoke. PowerPoint probably became a bit tedious towards the end of longer workshop sections, but a longer course consisting of shorter increments would make it less so.

The Workshop

Figure 1: Flyer for Workshop

The flyer I used to advertise my workshop is shown above. There were 8 "core" people present and 3-4 additional people who were unable to stay the entire time. Attendance was beyond my expectations given that this workshop came at the end of the spring quarter, on a Saturday, and the first nice weather day of the year. Considering that there were only 15 or 16 full time grads at this time, I was thrilled. I also appreciate very much the participation of one of my advisors. My other advisors understandably were unable to attend due to pre-existing conflicts.

Pre-Workshop Exercises

Three tasks were given prior to any discussion so I would have something to compare later results to. I asked each student to make concept sketches of a teapot, a remote controller, and a chair. I collected the sketches immediately after completion, and the students did not have access to them until the group evaluations at the end of the workshop.

> # Form and Visual Cues
>
> A Workshop For Design Students
> by Bill Campbell, in preparation for a
> Master's Thesis

Figure 2: Title Slide

> # Good Morning!
>
> - Design a teapot, a remote control unit, and a chair, simple sketches are ok.
> - Write "Pre-workshop" with your name on the page.
> - When you're done, give them to Bill.
>
> 2
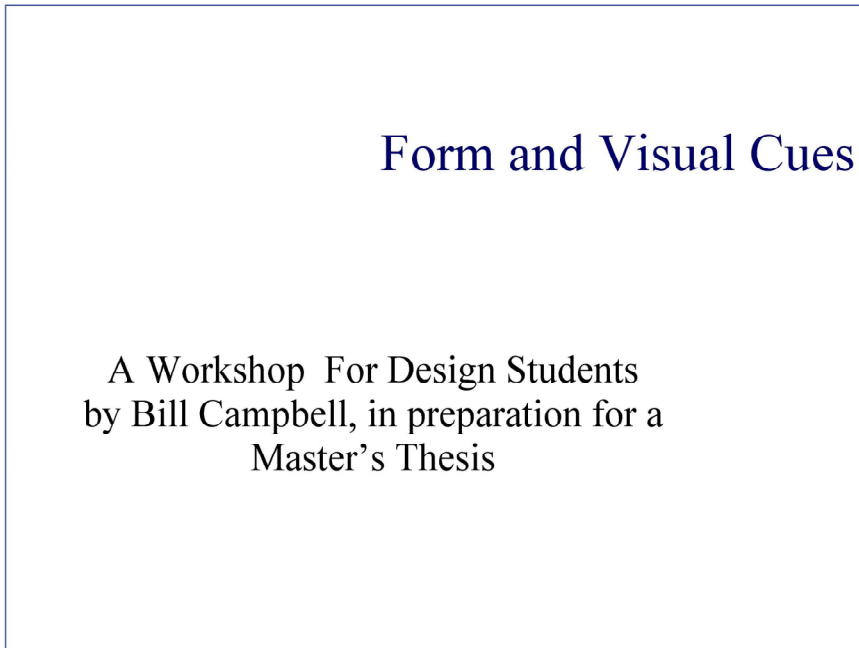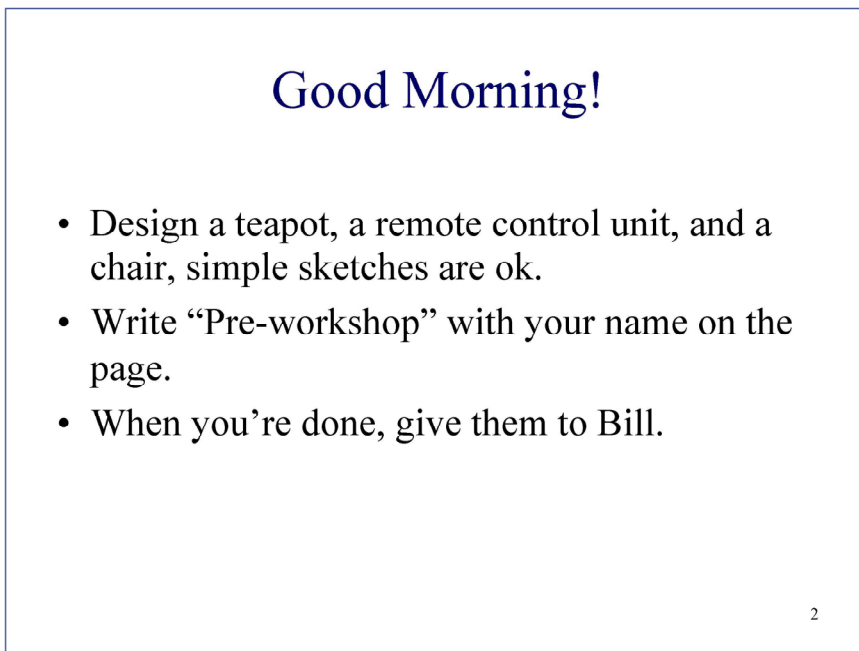
Figure 3: Presentation Slide 2

Below are examples of simple sketches of two students' preliminary designs (figs. 4, 5). Discussion in further detail will follow with comparisons to later work in the appropriate sections.
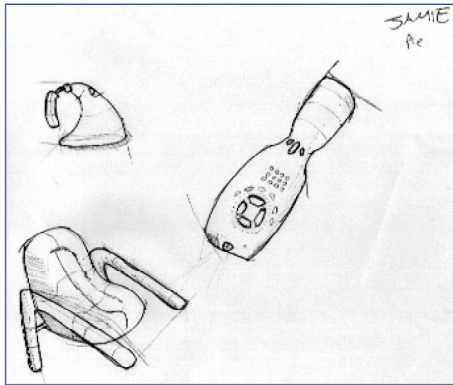
Figure 4: Preliminary Sketch
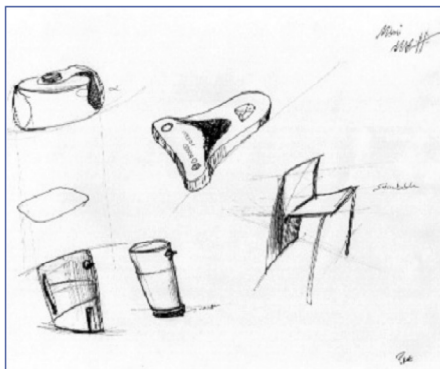
Figure 5: Preliminary Sketch

Moving forward, I outlined the objectives of the workshop, and provided a brief road map of the first half of the workshop.

Now...
What Are We Doing Here?

Learning to use form to make our products easier to understand
> – who needs instructions?

- The form of the product can give us visual clues as to how it can be used.
- These clues can lead us in ways that are very basic and easy to remember.

3

Figure 6: Presentation Slide 3

Is He Serious?
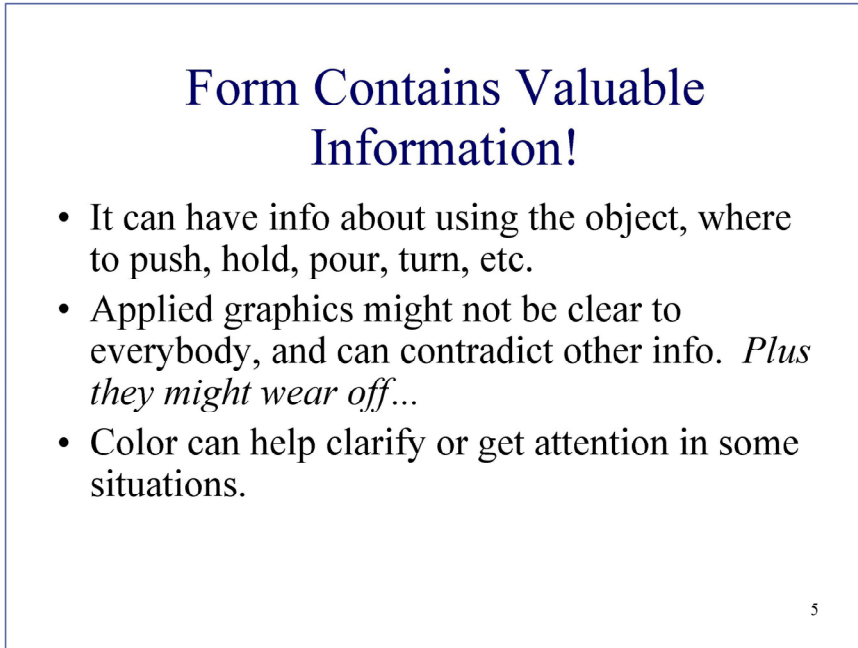
Yes! But there are some issues…
- Lots of things can influence peoples' perception: culture, age, past experience, physical abilities, etc.
- As a result, we can't always send the same message to everybody.
- Some information should carry over: size, proximity, etc.

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Figure 7: Presentation Slide 4

Information Conveyed With Form

This section discussed the kinds of information that can be learned just from looking at a form. Form can answer questions such as, "Can this fit inside? Is this a handle? Does this move? Which way? How far?"

Figure 8: Presentation Slide 5

Why Graphics Are Not Always A Good Solution

Graphics are not always a good solution because of language and ability barriers. They can also sometimes contradict other information. Further, they can wear off leaving the user to guess what the function should be. Using form to convey as much information as possible is much more intuitive and reliable. Donald Norman is a great resource in this area.

Define Form

Defining form seemed like a simple thing, but is crucial for the rest of the material. I used Webster's definition[1] where Form *is the shape or structure of an object*.

So What Is Form?

There are many definitions…but for us,

Form = the shape or structure of an object

6
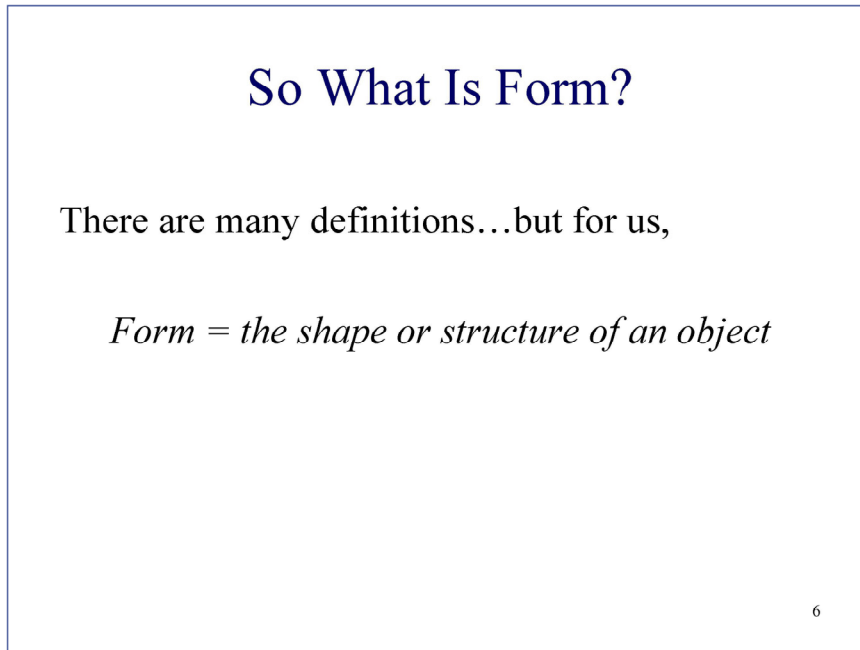
Figure 9: Presentation Slide 6

1 Merriam-WebsterOnline Dictionary, http://www.m-w.com/dictionary/form

Things We Can Do To Forms

The next slides showed how form can help us understand how to use an artifact (fig. 10), and also some of the ways we can manipulate form (fig. 11). For example, the shape of the dentist's chair in the slide below is shaped in a way that reminds us of a person, showing us exactly what the intended orientation of the patient is.

Figure 10: Presentation Slide 7
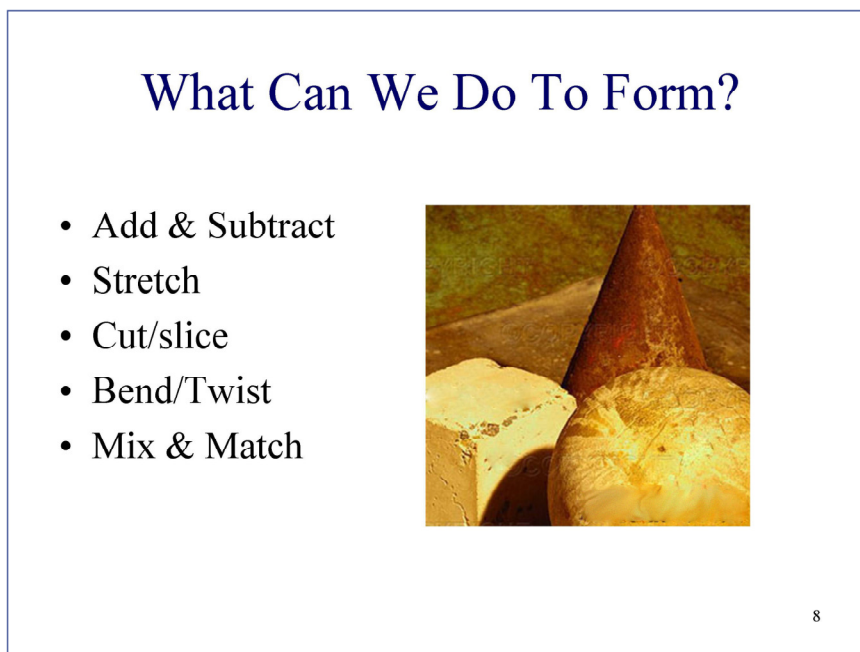
Figure 11: Presentation Slide 8

The following slide (fig. 12) illustrates how form can change based on the modifications we can make, as described above.
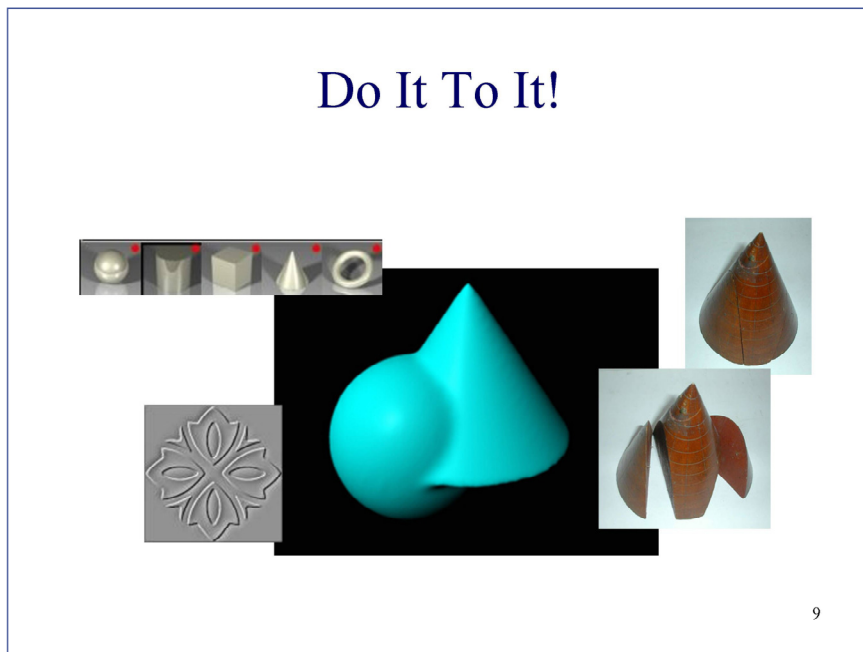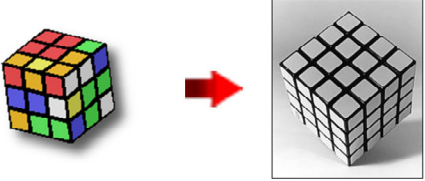
Figure 12: Presentation Slide 9

Rubik's Exercise

This exercise was intended to show students how to use form in place of colors or graphics. A traditional Rubik's cube relies on colored graphics to delineate the six sides. By removing color, each side of the Rubik's Cube would need to be different through simple manipulations of the basic surface form.

Figure 13: Presentation Slide 10

I regret that we only performed this exercise verbally due to time and material constraints. Answers to how we might create a Rubik's cube without color did not come immediately. It was still pretty early. After a few moments though, several answers came quickly. Actually carving into or pasting onto a Rubik's shaped cube would illustrate the concepts more profoundly, and I think it would be most successful as a homework assignment. Low-density polyurethane modeling foam would have been perfect. This exercise could be taken further to examine which types of forms seemed more effective for this application.

Affordances & Constraints, Real & Perceived

I became interested in this topic when I started to consider what people perceive first when they encounter a new product. Norman's, Gibson's, and Alexander's work was extremely helpful, although they seem to disagree about affordances in some instances.

So, for my purposes, what types of characteristics let a person know where to grab something, hold it, squeeze it, etc.? Is this learned or innate? Could it be some combination based on past experience? Certainly it's not something that one always consciously thinks about. I personally believe that at the most basic level, initial perceptions and reactions to an artifact are partly based on survival and reproductive instincts. Other initial perceptions are probably learned from similar past experiences.

New products should be designed with a clear understanding of the things the product should do and the things it shouldn't do. I would like to qualify that by saying that there are no clear lines here, depending on the product, and unforeseen applications are hard to predict.

To be sure, a cell phone could be used as a very ineffective hammer in certain unforeseen situations. Existing conventions should also be respected, which will be discussed in a following section. Sometimes ambiguity is desirable, e.g., when designing a game or toy, or a multi-purpose tool. When the product is intended to do only certain tasks, though, the form should express the affordances and constraints as clearly as possible to avoid confusion. A door to an emergency exit should not contain any ambiguity.

The following slides helped me illustrate my main points in this area. The image of the oatmeal containers (fig.17) would have been especially helpful if I had been able to find and bring in the containers shown. The redesign of the container makes people think that the lip of the lid can also be used as a handle. However, that action would allow the container to separate from the lid, dumping the contents all over.

Most students understood this easily. Unfortunately, my image of the little boy in jail (fig.19) to humorously show a constraint was confusing to some international students. I chose images that showed both affordances and constraints, as well perceived affordances and constraints, but it may have been better to pick images that were more clearly one or the other.

Affordances Provide Ways to Do Things

- The doorway *affords* a way to get from this room to that room.
- The *door* affords a way to control the doorway.

We can apply this idea to help people understand how to use our products.

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Figure 14: Presentation Slide 11

Real and Perceived Affordances

- *Real:* looks like it might allow you to do something, does what you expect.

- *Perceived:* looks like it might allow you to do something, but doesn't.

Q. When would you want to trick someone with perceived affordances?

12

Figure 15: Presentation Slide 12

Figure 16: Presentation Slide 13

Figure 17: Presentation Slide 14

Constraints

Constraints prevent us from doing something.

- A door can act as a constraint as well as an affordance.
- We can use constraints in conjunction with affordances to help people understand how to use our products.

15

Figure 18: Presentation Slide 15

An Affordance for Me, A Constraint For You

16

Figure 19: Presentation Slide 16

Water Bottle/Teapot Exercise

I like to use a teapot or a water bottle as an example to help explain my thesis topic. Most people know how to use a teapot or water bottle just from looking at it, i.e. all the information that they need to use it is contained in the form, they generally do not need other instructions beyond simple exploration.

Figure 20: Presentation Slide 17

After the section on affordances and constraints, I asked everyone to draw another teapot or water bottle. In some cases, the students drew a teapot for the preliminary sketches, and a water bottle for the workshop exercise. In other cases, the students did not complete a preliminary sketch for all three objects. This makes a direct comparison difficult in some cases, but most of the students' workshop exercises shows application of the workshop's concepts regardless of what they sketched prior.
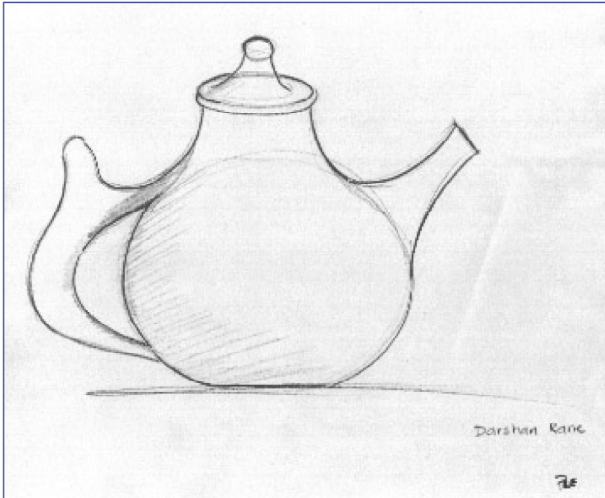
Figure 21: Pre-Workshop Exercises, Teapot.
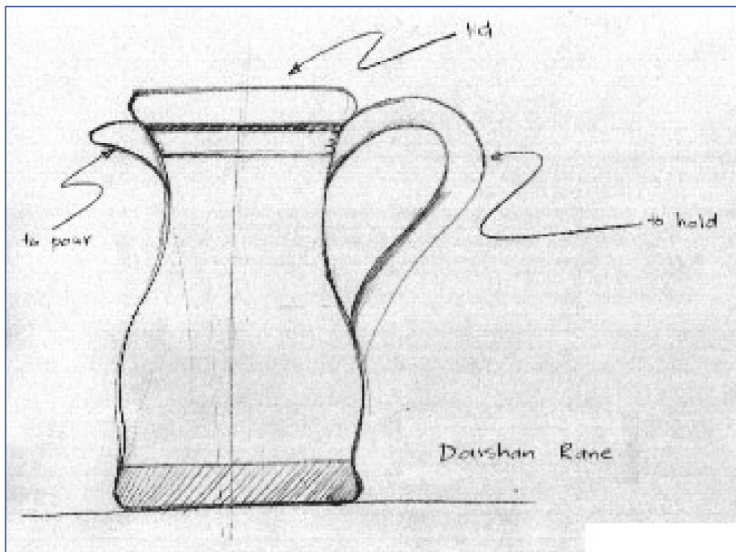
Figure 22: Workshop Exercises, Teapot.

The original sketch in this example (fig. 21) is most likely a slight variation on a mental model of an existing product. However, the second design (fig. 22) shows much more thought as to why the parts are the way they are, and some of the intended affordances are labelled. For example, though it's not labelled, the base is wider, making it harder to tip the pot. However, it is not clear if the handle will promote a safe position for the hand when pouring, but there is a definite improvement over how much room is provided to prevent burns against the side of the pot. With refinement, perhaps through a mock-up, I feel this student would have a decent original design that reflects participation in the workshop.
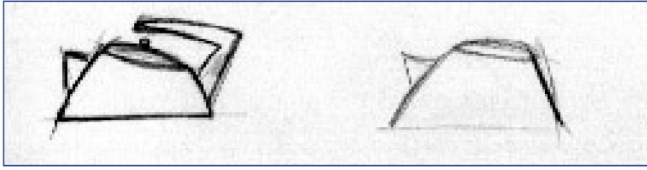
Figure 23: Pre-Workshop Exercises, Teapot.
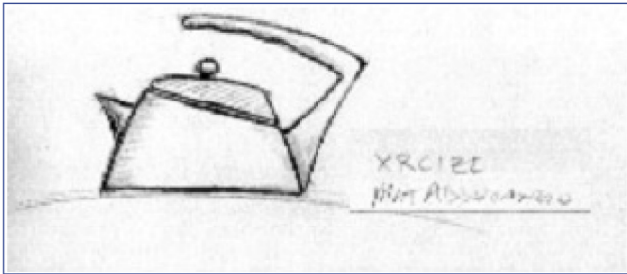
Figure 24: Workshop Exercises, Teapot.

Not much of a change here between versions (figs. 23 and 24), but in the workshop exercise (fig. 24) some characteristics are more defined and thought out such as the way the lid fits, the handle allows more space and has finger grips, and the lid knob is bigger.

Figure 25: Pre-Workshop Exercises, Teapot.
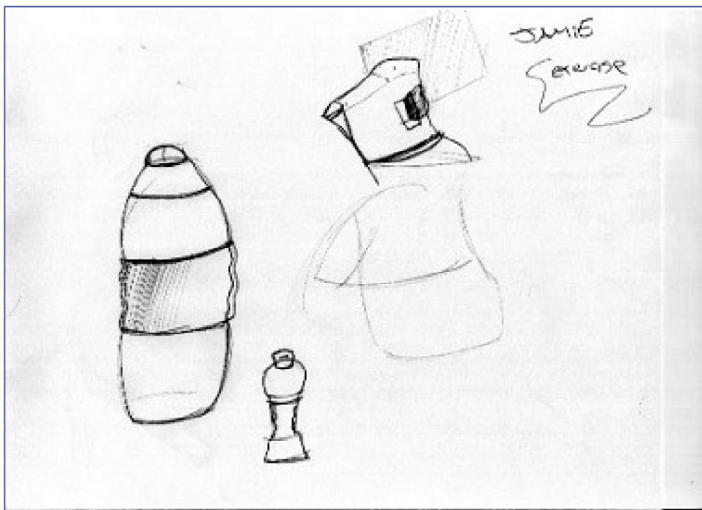
Figure 26: Workshop Exercises, Teapot and Water Bottles.

The original teapot (fig. 25) had some issues with regard to function. There is intentionally no spout, and the handle would be rather awkward to hold and pour with. The second teapot (fig. 26) shows a well thought out design that provides affordances for holding, filling, and pouring. The left side sketches also show an intention to make the water bottles easier to hold.
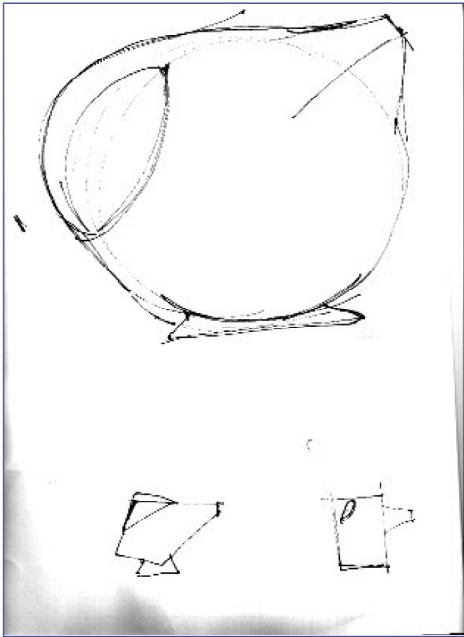
Figure 27: Pre-Workshop Exercises, Teapot.
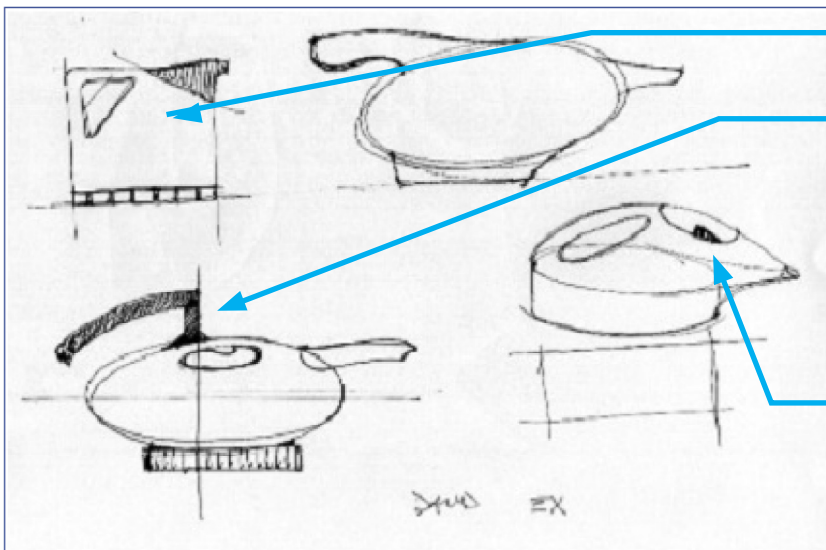
Location of handles relative to spouts allows for safer/easier pouring- these arrangements help avoid burns from rising steam

Use of affordances via a hole for easy filling

Figure 28: Workshop Exercises, Teapot.

This example is one of my favorites. The original sketch (fig. 27) shows ideas mostly with regard to what the intended shape is, with a minimum of the necessary affordances shown. The second group of sketches (fig. 28) shows not only better thought out affordances, but wider variations on the original shapes.

Exploration of New Artifacts

If someone encountered a teapot or a water bottle for the very first time, they would probably figure out the intended uses for it through exploration and experimentation with the inherent affordances and constraints. I believe that this natural tendency to explore is related to survival and sexual reproductive instincts. Toddlers explore all the time, and who's happier than that? One might even find new unintended abilities for things based on the need of the moment ("Hey! These pliers work great as a bottle opener...!"), so ambiguity is not necessarily a bad thing.

Figure 29: Presentation Slide 18

The motion picture "The Gods Must Be Crazy" might be an excellent illustrative resource here because of its depiction of the many uses found for a discarded Coke bottle in a culture that's unfamiliar with such an artifact. How the bottle is perceived and used is relative to what the need of the user is and the existing form of the bottle or its remnants. This situation is especially interesting given that the bottle is found by a culture that uses more traditional artifacts that are constantly refined through use over time, discussed below. The film would work well with numerous other sections also. Alexander's work in this area is especially helpful, also.

Figure 30: Presentation Slide 19

I explained the idea behind this exercise, but did not assign it. I thought we were behind schedule (we weren't), and felt that another exercise might interrupt the flow of the lecture sections. I believe this is a worthwhile exercise, especially if the workshop became a full quarter class. The exercise should probably come at a different time in the workshop, perhaps closer to affordances and constraints, or after conventions, discussed later.

Darwin and Design

Survival of the fittest!

- Artifacts change to meet needs by trial and error and constant refinement.
- Things that work remain, things that don't get discarded.

Designers don't have that kind of time today, we'd best use whatever we can!

20
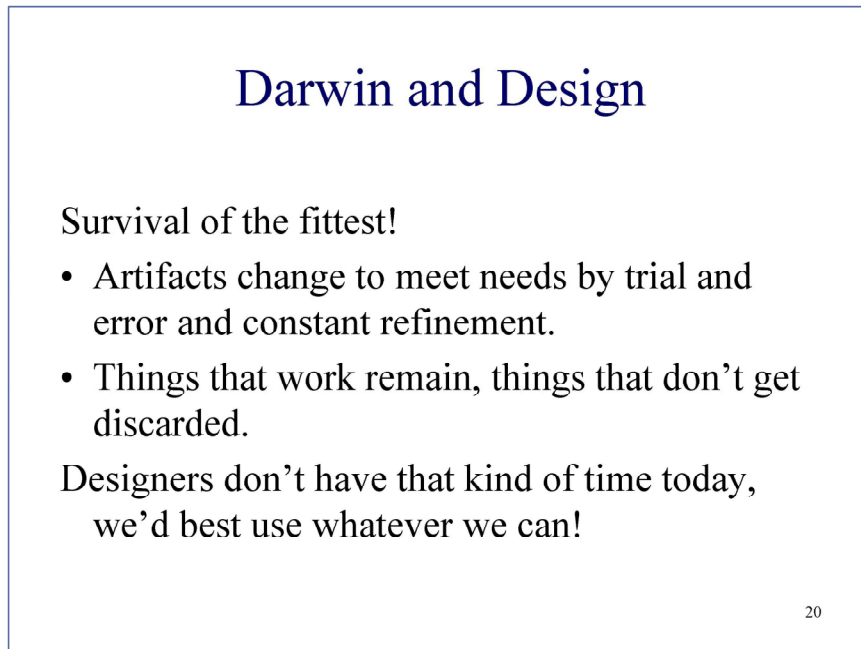
Figure 31: Presentation Slide 20
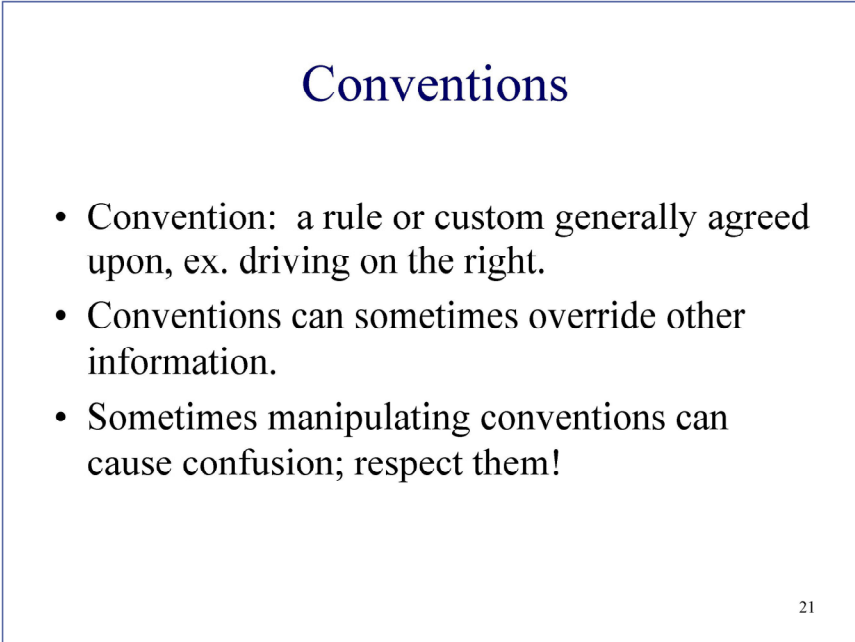
Designers don't have the extended time required to really refine a product, which happens naturally over time through trial and error, and incremental refinements[2]. In many ways, this process could be described as "survival of the fittest." I included this section to help illustrate how form is refined and so helps to express the use of an artifact. More examples of this process, especially as it existed before the Industrial Revolution, would help. Alexander does a great job of explaining this process, and a few short excerpts would make a useful homework assignment.

2   Alexander, Christopher. 1964. *Notes On the Synthesis Of Form.* Harvard University Press, Cambridge, MA and London, England.

Conventions

Artifacts develop quite naturally by themselves over time through constant refinement. In some cases, conventions are formed and become widely accepted. Sometimes a more efficient way might be possible but fails to change the convention. This is usually because the effort or expense involved in relearning a new way outweighs the benefits of using it[3].

Some examples of this include the "QWERTY" keyboard layout (fig. 33), and the continuing use of the "English" measuring system in the US. Both of those systems are less efficient than other newer ones, but the cost and time associated with phasing out the existing conventions inhibits the use of newer systems. There are many instances of conventions in product semantics.

Figure 32: Presentation Slide 21

3   Norman, D. A. 1988. *The Psychology of Everyday Things*. Basic Books, New York.

Figure 33: Presentation Slide 22
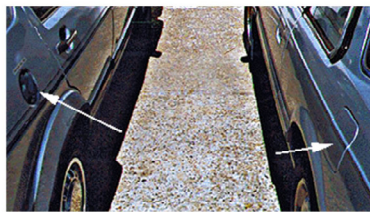
Figure 34: Presentation Slide 23

Figure 35: Presentation Slide 24

Problems and confusion can occur when conventions are not respected in the design process (figs. 34, 35). Also, conventions can sometimes override other information. This is not to imply that designers should continue to apply and reinforce outdated conventions in new designs. However, the designer needs to provide a way for the user to avoid confusion if an existing relevant convention is not followed. Cultural conventions can vary widely and even contradict others, making this process difficult. My main point is that conventions should be understood and used accordingly, especially when using form to provide information.

I feel that this topic was understood well enough, but also needed a little more attention. Perhaps more examples and an exercise in identifying conventions would help. Another exercise might involve designing a mechanism for several markets where the conventions sometimes contradict each other. This would promote an understanding of the conventions involved, as long as the student doesn't feel that the requirement is to create a universal design.

Lunch

We broke for lunch about halfway through the workshop. I provided pizza, water, soda, iced tea, and fruit to help express my appreciation to those who attended. Beer might have gone over even better, but we had work to do.
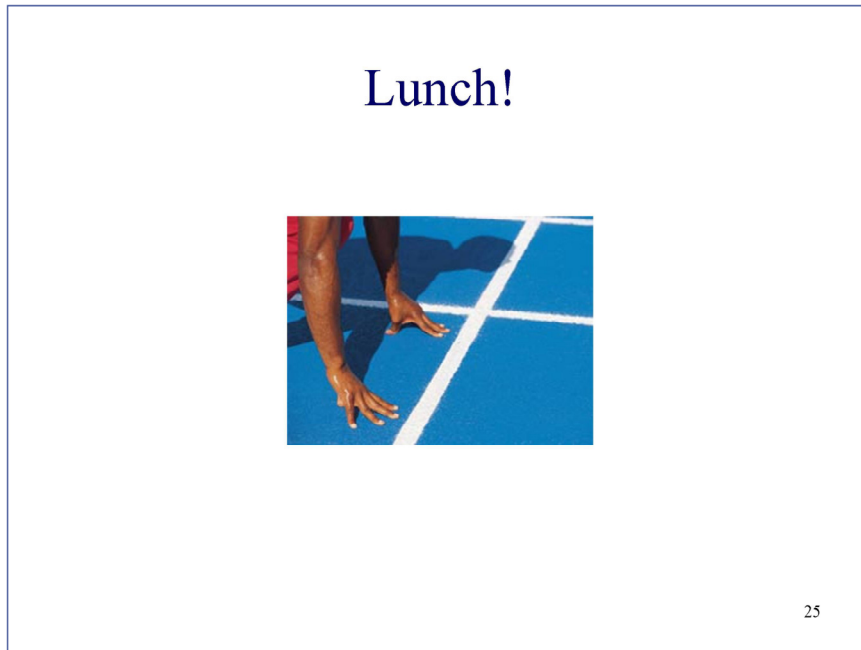
Figure 36: Presentation Slide 25
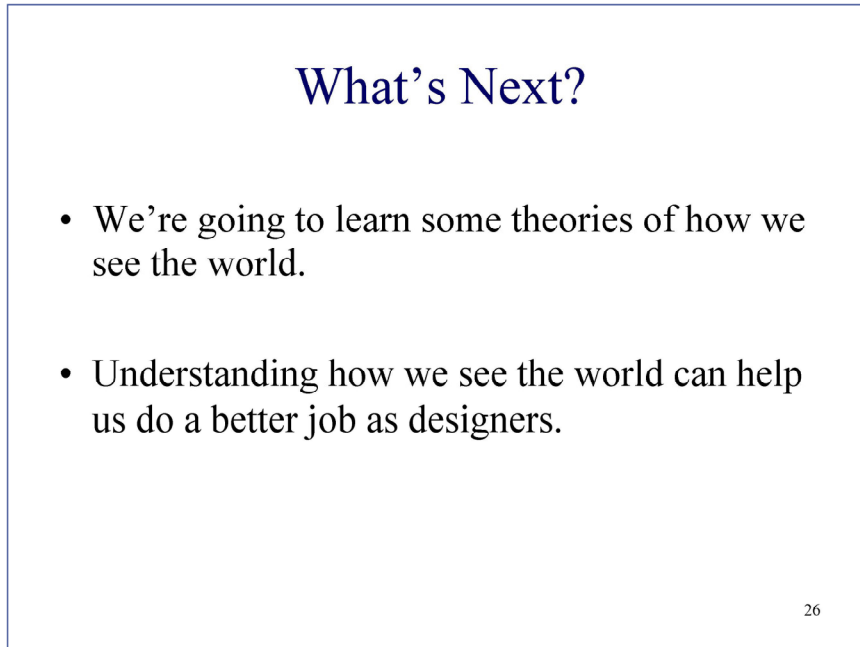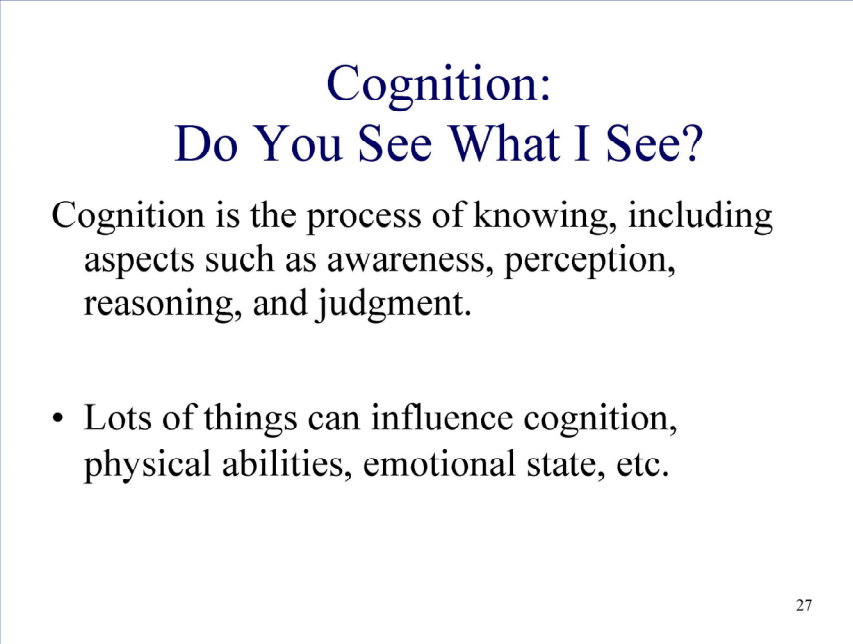
Figure 37: Presentation Slide 26

Cognition

Cognition is defined here as the process of knowing, including aspects such as awareness, perception, reasoning, and judgment. Lots of things can influence cognition; such as physical abilities, emotional state, etc. I feel this material is important to the workshop so that the students can better understand some of the mental processes people use to understand a product through form.

Figure 38: Presentation Slide 27

The following slides (figs. 39, 40) are optical illusions, which I thought would help show cognitive responses first hand.

Figure 39: Presentation Slide 28
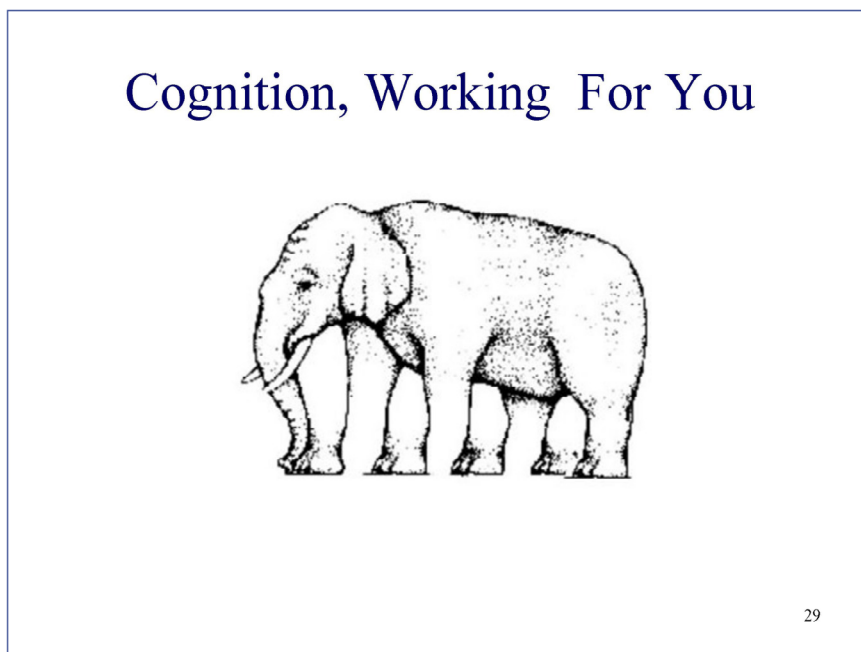
Figure 40: Presentation Slide 29

I also gave a brief map of where we were headed under the topic of cognition.

Cognition And What We're Going to Learn Next

- Geons
- Gestalt Theory
- Patterns
- Context and Relationships
- Semiotics

- Focal Points and Hierarchies
- Metaphor
- Redundancy

30
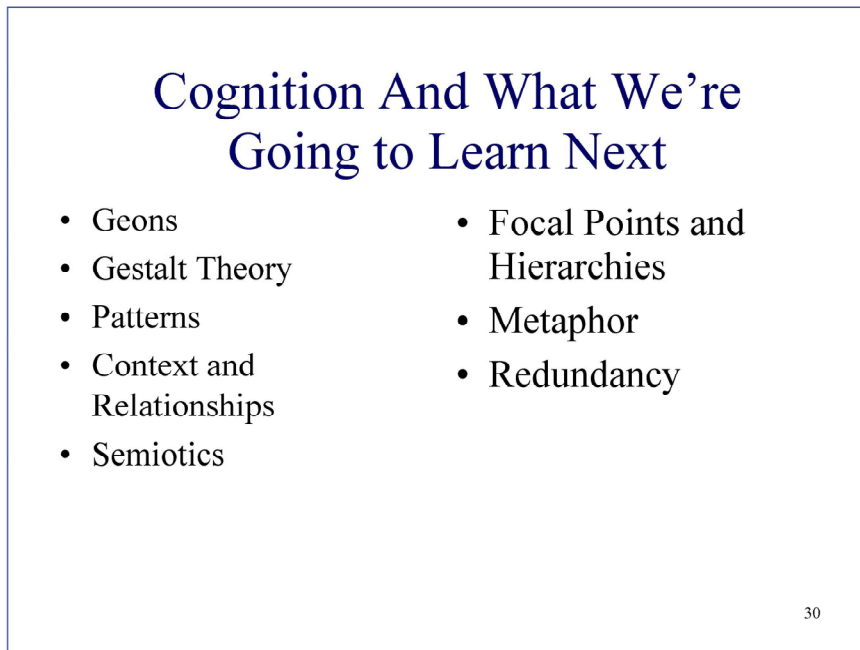
Figure 41: Presentation Slide 30

I only scratched the surface in this broad area. Overall, I'm not sure that I explained some of these concepts adequately, especially to a few people who are not native English speakers; perhaps some of the material did not translate, or the relevance wasn't clear enough. More time, other examples, and written definitions might help.

Geons

Geons are the smallest recognizable components of form[4]. Different geons are often mixed into groups to make a unique form (fig. 43). Biederman's work in this area explains that almost any object can be broken down into geons. We discussed this theory during the workshop, and some people questioned if we actually see things this way. I personally don't believe the process is a conscious one.

I do believe that at some level of cognition, what we see is processed into easily grouped "chunks" which can be used for pattern matching and identification. I also suspect that this is a survival instinct to help quickly identify a predator, as described in the next section. This "chunking and grouping" process likely happens during design visualization processes as well.

Geons And Cognition

- Geons are the smallest recognizable components of form.
- Different geons are often mixed into groups to make a unique form.

Q. Are we born with this info, or do we learn it from birth? Remember *memes*?

31

Figure 42: Presentation Slide 31

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4   Biederman, I. 1987. Recognition-by-Components: A Theory of Human Image
             Understanding. Psychological Review, 94, 115-147.
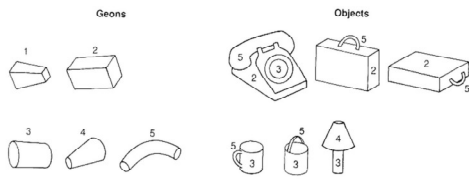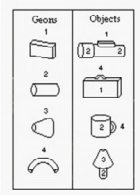
Figure 43: Presentation Slide 32

Gestalt and Kanizsa Triangle, Step By Step

Gestalt is a German term that loosely refers to the whole being greater than the sum of its parts. The brain is able to group certain things together quickly for identification, and it's theorized that this process may be part of a survival mechanism to identify a predator as quickly as possible. I believe this lends more credibility to Biederman's theory of geons, as its easier to process several small chunks at once than the whole.

Figure 44: Presentation Slide 33
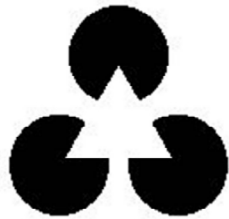
Figure 45: Presentation Slide 34

Figure 46: Presentation Slide 35

Figure 47: Presentation Slide 36

Figure 48: Presentation Slide 37

This process of seeing a triangle within the three circles (figs. 45, 48) relies on several things such the contrast between figure and ground, proximity, closure, etc. I described each of these concepts briefly and how in combination they helped us perceive an implied shape (i.e. a "circle" outline created from many smaller circles arranged in a concentric pattern such as in fig. 47).

One student seemed to have difficulty with this concept and perhaps others did too. Again, perhaps I needed to show more relevance, or place this material better within the workshop. An animation showing the individual circles (Figure 47) farther apart and then coming together to create the outline of a larger circle might be helpful too.

Gestalt by itself is a simple concept, but ironically, I think it's difficult to define without making it seem like more than it really is. Less definition may have been a better approach until after the concepts were experienced.

Patterns and How They Help Cognition

Patterns allow us to identify people, faces, places, buildings, and any number of things. Pattern identification is a natural process that I believe is developed from birth and based on more instinctual processes, some of which have already been discussed in sections above.

Figure 49: Presentation Slide 38

Patterns Doing Their Thing
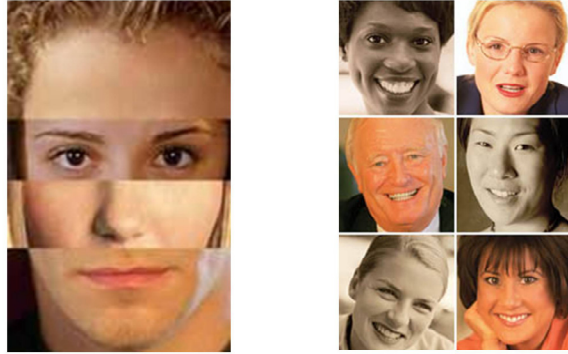
39

Figure 50: Presentation Slide 39

Patterns Doing Their Thing
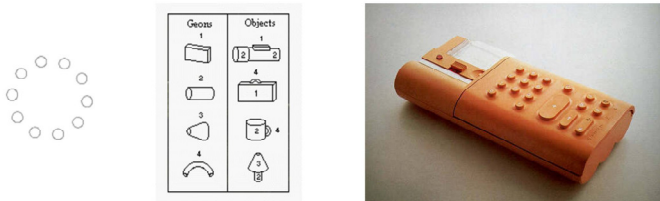
40

Figure 51: Presentation Slide 40

Context, Relationships, and Cognition

Much like words, when an object is taken out of its intended context, it may lose information that helps us understand why it's there.

Context And Cognition

- Where an object is can help people understand it; how does it relate to its surroundings?
  - A chair in a house, a house on a street, a street in a neighborhood, etc.
- Things out of context can mislead people, and/or create new expectations.

41

Figure 52: Presentation Slide 41

The forms shown below (fig. 53) are interesting but by themselves don't give enough information to know immediately what they are. However, when placed next to something that we are more familiar with (fig.54), we can easily deduce that these are fancy-boy soap bottles. The image at the bottom of the left slide (fig. 53) is actually a chess piece, but without context to judge other characteristics, it looks very similar to the objects above.

Figure 53: Presentation Slide 42

Figure 54: Presentation Slide 43

The image below (fig. 55) shows a sign posted over some kind of plumbing fixture. Because the fixture is very close to a toilet, it may be easy for someone to assume that it is a urinal. Unfortunately for the janitor in this building, that is not actually the case (fig. 56).
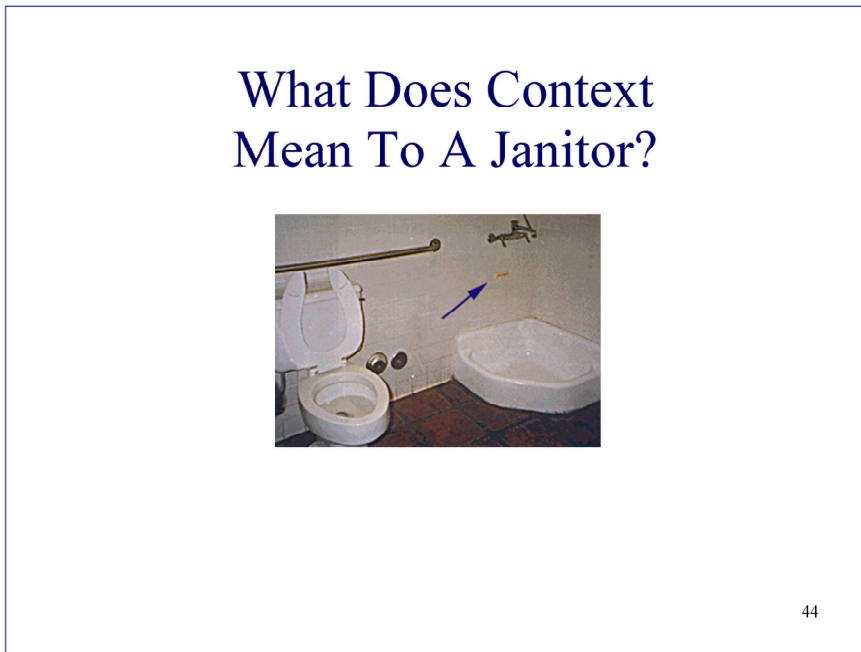
Figure 55: Presentation Slide 44
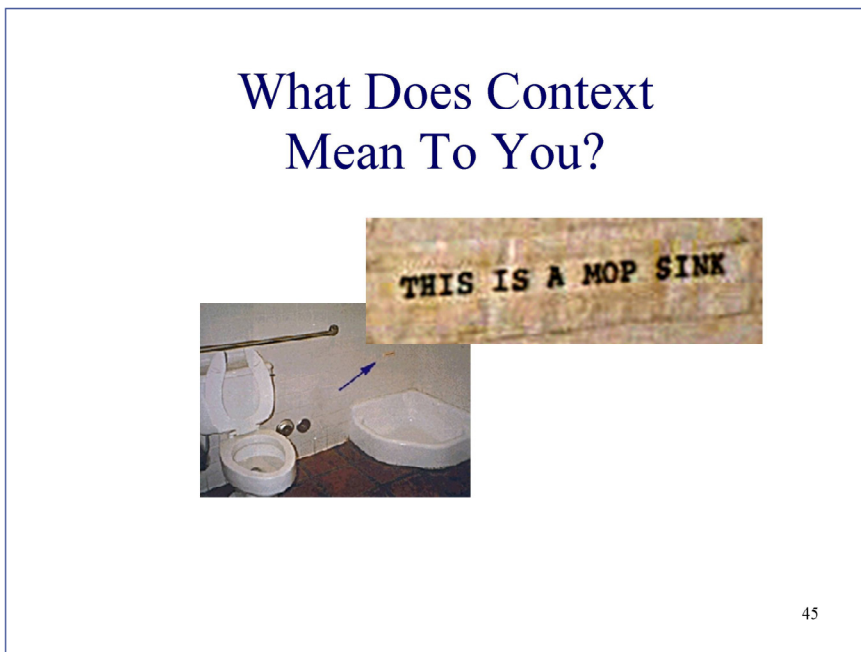
Figure 56: Presentation Slide 45

Likewise, the shapes, sizes, placement, and groupings of the buttons shown on the object below (fig. 58) help put them into context and form relationships to each other. This approach helps us to not only understand what the functions of each may be, but remember them once we figure them out.

Figure 57: Presentation Slide 46

Figure 58: Presentation Slide 47

Focal Points

I included this section to help illustrate what types of things attract someone's focus first. It may have been better placed earlier in the workshop, but I hoped to use it to segue into semiotics.

Figure 59: Presentation Slide 48

Figure 60: Presentation Slide 49

I used the same object as I did previously to help reinforce the fact that many objects don't use just one characteristic, but many. The button on this object (fig. 61) that is likely used most often is the largest, and placed near the center of the button groupings.
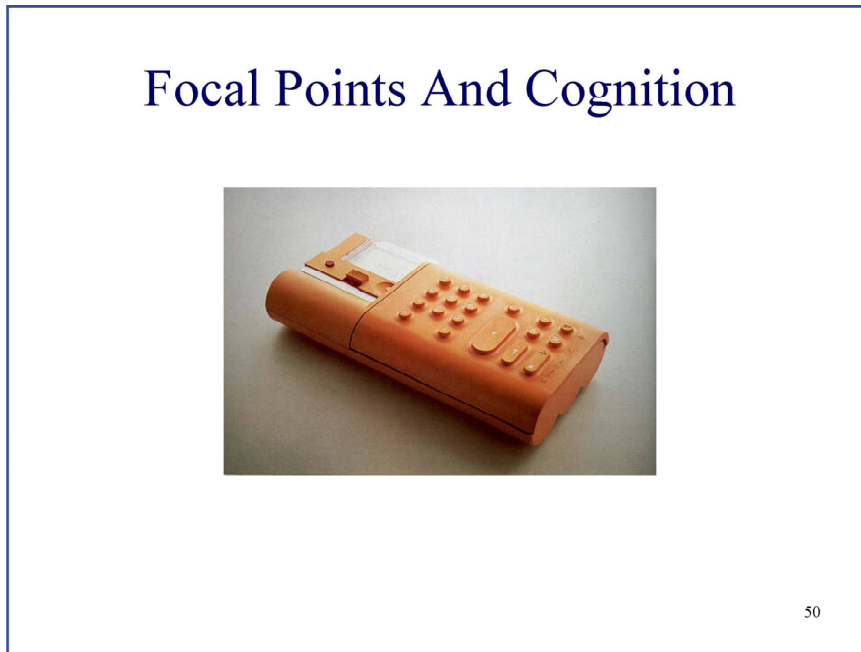
Figure 61: Presentation Slide 50

Figure 62: Presentation Slide 51

The exercise was intended to show an understanding of this principle with something I thought would be familiar, quick, and easy. I asked them to draw a cartoon face because it allowed for easy exaggeration. The first should have the mouth as a focal point, and a second with the nose as a focal point.

Focal Points Cartoon Face Exercise
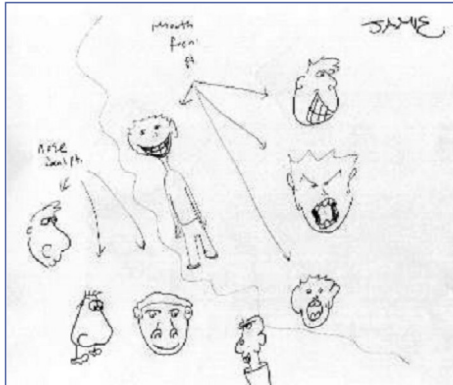
Figure 63: Workshop Exercises, Faces.

Lots of variation!
Definitely some focal points and not all are based on relative sizes.

Figure 64: Workshop Exercises, Faces.

I wasn't sure at first if this student "got it." However, I later wondered if he intended the beard to place emphasis on the mouth. Reminds me a little of Bob Ross, R.I.P.
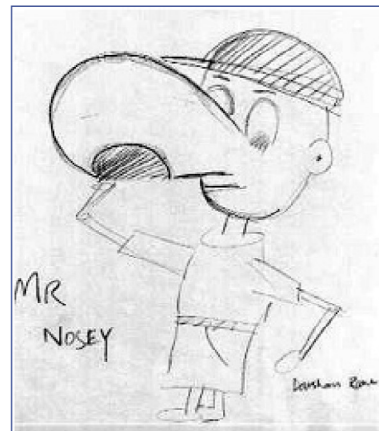
Figures 65 and 66: Workshop Exercises, Faces.

This student asked if he could do the ears instead. Interesting to note he pierced his ears shortly after. (Thanks for the vote of confidence, also!) The nose is working nicely for several reasons I won't go into!

Semiotics

I originally intended this topic to segue into the section on metaphors, as well as tie into the remote exercise described below. I'm still not sure where to best place this topic in the workshop, but feel it is very valuable to all design disciplines. Perhaps it belongs closer to the beginning during the discussion of why graphics might be problematic. Regardless, as I continued my research, I felt that semiotics merited its own section.

Unfortunately, there is little consistency in the way terms relative to the study of semiotics are defined from author to author. I also wasn't sure of how deeply to cover the topic. Ultimately, I decided that the best way to present the use of semiotics relative to form was "the use of a symbol to help represent something else," rather than deep dive into the varied specifics of sign, signifier, signified, etc.

The use of symbols extends to virtually all aspects of communication. Some symbols are general enough to transcend cultural, context, and language barriers, while others are so specific that few people understand them, especially when removed from their intended context.

Technology often allows new abilities and functions in a device that weren't before possible. There may not be a consistent way to step through the actions necessary to complete a task, much less that a clear symbol exists for that sequence of events. So in some cases existing symbols sometimes gain widespread use outside of their original context or conventional usage, and initially the association to the new task isn't always clear. Fortunately, once someone is able successfully complete a task the symbol and newly associated task are both easily remembered and a new context is formed.

Examples include the use of an envelope icon on a cell phone keypad, or perhaps the tab or enter keys on a laptop keyboard. On a computer keyboard, the enter key has a similar "line break" function and shape as the mechanical carriage return key used on typewriters to create a new line, but the enter key on a computer adds additional functionality. Additionally, the general location is the same on both keyboards, but the text label is different. With e-mail software or cell phones, most people are familiar with the use of an envelope to send a letter, and so the association to a messaging function on a cell phone or e-mail program is relatively clear.

Sometimes the symbol may lose relevance to the original signified task or object when the original becomes obsolete. Typewriters are pretty rare today and so the association of the modern enter key to the original return key is probably missed. I can't help but wonder how much longer we'll actually mail letters cross-country. Mailing letters might very well be a story I tell my grandchildren.

In the meantime, many products rely on graphic symbols combined with text to communicate various functions. While I believe that redundancy is good in this instance, it is important that symbols and text do not contradict other information such as that contained in the form

or cultural conventions. Donald Norman explains several instances of this phenomenon in great length throughout his body of work.

Some of the images shown (fig. 68) were chosen to show not only good use of semiotics, but bad ones as well. This section could be a good homework assignment, perhaps to make a list of things that incorporate semiotics and to what extent they communicate successfully.
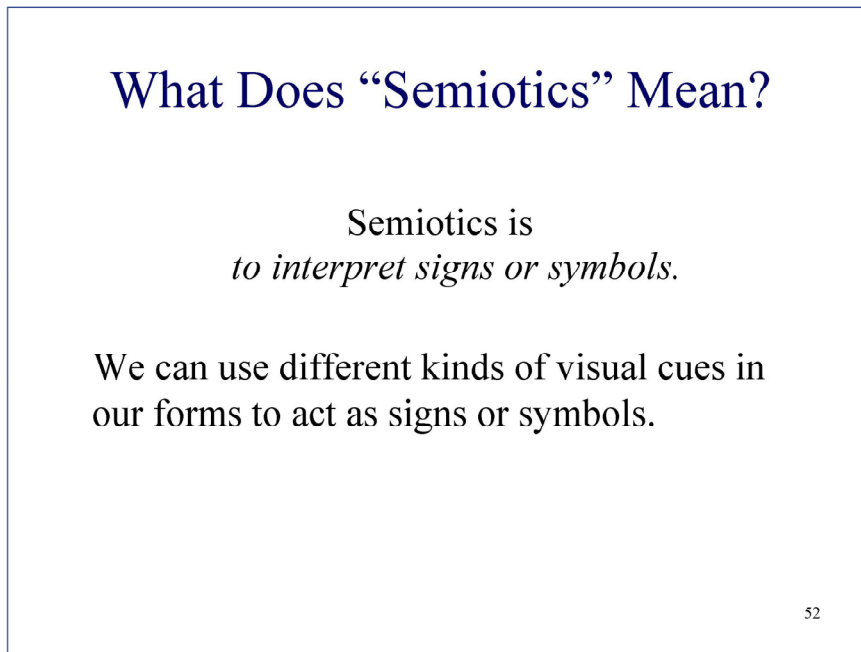
Figure 67: Presentation Slide 52
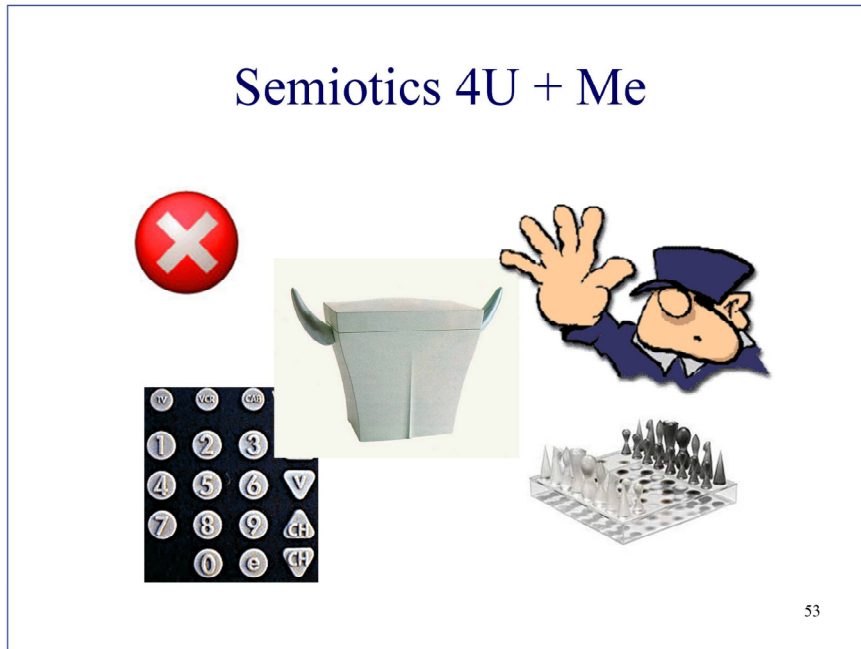
Figure 68: Presentation Slide 53

Design Objectives and Hierarchies

I wanted this section to tie many of the preceding concepts together with an object everyone in the class could relate to, a remote control unit.

A clear hierarchy organizes items into levels of relative importance. A clear hierarchy helps the user understand what is most important to using devices like a remote control and easily find the controls they use most often. Using design principles to emphasize one element over another can help the designer achieve a clear hierarchy.

However, a problem when designing such a device is deciding what's most important. A typical remote has many different and varied functions. Beyond the issues of simply getting all those functions to even fit into the unit, the problem ultimately is how to organize and express those functions in the design without degrading human factors concerns or going against established conventions.

Again, I feel it's important to stress that there is no such thing as a "universal design."

Figure 69: Presentation Slide 54

Figure 70: Presentation Slide 55

Remote Controller Exercise

- Design a Remote Controller Sketch Model using materials provided by Bill.
- The Remote should include a way to turn something on and off, and control a few other functions of your choice.
- The remote should show a clear hierarchy that doesn't rely on graphic labels.

56

Figure 71: Presentation Slide 56

This exercise was intended to help the student put many of the previous concepts together: Form, affordances, constraints, conventions, focal points, gestalt, patterns, semiotics, and hierarchies. They did not view or have access to their sketches from the first minutes of the workshop.

Remote controls are very difficult to design well because of the many varied issues that need to be considered. Interface design wasn't discussed very much in the workshop, or in other classes for that matter, but might have helped. Overall, I'm pleased with the results, and most people had lots of fun with this exercise. If the workshop became a full quarter class, more 3D-sketch models should be incorporated into the conceptual exercises. I would encourage other instructors to increase the use of 3D-sketch models into other classes as well.

Candid Shots

Figure 72: Some of the remote sketch models materials.
Foam core, wooden beads and cut-outs, and white glue.
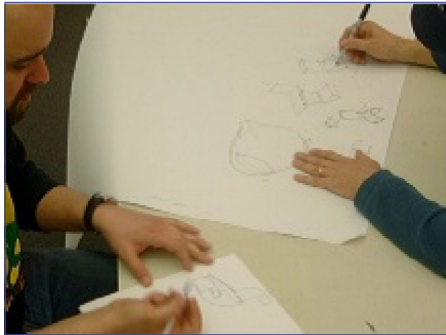
Figures 73 and 74: Candid Sketching and Model Assembly

Figure 75: Pre-Workshop Exercises, Remotes.

Use of focal points via relative size, orientation, and location

Use of grouping to suggest related functions

Use of affordances through curved shape and sculpting allows for easy holding

Figure 76: Workshop Exercises, Remotes.

There is a clear use of the concepts in the sketch model of the remote (fig. 76), and some refinement of the ideas presented in the pre-workshop sketches (fig. 75). The student appears to have included focal points and a hierarchy initially. The model has been refined to include a more definite use of patterns and hierarchy. Further, there are several focal points included, which are layered into a hierarchy based on relative sizes, orientation, and locations.
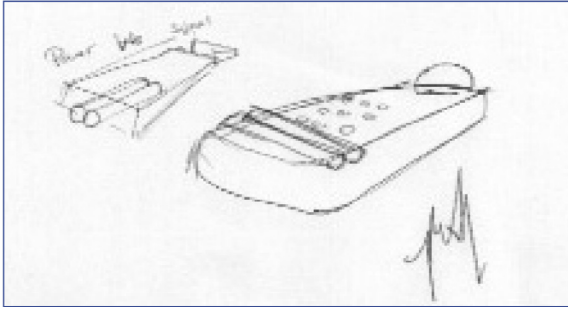
Figure 77: Pre-Workshop Exercises, Remotes.
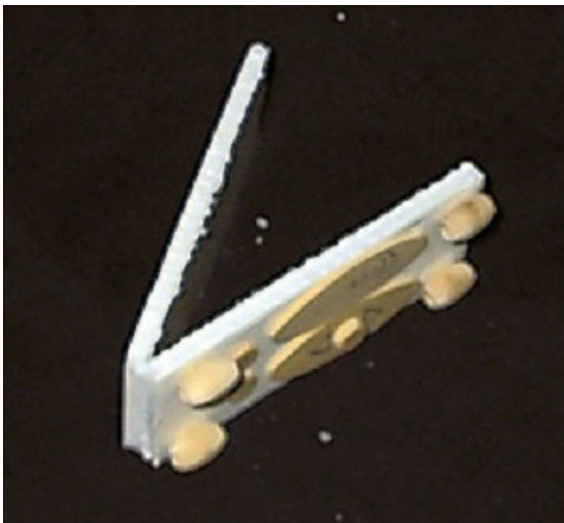
Figures 78 and 79: Workshop Exercises, Remotes.

Sometimes designers get too "clever" for their own (or anyone's) good. During the group evaluations, no one understood how this remote (figs. 78, 79) was intended to work until the concept was explained. The same was said of this student's pre-workshop sketches (fig. 77).
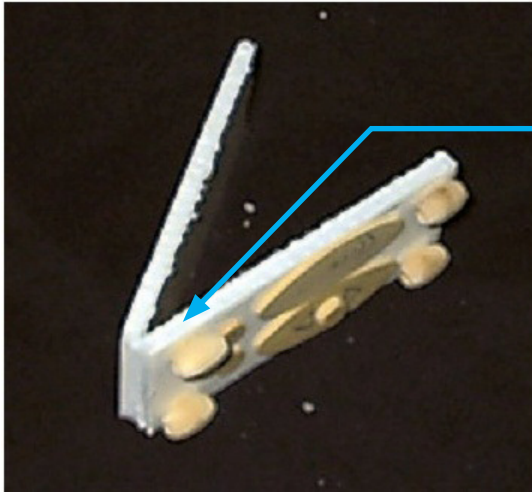
Hinge intended to create an on/off switch

Figure 80: Workshop Exercises, Remotes.

The student intended for this remote (figs. 78 - 80) to turn a device on and off by squeezing the remote halves together via a hinge and spring mechanism at the bottom of the remote body. Although this could easily be accomplished through the use of form, it is somewhat difficult to show with the materials as provided.

If the model were a working prototype, I would imagine that the intended use of the hinge would be more easily discovered through natural exploration, as covered previously in the workshop. With a little more time and thought, I think this model would have been more successful.

So although this sketch model failed on some levels, I do think that the student grasped the many of the concepts presented in the workshop. There is a use of hierarchies and focal points through the use of relative sizes, proximity, and location in the 3D- sketch model's buttons.

Although the exercise was intended to rely on the use of form, he also indicated embossed semiotics to help identify some buttons. Again, he could have more successfully used form to accomplish those tasks with a little more thought and exploration, and this model helped me illustrate the use of redundancy a little later.
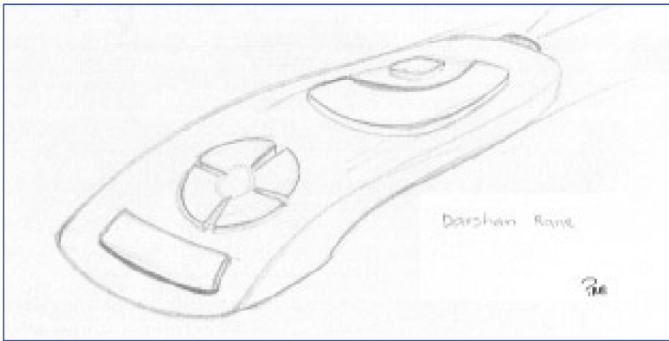
Figure 81: Pre-Workshop Exercises, Remotes.
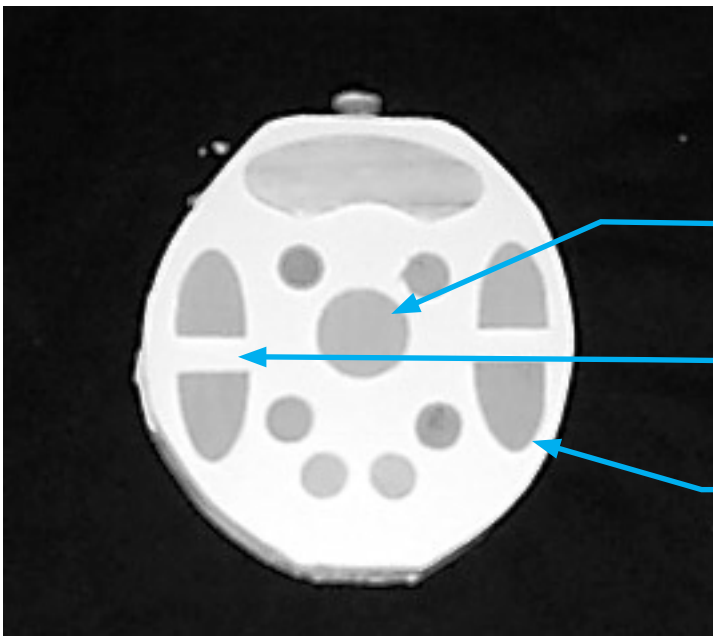
Use of focal points via relative size, orientation, and location

Use of grouping to suggest related functions

Use of semiotics in the form implies direction, i.e. up or down

Figure 82: Workshop Exercises, Remotes.

The pre-workshop sketch (fig. 81) in this example appears to be a mix of an existing remote and pure styling. The model (fig. 82) shows a clear use of patterns, focal points, semiotics, hierarchies on several levels, and as was pointed out during the group evaluations, also looks a bit like a face.
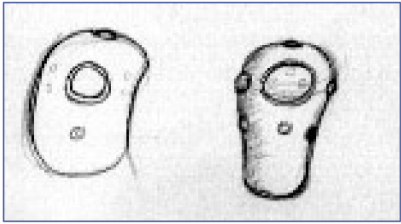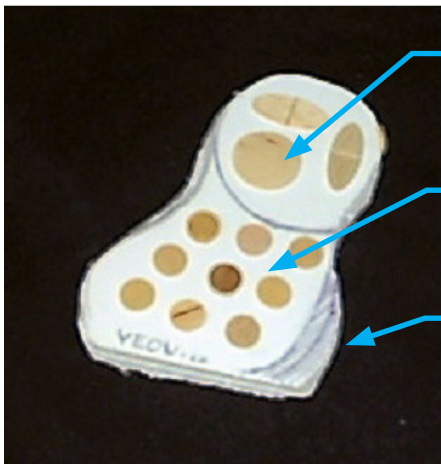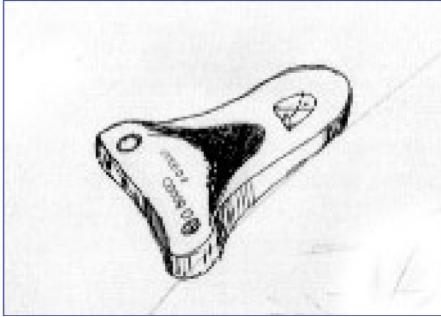
Figure 83: Pre-Workshop Exercises, Remotes.
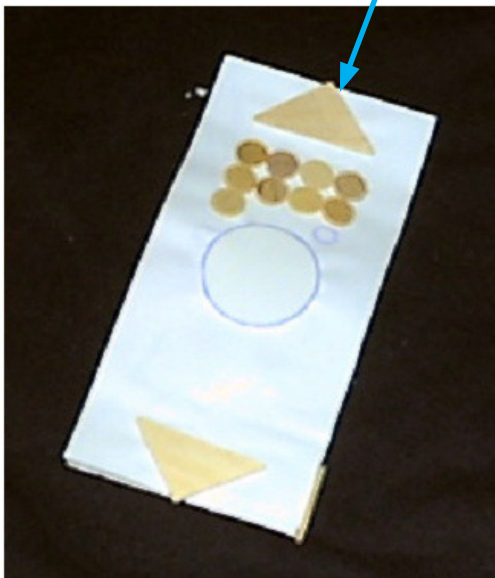
Use of focal points via relative size, orientation, and location. Use of semiotics.

Use of curve in the form creates an affordance for picking off a flat surface. Clips on bottom afford holding a printed schedule.
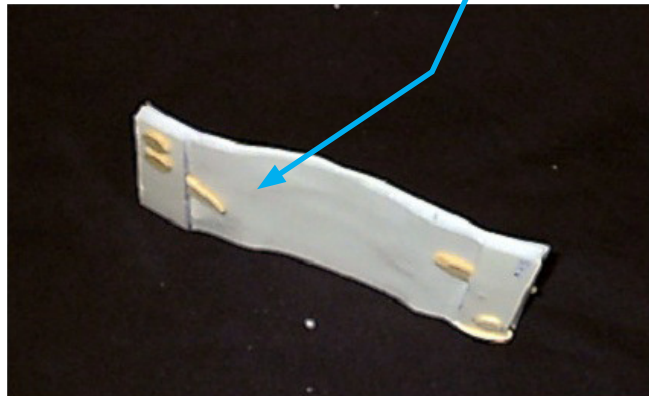
Figures 84 and 85: Workshop Exercises, Remotes.

This is probably my favorite remote example. The pre-workshop sketch (fig. 83) is almost pure styling. The model (figs. 84, 85) is a significant improvement and shows a good grasp of the material presented. There is a clear use of patterns, constraints, hierarchies based on relative sizes and locations, and the backside includes "affordances" to slip a schedule or channel guide into the back of the unit. Further, the curve of the unit (fig. 85) allows it to comfortably fit in the hand, rest on the lap more securely, and be more easily picked up off a flat surface than if it were completely flat. The curve and layout also provide visual interest.

Figure 86: Pre-Workshop Exercises, Remotes.
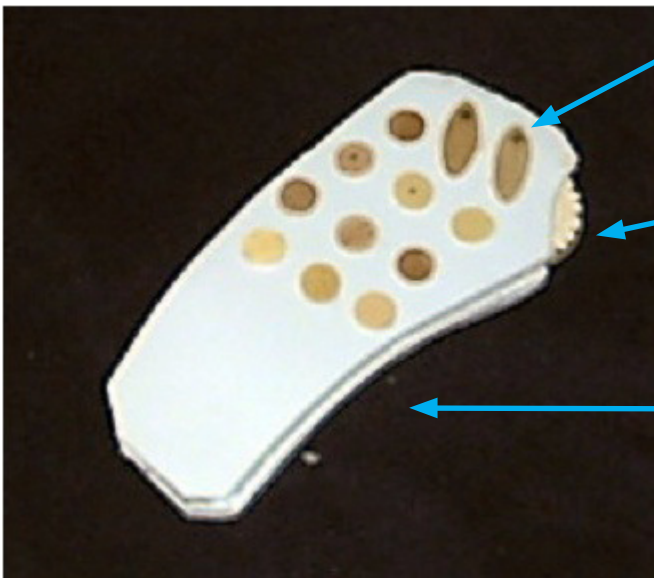
Use of focal points creates a hierarchy via relative size, orientation, and location.

Form implies rotational function, and notches allow for easier turning

Use of affordances through curved shape and sculpting allows for easy gripping

Figure 87: Workshop Exercises, Remotes.

Again, the initial sketch (fig. 86) seems to be an exercise mostly in styling, but it does contain some examples of focal points, patterns, and hierarchies. However, the model (fig. 87) is refined to a higher degree. There is a clear use of patterns, focal points, and hierarchies. Further, the dial in the corner has a location, shape, and size that is quite natural for the thumb to operate. The notches on the dial allow for easier turning and also help to encourage natural exploration.
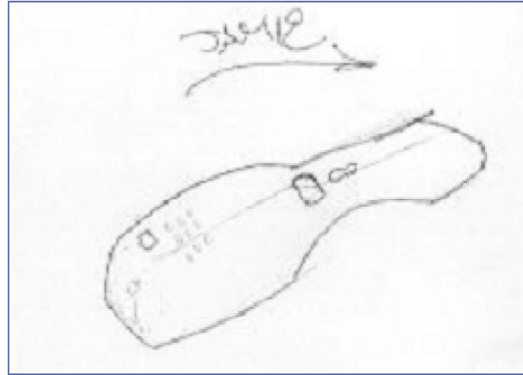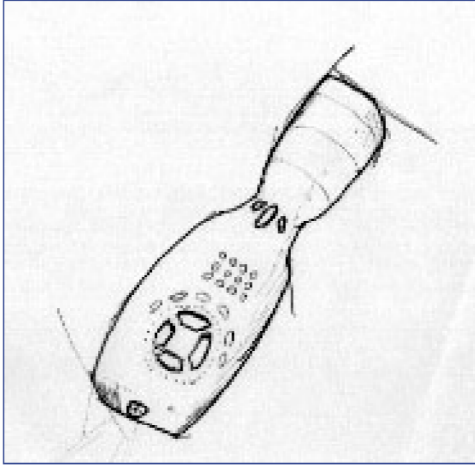
Figures 88 and 89: Pre-Workshop Exercises, Remotes.
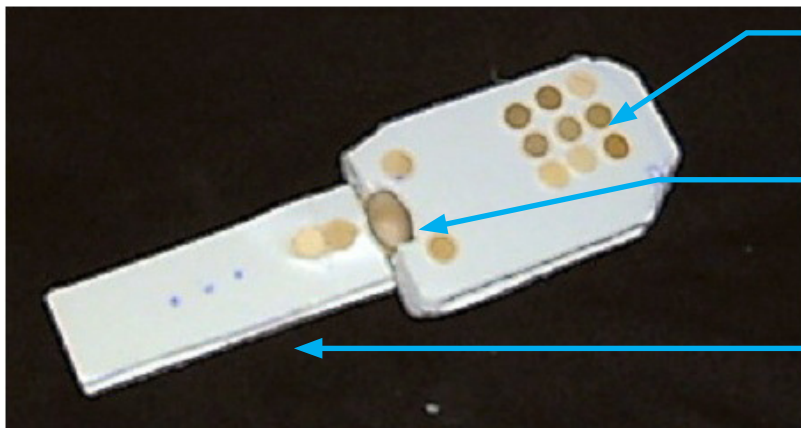
Use of grouping to suggest related functions, relative location suggests order of importance

Use of form suggests rotational movement, orientation suggests "up and down" function

Use of affordances through relative size allows for easy holding

Figure 90: Workshop Exercises, Remotes.

The initial sketch (fig. 88) looks almost exactly like an RCA remote I used to have when I could afford satellite TV, so I have to believe that it is mostly based on a mental model of an existing remote. It is interesting to note that this sketch includes many of the concepts discussed earlier. The "refined" sketch (fig. 89) shows a move slightly away from the initial sketch, but the overall form is similar. However, the layout of the controls is different, but still shows an application of patterns, hierarchies, focal points, and affordances. The model (fig. 90) is not quite as polished as the sketch, but shows further refinement based on trial and error application of human factors.
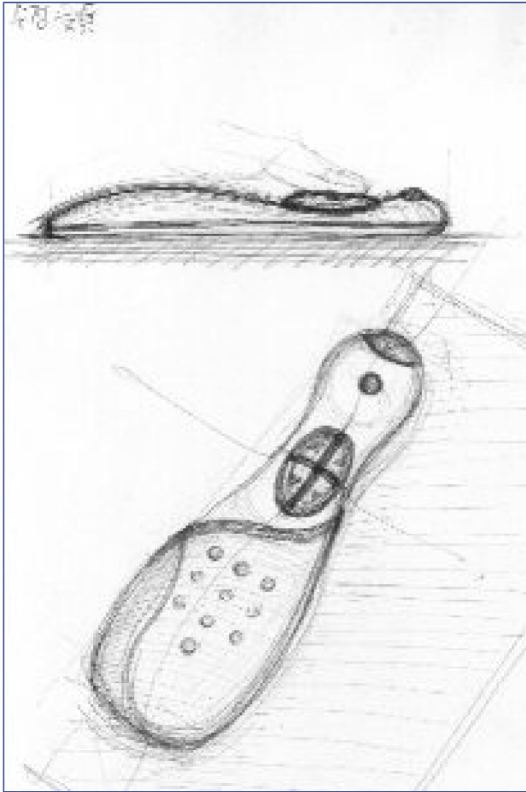
Figure 91: Pre-Workshop Exercises, Remotes.
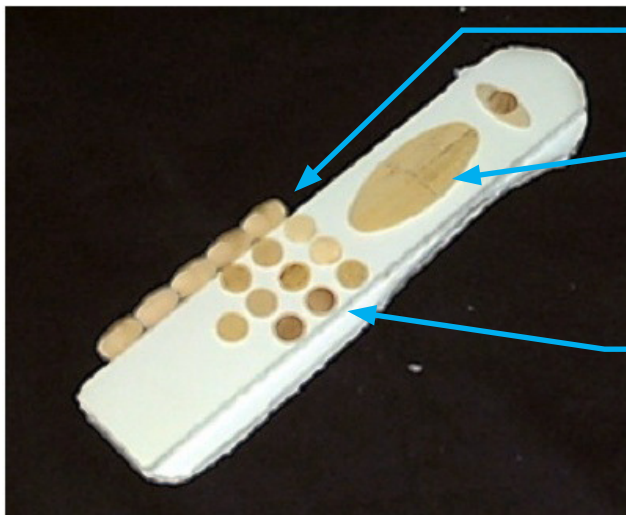
Use of form to create an affordance for easier holding

Use of grouping to suggest related functions and relative sizes and locations to create a hierarchy

Use of grouping and proximity to suggest related functions

Figure 92: Workshop Exercises, Remotes.

Interestingly, this grad student is the only one attending who had an undergraduate degree in Industrial Design. The initial sketch (fig. 91) showed a good understanding of these concepts before the workshop, much more so than the students with undergraduate degrees in other disciplines did. Thankfully, the model (fig. 92) shows that I didn't screw up that understanding too much. There are many similarities between the sketch and the model, but there are additional "affordances" provided in the way of a "grip" along the side.

Metaphor and Cognition

Metaphor can be an effective way to communicate a relationship between objects and their intended use. However, the use of metaphor can also be misused or overused depending on the situation.

Metaphor And Cognition

- A metaphor is when one idea or symbol is used in place of another to suggest relationships between them.

Q. How does this relate to semiotics?

57

Figure 93: Presentation Slide 57

I'm a poet, but you don't know it

- We can use metaphor to recall things that we are familiar with.
- Examples are chairs that outline body shapes, birdlike airports or planes, etc.
- Metaphors can be misused or overused, *ex. Win95 plus' virtual office desktop.*

58

Figure 94: Presentation Slide 58

Some examples of metaphors in product design are shown in the slide below (fig. 95).
For example the orange chaise lounge in the center is reminiscent of a person leaning back on their elbows, effectively suggesting both the position and attitude intended for the user.

Figure 95: Presentation Slide 59

I attempted to encourage such thinking by adding an exercise to design a chair that forms a relation to something else.
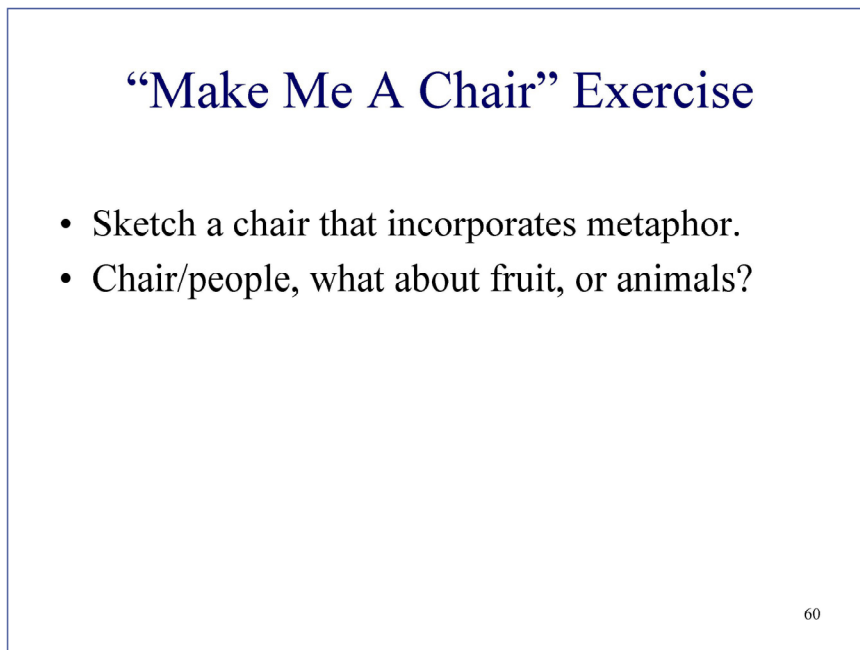
Figure 96: Presentation Slide 60

Pre-Workshop Chair Sketches

I decided to present these sketches in "before" and "after" groups because some of the people who did before sketches were no longer present due to time conflicts, and some after sketches were done by people who did not complete a pre-workshop chair sketch. Most of the pre-workshop sketches seem to be based mostly on styling concepts with a few exceptions.
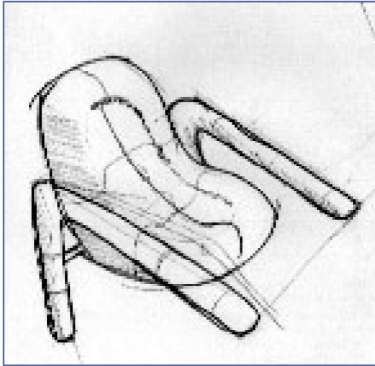
Figure 97: Pre-Workshop Exercises, Chairs.
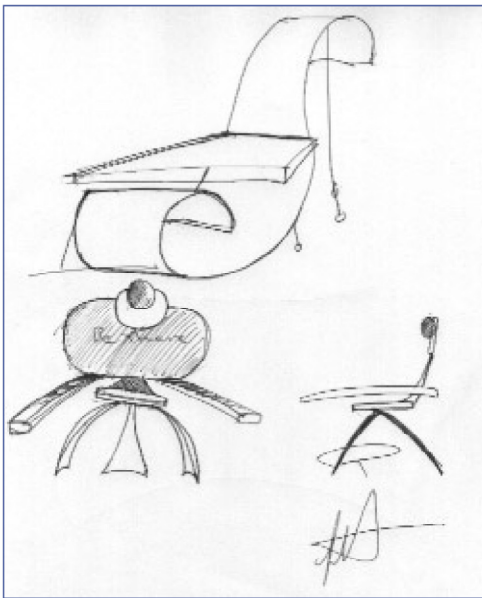
Figure 98: Pre-Workshop Exercises, Chairs.
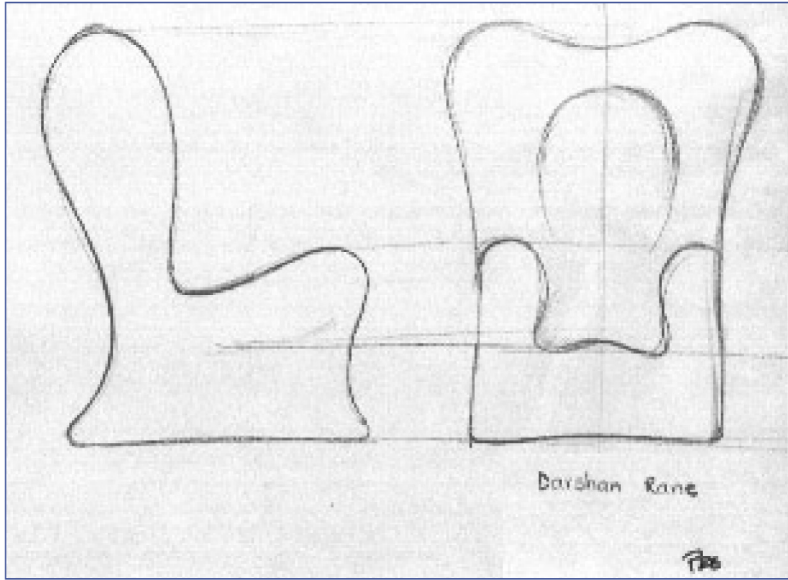
Figure 99: Pre-Workshop Exercises, Chairs.
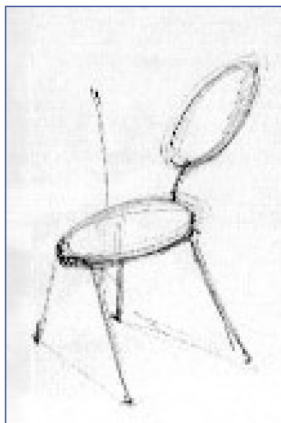
Figure 100: Pre-Workshop Exercises, Chairs.
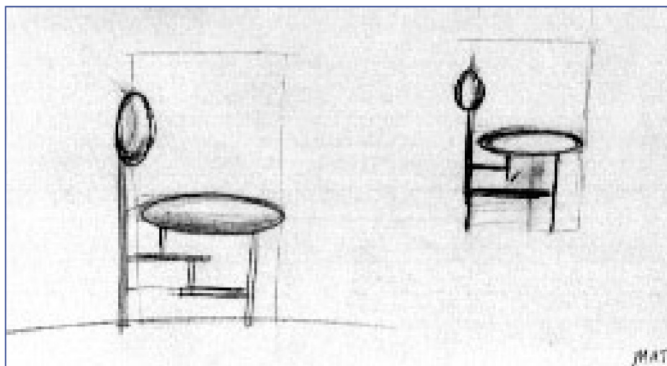
Figure 101: Pre-Workshop Exercises, Chairs.

Chair and Metaphor Sketch Exercise

This exercise is possibly more correctly described as a "Chair and Simile" sketch exercise, because I asked them "to design a chair that looks like something else."

However, my objective of using form to bring the idea of unrelated objects into something to sit on was achieved. The group had fun with the exercise, and during the evaluation felt the results were very creative, especially compared to the pre-workshop sketches. In most cases, affordances and constraints were also incorporated.
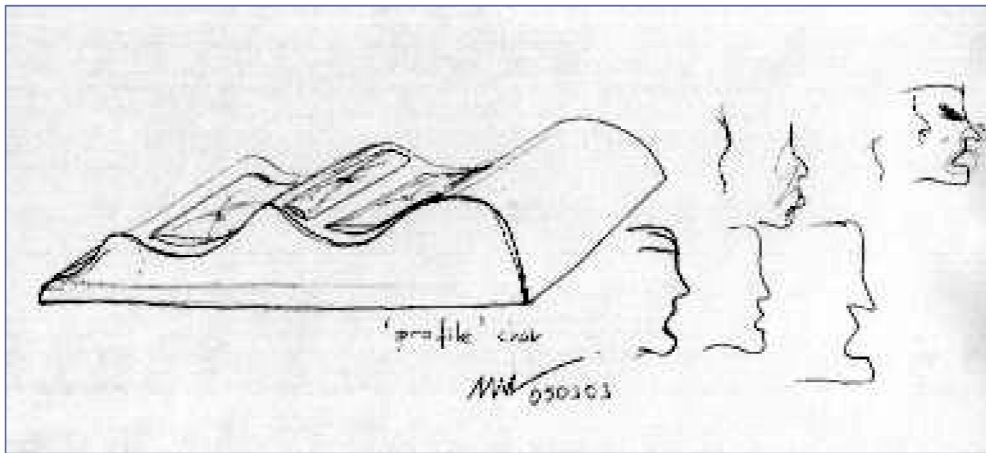
Figure 102: Workshop Exercises, Chairs.
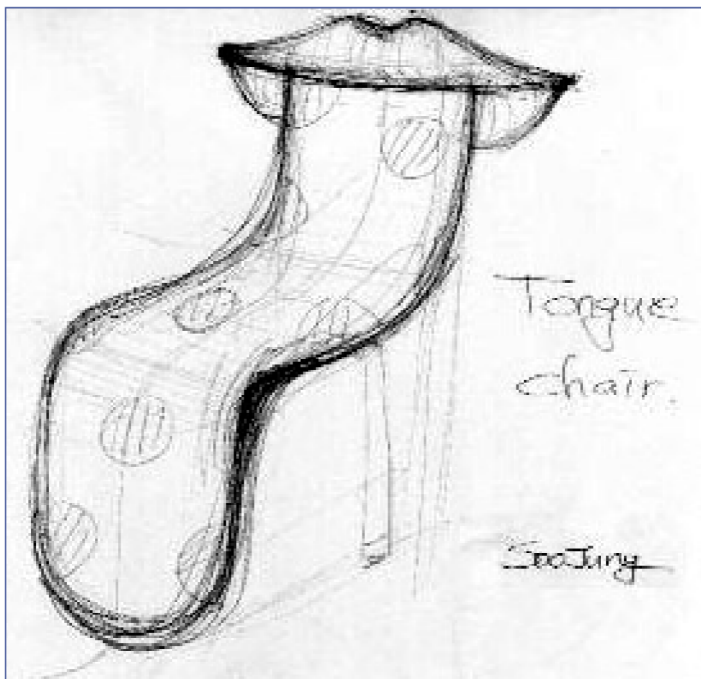
Figure 103: Workshop Exercises, Chairs.

79
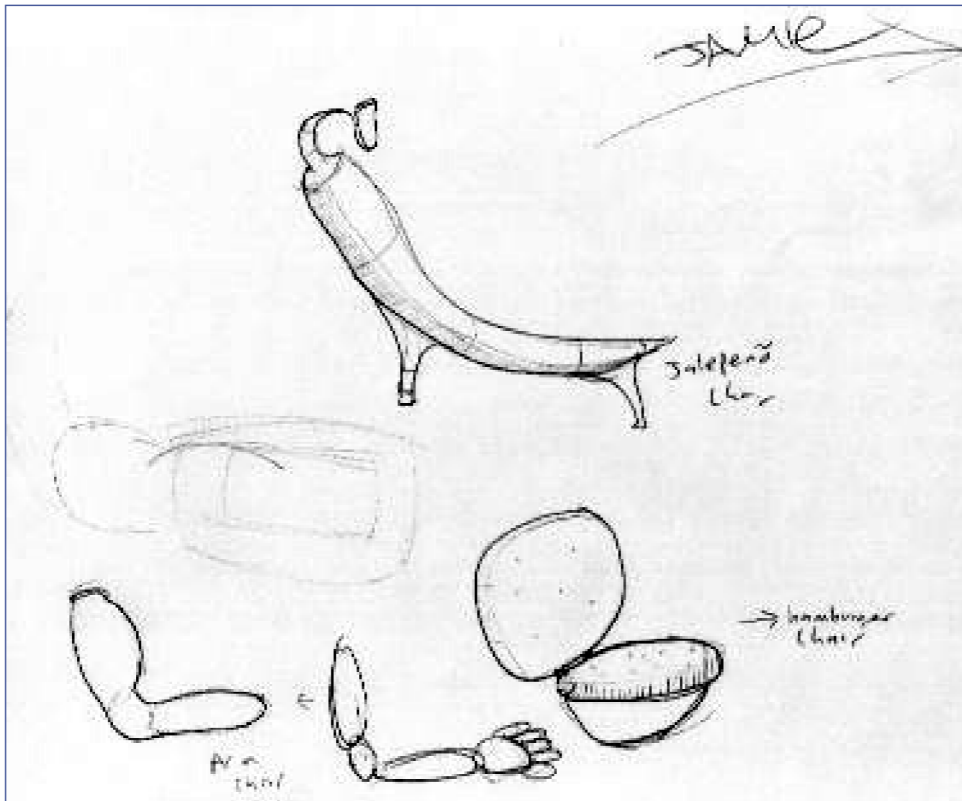
Figure 104: Workshop Exercises, Chairs.
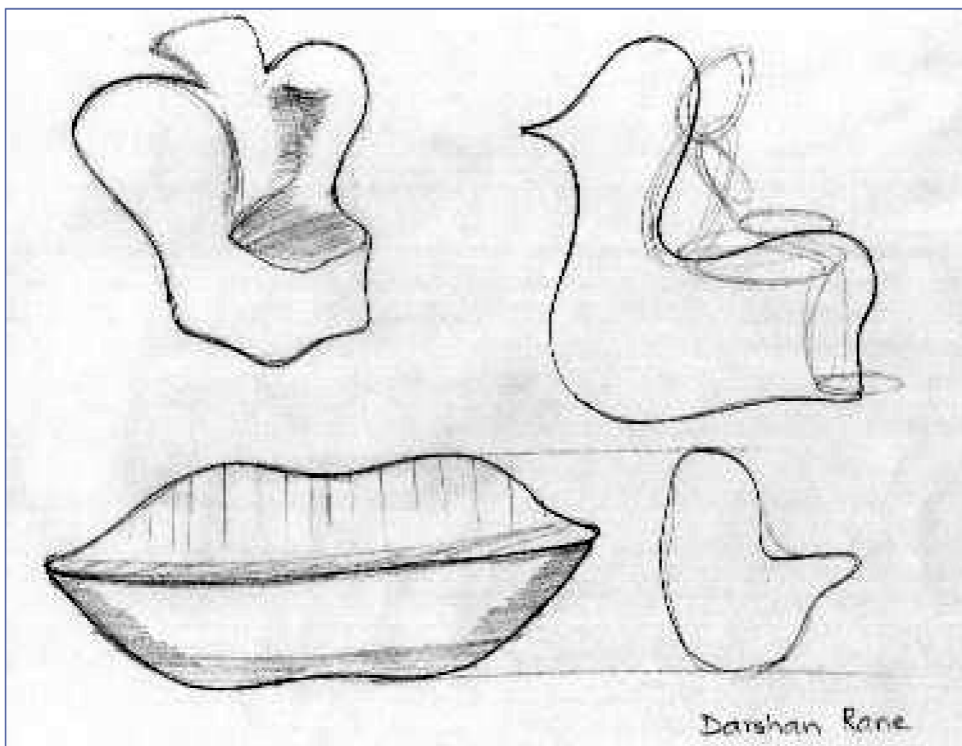
Figure 105: Workshop Exercises, Chairs.
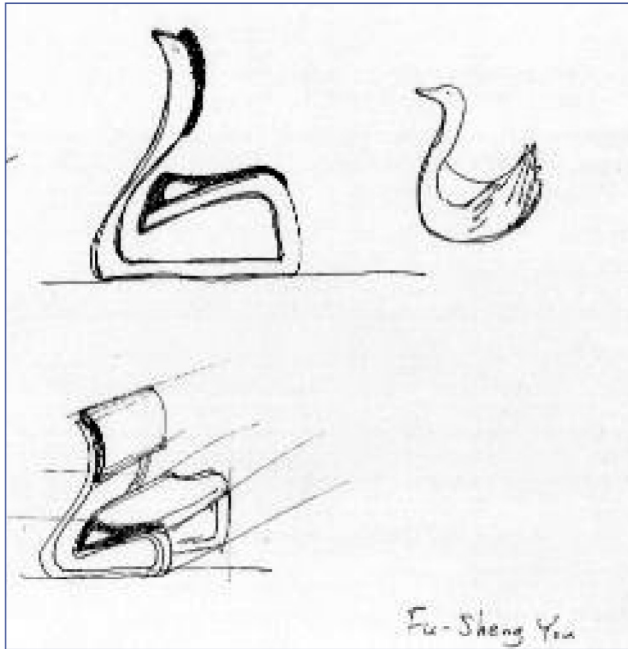
Figure 106: Workshop Exercises, Chairs.
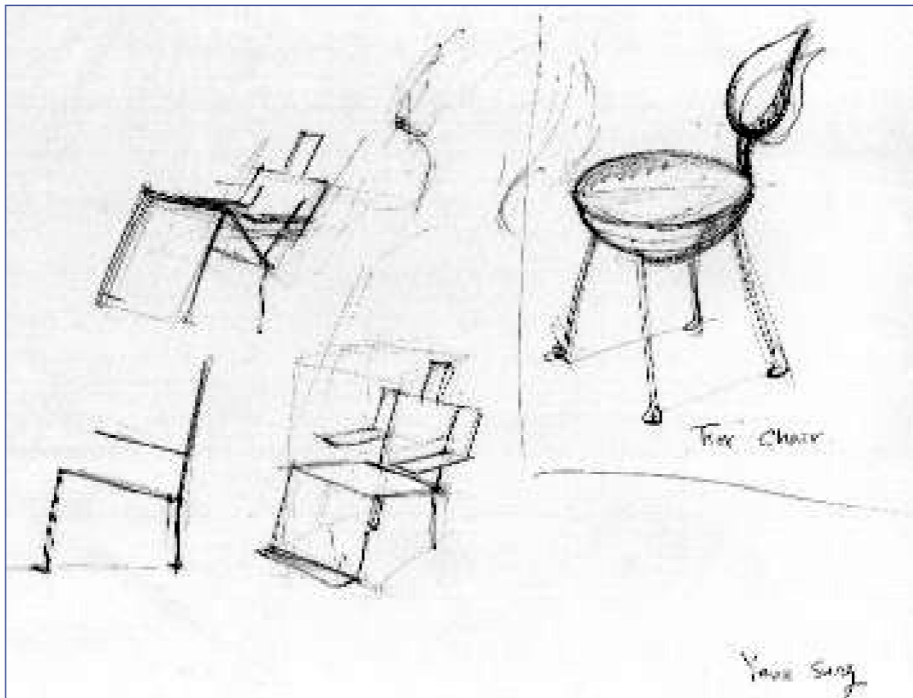
Figure 107: Workshop Exercises, Chairs.

Redundancy

This section may have been better placed near affordances and constraints, or before the section on semiotics. I'm not sure why I chose to place it at this point in the workshop, but I did feel that this material was important.

Although redundancy usually has negative connotations, in design it can be an important consideration. Redundancy allows us to reinforce information, giving the user additional cues in the event that others aren't clear or working.
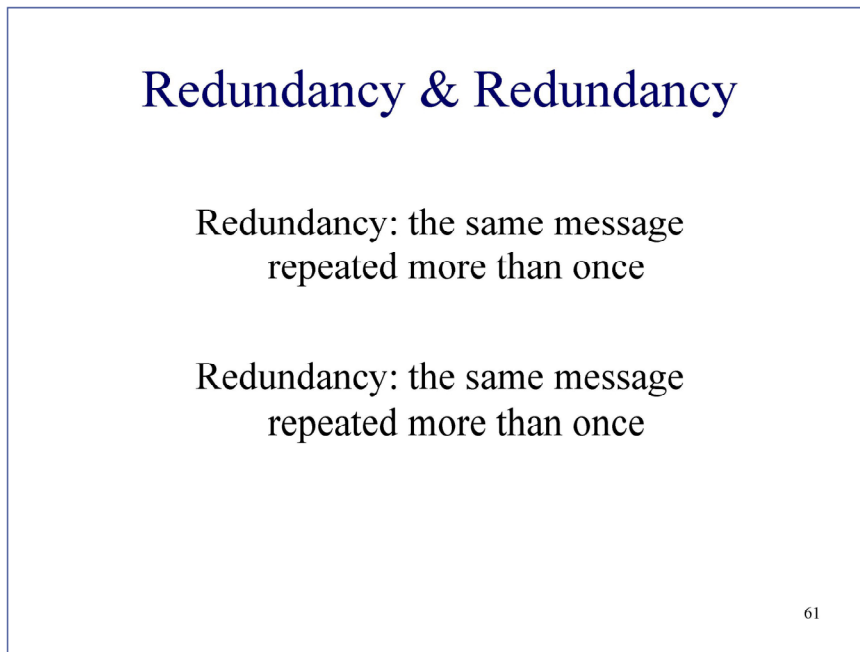
Figure 108: Presentation Slide 61

Figure 109: Presentation Slide 62

An example of this is a mechanical click when something has reached its intended limit of travel; the click reinforces other information as well as pre-conceived expectations by the user, i.e. that there is a limit of travel for the button.

Class Discussions & Questions

I wanted students to be able to ask questions during the workshop as they came up, and they did. Though they are questions for the ages, some of those questions are listed below and helped me refine the workshop as it progressed. They also helped me evaluate the effectiveness of the relative sections.

•*Conventions, when do they change, and why?*

•*Universal Design?*

•*What is Gestalt, how does it relate to artifacts?*

•*Geons, do we really see things that way?*

Evaluations and Comparisons

To help avoid hurt feelings, embarrassment, or the sense of being singled out, I chose to have the class evaluate themselves as a group by comparing the pre-workshop sketches to the work they did during the workshop. This method was based in part on "goodness" evaluations[5]. Almost everyone was surprised by the amount of material that was covered and the things (both good and bad) that they were able to point out during the evaluations.
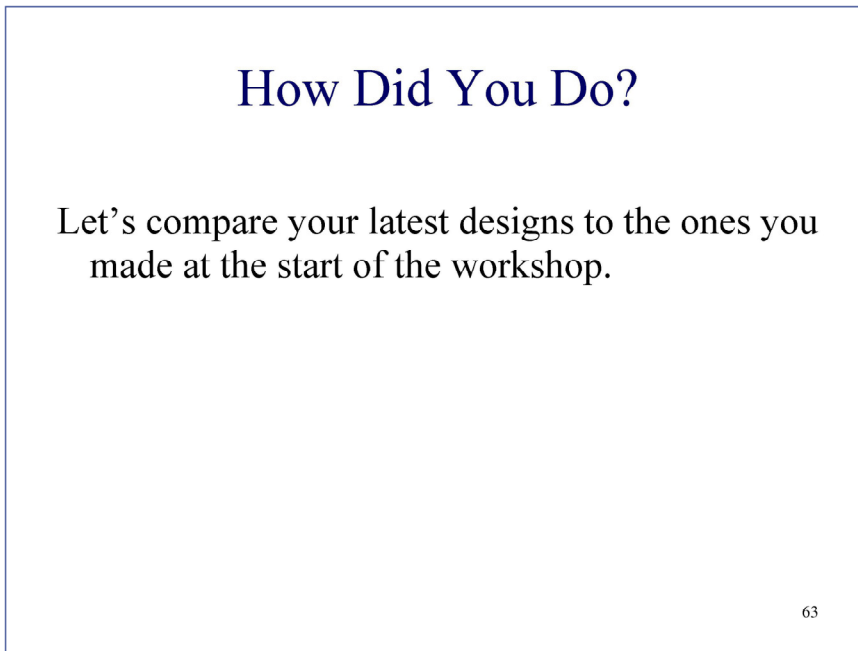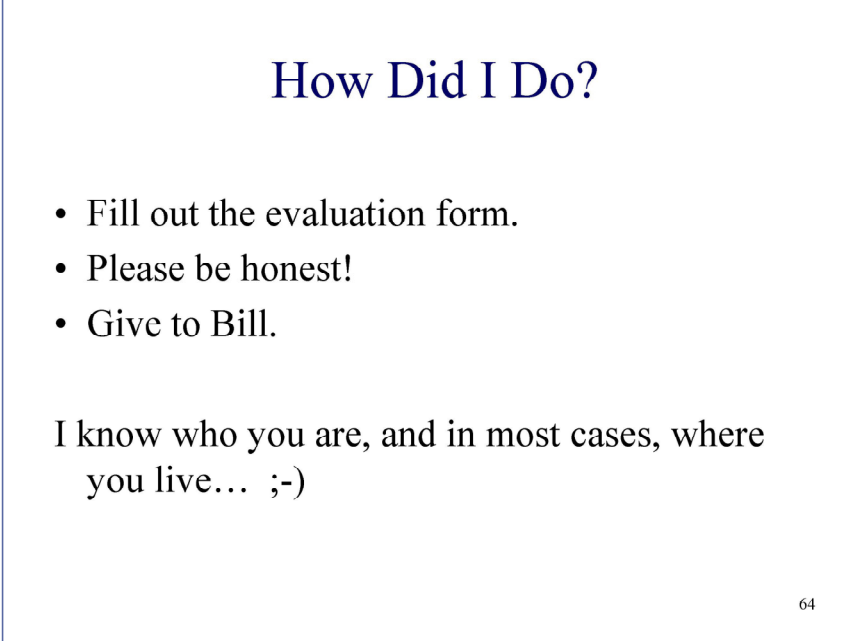
Figure 110: Presentation Slide 63

Figure 111: Candid Group Evaluation

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5   Hamada, Jiro and Toru Ishihara. 1988. *Complexity and Goodness of Dot Patterns Varying in Symmetry.* Psychological Research 50: 155-161.

Figure 112: Presentation Slide 64

I handed out a one-page sheet of questions to the class about the workshop to get their opinions on length, materials, suggestions, and how worthwhile they found the workshop. I asked them not to put their names on the sheets or worry about hurting my feelings. One student collected the responses and gave them to me after the workshop.

Evaluation Questions and Responses Summary

The amount of material covered was: *Just right (7), Too much (1 "sort of")*

The pace of the workshop was: *Too fast (2), Just right (6)*

The material is useful to the design curriculum: *Yes (8)*

Most of the material was covered in enough detail: Yes *(6.5), No (1.5)*

There was new material I wouldn't have learned otherwise: *Yes (7), No (1)*

I wish I could study this for a whole qtr: *Yes (6.5), No (1.5)*

I already knew most of the material: *Yes (1), No (7)*

This material would be best for: *Both grads & undergrads (7), undergrads (1)*

The exercises helped me understand the concepts better: *Yes (8)*

The exercises should involve less drawing: *No (8)*

What I liked most about this workshop was:
New info; exercises & visuals; new way to approach design; clear explanations & visuals; exercises; good explanations & visuals

What I liked least about this workshop was:
long; class too short; class too short to prove results of workshop; want more visuals; lack of time to explore deeper; PowerPoint; fast

The material that was hardest for me to understand:
what is universal design; what is good design; is there a rule for design; none; none; cognition

The material that was easiest for me to understand:
affordances; gestalt; geons; pictures & clear sentences; metaphor; most of it

Suggestions:
need a form & design class; make class longer/entire quarter; lots of good info & perspective change for a 1/2 day class!; Very good job; more exercises, make longer; more humor

Suggested Changes Based on Class Evaluations

From the results of the class's evaluation of the workshop listed above and my experience in teaching the workshop, I feel that the following changes should be made:
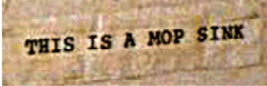
- Make the class an entire quarter, or a series of shorter workshops
- More "hands-on" form exercises and more visuals for each concept
- Exercises should involve both Form and Drawing
- Cover more elements: symmetry, balance, proportion, abstraction, etc.
- More about "universal design," what works and what doesn't
- Stress relationships between exercises, i.e. metaphor and affordances
- Provide more ways to evaluate a design
- Less PowerPoint?

Closing

At this point, I felt like I accomplished most of my objectives for the workshop (and many I didn't anticipate), so I thanked everyone for their participation and support, and ended.

Figure 113: Presentation Slide 65

Although I ended the workshop in a little less time than I expected, it was still a rather long day. Immediate feedback outside of the workshop was very positive, and I really feel like we all accomplished something.

Students not only wanted to keep their models and sketches after I finished with them, but also requested copies of my presentation for future reference. In hindsight, I should have kept the models and sketches since imaging technology has improved quite a bit since my workshop and this writing. I'll wait until I get my grade before I provide copies of my presentation though…

Conclusion

Ultimately, I feel my workshop was very successful and in more ways than I imagined. Most classes probably also achieve some "extra" benefits. Eventually, I suppose the extras are taken for granted but without discussion in the detail they warrant. During the four years that an undergraduate studies, many of these extra concepts might get absorbed naturally, and without much thought. Over two years as a graduate, it's possible some things get missed, and that feeling is what finally led me to create this workshop.

Based on the students' work in my workshop and their survey responses, I emphatically believe that the graduate ID curriculum would benefit greatly from a theory course based on the influence of form and cognitive psychology. This is especially true for those students who are new to ID. A good understanding of the ideas and principles discussed can help a designer arrive at a better solution, faster. The students' work included earlier illustrates this in many cases; at the least, it's more creative and shows use of the material covered. However, I know that my workshop needs refinement.

While there are "universal" characteristics, there is no such thing as "universal design" in today's world. Some students found it hard to make this distinction, but I'm not sure how to make it clearer than I did in the workshop. Having the student create a list of examples of "universal" designs that are not actually universal might help. However, I think to some extent certain people will always "search for a recipe" instead of "learning to cook." I did not want this workshop to teach "recipes," but instead focus on "different ingredients and techniques."

During my planning stages, my advisors and I discussed the way I ordered the concepts. When I arranged the concepts one way, they suggested I try a different order. After I rearranged it, they suggested the previous order. Maybe my intentions blurred in light of other issues, but I agree that the order of the concepts is not quite right. Overall, I tried to make related materials cohesive. For cumulative concepts I tried to put the most basic ideas first. In some cases, it might be better to present the concept and examples, and then present the definition. Breaking up the workshop into shorter segments might help define the structure better. Shorter segments and better organization could also help student retention of the concepts.

Most topics need more visual examples, exercises, and discussion time to clarify further. Some concepts could expand to include other related concepts. Something that recently occurred to me is including *physiological* and *tactile* responses to form, and how those responses relate to psychological responses to form.

"Form and Metaphor" was the weakest concept, possibly because of my verbal presentation. Further, it should expand to include analogies, similes, etc., and the distinctions between them. The strongest concept was "affordances," possibly also because of my verbal presentation. If you ask someone to design a product to safely hold, heat, and pour boiling water into a cup, the result is very different than you get asking him or her to design a teapot.

Problems are understood more quickly when considering relative affordances and constraints, but even more so when the initial question reinforces those ideas. Such an approach leaves more time and energy for creative solutions, since it helps define "anchor points" and the design can play off what's in between.

Ideally, students could better understand each workshop concept and how to apply it more thoroughly with a full-quarter class based on these concepts. That also provides easier integration with other classes, both in time and practice. A full quarter schedule also allows time for more hands on exercises and examples, which in turn would help reduce reliance on PowerPoint to make points and examples efficiently. In my opinion, adding this material and an additional studio class based solely on the pure aesthetics of form and space, such as those offered at Pratt, could help create a superior graduate ID curriculum at RIT.

I enjoyed my time at RIT immensely. I'm very grateful for the opportunity to change my career and any criticism is intended for constructive use only. I very deeply appreciate the support and attention from my fellow students and my teachers, the staff at KEK Associates, and especially the support from my wife, parents, and siblings. There are no words to properly express my gratitude.

At the time of this writing, several years later, I've only now started to see similar topics formally addressed within the design community's literature. I am sure that I'm on to something, but I sure wish I had those resources available when I began these efforts in 2002!

Ultimately, my research for this workshop helped me understand many of my questions, and as usual, led me to other questions that I will likely spend the rest of my life trying to answer.

Appendix

Form and Visual Cues

A Workshop For Design Students
by Bill Campbell, in preparation for a
Master's Thesis

Good Morning!

- Design a teapot, a remote control unit, and a chair, simple sketches are ok.
- Write "Pre-workshop" with your name on the page.
- When you're done, give them to Bill.

Now...
What Are We Doing Here?

Learning to use form to make our products easier to understand
— who needs instructions?
- The form of the product can give us visual clues as to how it can be used.
- These clues can lead us in ways that are very basic and easy to remember.

Is He Serious?

Yes! But there are some issues...
- Lots of things can influence peoples' perception: culture, age, past experience, physical abilities, etc.
- As a result, we can't always send the same message to everybody.
- Some information should carry over: size, proximity, etc.

Form Contains Valuable Information!

- It can have info about using the object, where to push, hold, pour, turn, etc.
- Applied graphics might not be clear to everybody, and can contradict other info. *Plus they might wear off...*
- Color can help clarify or get attention in some situations.

So What Is Form?

There are many definitions...but for us,

Form = the shape or structure of an object

Go Form, Go!

What Can We Do To Form?

- Add & Subtract
- Stretch
- Cut/slice
- Bend/Twist
- Mix & Match

Do It To It!
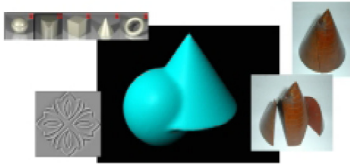
9

Form Exercise

Redesign a Rubik's Cube to eliminate color. *How can you use form to make each side different from the others?*

10

Affordances Provide Ways to Do Things

- The doorway *affords* a way to get from this room to that room.
- The *door* affords a way to control the doorway.

We can apply this idea to help people understand how to use our products.

11

Real and Perceived Affordances

- *Real:* looks like it might allow you to do something, does what you expect.

- *Perceived:* looks like it might allow you to do something, but doesn't.

Q. When would you want to trick someone with perceived affordances?

12

Real Affordances

13

Perceived Affordances

14

Constraints

Constraints prevent us from doing something.

- A door can act as a constraint as well as an affordance.
- We can use constraints in conjunction with affordances to help people understand how to use our products.

15

An Affordance for Me, A Constraint For You

16

93

"Don't Spill It!" Exercise

Sketch a water bottle or tea kettle
- It should include a number of affordances and constraints, such as where to hold, where to fill, etc.
- Bill needs a copy with your name on it!

17

Exploration Is Natural

When we find a new object we:
- Examine it.
  (Is this like anything else I know?)
- Determine affordances and constraints.
- Interpret feedback.
- Apply what we learned & use the object, then find new uses.

18

Battery Door Exercise

- Concept sketch a battery access door for an electronic product.
  - Should be easy to identify, open, close, stay closed, and show battery orientation.

How can you use form to do this?

19

Darwin and Design

Survival of the fittest!
- Artifacts change to meet needs by trial and error and constant refinement.
- Things that work remain, things that don't get discarded.

Designers don't have that kind of time today, we'd best use whatever we can!

20

Conventions

- Convention: a rule or custom generally agreed upon, ex. driving on the right.
- Conventions can sometimes override other information.
- Sometimes manipulating conventions can cause confusion; respect them!

21

Conventions

22

Conventions

23

Conventions

24

94

Lunch!

25

What's Next?

- We're going to learn some theories of how we see the world.

- Understanding how we see the world can help us do a better job as designers.

26

Cognition: Do You See What I See?

Cognition is the process of knowing, including aspects such as awareness, perception, reasoning, and judgment.

- Lots of things can influence cognition, physical abilities, emotional state, etc.

27

Cognition, Working For You

28

Cognition, Working For You
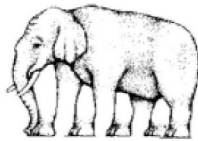
29

Cognition And What We're Going to Learn Next

- Geons
- Gestalt Theory
- Patterns
- Context and Relationships
- Semiotics

- Focal Points and Hierarchies
- Metaphor
- Redundancy

30

Geons And Cognition

- Geons are the smallest recognizable components of form.
- Different geons are often mixed into groups to make a unique form.

Q. Are we born with this info, or do we learn it from birth? Remember *memes*?

31

Geons In Action

32

95

Gestalt
& How To Pronounce It

- **Ge·stalt:** *n.*(g-shtält, -shtôlt, -stält, -stôlt) originates from the high German word for form, derived from place.

- Gestalt refers to a configuration of elements where *the whole is greater than the sum of its parts.*

Gestalt and Cognition:
Kanizsa Triangle

Q. Do you see a shape in the center of the image below?

Kanizsa Triangle, step by step

- Figure and Ground

- Similarity, proximity

Kanizsa Triangle, step by step

- Closure, area, symmetry

Kanizsa Triangle, step by step

- Figure and Ground
- Similarity, proximity
- Closure, area, symmetry
- May be a survival instinct to quickly "see" a predator

Patterns And Cognition

- Pattern: system or repeated grouping.
- Forms can be grouped into patterns (so can geons).
- Patterns can help us learn complicated systems more easily.
- Patterns are very important in identifying objects.
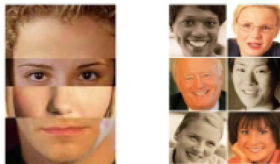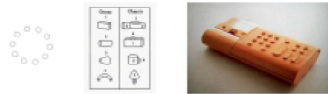
Patterns Doing Their Thing

Patterns Doing Their Thing

96

Context And Cognition

- Where an object is can help people understand it; how does it relate to its surroundings?
  - A chair in a house, a house on a street, a street in a neighborhood, etc.
- Things out of context can mislead people, and/or create new expectations.

41

Context And Cognition

42

Context And Cognition

43

What Does Context Mean To A Janitor?

44

What Does Context Mean To You?

45

Relationships And Cognition

- Relationships, much like context, can help clarify groups of form.
- Relationships can be formed through proximity, size, scale, shape, similarity, alignment, direction, location, etc.
- They can also help us determine what kinds of things aren't related.

46

Relationships And Cognition

47

Focal Points And Cognition

- A focal point is something that gets your visual attention first.
- They can help show relationships and what's most important.
- Focal points can relate to other focal points to create a pattern and/or *hierarchy*.

48

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Focal Points And Cognition

Focal Points And Cognition

Exercise:
Focal Points For All of Us

- Sketch a cartoon face where the mouth is the focal point.
- Sketch another cartoon face where the nose is the focal point.

What Does "Semiotics" Mean?

Semiotics is
to interpret signs or symbols.

We can use different kinds of visual cues in our forms to act as signs or symbols.

Semiotics 4U + Me

Geons, Form, Patterns, Context, Relationships, Focal Points, Hierarchies, Semiotics, and Remotes

What's Most Important?

You can write your "design objectives" on index cards, and re-arrange the cards to help find the focal points and a hierarchy for your design.

Q. How does this relate to graphic design, art, architecture, etc?

Remote Controller Exercise

- Design a Remote Controller Sketch Model using materials provided by Bill.
- The Remote should include a way to turn something on and off, and control a few other functions of your choice.
- The remote should show a clear hierarchy that doesn't rely on graphic labels.

Metaphor And Cognition

- A metaphor is when one idea or symbol is used in place of another to suggest relationships between them.

Q. How does this relate to semiotics?

57

I'm a poet,
but you don't know it

- We can use metaphor to recall things that we are familiar with.
- Examples are chairs that outline body shapes, birdlike airports or planes, etc.
- Metaphors can be misused or overused, *ex. Win95 plus' virtual office desktop.*

58

What's In A Name?

59

"Make Me A Chair" Exercise

- Sketch a chair that incorporates metaphor.
- Chair/people, what about fruit, or animals?

60

Redundancy & Redundancy

Redundancy: the same message repeated more than once

Redundancy: the same message repeated more than once

61

Redundancy

- Can help to reinforce other feedback in a positive manner, ex. a click or beep when pushing a button.
- Can also be annoying if overused, like on your stupid cell phone.

62

How Did You Do?

Let's compare your latest designs to the ones you made at the start of the workshop.

63

How Did I Do?

- Fill out the evaluation form.
- Please be honest!
- Give to Bill.

I know who you are, and in most cases, where you live… ;-)

64

Such Sweet Sorrow

- Thanks for coming...
- Hope this helps you, good luck to you all!
- Would a rose by any other name smell as sweet? Forget me not!

THIS IS A MOP SINK

68

Works Cited

Alexander, Christopher, and others. 1977. *A Pattern Language: Towns, Buildings, Construction.* Oxford University Press, New York.

Alexander, Christopher. 1964. *Notes On the Synthesis Of Form.* Harvard University Press, Cambridge, MA and London, England.

Arnheim, R. 1954. *Art and Visual Perception.* University of California Press, Berkeley.

Biederman, Irving. 1987. *Recognition-by-Components: A Theory of Human Image Understanding.* Psychological Review, 94, 115-147.

Biederman, Irving. 1988. *Aspects and Extensions of a Theory of Human Image Understanding.* In Pylyshyn, Z. pp. Preprint. Ablex, New York.

Biederman, I., Hilton, H.J., & Hummel, J.E. 1991. *Pattern goodness and pattern recognition.* In J.R. Pomerantz & G.R. Lockhead (Eds.) The Perception of Structure, Chapter 5, 73-95.

Coates, Del. 2003. *Watches Tell More Than Time.* McGraw-Hill Companies, New York.

Edwards, Betty. 1979, 1989, 1999. *The New Drawing On The Right Side Of The Brain.* Penguin Putnam, Inc. New York.

Elam, Kimberly. 2001. *Geometry Of Design, Studies in Proportion and Composition.* Princeton Architectural Press, New York.

Gelb, Michael J. 1998. *How To Think Like Leonardo Da Vinci, Seven Steps to Genius Every Day.* Random House, Inc., New York, NY.

Gibson, J. J. 1977. *The Theory of Affordances.* In R. E. Shaw & J. Bransford (Eds.), Perceiving, Acting, and Knowing. Lawrence Erlbaum Associates, Hillsdale, NJ.

Gibson, J. J. 1979. *The Ecological Approach to Visual Perception.* Boston: Houghton Mifflin Co..

Gilson, George. 1996. *Spatial Ambiguity: The Element of Magic In 3-Dimensional Drawing. Identifying the Primary Source of Illusion and Beauty in the Visual Arts.* Rhombic Press, Brooklyn, NY.

Gladwell, Malcom. 2000. *The Tipping Point, How Little Things Can Make A Big Difference.* Little Brown and Co. Boston, New York, and London.

Green, Peter Arthur. 1974. *Design Education: Problem Solving and Visual Experience.* Batsford Limited, London.

Hamada, Jiro and Toru Ishihara. 1988. *Complexity and Goodness of Dot Patterns Varying in Symmetry.* Psychological Research 50: 155-161.

Hannah, Gail Greet. 2002. *Elements of Design: Rowena Reed Costellow and The Structure of Visual Relationships.* Princeton Architectural Press, New York.

Hirshberg, J. 1999. *The Creative Priority: Putting Innovation to Work in Your Business.* Harper Collins Publishers, New York.

Howe, Edmund and Kenneth Jung. 1986. *Immediate Memory Span for Two Dimensional Spatial Arrays: Effects of Pattern Symmetry and Goodness.* Acta Pyschologia 62, pp. 37-51.

Humphrey, G. Keith. 1980. *Effects of Partial Symmetry, Exposure Time, and Backward Masking on Judged Goodness and Reproduction of Visual Patterns.* Quarterly Journal of Experimental Psychology 32, pp. 27-55.

Krippendorff, Klaus and Reinhart Butter. 1984. *Product Semantics: Exploring the Symbolic Qualities of Form.* Innovation. The Journal of the Industrial Designers Society of America, pp.4-9.

Kurzweil, Ray. 1999. The Age of Spiritual Machines, When Computers Exceed Human Intelligence. Penguin Putnam Inc., New York.

McCloud, Scott. 1993. *Understanding Comics, The Invisible Art.* Harper Collins Publishers, New York.

Norman, D. A. 1988. *The Psychology of Everyday Things.* Basic Books, New York.

Norman, D. A. 1999. *Affordances, Conventions, and Design.* Interactions, May/June, pp. 38-42.

Papanek, Victor. 1995. *The Green Imperative, Natural Design For The Real World.* Thames and Hudson Inc., New York.

Preble, Duane, Sarah Preble and Frank Patrick. 1999. *Artforms: An Introduction To The Visual Arts.* Addison-Wesley Educational Publishers, Inc.

Stabin, Mel. 1999. *Watercolor: Simple, Fast, and Focused. Essential Concepts for Mastering the Medium.* Watson-Guptill Publications, New York.

Strunk Jr., William and E.B.White. 1979, 2000. *The Elements Of Style, Fourth Edition.* Allyn & Bacon, Massachusetts.

Turabian, Kate L. 1937, 1955, 1967, 1973, 1987, 1996. *A Manual for Writers of Term Papers, Theses, and Dissertations, Sixth Edition.* University of Chicago Press, Chicago.

Yue, X., Tjan, B.S., & Biederman, I. 2006. *Why are faces special?* Vision Research, 46, 3802-3811.

Internet:
(all sites accessed between November 2002 and May 2003 unless otherwise noted)

Beuker, Ralf and Peter Schneider. 2001. *Braun Design: Dream Real Products, Make Real Products.* DMI Journal, Vol. 12, No. 4, Fall.
   http://www.dmi.org/dmi/html/publications/journal/fullabstract_
   d.jsp?itemID=01124BEU15

Djajadiningrat, Tom, Kees Overbeeke & Stephan Wensveen. *But How, Donald, Tell Us How? On The Creation Of Meaning In Interaction Design Through Feed forward And Inherent Feedback.*
   http://www.idemployee.id.tue.nl/djajadiningrat/publications/02DjajDISButH.pdf

Walter,Glen. 2001. Building a Better Birdcage, and Other Tales. DMI Journal, Vol. 12, No. 3, Summer.
   http://www.dmi.org/dmi/html/publications/journal/fullabstract_
   d.jsp?itemID=01123WAL43

Untitled
   http://www.uiah.fi/attachment.asp?path=1;1456;2806;11851

All Things Web The Value of Usability
   http://www.pantos.org/atw/35679.html

Don Norman's jnd.org – essays
   http://www.jnd.org/dn.pubs.html#design

Group for User Interface Research – Projects
   http://guir.berkeley.edu/projects/

The Gateway to Educational Materials
   http://www.thegateway.org/

Active and Passive Verbs
   http://owl.english.purdue.edu/handouts/grammar/g_actpass.html

NCRTEC Lesson Planner
   http://www.ncrtec.org/tl/lp/

A Model of Stages in Object Perception
   http://watarts.uwaterloo.ca/~acheyne/biedobj.html

Affordances
   http://research.cs.vt.edu/usability/projects/uaf and tools/affordance.htm

AIFIA 25 Theses
    http://www.aifia.org/pg/25_theses.php

Americanteachers.com - Teacher Workcenter
    http://www.americanteachers.com/teacherworkcenter.cfm

An AskERIC Write-A-Lesson Plan Guide
    http://www.askeric.org/Virtual/Lessons/Guide.shtml

APA Division 10 - Society for the Psychology of Aesthetics, Creativity and the Arts
    http://www.apa.org/about/division/div10.html

Applied Semantics, Inc. - Download Ontology Usage White Paper
    http://www.appliedsemantics.com/as_support_wp_ontology_d.shtml?ref=cgi

Arteology Semiotics Of Artefacts
    http://www.uiah.fi/projects/metodi/157.htm

BBSR - Chapter 3 Perception, Attention, Learning, and Memory
    http://www.nimh.nih.gov/publicat/baschap3.cfm

bigchalk HomeworkCentral Lesson Plan Aids (Curriculum Design)
    http://www.bigchalk.com/cgi-bin/WebObjects/WOPortal.woa/Homework/Teacher/
    Resource/Teacher_Resources/Curriculum_Design/Lesson_Plan_Aids_11901.html

Bodily semiotics and the extensions of man
    http://www.arthist.lu.se/kultsem/sonesson/ImatraConfTx1.html

Center for Evolutionary Psychology
    http://www.psych.ucsb.edu/research/cep/

Cognetics - Papers & Resources - Whitney Quesenbery - What Does Usability Mean
    http://www.cognetics.com/papers/whitney/whitney1.html

Consider the source The evolution of adaptations for decoupling and metarepresentation
    http://www.psych.ucsb.edu/research/cep/metarep.html

Cover Story Industrial Design Designing for Global Appeal
    http://www.ammagazine.com/CDA/ArticleInformation/coverstory/
    BNPCoverStoryItem/0,2604,86791,00.html

CPDI - Design theory
    http://www.cpdi.co.uk/designtheory.asp

Cultural Semiotics
　　　http://www.arthist.lu.se/kultsem/semiotics/kult_sem_eng.html

design theory as analysis of a product language, design theory and practice morphology, semiotics
　　　http://www.geocities.com/Athens/Aegean/4217/theory.html

designfeast.com -- thoughts on design
　　　http://www.designfeast.com/thoughts/default.htm

Dissertation Strategies Newsletter
　　　http://www.dissertation.org/

Don Norman -- Human Centered Design
　　　http://cogsci.ucsd.edu/~norman/

Dr. Abel Scribe's Guide to Chicago-Turabian Style and Documentation
　　　http://www.docstyles.com/cmsguide.htm

Evolutionary Psychology Primer by Leda Cosmides and John Tooby
　　　http://www.psych.ucsb.edu/research/cep/primer.html

Experimental Cognitive Science, Humanities, and the Arts Bibliography Query
　　　http://www.hfac.uh.edu/cogsci/biblio/biblio.cfm?Category=Visual Arts

Explore Design@Carnegie Mellon
　　　http://www.cmu.edu/cfa/design/index.html

Faculty of Graduate Studies Thesis Guide
　　　http://www.uwo.ca/grad/thesis/

Form and Motion Perception Form
　　　http://www.cs.unc.edu/~seanho/classes/c235/proj/

form Human Perception of Objects Early Visual Processing of Spatial ...
　　　http://enotalone.com/books/ASIN/0878937536.html

form Perception and Realism A book review of THE EVIDENCE OF THE ...
　　　http://uweb.superlink.net/neptune/Percept.html

form perception Gestalt psychology
　　　http://www.cultsock.ndirect.co.uk/MUHome/cshtml/perception/percep4.html

Form Perception What Is It
http://www.awa.com/norton/struc/chap_06/6_208.html

GESTALT
http://www.princeton.edu/~freshman/gestalt/

Gestalt Principles of Perception
http://www.usask.ca/education/coursework/skaalid/theory/gestalt/gestalt.htm

Gestalt Theory Society for Gestalt Theory and its Applications (GTA)
http://www.enabling.org/ia/gestalt/gerhards/

GLaD Tschichold's Canon of Book Design
http://world.std.com/~wij/glad/tschichold.html

grad student tips- paper writeup, talks, etc
http://www.med.uwo.ca/physiology/courses/survivalwebv3/frame.htm

Graduate Guide to Aesthetics in North America
http://www.aesthetics-online.org/graduate/index.html

honche.html
http://www.geocities.com/Athens/Aegean/4217/MDM.htm

http--watarts.uwaterloo.ca-~acheyne-signcon.html
http://watarts.uwaterloo.ca/~acheyne/signcon.html

interdisciplines Art and Cognition Pictorial language
http://www.interdisciplines.org/artcog/papers/1

IVLA Home
http://www.ivla.org/index.htm

IVLA Visual Literacy Bibliography
http://www.ivla.org/news/rdocs/vlbib/

IVLA Visual Literacy Bibliography - II. General Theory
http://www.ivla.org/news/rdocs/vlbib/vbl2.htm#c2

John Milanski, institute of design (chicago), industrial design, product semantics
http://www.id.iit.edu/~milanski/strategy/cubes/cubes.html

Mark Rollins' Web Site - articles and books
http://www.artsci.wustl.edu/~mrollins/MRsite.html

Mats Bergman Reflections on the Role of the Communicative Sign in Semeiotic
    http://www.helsinki.fi/science/commens/papers/refrole.html

Merriam-WebsterOnline Dictionary
    http://www.m-w.com/dictionary/form

Nature and Aesthetics of Design by David Pye 0-9643999-1-1
    http://www.cambiumbooks.com/books/design/0-9643999-1-1/

Paradigm Mapping
    http://home.att.net/~visualizer/page10.html

Pattern Recognition
    http://www.oakland.edu/~sifonis/Classes/Cog316/cogline/Pattern.html

Perceptual Processes in Action - Perceiving Affordances
    http://www.hms.uq.edu.au/percept/afford.htm

Review of Visual Arts - Some aspects concerning Aesthetics
    http://www.latin-art.net/english/revista3.htm

Semiotic Product Functions – SeFun
    http://www.soberit.hut.fi/sefun/

Semiotics for Beginners Strengths
    http://www.aber.ac.uk/media/Documents/S4B/sem10.html

Semiotics of design
    http://www.ars-logo-design.com/ar_semiotics_corporate_logo_design.htm

Sensation and Perception in Psychology 101 at AllPsych Online
    http://allpsych.com/psychology101/sensation_perception.html

SENSES.ORG.UK
    http://www.senses.org.uk/new/senses_org_uk_2.shtml

Student Factors 4
    http://www.core77.com/design.edu/student_factors4/

That There Are Many Kinds of Iconic Signs
    http://www.arthist.lu.se/kultsem/sonesson/many_iconic1.html

The Lesson Plans Page - 10 Step Lesson Plan Guide
   http://www.lessonplanspage.com/WriteLessonPlan.htm

The Passive Voice
   http://web.uvic.ca/wguide/Pages/SentPassiveVoice.html

The Usability Methods Toolbox
   http://jthom.best.vwh.net/usability/

Theory Into Practice (TIP)
   http://tip.psychology.org/index.html

Thomson-Shore's Printer's Ink Vol 12 Issue 2
   http://www.tshore.com/lib/pi/12pi2.html#Summary

TU Delft faculteit IO
   http://www.io.tudelft.nl/english.html

Turabian Citation Style
   http://www.liunet.edu/cwis/cwp/library/workshop/cittur.htm

usability engineering Resource Materials (Public Domain)
   http://www.ucc.ie/hfrg/resources/index.html

Usability First Welcome
   http://www.usabilityfirst.com/

User Experience Design
   http://semanticstudios.com/publications/semantics/000029.php

VIRTUAL_DESIGN_MUSEUM Index Luigi Colani
   http://www.io.tudelft.nl/public/vdm/fda/colani/

VIRTUAL_DESIGN_MUSEUM Mario Bellini
   http://www.io.tudelft.nl/public/vdm/fda/bellini/olivetti/quaderno/bell177.htm

Vision Development - form perception
   http://www.psych.ucalgary.ca/pace/va-lab/Marcela/Pages/page38.html

Visual Cognition Lab
   http://ruccs.rutgers.edu/~jacob/vcl.html

Visual perception of objects and form
   http://www.psychology.stir.ac.uk/46AB/lectures/form.htm

Web Page Design for Designers - Symbolism
http://www.wpdfd.com/wpdsymb.htm

Welcome to The Symbolic Interactionism Site!
http://socsci.colorado.edu/SOC/SI/index.htm