Stage 4

OBJECTIVE

This chapter explores the basic methods for exploring and refining concepts so they are as clearly understood as possible before the designs are finalized. Readers will understand that their choices of methods and media affect the development of ideas both positively and negatively. Finally, this chapter shows how a concept benefits from being examined and tested to its limits.

KEY CONCEPTS

- A concept for a design contains many unexplored possibilities that should always be explored, no matter what the outcome.
- Drawing is a language; it is a personal method of communication that you can develop to be as effective and clear as written or spoken language.
- The methods and media you use will influence the development of a concept; therefore, you need to be fluent with many different media.

PRACTICING ALCHEMY

Medieval alchemists blended superstition and folk medicine with mystical religious practices and emerging sciences. Anything and everything was worth studying, and no method of inquiry was too bizarre. Nothing was assumed, and they attempted everything at least once. To determine the true nature and basic essence of things, they would dissect, dissolve in acid, and otherwise reduce the object of their study to an elemental state. Their experiments often involved large quantities of mercury and phosphorus, which put them at risk for blindness, poisoning, and even death. That was, of course, if they weren't first beheaded or burned at the stake by those who were offended by their ideas. Despite all this, their search for the essence of things continued.

The methods *you* use to find the essence of your ideas should also be a strange blend of the practical and methodical with the esoteric and impulsive. Transmuting a basic idea into a golden one may not be quite so fraught with danger, though losing your head (for a while) is a common occurrence, and things can metaphorically explode. The analogy, however, is sound enough: When exploring and refining your concept, you must examine and question everything, try everything, test everything, and risk everything. If the idea is worth pursuing, it will stand up to any test.

Figure 4.1 The alchemist's laboratory, like a designer's studio, becomes a strange mix of practical applications and strange inquiries. The constant search for new understanding of the basic elements of things often leads to answers that may have more value than anyone expected.

OBSERVING AND TESTING

In the stage of exploration and refinement the brainstorming process segues into a more focused and solution-oriented state, and the tools you use become more tailored toward creating a specific result, such as a sketch or a technical diagram. By carefully exploring an idea's potential, it becomes possible to both expand and refine it at the same time.

It becomes very tempting very early in the process to begin producing a finished product, and indeed, the pressure may be on to do so. However, it is important to proceed without rushing. By rushing you can miss less obvious but possibly more interesting areas. You can certainly create a design that efficiently meets all the criteria in the thesis and concept board, but the

challenge is to do something other than the obvious. You can make a larger statement with more impact only by determining what the idea is capable of and pushing it to its limits.

Insight can arrive in a flash but is usually built on knowledge you acquire and digest over time. By brainstorming, you should be well situated to peer at the inner workings of your idea, and by observing it from various angles, you can begin to see it in ways that you initially did not. Invite observations and opinions from other team members or anyone around you, be open to comment and critique, and make a point of accepting all comments as valid until you are able to prove them invalid.

Apart from such concerns, there is also the task of testing a concept's viability before you commit to specifics. By visualizing your design, you can observe its interaction (or collision) with reality. As your idea takes shape and becomes more concrete, you can question its behavior and in such a way determine that you have made the right choices, be they practical or aesthetic. Your methods can be as diverse as your average alchemist's. You proceed with a wide-ranging inquiry, relying more on intuition than logic, until you have discerned your idea's essence and recognized the laws that control it. Focus your vision and refine the idea until it is exactly what you want it to be.

LOOKING FOR GREEN

The stage of exploration allows you to question the viability of your concept by testing the imagined elements involved against reality. This you can do through visualizing, sketching, and examining scenarios that model the effects of bringing the ideas into the world. At this stage, perhaps more than any other, you have a chance to examine how the ideas you have outlined interact with and affect the environment.

In the conceptual stage, you pulled the concept apart and examined how its elements each had an environmental effect. Now look at the design in *context*: how it *interacts* with the world. As you sketch and visualize your concept in the world, you have a perfect opportunity to examine the details of its life cycle and the impact that life cycle has on the environment at each of its stages: harvesting of materials, production, packaging, shipping, use, reuse, and disposal or recycling. Regardless of whether you are designing an appliance, a garment, a car, or a building, the research for this is not difficult. The production-chain is usually well-established or, in any case, models exist.

Explore your concept in even greater detail at each stage of the life cycle, and use environmental constraints to inspire you further still. How can you best design away the environmental impact? Place your design in situations throughout its life cycle and examine its interaction with the world. Your decisions influence the nature of each of these stages in the product's life. Small changes in your choices of materials and manufacturing methods may contribute to differences in energy use and materials for packaging, storage, and retail, and of course the materials you use will inform the method of disposal and/or reuse. Picturing the product in the hands of the consumer, running it through its maintenance, repair, and applications, will allow you to question your own notions of the product's behavior in the world. Be very careful not to fall prey to your own "imperious immediate interest"—your own wishes for how the product might be used. This is the most common mistake made by designers who later can then only say, "I didn't imagine that they would do *that* with it." At this stage it is very important to cover as many eventualities as you can and look carefully at the possibility of any unintended consequences. Look into the life cycle in great detail. Talk to people who are not familiar with your thought process and have them tell you how they would interact with your design. They may have unexpected ways of approaching things that you have not thought of. If your examination begins to suggest that there are problems with the environmental impact of your idea, do not shy away from rethinking it.

There is, however, a point of diminishing returns, where you will find that chasing down a more environmentally friendly solution becomes simply a look at finer and finer details with smaller and smaller payoff. You will need to decide—along with your client perhaps—when enough is enough. You may also find that your search results in a design that is too far from the original intent, is too expensive, or simply not possible at this time (say, requiring technology that doesn't exist). The best you can hope for is to *minimize* the environmental impact, not to do away with it altogether, but this minimizing must not be avoided. Go as far as you can. The best you can do is the best you can do. The worst you can do when faced with ecological concerns is to do nothing.

Here again is a good reason to begin building environmental concerns into your concepts, so that you have covered most of this ground *before* it is too late in the process. Your client will by now not be surprised by your efforts and you will not run into unexpected problems.

EXPLORATION AND REFINEMENT

The most recognizable method of exploring a design is to visualize it through sketching and modeling. With all the visual prompts available from the concept boards and brainstorming, the obvious thing to do is to begin sketching what is in your mind's eye. To use your sketches and illustrations most efficiently, clearly, and consistently, you must develop a visual language.

Whether it's with a ballpoint pen on a napkin, computers and software, or traditional media such as pencils, ink, and paint, the stereotypical image of a designer is of a person sketching. For once, a stereotype is true. Finding, approaching, understanding, and explaining ideas requires reflection and dialogue, and words in writing or speech serve well. However, sketches and illustrations are the most important tools, in that they can quickly show things that do not exist, can often easily show things that cannot easily be explained with words, and in doing so flesh out the ideas and explain them to the clients and collaborators.

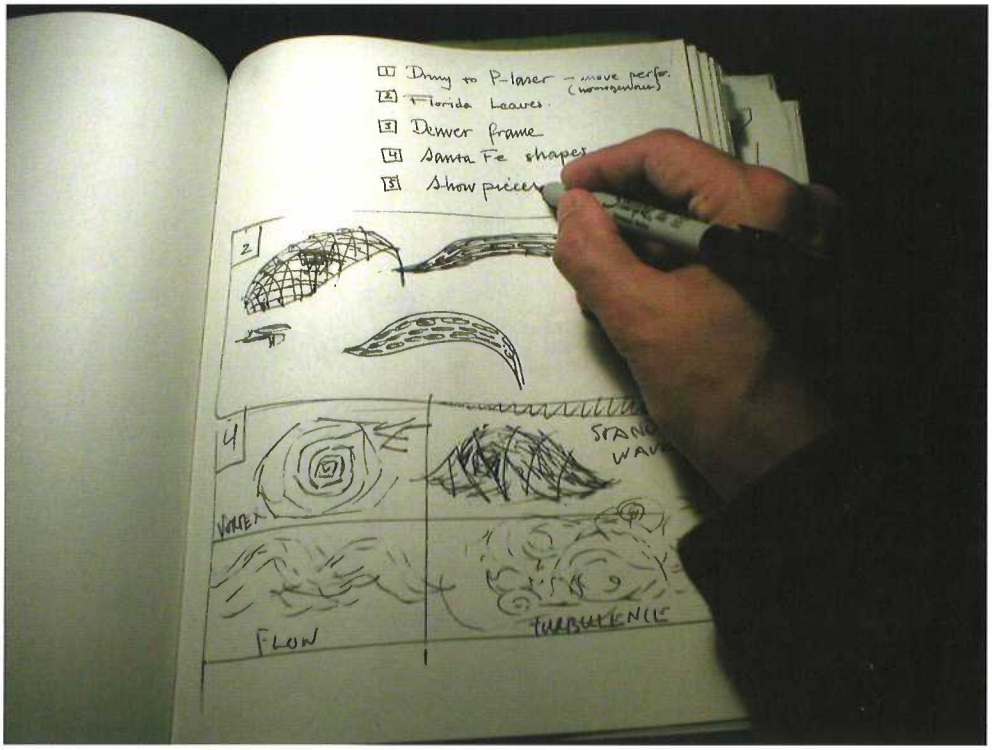


Figure 4.2 Sketching is a dialogue between you, the design, and your audience. The audience may be only you, it may be your client, or it may be someone unknown. But remember there will be an audience.

SKETCHING AND ILLUSTRATING: TOOLS AND LANGUAGES

The idea of a language of sketching and illustrating becomes important when you consider that sketches are used for two primary reasons: to explore the possibilities inherent in the idea and to communicate the idea to someone. A dialogue requires language. These two reasons can be seen to be two sides of the same coin, if you consider that the exploration through sketching is essentially a dialogue with yourself.

We effortlessly develop basic communication skills as children. In our second and third years, we begin to make our thoughts and wishes known in words, codifying our thoughts through examples we learn from the people around us. This language gets reinforced through daily interaction and then established firmly in school as we learn to read and write. Because of the emphasis on spoken and written language, the realization that we have also developed another language—a language of visual cues and images—tends not to materialize.

But we learn to recognize and create pictures as representations of objects, and we learn this to an astonishing degree. A two-year-old child who has been introduced to elephants will recognize a hastily sketched outline as an "elephant" and will recognize new versions of it as the animal, even if those versions look nothing like anything the child has seen before. Elemental features become quickly established in children's drawings, and the rest is just refinement over the years. Our perception quickly becomes more open to subtle cues, and we find it easier and easier to decode partial signals, such as recognizing an "elephant" by its ears or trunk, or recognizing a "face" as a couple of lines and dots.

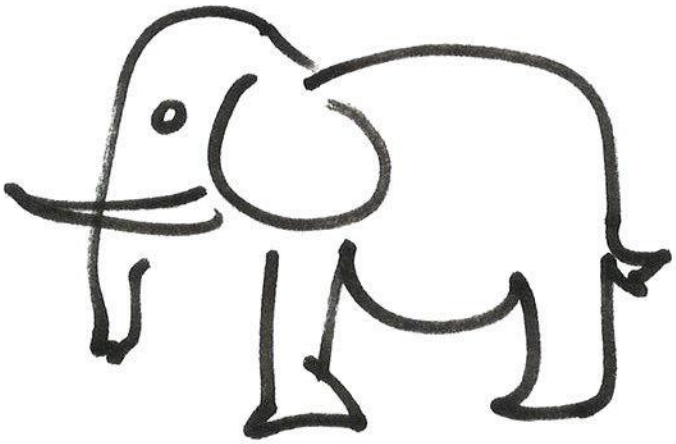


Figure 4.3 A sketch is "code." This drawing is not an elephant and doesn't look like any elephant and yet we understand it to be an elephant. The elemental features included somehow manage to represent "an elephant" even to someone who has only ever seen pictures of elephants.

Our brains are constantly trying to make sense of the cacophony delivered to it by our senses. As you saw in the discussion of gestalt perception, we arrange things into recognizable arrays of meaning and fit unknowns into previously categorized groupings. This is a survival mechanism from way back in our existence, and we have become very good at "reading" our surroundings. Indeed, we are so good at this, that we will persist in seeing meaning where there is none. We see objects and animals in cloud formations, faces in rocks, patterns in starry skies, and so on. It seems to require very little prompting for us to layer a visual code onto random arrangements, so it is hardly surprising that we would be ready to accept a simple sketch for something far weightier.

The development of a "sketch language" relies on establishing a "code" with which to communicate effectively. You can create a language of symbols that has a one-to-one relationship with reality where each thing you imply on paper has a corresponding "thing" in physical reality.[1]

We all travel a similar path at the start, and one may surmise that our capability to express the world in pictures is as hard wired as spoken language. It all begins with a scribble. As soon as the motor functions are in place, usually just after the 18-month mark, a child will pick up an available pencil or crayon and gleefully scribble on whatever is at hand. This is done for the enjoyment of the action, and it is not clear that it is related to the expression of any thought. That, however, follows very soon. Depending on the availability of materials, examples, and encouragement, children quickly begin to actively create symbols. They will have names for their creations and be very adamant about the "reality" of their symbols.

They develop quickly, and along with their new understanding, they seek new ways of expression, so these symbols change frequently. A year or two later, when the child reaches school age, the symbols solidify: there is now a consistent way of representing the world, usually

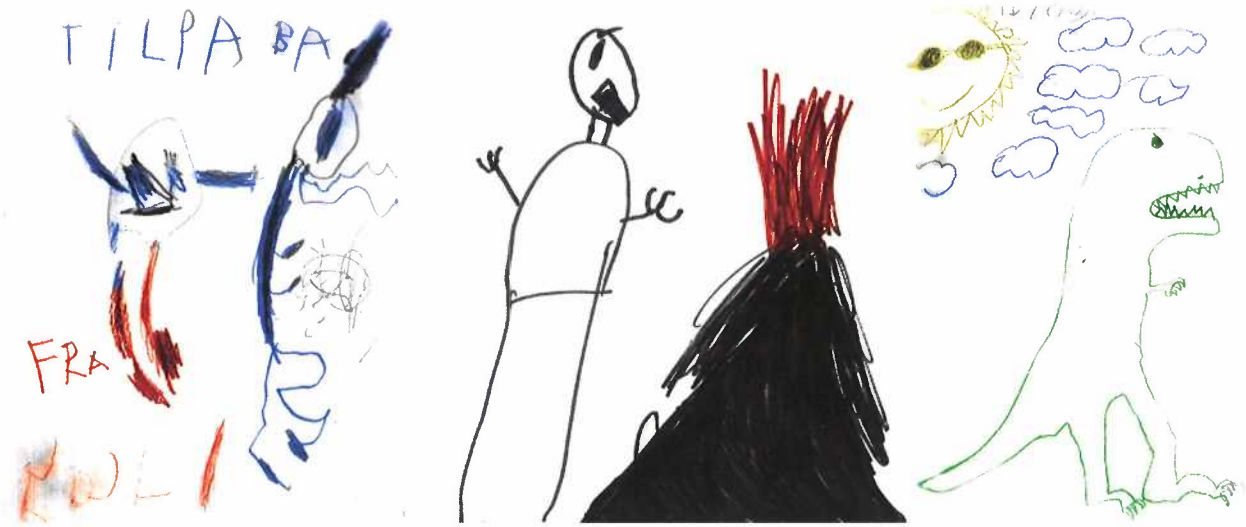


Figure 4.4 In the learning stage, children will form visual codes for real and imaginary things and will be invested in the reality of that representation. This drawing of "dad and a dancing dragon" illustrates, as clearly as the child could possibly manage, a specific scenario. To the child, this "code" was as real as anything else at that point. More remarkably, perhaps, it is equally clear to an adult as soon as it has been explained.

one in which space is not illustrated and sizes of things are according to their relative importance, rather than their "real-world" scale.

Here, the potential appears for a rather unfortunate series of developments. It all begins well enough, with a need and excitement over mastering "realism" in drawing. A child becomes very proud and happy at achieving "the way it looks" and the goal of making the images look real supersedes the symbolic. Space, color, and texture are all discovered and used to this end. Being in a school environment allows children to learn from others, but also encourages comparison and self-criticism. An awareness of "drawing" develops either from observing or from direct instruction. While this is all fine, what follows is often not. As the child progresses through grade school, an increasing self-criticism sets in, especially in comparison with classmates and friends. It becomes clear that there are students who "can draw" and there are students who can't. After four or five years in school, drawing becomes a "project," and with the discovery of perspective and other taught techniques, the gap between those who can draw and those who can't widens. The natural development of drawing and perception tends to slow down or stop and an increased frustration and preoccupation with depicting reality can lead to children consciously abandoning drawing altogether. For those who do, it is interesting to note that drawing often comes to be perceived as something for children: frivolous and trivial.

For those who continue to draw, there are hurdles to overcome in technique and expression, and discouragement is unfortunately close at hand. The saving grace can be an understanding mentor. The introduction of nonrepresentational art, as well as non-fine-art-related applications of drawing, such as design or architecture, can also serve to get students through this crucial time. (Use Appendix 3 "Notable Designers and Architects" to get acquainted with the canon. Let this inspire you!)

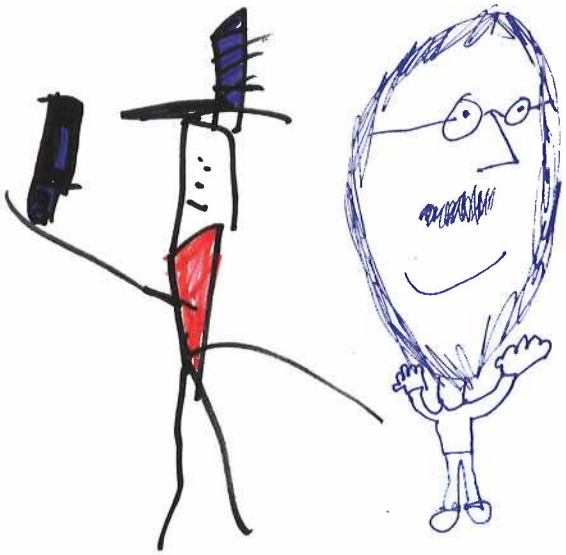


Figure 4.5 A child's sketch can include and encode entirely fanciful notions, and the code needs not have a reference to anything but itself in order to work. As seen here, my son would represent me as a person wearing a top hat, even though I never wore such things. The top hat had somehow become "code" for "dad."

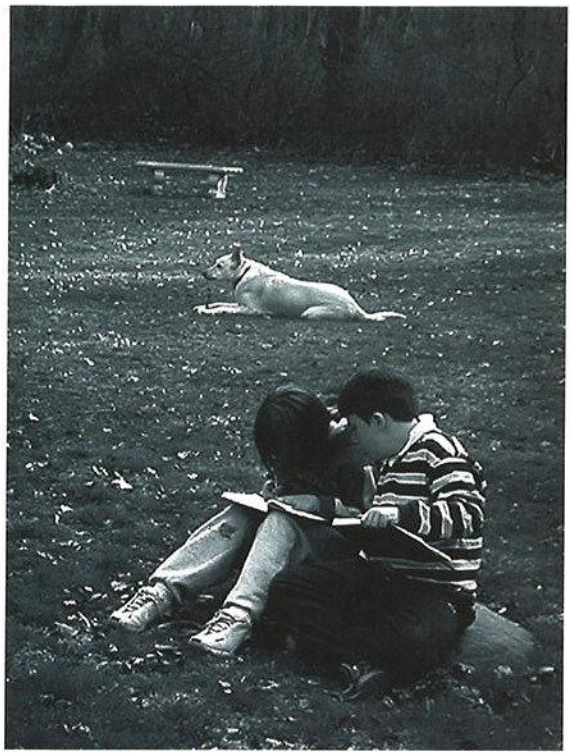


Figure 4.6 We learn from observing and doing, and drawing is just another thing to do. It is important to allow this talent to develop, just like any other talent of communication. It is a life-skill and should not be put down after the initial childhood engagement.

This is key not only to the development of drawing for children but also for our understanding of how drawing works in the context of design. It is absolutely crucial to not consider drawing as an end in itself. You must use sketching and illustration primarily as a means of conveying *information*, then emotion, and finally a sense of the "real," if at all. You must understand your language and develop it so you have a vocabulary that is point-to-point. You must also make sure your audience understands this language even if they cannot speak it. And . . . it must be fun. (However "fun" is defined.)

The language of your sketches does not have to be the language of fine art. As long as the idea is being communicated, the designer is fulfilling the mission. In fact, it may well be a hindrance to put too much store in "pretty pictures" early on in the process, when the energy should be going into the creation of the idea. This is why it is vital to recognize the importance of maintaining the impulses of five-year-olds. Draw for expression and for fun; draw what is there to show what it is, not how it looks. If it is necessary to show an accurate detail or texture, draw the detail, get a sample of the texture, cut a picture out of a magazine, and write descriptions; don't use valuable time on illustrations that in the end don't deliver crucial information. "Pretty pictures" do have their place at a later stage: they are extremely good at presentations for capturing and holding an audience's attention, they create an aura around the designs that can fuel your audience's imaginations, and they enhance the designer's credibility.

Sketches are, however, most effective at the beginning. At this stage, sketches can clarify an idea for you and your client. By sketching the idea for yourself, you are forced to make decisions, and once the image is on paper, the idea exists in the world. It is a very powerful step,

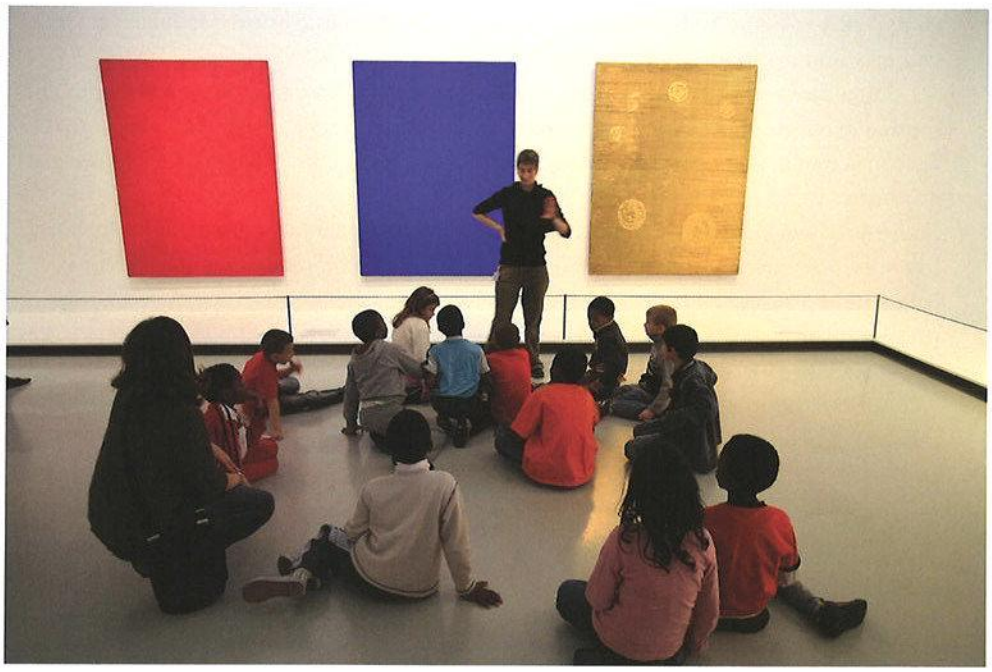


Figure 4.7 Introducing non-representational art as well as non-fine-art-related applications of design broadens students' understanding but can broaden anyone's understanding at any age. Open up to the possibilities of visual language and unorthodox ways of displaying designs.

one not to be underestimated. By placing an idea in the context of an image, even if that image is a rough sketch on a cheap napkin, you have invested it with a reality that cannot be taken away again.

DO

- *Sketch quickly and repeatedly.* Sketching both describes and drives your thinking. In both cases, visualization must proceed quickly to keep the idea fresh and to keep you from getting bogged down in the mechanics of drawing. It's a fine line, but if you find yourself spending more time on making the sketch look good rather than examining the idea, stop and refocus.

  Sketch quickly and sketch again to cement what you have done. This procedure also allows you to set up a quick feedback loop in which you can look at the first quick sketch, decide what needs improving, sketch again, and so on. A good method is to first decide on the number of sketches and, when you've sped through those, pick the best.

  I've become accustomed to doing 12 sketches and impulsively dismissing half of them before choosing 2 or 3 to keep. The number 12 feels right; it somehow manages to be more than enough without becoming so many that the exercise becomes tiresome. I find that the best sketches are somewhere around the three-quarter mark, so with 12, the best are somewhere around number 7 or 8. This is the comfort range of *my* sketching, but you should experiment and see what works for you. You may find that your energy peaks at a different point. Find the space between where you feel most interested in your project and where your energy begins to fail; this is where your best sketches will show up.
- *Sketch constantly.* Another reason to build up the speed of your sketching is so that you can sketch constantly. As you are pondering an idea, sketch every thought you have. Carry around a small pad and put everything in it. This frees up your brain and also makes sure you keep a record of all your thoughts. I never have my best ideas when I'm at the drawing board or computer; I get them at the kitchen table or when I'm shopping or driving. (As sketching while driving proves to be rather problematic, I've invested in a digital tape recorder that I can clip onto my seatbelt.)

  Often you start generating ideas that are not relevant to the particular project you are working on, but are perfectly viable for some later unknown project. It's a shame to let that go to waste, so put it in the sketchbook, or scan it, write a note or two, and date it. Later you may want to go back and look at these ideas.

  Put a date on everything because you may need to backtrack, especially if an idea goes south on you. By going through the sketchbook, you can find and extract the ideas that were in action at that time, what led up to them, and determine where exactly you veered off course.
- *Sketch large and small.* Having a small sketchpad is good, but you should not limit yourself to pocket-size sketching. This can cause you to focus only on the larger forms and may habituate you to a small scale, which may cause a bit of shock later when the actual size of the object becomes significant. Make sure you change the scale of your sketches every now and again. Sketch very large to get a feel for scale and to envisage detail. Sketch small when you want to focus on the form and when you want to avoid going into too much detail.
- *Avoid limitation; use different media.* The size of your sketch as well as your choice of medium limits you. The expressiveness of crayons, pencils, markers, or watercolors couldn't be more different, and you must be aware of how each limits or expands your work. Try different media, and experiment with what suits you and the idea best. Use CAD software until you use it with equal ease as physical media. Look for the benefits of speed, color quality, and accuracy. Tailor your media choices to the character of the sketch you are

trying to produce. Make a point of switching media every now and then so you don't get stuck in a certain mode, and don't be afraid to mix media if you feel the need. Later, when you begin to create illustrations, there may be certain requirements or industry standards, but by then you will have a good grasp of the character and image of your design.

When something works well for us, we begin to rely on it doing so again, and so get attached to certain methods and materials. We begin to depend on a certain environment or tool and cannot sketch unless we have a certain type of pencil, are in a certain place, or listening to a certain kind of music. Don't let this happen. As you practice your sketching you should not rely on the same tools or routines. Good work habits are essential, but don't build patterns that you cannot break out of at will. Purposeless habits are lethal to creativity.

- *Consider the purpose of your sketching.* In choosing the size and medium for your sketch, consider its purpose. What is this sketch to achieve? Is it for your benefit or someone else's? What is it meant to examine? What is it meant to show? These questions may seem simple and obvious, but it is surprising how often they are necessary.
- *Practice.* Sketching is, in fact, an art. The ability to quickly rough out an image that tells a story, inspires, and informs is nothing to be careless about. This ability must be nurtured in the same way a professional musician rehearses and practices constantly. The most seasoned soloist will go through a daily regimen of practice, playing scales, limbering up on difficult passages, and staying in contact with the instrument.

  Sketch something every day. Make it a habit to sketch freely for at least 10 minutes. The routine is as important as the daily practice routine of any musician or athlete. Without a routine you will be overtaken by the flow of your day. Make it a habit to grab a pencil and sketch at the beginning or end of the day, just as you would brush your teeth. If you think you don't have 10 minutes to spare, you're wrong: You just have to want to do it more than you do.

Figure 4.8 Put everything in your sketchbook. Don't edit and choose. Your sketchbook is not a finished product to display, it is a work area. Treat it as a zone for experimentation and impulsive collection of ideas. Show it off by all means, but don't be precious about it.

Link the sketching to whatever project you have going or just play around. If you find the idea of practicing tedious, here's the good news: *What* you do doesn't matter as much as *whether* you do it. Pick something fun to practice on. But, if something is routinely a problem for you, such as specific textures or the human figure, practice that. If it's irritating or putting you to sleep, stop and do something fun.

Practicing involves repetition and, therefore, some tediousness, but you can at least choose a subject to sketch that is interesting or relevant. The main issue is to keep in contact with your tools and the feel of sketching. Try different media, different paper types and sizes, and levels of accuracy and speed.

One thing I found particularly helpful was to study and practice calligraphy for a while. The discipline required was difficult, but it quickly transferred to other methods and was suitably different enough to be entertaining. Also, when I got really bored, I switched and sketched with my left hand; anything to keep it challenging and therefore interesting.

DON'T

- *Edit yourself.* When exploring an idea, don't edit it. Let the sketch or sketches arrive on the page before critiquing them. If you are second-guessing as you go, you will interrupt the flow and never get anything done. There may be something in your sketches even though the entire sketch or idea isn't what you wanted. There may be a good detail or some well-formed line that you would like to duplicate. This is another reason to sketch quickly. You want to stay ahead of your critical eye by dropping the sketch onto the page as fast as you can and moving on. Let your intuition work faster than your logic. There will be plenty of time for logic later.
- *Keep your sketches to yourself.* One more reason to practice your sketching unceasingly is to overcome the fear of sketching in front of clients. A version of the fear of public speaking, this phobia has the same explanation and the same cure.

  The fear of public expression is essentially a fear of making a fool of yourself. Make a habit of sketching as part of any discussion about your idea until it becomes second nature. Practice a diagrammatic style and use as few lines as possible so that your sketches are immediately clear to your audience.

  Get to the point where you are as comfortable using sketches as you are using words. The power of a simple visual is too great to allow embarrassment or modesty to keep you from pulling out your pen and sketching on a napkin.

FORMING

There are many more ways of visualizing a design than just sketching. Look for ways to quickly depict your design in a three-dimensional medium. A quick model can give you a feel for the form of a design without having to go through the process of creating a fully realized sample. It can be very helpful to model before sketching; even a rough model can give a sense of space and form that is then more easily interpreted on paper.

Possible materials include papier-mâché, clay, plaster, balsa wood, and paper. Be creative in your choice, and, as in sketching, don't bind yourself to the use of one specific material. Although speed is important at this point, approach your choice of modeling material with an eye toward qualities that are inherent to your design: Consider color, texture, movement, and mass, and keep an eye on the scale you are working in. Choose a material that will come closest to depicting the characteristics of your end product. However, if you are focusing on one particular aspect of the idea, such as proportions, or on a technical issue, choose whatever works best for that specific purpose and worry about the other issues later, when you build an appropriate model.

COMPUTER-AIDED DESIGN

> This technology [CAD] provides a way for me to get closer to the craft. In the past, there were many layers between my rough sketch and the final building, and the feeling of the design could get lost before it reached the craftsman. It feels like I've been speaking a foreign language, and now, all of a sudden, the craftsman understands me. In this case, the computer is not dehumanizing; it's an interpreter.[2] —Frank Gehry, architect

Computer technology changed the design process in that the visualization of the design is available with greater speed and detail than more "traditional" media can provide. Often the rough sketch is directly interpreted in a three-dimensional model or graphic illustration, allowing the designer much more control over the vision than before.

As Frank Gehry points out, this level of control has changed the way designers approach their work. The designer can interpret the vision with much more clarity than before, to the benefit of everyone involved in the project, as CAD programs can serve as sketching, drafting, modeling, and rendering tools.

The increased control and clarity, beneficial as it is, has its own inherent dangers. Somewhat counterintuitively, CAD renderings and models can be almost *too* real. Textures and lighting are extremely realistic in off-the-shelf programs, and although the overall feel is still very clean and antiseptic, good renderings are almost interchangeable with photographs. This perception of reality influences the viewer's relationship with the design, mostly to a good effect, but with some side effects. Too much reality, especially at the sketching stage, can freeze the development of the idea. It becomes difficult to substitute the reality that now exists in the CAD model with another less substantial idea. A good work habit that can help with this problem is to save versions of the CAD models before making any major changes. Keeping a file of each version makes it very easy to go back and also allows for fearless experimenting. Just make sure you have a clear system for naming files so you can find them later.

Another potential problem is that being able to visualize everything makes endless revising very tempting. More control coupled with more clarity allows more opportunities for tweaking and fixing. This is, more often than not, beneficial, but it is important to keep an eye on the prize and not be tempted to fix it for the twentieth time at this stage. A sketch is a sketch, whether it's virtual or physical. Save the finesse for a later model.

To be free from the influence of environmental forces when using off-the-shelf modeling programs can be liberating. But this freedom can also cause problems. There is in a CAD environment, for example, no sense of having to obey physics. Objects can be disintegrated or embedded in one another without a problem, and gravity does not exist. With natural laws out of sight and out of mind, we are allowed to play as much as we want when sketching in these programs. If we are not careful, this can lead to sketch models that are impossible. This

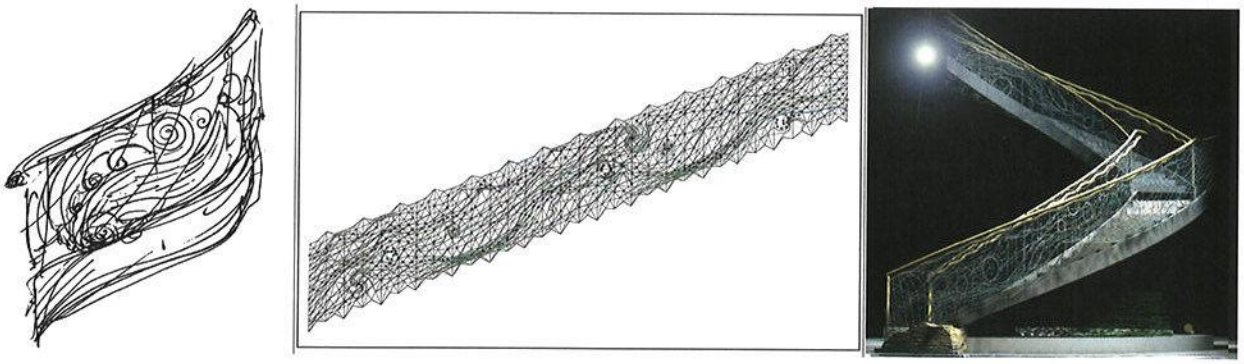


Figure 4.9 Use CAD as a way to further your designs in tandem with sketches and modeling. Use the different methods to show different aspects of the design. Don't dismiss one or the other: Rough sketches have a place and so do realistic CAD renderings.

does not necessarily have to be a problem, and it is just as easy (if not easier) to create impossible things with a pencil and paper. The main problem is that our critical sense is disabled by everything on the screen having a much more finished look much sooner than in a hand sketch. Thus, everything seems much more possible. This boils down to a problem that is really solved very simply: by basically getting used to it and by making a habit of performing a reality check on the model every now and then.

A sketch does not have to be "real." On the contrary, the sketches reveal the vision, and the designer solves the discrepancy by bringing the idea into reality by degrees. If this is not possible, then simply sketch another idea—yet another reason for speed and multiple sketches.

Speed and CAD sketching have a curious relationship. Although speed is important at this stage, digital sketching can sometimes be a little bit too easy. Modeling and graphics programs allow you to do the strangest of things in very little time, and there is a tendency to equate the ease of designing with an ease of execution in the physical world. Programs are designed to allow for the ease of operation, and it is easy to add elements, colors, and typefaces, and to manipulate shapes and constructs endlessly. Endless tinkering is dangerous, and the manipulation can continue far beyond any necessary or even sensible limits.

The lack of a sense of physical scale on a computer screen will also contribute to the confusion. You can zoom in and out, but there is nothing to anchor you in the relative size of your design. Again this is a problem that tends to go away with increased familiarity. The concern until then is in the ability to add extremely fine detail and zoom and focus down to the level of individual pixels. This can lead us to working on areas so small that they have no significance. Conversely, we can neglect to go into detail and let the computer screen dictate the "frame," losing contact with the notion that the object being designed on the screen will perhaps be hundreds of times larger than the neat little model. I frequently encourage my students to keep a measuring tape next to their screens at all times and ground their thinking in an actual dimension or two every now and then. If choosing a size for anything, take a look at the measuring tape; get a feel for the actual size.

Again, this is also very easy to do with a pen and paper or clay model, but physically working by hand does tend to slow you down, compared with the clicking of a mouse. The time this allows you to consider your actions matters. The physical sketch and model also have a constant size, which grounds you in a fixed scale.

The solution is obviously to slow down a bit, remind yourself between clicks of the mouse that there is a reality being represented, and ask yourself now and again whether your design is at least not flagrantly disregarding it. A good safeguard in three-dimensional modeling is to place an object into the rendering that creates a reference point and a sense of scale. If you are working two-dimensionally, print a test page now and then, or make a habit of referring to the grids and rulers available. How large is a millimeter, an inch, a foot? Make sure you have a sense of scale.

However, the speed and flexibility of CAD is a great strength. Use computers as sketching tools as much as you can. Think of the software in the same way as you would any traditional media in terms of how you aim to use the results. Sketching with a CAD program is really not that different from sketching with classic media such as pencils, ink or paint. The software is a tool—albeit a much more flexible and correctible one. Sketches are not ends in themselves. They are tools to aid in the exploration and refinement of your ideas.

DIALOGUE

Dialogue is of great importance. Discuss your ideas and concepts with clients, designers, production staff, or anybody else you can find. These discussions will bring to light the needs and constraints of the concept faster than any analysis you can perform by yourself. While everyone

has an opinion to share, not everything contributed will be relevant or useful, so you must know what you are listening for. Just as in brainstorming, a lot of the work takes place afterward when you are sifting through, finding the valuable elements.

The concerns of each group are different and varied. Clients focus primarily on the end-result (even if it is still unclear) and will have numerous suggestions toward that end. They will also be very budget conscious, which may be premature at this point, depending on how clear your direction is. The production staff contributes fabrication solutions, and your fellow designers brainstorm and analyze design methods and directions. Virtually anyone you can think of can provide valuable feedback as long as you know where you are going and what you are looking for. Friends, family, colleagues, students, fellow air-travelers, and cab drivers have all served me well in finding out what an "uninformed" audience thinks. Do not assume that the expert opinions are always the best. Direct involvement in a project often creates blind spots. We want to believe in an idea and, therefore, do not see what is right in front of us. It is good to consider the folktale where it was a child that pointed out that the Emperor had no clothes. The obvious sometimes needs to be seen by fresh eyes.

Make sure you take in all opinions and comments, but don't fall into the trap of running after every idea thrust at you. Evaluate ideas you are offered, sketch them, write lists of pros and cons, and assimilate what you will. Don't take disagreement personally. You asked for opinions. Be grateful that you are getting them now rather than later when it may be too late to turn back.

REFLECTION

The art of reflection is one of the more important—and also frequently neglected—tools of design. The speed of the process and ever-looming deadlines contribute to methods that do not allow for much contemplation. Clients have difficulty justifying payment for "thinking time." (How do you measure it? Where are the visible and tangible results?)

It is very important while exploring and refining your ideas to reflect on what you have done so far and whether this is where you want things to be. There are numerous ways to think, reflect, and meditate on your ideas, but basically your reflection can be focused, indirect, or unconscious.

With *focused reflection*, you may be actively solving problems or seeking new solutions. Take time to go through your idea, piece by piece, element by element, and question it. Does this work? Does that work? If not, how can you make it work? What are the possible solutions? What is the closest you can get to a solution? Don't give up until you have at least one answer. Then visualize and sketch it.

Indirect reflection can be helpful when you are stuck. You have a feel for where you want to go, but cannot get there. Everybody has a dry spell and the way out can often be found by looking at the problem from another, often unexpected, direction. A good example of this technique is the Zen *koan*. A koan is a statement or question from a Zen master intended to compel a student into awareness by releasing the mind from its habitual patterns. The master introduces a seemingly absurd or impossible problem that the student is meant to solve, such as, "What did your original face look like, before you were conceived?" or "When you can do nothing, what can you do?" The impossibility of the problem backs the student's mind into a corner from which the only escape is a new realization.

Another interesting version of this kind of indirect thinking, resulted in the artist/musician team of Peter Schmidt and Brian Eno producing a set of cards called "Oblique Strategies."[3] They had realized that their methods of creation were often similar when seeking solutions in their respective studios, and they began collecting their rules for getting out of difficult situations. This gradually resulted in a deck of cards that has now been published in several editions. Drawing a card, you will be given "oblique" instructions such as "Emphasize repetitions" or "In

Figure 4.10 Putting your mind into an unaccustomed place is always a good way to find your way around a problem. Trust your own instincts and trust that what has been processed in your mind will find its way to the front if you get out of the way. The method is not important as long as you find a way to redirect your thinking.

total darkness, or in a very large room, very quietly." Clear or not, the card is to be trusted and reflected on to produce a way out of the dilemma.

Find ways to redirect your thinking when you get stuck. Learn both how your own process works and learn how others (such as Schmidt and Eno) go about it. Becoming accustomed to knocking your brain out of a rut may be the best design education you can get. Random input such as a koan or Oblique Strategy card can be exactly what you need to get past an obstacle. This kind of thinking does not work without having the time to reflect. You cannot expect it to work like magic, but you can often trust the mind to do the work if you get out of its way. The more stuck you are, the further away from the problem you have to go for clarity to return.

The real tool here is your brain, not the input. The input is merely the tool that creates the opening through which the light shines. *Unconscious reflection* occurs when you trust your instinct and previous knowledge to create a solution that will rise to the surface while you look the other way. After focusing on the problem, go for a walk, listen to some music, or look at the sky. Any activity that occupies but doesn't tax your mind will suffice. This allows the brain to process what you have been thinking about, and more often than not, this is all that is needed for an idea to appear. Sometimes just a few minutes away from a dilemma is enough; sometimes you have to "sleep on it." Don't underestimate the power of the unconscious, and give it time to work.

LEIFUR BREIDFJÖRD, ARTIST/DESIGNER

Leifur Breidfjörd has been working out of his studio in Iceland since 1968 and is one of Europe's foremost stained-glass artists. His numerous commissions, both public and private, can be found in buildings, collections, and churches in Germany, Scotland, and all the countries of Scandinavia. Leifur does not limit himself to glass: He also works with oils, pastels, and various sculptural media. He collaborates on textile projects with his wife, Sigridur ("Sigga") Johannsdottir, an accomplished textile artist in her own right.

When I create a proposal for a specific location, a public building, for example, I first go and look around the building and its surroundings to figure out what they require. Stained glass is really a rather risky material; you can quickly spoil a building by choosing the wrong colors or by creating a piece that is too dark. Stained glass can change things very radically—sometimes for the better, sometimes for the worse. It's very important, for instance, to realize very quickly how much light the glasswork should let flow into the space. Glass can actually be treated as three-dimensional, or even four-dimensional, if you consider how time comes into play. The window changes its nature depending on the time of day and whether you are standing inside or outside, looking at daylight streaming in or electric light streaming out. In addition, the light can be streaming through the glass or reflecting off it. Sometimes I will even use mirrors to reflect the space itself.

So, I look at the building from the outside as well as spending time inside it looking at the light and structures. It becomes very important to understand the space and how the work will affect it, to understand what the building needs. I also consider whether I should create an abstract or figurative work. I tend to work equally with the two, and through the years I have seen that each building has a different demand in that regard. It's also an intuitive thing. For instance, if I'm working in an older building, it might seem more appropriate to choose a more figurative style, but that's not a definite rule. It's really an intuitive response.

I also consider the scale of my work relative to the building very carefully, questioning whether the work actually fits the structure. This is especially important with figurative work where the size of the figures in the window can make the building seem large or small. One huge figure in a 30-foot window would make a church seem smaller, but putting a multitude of tiny figures in the same window would make the building seem too large for the artwork.

It really matters to look at what suits each building: figurative, abstract, modern, or older styles. I make a point of working with the surrounding structure rather than forcing some preconceived style I might have into all the buildings I create work for. I feel that it is necessary to create something that fits into a specific building, something that answers the building's demands. What I find very rewarding and exciting is something that I have actually achieved over the years: to create a piece for a building and hear people say, "It's like it has always been here."

I make a point of working in close contact with the architects; I will always consult with them first and show them my proposals. It's rare, but very exciting, to be included right at the start of a building being designed, although that has happened. It's great to be in on the process when the architect is sitting there with pencil and paper, sketching out things and throwing questions around like, "Where do you think the windows should be?" and "How much light should we let in here?"

Sometimes I'll spend time inside the building even as it's being built. I did that for the Icelandic National Library in Reykjavik. As it was being constructed, I sat in there for a few days, observing the space and the windows, sketching all the while. For a church in Reykjavik, I sketched the first drafts over the course of a few days, sitting in my car in their parking lot.

I've developed my use of color over the years and have no specific rules—except I think I have a tendency to not use green as a dominant color. I think that's just a personal thing. Again, I usually go by whatever the building needs each time. It can be a window without any color, just white and gray; it depends entirely on the building and the space. It depends on what I see. It's also a question of what the window should achieve. For example, is the sun to shine through it and project the colors onto the interior walls? You can change, or even ruin, an environment by dousing the space and the people in it with color.

You can do anything. I went into a church once, where someone had decided to put yellow glass in all the windows. You'd go in and look around, and everyone and everything you'd see would be yellow. However, one little window right at the top was broken, a little triangular hole through which you could see the sky. That triangle was the brightest most intense blue, contrasting with all that yellow: a strong bright blue, almost violet. It was magnificent! That's the kind of thing you can do by controlling the light and influencing all the colors in the space, and you've got to think it through right at the sketching stage. So, I look at all the demands of the building and the site, and then look through my mind; I look through my memories and what I've learned through the years. I think of what I've seen in buildings and churches all over the world and in my own older works. Then I begin sketching.

First I do a lot of quick pencil sketches, and then I move on to sketches in either 1:10 or 1:20 scale; these are usually in gouache. Here, I keep the scale of the work relative to the space very much in mind. I usually sketch a human figure off to one side of the drawing to have an immediate sense of scale while I'm working.

I used to make a model of the building at this point and put an enlarged photo of my sketch into it, but lately I've taken to scanning my drawings and inserting them into a photograph of the location in Photoshop. This allows me to also simulate what it would look like from the outside looking in and is really quite good for presentation to the client. I don't do any of the artwork on the computer though. It's too slow; there's too much messing about. Sometimes I'll tweak the colors a bit [on] the computer, but other than that I find it much better to create the original by hand.

Once I've done this, I'll present the scale drawing to the client, and if everything looks good and we decide to go with it, I'll create a full-scale design in color. I've always worked this way and attach great importance to this method. I also keep all my sketches and everything. When I exhibit in galleries, I show the whole process—mounted sketches and photographs, the full-scale drawings, and the finished work.

I only ever show the client one proposal. It can get complicated, especially if there is a large committee involved, to show more than one. You might be happy with one proposal, but decide to show them three, so they can pick and choose. Then suddenly things become difficult because a third of the group will like this, a third will like that, and then someone will say, "Could you come up with a fourth proposal?" or "Can you show us three more?" It's best to show just one that you are happy with and ready to develop. Of course I'm open to discussion later, if there are any requests for changes; you can't be so close-minded and stubborn that you can't accept requests for changes. I feel that's especially important for private clients. I might show the clients a proposal—let's say it has some red and pink in it; then I find they can't stand pink. At that point I'm perfectly willing to say, "Okay, we'll drop that." These people have to live with your work. But, it's best to show them one and say, "This is what I would like to do." However, to do that you have to have done your research and come up with something that you both know and feel is right for the location.

The key to successful cooperation is not to be too fixed in your opinions and to be open to others' views. You have to listen to people. When I was starting out, I often found it difficult to be creating pieces for specific locations. I was finding my way, trying things out, and it took a long time to figure out what was appropriate for a specific place. In time, this has become easier and simpler. I look things up in my mind and find the solution for a place. Another thing is that I like working with others. If someone brings in an idea and says, "Wouldn't this be better?" I think it should absolutely be considered. If the idea is good, then you should try to approach it. But, it's really very important to be broad-minded and listen to all points of view. As soon as you get negative and ignore other voices, you're in trouble. It can't hurt to look at other ideas. Whether you use them in full or not, you may be able to use parts of what people are suggesting.

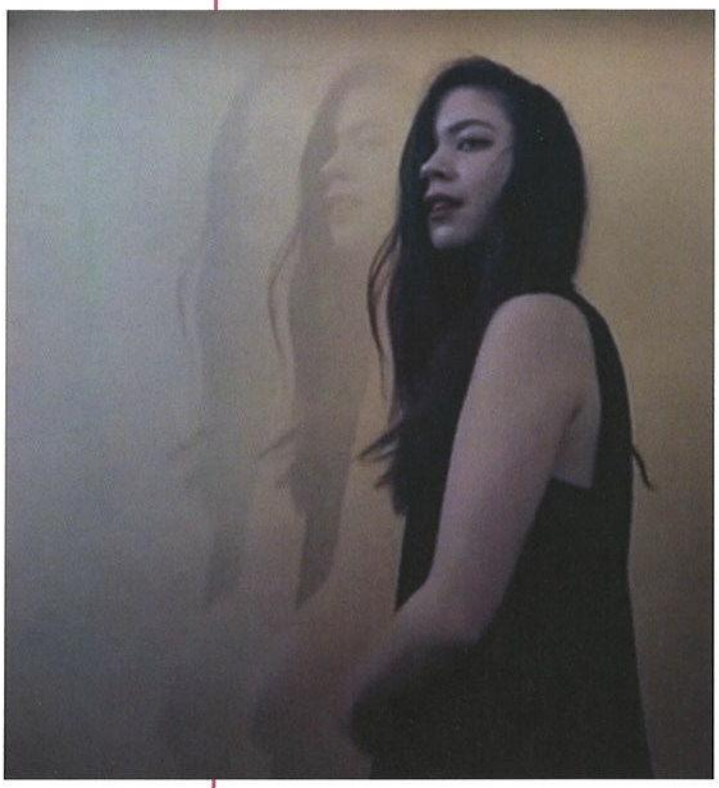
It's important to be working in different media and not to focus too heavily on one discipline. My wife and I have traveled all over the world and like to go to galleries and museums to see what artists in other fields are doing. She's in textiles, has specialized in woven tapestries and church vestments, so we've collaborated on that for shows and churches and such, but I also draw and paint and sculpt and use mixed media as well. It's hard to say why I choose one medium over another at any given time, but I find it good to give my mind a rest. After a project it's sometimes good to go and do something completely different. It also happens that after I've been working with a certain material or style for a while, that I'll just veer off into something totally different. Then I'll find my way back and wind up somewhere in between. Thesis, antithesis, synthesis, and all that . . . I'll go to extremes, and then it all flows together somehow afterward. It's another reason why it's important to work on several different things, not to be confined to one.

As far as inspiration goes, I can tell you right away what doesn't inspire me much: landscape. Whether it's an actual landscape or a painting of one . . . doesn't affect [me] at all. It's a very Icelandic thing to appreciate a good landscape, but it just doesn't touch me. Rather than look at some mountains or vistas, I'd rather take a magnifying glass or a microscope and lie down on the ground. That has a much larger impact on me. Or rather than look at some majestic mountains, I'd rather go down to the shore and look at things that have washed up; look at the rock formations, the moss, the flotsam and jetsam. Actually, what I'm looking at is their forms. They may be clearly defined and identifiable objects, but I'll be looking at them as abstract shapes.

For stained glass and textiles, it works very well to look at things very close at hand, to look at the abstract forms in nature. This goes for form, color, and light. . . Even when I'm working with readily recognizable things, like the human body or head, I still use them in an abstract way. My work doesn't necessarily contain any narrative; these things are just forms. I'll often use text in my images, but even then that is also just form—the image of text.

A lot of people wait for inspiration in order to get their work done. They wait, and they wait, and then in the end all they've done is wait because the Muse never shows up. However, it's also true that you can sometimes be less than motivated for conceptual work. That's why I also like to work on the practical aspects, like the cutting of the glass for my windows. My wife—Sigga—she does all the lead-work, but I'll be cutting glass or working on the computer or caulking or whatever comes to hand. So, say I'm sketching something, and I see that it just isn't happening. I'll just put it aside, instead of banging away at it. Just take a break from it, and go do something else. Try again the next day, and again, if it isn't working, just let it go. This is why it's good to have several projects going at once, rather than just having one and waiting around for a major flash of inspiration to get it done. Then, once you've got it done, that's all you've been working on. Just go work on something else. With two or three active, if one is stuck, then you go to the other and that works, or you go to the third, and then back. Or you just go sweep the floor. Anything will do.

Some people talk of emptiness between projects and the need to refuel. I don't really experience that; I have my different projects all around, and I just keep going. Sure, I take it easy for a bit; I go swimming every morning, or I'll watch a good movie at night, but I'm not really refueling anything. It's great, though, to travel and look at museums and architecture. My wife and I have done a lot of that. We go to a lot of museums and galleries of any kind. Paintings, sculpture, design, natural history, whatever: it all has an energizing effect; it's all an inspiration.



PERSPECTIVE: MARI KUSSMAN, DESIGNER AND FUTURIST

Mari is an enthusiastic futurist, fashion designer and aspiring polymath. As the first American to attend Bunka Fashion College in Tokyo, she learned haute couture tailoring and patternmaking under the advisement of Japanese artisans. Fascinated by full sensory experience, Mari spent her early career formulating custom fragrances as an experiential perfume apprentice. She went on to design at Helmut Lang before becoming the Designer at Kimberly Ovitz. She is currently cofounder at CRATED, a fashion and technology lab looking to revolutionize garment manufacturing.

Going all the way back: I grew up in Tokyo until I was 12 years old and was a real comic book enthusiast. So I spent my childhood where everything was anime, with these die-hard science-fiction scenarios, very futuristic, a lot of cyborgs, and integrated technology. I was a huge fan of the *Evangelion* series that included large anthropomorphized, half-organic machines they would ride in. This integration of machine and man blew my mind. It seemed so normal in the context they were presented. *Blaine* was another one: A sort of Internet-wired-in pre-singularity situation . . . I thought that was what the world was supposed to be!

I liked thinking about the kind of tools they would be using and what they would be wearing and thought it would be wonderful to create a tangible version of the scenarios portrayed. So I approached it from a very abstract narrative, trying to create a tactile version, trying to portray this futuristic setting of the pre-Singularity Universe [of human-machine integration.] In a practical sense, this works with 3D printing, making jewelry, that sort of thing. But that seems very limited. The research we are doing comes from realizing that it all needs to be rethought from its foundation. Hence, textile research. How can we build something from the foundation up that could really rethink the way people interact with the things they are wearing on their bodies? Can that be something that helps get you through your day more than it already does? Right now we're working on wearables that we expect to enhance connectivity. At the same time we are aiming for transparency in our manufacturing process.

I can't picture doing anything else. What I do plays to my personal strength, which has always been integrating form and function. But having worked in fashion for about a decade, I have now also developed a sense of responsibility. I want to change how people use what they use and how the things they use are manufactured. With this background, how can I now create something that is socially productive in both its use and manufacturing? That's a huge driver now.

There are countless problems in fashion. The big one is probably that the development process has no concern for the production process. So things are developed in the studio without keeping in mind how it's going to develop in the marketplace. This can be an incredibly wasteful process. Things are moving around: People import a fabric, treat it in one country,

send it to another to have it cut, then perhaps sewn somewhere else, which creates an astronomical carbon footprint with no regard toward what that process might be. Even organic cotton might be treated in such a way that has no regard for the waste that's being produced. Organic cotton is actually awful. We make and wear so much denim in this country, and it's actually a terrible fiber for the environment. So how can you start rethinking these things, these really basic things, and start making the standards shift.

That's a huge problem when you add to it the unrealistic expectations people have about how they should look in high fashion. I think the designer's responsibility is to make it cool to care about these things. How can we trigger an interest on the consumer's end to be a conscientious consumer? Can you design in such a way that it's cool to be using things responsibly? It's completely possible—and it always has been—to have a development process where you are conscious about how a product will be recycled and how it will be after-market.

I would ask design students to turn the mirror on themselves and their process, keeping these questions in mind: Do *you* want what you're making? Do *you* need what you're making? Do you think what you're making will be helpful to other people? By defining those answers you realize what's important to you and where your passion may be in the process.

Looking back, 30 years from now, I would hope that I and my achievements would have eventually become a wrench in the machine, twisting things in the fashion world in the direction of sustainability. It's simply not sustainable, the way that we make things now. There's an expectation of what things should cost that is completely unrealistic, and that pricing-system is based on slave labor. If I could wedge a wrench in that system and start something to move in the right direction . . . And on a purely selfish note, I would hope that I could experiment with new technologies during this process. If I could use all the emerging materials that are coming out and really embed the solutions in the nanoscale, that would be my dream.

STAGE 4: EXPLORATION

APPAREL: EXPLORATION

Exploring the possibilities of apparel is what the cycle of fashion change is all about, but the functional aspect of the elements of apparel design should not be forgotten. Considering SCAMPER-ing the jacket brings the possibilities it affords to the fore very quickly. The constraint of using recyclable or recycled materials in itself demands exploration: The qualities and behavior of the materials will be more variable than if the materials were more traditional. However, the main exploration here will be involved with exploring the viability of the life-cycle of the fabrics and notions. Use the concept map to identify the different elements involved.

Aesthetically, on the other hand, the exploration can revolve around form and color, maintaining a "high-fashion look" of studied design and fit. Different color schemes will be explored and the size, form, and fit can be altered. The jacket can be tighter, wider, longer, shorter. The sleeves can have different shapes and details. The collar can be formed in various ways. The exploration takes its direction from here and produces three or four variations on the basic concept.

FURNITURE: EXPLORATION

Since the materials are found objects, the gathering of these elements and the examination of their use is automatically a massive exercise in exploration. But, as the chair is meant to be a whimsical variation on a classical style, the exploration will revolve around that. Modeling different uses of classical forms—through exaggeration, simplification, and focus—could be a way to go. The materials can also be swapped around and used in a slightly offbeat fashion. Each choice should be held up to the possibilities afforded for comfort, ergonomics, and overall style. The game here forms around a couple of "in jokes" in classical forms of rococo style and in the flipping of materials. But given the contemporary feel that is to be brought in, the classical style can also be "bent" a bit to allow for more room and comfort and a lower center of gravity.

GUI: EXPLORATION

The exploration of design for a GUI takes a slightly different route than for a physical object because the variations in aesthetics revolve around the use of imagery and color, and all form and texture is derived from elements of graphic design. Exploring the design of a GUI also involves a relationship between the functional and the aesthetic. The "look" can be played with in terms of form and color almost entirely separated from the function of the site, since links on a GUI can appear as text and form or both, and apps can have "buttons" of any kind as long as they are the right size for someone's fingers. In this case, the links are both and the exploration revolves largely around the balance between text and graphics. The graphics are then divided into those that create the environment (frames, buttons, stylistic elements, etc.) and images of the products involved (photos of artworks and books.) Not all the products are "visual" as such, although most are works with visual appeal. Many are more "information heavy" than others. The choice of increasing degrees of "text-heaviness" as the search progresses into new pages, rather than front-loading all the information on the main page, results from exploring the needs and search methods of visitors to similar sites and from the designer spending time looking at similar environments. Aesthetically, SCAMPER-ing your way through image sizes, fonts, and colors becomes the most important approach.

As you begin to coax your idea into the physical world, it is important that you understand what its nature is and how best to depict it. The following exercises will assist you in isolating the elements of your design and revealing how they contribute to the totality of the concept.

1. Now that you have a more concrete idea of your designs, refer back to the SCAMPER exercise as described on page 108, and use it to complete the following with a more practical slant. Question all assumptions, and don't go with a solution just because it's the standard one.
   - *Materials.* Examine the materials your designs call for. What are they capable of? How do they behave? What is their ecological impact? Try substituting other materials. What does this do?
   - *Function.* Confirm the functionality of your design. Think about energy use. Create a few sketches that show it in use. Contemplate this, visualizing with the help of your sketch how it would work in the physical world.
   - *Form.* Sketch a few variations on the form. Larger, smaller, rounder, whatever you can change, change. Go to extremes and switch things around. Make short what is long. Make angular what is curved. Work against symmetry, if symmetrical, or rearrange an asymmetrical object.
   - *Colors.* Always sketch in color whenever you can. Examine how your choice of color influences the feel of the design. Which colors belong, and which do not? Try to minimize contrast, and then create intense combinations. Look at color trends and follow them or go radically against them.
   - *Sustainability.* Where in your design's life cycle does it run into problems in terms of environmental impact? How will you minimize these problems? What is the most significant change you can make to your design? Where is the most waste resulting from your design? What is the most counterintuitive thought you can apply? How to ease recycling, repair, and reuse?
   - *Usage.* How has this design been used before? What worked? What didn't? What is logical and rational and what is just habitual? If something should change, how can you affect this? Consider ergonomic issues and wasteful practices. What can you improve?
   - *Production Techniques.* How is a design such as yours commonly produced? Is there anything in the production techniques that influences how you should design it? Are there any new technological developments or new materials that could influence this? Where would your products be produced? Would rethinking the geographical location change anything?
   - *Background/History.* By looking at the background and history of your client and design, you may find clues to changes that could be beneficial. You may also find problems that have become accepted through familiarity: "This is how it has always been done" is not a valid reason to continue, unless it can be shown that it is also because it is the best way to do it.

2. By sketching or modeling, create visual responses to as many of the questions above as possible. Use different media if you can.

   Once you have 10 or 12 images, look for a common effect. What ties your sketches together? What separates them? What have you emphasized? When working quickly, sometimes your unconscious mind will show you things you didn't expect. Either you are clearly emphasizing something, or you feel that something is missing. Either way, once you have figured out what's there and what's missing you can consider the following:
   - What are the main elements of your design (form, color, texture, or proportion)?
   - What is the "language" you are setting up in terms of how you sketch the designs? How do you interpret and signify the different elements you are using? Do you think your meaning is clear to others? If not, how will you make it clear?
3. Take the element of your design—color, line, texture, pattern, shape, or space—that you feel has the most significance. This can be chosen on the basis of visual impact or technical importance. Sketch the design, placing maximum emphasis on exhibiting the significance of this element, using three different media (e.g., pencil, markers, or watercolor). Which one serves it best? Why?
4. Create three sketches going from small to large. Use three sizes of paper, one the size of your hand, one the length of your arm, and one the length of your body. For the first, use pencil, for the second use a thin marker, and for the third use wax crayons or a thick marker. Put as much detail as you can into each sketch. How much detail is enough to explain your thinking? How does your perception of the design change with the change of scale? Which of these three do you think is the most effective way to present the idea? Why?
5. Take the elements of your idea and portray them in sketch form independently of one another. Create a set of sketches that address different elements of your design: color, form, proportion, texture, and movement. One way of doing this is to choose a subject at random. Create a sketch where you apply the elements of your design to that subject (e.g., a red, angular, shiny elephant). As you sketch, consider how the context informs your usage of the elements involved (how do you apply angles to an elephant?) and how the nature of the design changes by your application of these elements (what is the elephant now?). Playing with this idea, substitute various animals, people, objects, and plants, and keep sketching. This activity will connect you with the elements of your design and let you fully understand their effects, without tying you to the practicalities of the design in question. Apply what you have learned about your design in the previous exercises to one "master sketch."
6. Use the media and scale you found best suited, and create a sketch showing your design from a few significant directions. Make sure all the main elements are emphasized (the angles of your sketch may be determined by this). Make any notes on the sketch you feel may be necessary to underscore what your audience is looking at.

1 See Noam Chomsky, *Language and Mind* (New York: Harcourt Brace, 1968).

2 http://www.dte.co.uk/case-studies/frank-o-gehry-associates-inc.php (Accessed March 2014)

3 http://www.rtqe.net/ObliqueStrategies. (Accessed March 2014) Oblique Strategies by Brian Eno and Peter Schmidt. Copyright © 1975, 1978, and 1979.