Chapter Two: Line is the Shortest Distance

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## Introduction

We learned early in our education that a line may be defined as the shortest distance between two points. In Chapter Three we will expand this discussion and derive something called a \*Cuboid Generalization Analogy\*. In that discussion it is presupposed that a point has only one meaningful attribute, its location in an x, y & z coordinate system. A point has no dimension or mass. May we infer that a point has little pragmatic meaning to us without its context or relationship to another element?

On the other hand, a line has direction. Outside of the realm of pure mathematics, it also has several useful qualities that we can propose below in a discussion, “What is Line Quality?” Consider line as the fundamental syllable we utter in this language called drawing.

## Volumes = Shapes: Transformations from a 3D world to a 2D page

Architectural drawing communicates a story about our shared spatial and experiential world. The act of drawing is a snapshot that filters the element of time and also filters the element of depth. Here is the magic of a good drawing: it reinterprets experiential time, and space onto the flat plane of the drawn surface not by surrendering to those reductions in depth; rather, drawing has the potential to amplify those very dimensions of time and space. How you ask?

The first transformation has to do with scene selection that is evocative of our shared experiences about interacting with the built environment. Let’s lay this aside for the moment, knowing that this will be covered in later chapters. The second transformation is obvious to say and less obvious to represent convincingly. Three-dimensional volumes are translated to shapes. Spheres are circles. Cubic volumes are polygonal shapes. The principal is this: an image plane is implied between the viewer and the viewed object(s). Lines, vertices and curves project onto and intersect with the imaginary image plane. Drawing is projection. The direct mechanical analogy here is a camera. The sensor of the camera (e.g., either unexposed film or a CCD) is a physical image plane that captures projected and reflected light.

This course in architectural illustration and design visioning is concerned with these two transformations and challenge you to answer two basic questions:

1. Temporal: How do I communicate the experience and feeling of this built environment?
2. Spatial: Can I invite the viewer to move around an imaginary three-dimensional construct?

The most common anxiety students have in this course revolves around the fiction of inherent artistic ability. The fallacy of the natural-born artist assumes that one cannot overcome the *head-start* that artistic students enjoy. This view is too narrow. It underestimates both the *time-on-task* that so-called *natural* artists have dedicated to developing their skill in the past. It overestimates the extent to which architectural drawing is *art*. Finally, it equates the act of architectural illustration with artistic skill, which is also a too narrow definition. For our purposes, may we suspend these preconceptions for a moment and also separate the act of marking on a surface and the deliberate recording of an image and idea? Trusting instead in your ability to learn new things may make your success in this class more a function of deliberate practice (within your control) than *talent* (outside of your control).’

## Exercise One. Breathing Lines

### Introduction

<Insert Figure 2.2>

Figure 2.2: Exercise One. Breathing Lines Example in Felt Tip Pen on Bristol Board

This drawing is called breathing lines, because the simple exercise of making marks should be no more stressful than breathing. There are just two rules for this assignment. The first rule is that no line shall cross another line. The second rule is that a line shall be consistent in all respects. For example, each line shall have a consistent width. Also, each line shall be consistent and unbroken from the top of the page to the bottom of the page. The process for making this drawing involves making a 1/2-inch border inside an 11" x 14" piece of paper. Adhesive tape shall be placed along the top margin and along the bottom margin. While doing the drawing it is helpful to breathe out continuously and quietly as in the film that we saw with John Franzen (Franzen 2015)

### Learning

This assignment module contributes to the following design learning outcomes, which finish the sentence “As a successful student in this course, I am now able…”

* … to control line weight and consistency (e.g., width, continuity and control)
* … to abstract a simple line exercise that evokes a complex topography.

### Scenario

Our sole focus in this assignment is to make the most consistent marks on a page that we can. Working slowly and with purpose and care, we allow the pen or pencil to glide from the top of the page margin to the bottom in one continuous motion. We are free flowing in our mind and body. The challenging part of drawing is not mark making; rather, it is effective *seeing*.

It may surprise you that a contemporary understanding of the phrase *Fine Art* has less to do with a quality of *Fineness*. It has more to do with the finality of its purpose. Most definitions of fine art have suggested the term derived from the French, *Beaux Arts*, concerned with aesthetic beauty and implied agreeableness. Yet we know that much important fine art of the last 75 years and more is neither aesthetic nor beautiful, nor agreeable! Would you permit this author a conceit of a complementary French translation of *Fin Arts*, or art that is an end in and of itself? For guidance we can refer to scholarship about the philosopher Immanuel Kant.

Works of fine art, Kant is saying, like products of “agreeable art” (angenehme Kunst), are objects designed with a view to producing a phenomenological and physiological effect in the spectator, namely the sensation of pleasure. But unlike “agreeable art,” a work of fine art is produced in addition with a view to engendering a certain kind of reflective activity in spectators (“the end of the art is that the pleasure should accompany the representations … considered as *modes of cognition*”) … “advancing the culture of the mental powers in the interests of social communication.” (Haskins 1989, 44)

While beautiful architectural illustrations are compelling and may seem unattainable at your current place in your studies, freeing yourself from the yoke of misunderstanding about artistic limitations and about the role of illustration in our profession will help relieve you of the burden of anxiety surrounding our work in the studio. After you complete this project, I hope you will agree with the simple proposition that you can *draw* effectively, inasmuch as you can make *beautiful* marks on a page. Then we can proceed with the challenge of helping you to *see* more deliberately and to *translate* your vision effectively to the page.

At times, you may be compelled to think of this as an *art* class. We will discuss in later projects an alternative view of this studio course. Architectural illustration borrows from artistic skills, from graphic design, from psychology and sociology, as well as from computer arts. We will engage theories of perception, of color and of persuasion. For the present, let us accept the proposition that this is **NOT** an art class. There, does your technically inclined brain feel more comfortable? Good. Now let’s learn some things together and find your vision.

### Materials

* Pencil or felt-tip pen (0.25 or 0.35mm)
* 11" x 14" (279x356mm) sheet
* drafting tape

### Steps

1. Select a good quality paper. For this assignment you may want to use something like Strathmore 300 Bristol with a Vellum Surface (270 gsm.) As this is a heavier paper, you may find it is more comfortable to leave this not taped to your board.
2. With a light pencil line measure a one-half inch (12mm) border around the sheet on all sides. Align and place drafting tape along the longer axis at the top of the page and at the bottom of the page.
3. Selecting the thinnest pen that you are comfortable using place the pen nib down within the tape border area and draw the first line on the left border margin if you are right-handed and on the right border margin if you are left-handed. Draw on top of the pencil border line you have made. At the end of your first stroke continue beyond the margin of the tape and only lift your pen within the tape border margin. This minimizes the “wicking” effect of the pen on the paper and results in a precise and implied border.
4. Continuing across the page make your next freehand line about 0.25mm or less away from the first line…as close as you dare without touching the previous line. Continue this process and welcome the small variations that begin to oscillate through your process.
5. Take periodic breaks to keep your mind and eye fresh and attend to the consistency of the ink pen which may dry up over time. Introducing a new pen to finish the drawing next to “dry” lines could be too abrupt.

### Video

<Insert Figure 2.2.1\_thumbnailVideoDemo>

Figure 2.2.1: Video Still. How to Draw the Breathing Lines Assignment

### Tips

* It may be helpful to keep your drawing clean with the use of a scrap of tracing paper naturally adhered by the oils on the side of your palm.
* This can also ease the uncomfortable feeling of friction that you may experience between your palm and the paper over time.
* The most pleasing effect combines a combination of very closely spaced thin lines and an oscillation effect that suggests topographic maps of steep mountains.

### Criteria

| DLO | Advanced (4 pts) | Proficient (3 pts) | Developing (2 pts) | Beginner (1 pt) |
| --- | --- | --- | --- | --- |
| Craft | Illustrator demonstrates exemplary attention to work product and excellence. | Illustrator demonstrates good attention and care towards work product. | Illustrator completes work, but the product seems rushed to completion. | Illustrator demonstrates attention towards work product, but work quality is |
| Rendering | Illustrator uses line to hold the viewer's attention. Image is controlled and evokes both power and subtlety. Image is descriptive and/or symbolic and supports compositional goals. | Illustrator's line work demonstrates several professional attributes. Rendering style does not distract the viewer and generally supports compositional objectives. | Illustrator's use of line is somewhat effective. Rendering style is consistent and competent. There are some non-contributing attributes. | Illustrator attempts to use line descriptively. Rendering is inconsistent and lacks attention to craft. |
| Professionalism | Student completes the work on time. Work demonstrates exemplary attention to learning objectives. | Student completes the work on time and demonstrates a good work ethic. | Student generally completes the work at a minimum level of expectation. | Student is missing parts of the work and makes a plan for completion of the remaining assignment. |

### Related Assignment

* Exercise Two. One Hundred Lines

## A Professional Ethos for Drawing

Professional architects and engineers have developed distinguishing characteristics and guiding ideas about what makes good drawing practices (i.e., process,) and in turn what makes a good drawing (i.e., product.)

Life is process…. To be concerned for improvement suggests a concern for methodology…developing skill in using the techniques that enhance the enjoyment of process. Products are but moments in time. Their value and meaning derive from process and are reapplied to future process…. For those who solve problems for others, as in a profession, documentation of process is part of the responsibility of such professional practice. (Koberg and Bagnall 1981, 100)

A good drawing communicates meaning through line work. What is good line work? Good lines are consistent, purposeful and clear. A consistent line has specific width appropriate to its purpose. A consistent line is rendered for meaning and can range from unbroken end-to-end to a kind of *hit-skip* line that suggests the influence of light. A consistent *squiggly* line is not an accident of technique or failing of confidence, rather it is an intention of mood and character. A purposeful line communicates with the directness of all the parts of speech and grammar that we employ in good writing and speaking. There is a drawing vocabulary with accepted rules of usage, not dissimilar to the way we employ words. A purposeful line communicates meaning. Clear lines have a *purity* on the page that show we have taken care to not only keep our drawings clean; and clear lines have a *simplicity* that demonstrates we have taken care to be economical in our expression.

Architecture and engineering drawing borrows ideas and ideals from the sciences and the arts. Our sketching and illustration can often seem like we are striving for the artistic. We can be inspired by the works and words of someone like the artist Jim Dine, who said:

A drawing is a labor for me, not in a bad way, but in an intense way. I am able to search through drawing…a total connection between my hand and my eye…. I don’t think hard work makes a good drawing. I have had a lot of students who worked very hard…. Drawing is not an exercise. Exercise is sitting on a stationary bicycle and going nowhere. Drawing is being on a bicycle and taking a journey. For me to succeed in drawing, I must go fast and arrive somewhere. The quest is to keep the thing alive – the drawing and the state of grace. (Brodie 2004, 28)

We can just as easily lean into the words of documentation and drafting and be inspired by the statistical sciences.

Graphical excellence is the well-designed presentation of interesting data – a matter of substance, of statistics, and of design. Graphical excellence consists of complex ideas communicated with clarity, precision and efficiency…. Graphical excellence is nearly always multivariate…[and] requires telling the truth about the data. (Tufte 1983, 51)

One area of particular interest to architects, engineers and landscape architects is the National Park Service’s Heritage Documentation Programs. There are several standards that address the qualities of drawings for documentation including the Historic American Building Survey (HABS,) the Historic American Engineering Record (HAER,) and the Historic American Landscape Survey (HALS.)

As such, these guidelines represent more than 75 years of comprehensive experience in building documentation practice. Individuals and teams wishing to submit documentation for inclusion in the HABS Collection at the Library of Congress should review this document closely and are required to follow the procedures described therein. (National Park Service 2008)

It can be tempting for a student to believe that *good drawing* is a matter of subjective taste. Indeed, many people think that assessing the qualities of aesthetics and, by extension, drawing is much like trying to guess what color the professor is thinking of right now! Burnt Sienna.

Throughout this book you will read about the history and theory of architectural illustration and drawing. From this, the author has distilled some principles into rubrics that we can use together to establish definable goals and objectives to make your drawings more professional. It turns out that there are more things that architecture and engineering professionals agree upon with respect to effective drawings than perhaps in any other area of our projects. This is another reason for setting aside the mistaken belief that what we endeavor to learn here is about the Fine Arts, or even about being artistic. Let’s learn to be professional and effective communicators through drawing!

## Craftsmanship: Mark Making as Second Nature

For an architect or engineer, mark making is second nature to our craft. A *maker’s mark* was historically struck into metal by a goldsmith and identified his/her personal mark. It was a sign of distinction and pride. It signified a high level of skill and craft.

The maker’s mark is a powerful metaphor of quality and can be inspiring for our work in this studio. We can aspire both to improving our skill and craft and someday make our mark on the profession; and the very act of mark making (i.e., drawing on paper) is the discipline we practice every day to achieve this goal of high craftsmanship. You can find many examples of how this idea transcends the craft of the goldsmith.

You may not have considered the connections between professionalism and craftsmanship. A profession is often distinct from a vocation in our society. A doctor tends to the body, is licensed to practice and is only called a doctor after years of academic study and internship in a medical setting. A mechanic tends to our vehicles, may be uncredentialed and may or may not have gone to school or apprenticed to a master mechanic. Both the doctor and the mechanic can nonetheless exhibit excellence and skill with their hands and with their craft.

Given the intrinsic richness of manual work – cognitively, socially, and in its broader psychic appeal – the question becomes why it has suffered such a devaluation as a component of education. (Crawford 2009, 27–28)

The nobility of work must therefore accrue from some other place than social capital, earned degrees or how much money one makes. Making excellent things takes time and attention to detail. Craft is the process for making.

Craftsmanship is an ethic and an approach to making that transcends the divide between the ideal of the idea and the reality of the realization of some object. Architects and engineers should attend to craftsmanship with the same attitude of the goldsmith who strikes a mark in a finished piece with an equal measure of humility about the experience embedded in the work and pride for the appreciation of a job well done. Our maker’s mark is in the linework and rendering of light on the page.

## What is Line Quality?

As we discussed, it can be tempting to think of quality as a subjective judgment and an opinion or a personal preference, especially in an aesthetic context. There are accepted principles of quality line work, and we can first state them and generalize to a useful model of line quality. Once we have established a few *rules* or principles for architectural line work, then we can plot these ideas on a continuum ranging from beginner, to developing, to proficient and advanced. These levels will form the basis of rubric assessments of the learning objectives that can be applied to and measured for each assignment. First let’s establish some goal statements about quality line work:

### Definitions and Aesthetic Goals:

* Line weight is a phrase referring to both line width and opacity.
* Line weight imparts meaning through dynamic tension, and a useful analogy for that quality is like what volume is to sound.
* Line continuity implies both constant width and opacity.
* Since both line weight and continuity can be varied, then we can assess linework within a framework of deliberate intention.
* Do the differences in line weight and continuity follow a coherent system that gives meaning to a drawing?

### Goals vs. Objectives

Permit your author the first of many brief interludes. As a reminder, goals are idealized and aspirational and describe outcomes that we hope to accomplish over a longer time frame, for instance the length of this course or even your university education. Goals are more open, less focused and do not describe the processes or methods you will use to reach the goal. A goal statement in its most structurally basic form can be stated as a verb-object phrase:

* Graduating university
* Achieving professional licensure
* Starting a professional practice

Objectives are measurable, more within our control and by their nature are iterative components of a larger system pointed at achieving our goals. You can think of an objective as a to-do list item that you have a high probability of checking off in a shorter time frame. An objectives statement can be written in the form of Time:Action:Object:Metric. Here are some examples:

* Before the scheduled deadline, complete each drawing assignment using the provided rubric as a guide.
* Each night for the next couple of months, study one chapter in preparation for professional registration and take the practice exams at the end of the chapter.
* Before talking to the bank manager, write a business plan that analyzes the competitive market for the professional services you want to offer and ask five professional colleagues to read and assess the plan.

What makes a good objectives statement for line quality? As you read through the exercises there will be many objective statements that imply good line quality. For example, here is one from an upcoming exercise, stated first in the Time:Action:Object:Metric scaffolding, and then verbatim as it will appear in the assignment.

1. Before the Scheduled Deadline (Time)
2. Control (Action)
3. Line weight (Object)
4. Consistent width, continuity and strength (Metric)

* Learning Objective: As a successful student in this course, I am now able to control line weight and consistency (e.g., width, continuity and control)
* Rubric Assessment: Illustrator uses line to hold the viewer's attention. Image is controlled and evokes both power & subtlety. Image is descriptive and/or symbolic and supports compositional goals.

### Line Quality Implies Meaning

Line is a powerful rendering tool. Architects and illustrators can create meaning solely with the use of this dynamic tension of line work. As we will see in later chapters, modeling our illustrations with tone-value and color are exciting tools to render as well. Beginning students can conflate the term render to mean only these tone and color lighting effects. The exercise that you will do in this chapter study the primary impact of line on representing form and shape. As you work through these, try to be deliberate and systematic in your line choices. Understand that accidental line variance, or conversely, monotonous unvarying lines each can confuse meaning and signal inconsistent thinking about your designs.

## Professional Results: Tips for Photographing Your Work

The most underestimated skill for success in architectural drawing is training yourself to see effectively. The second most underestimated skill must surely be documenting your artwork effectively. This can be as easy as taking a photograph with the very capable smart phone in your pocket. Two cliches come to mind:

* The devil is in the details.
* Garbage in…garbage out.

Achieving devilishly good images is definitely in the details, in preparation and most importantly, the quality of the light. Editing your photographs in a software program also comes into play, as we will discuss here. One great advantage of our contemporary study of drawing is the ability to upload digital images to a content management system (e.g., Blackboard, Canvas, etc.) for assessment. Even in the past when students submitted original artwork for a grade, there was a need to photograph work for a portfolio that could be shared either in print form, or as now, a digital attachment to an email or download from a hosted web site.

### How to Get Consistently Good Photos

#### Lights

1. If weather is permitting (e.g., dry, low wind, moderate temperature,) then taking photos outside is a great choice. Aim for the greatest light levels without glare. Often this means one of two things: shoot on an overcast day or shoot in the shadow of a building.
2. If taking a photo inside, then control the light sources. Use a similar color for your lamps. New developments in LED technologies yield high output and good color rendition. A soft diffuser or something as simple as translucent tracing paper (white, not yellow!) can improve even spread of light.
3. The two greatest enemies of photo correction are shadows and uneven light. If you do a search on a camera light stand, then you will notice that the standard design is to point two closely, oppositely positioned, and evenly lit sources at a 45-degree incident angle to the artwork. This reduces shadows and promotes even lighting.

#### Camera

1. If your smart phone has multiple cameras, then use the one with the least barrel distortion. If you can barely fit the artwork in the frame, then this is probably the zoom lens.
2. To clarify the point above, it is not advisable to use the digital zoom feature of your camera; rather, use the larger glass lens.
3. It is most typical for a smart camera to have the ability to set the focus and the exposure separately. If you can learn how to do this, then it is optimal. Focus by touching the screen in an area of detail and contrast. Set the exposure by finding a middle value (i.e., gray if possible) and touch the screen for exposure.
4. The brighter the lighting, the higher the implied f-stop of the camera lens and the greater the focus depth and the less the noise or grain. Conversely, the darker you shoot, the more bad things happen: 1.) gray, instead of white backgrounds; 2.) color aberrations and digital noise in the shadows; 3.) shallower depth of field with more chance for focusing issues, etc.
5. Using a grey card positioned outside of the crop area is a great idea. If you do not have a grey card, then it is easy to make a quick one with a white piece of paper and a pencil. Shade a box with the edge of a pencil and set your exposure as suggested above to this known 50% gray.

#### Action

1. Photo editing software comes in many flavors. As of this writing, the most popular choices are Lightroom (paid), Photoshop (paid) and GIMP (free.) Some beginning moves can also be made in the camera.
2. Here is a proven workflow that yields consistent results:
   1. Straighten the image using guidelines and a rotation tool
   2. Crop the image and remove unwanted artifacts outside the borders.
   3. Use either a Curves or Levels tool. Look for the eyedropper icon that is middle gray. Typically, there is a white, black and gray dropper. Touch the eyedropper to your gray card or pencil mark. If you have neither of these available, find something that is reliably “gray” in color to touch with the gray eyedropper. This is a powerful color correction. Finish with either the white dropper or the black dropper (not both!) and correct for the dominant issue.
   4. If setting the white point or the black point yields poor results, then reach for the Brightness and Contrast or alternatively, the Exposure tool.
   5. Scale the image (down!) for the selected output. The most important consideration is pixel width and height.
      1. Screen Resolution: Full size at 72 ppi. An example of this would be an 11" (279mm) x 17" (432mm) original artwork would have a pixel dimension of 792px x 1224 px.
      2. Print Resolution: Full size at 300 ppi. This is much larger and would yield an image that is 3300px x 5100px.
      3. Upscaling is undesirable. The programs will create pixels for you when up sampling, but the results, absent of Artificial Intelligence technology, are almost always useless.
3. The goals of photo editing for artwork are a push-pull problem:

* Minimize distortions
* Maximize crop choices
* Maximize clarity
* Minimize color aberrations
* Maximize contrast
* Balance darks and lights
* Maximize resolution

**Remember:** Garbage in, garbage out. When in doubt, take another and better photograph. Don’t waste time *in the box*.

## Exercise Two. One Hundred Lines

### Introduction

<Insert Figure 2.3>

Figure 2.3: Exercise Two. One Hundred Lines Illustrating Depth Using Only Straight Vector Lines

Use one hundred straight lines to create a sense of depth on a two-dimensional image plane (i.e., page.) Begin by drawing a 1/2-inch (12mm) border around the page and then fill the frame with your composition. Use a vector drawing program (e.g., Inkscape or Adobe Illustrator) to make the drawing, only using straight vector linework. Set up the artboard to an 11“x17” (e.g., ANSI B, Ledger or Tabloid) or 297x420mm (ISO 216, A3) sheet size. Familiarize yourself with the program and experiment with line type and thickness. All linework is to be achromatic (no color.) Print (export) the final on page to an Acrobat PDF file.

### Learning

This assignment module contributes to the following design learning outcomes, which finish the sentence “As a successful student in this course, I am now able…”

* … to control line weight and consistency (e.g., width, continuity and control) using a vector line art computer program.
* … to abstract a simple line exercise that evokes three-dimensional depth on an image plane.

### Scenario

Vector based drawings have several advantages over raster as discussed in the section below, *Vector and Raster Graphics*. You will want to have the ability to use both types of drawing in your illustrations. Often the best way to learn a new software program is to try to solve a specific and simple problem. This approach is both more enjoyable and more challenging than reading the manual. The programs are so comprehensive in scope, it can be overwhelming to learn everything, and it is unnecessary to know everything.

As an example, in Inkscape the first thing you will want to know how to do is navigate around the workspace and orient yourself to some recognizable measurement units. Zoom in and out and pan and notice the top and side rule bars. Notice that there are multiple ways to do the same thing: menu drop down bars, icons and shortcut keyboard commands. Confused yet? Good. Making mistakes and repeating them is definitely underrated as a learning tool.

Now you will want to draw something. Let’s try a rectangle. Can you find how to query information about the rectangle? Parameters may include line width, color, fill color or pattern, etc. Each is easily changed once you find the dialog box. Wow, dialog boxes are powerful and can serve as a quick way to simulate and experiment with different effects. Everything is parameterized and seemingly accessible through a dialog box.

OK, you are on your way. Have fun. Get frustrated. Ask each other questions. Ask your professor a question. Do an internet search. Who needs to read a manual? It is there if you need it. Your questions are getting smarter. You are more efficient. You got this!

### Materials

* Inkscape or Adobe Illustrator

### Steps

Procedure for the open-source application Inkscape ver. 1.0

* In your sketchbook with a pencil, develop your idea of a composition of lines that describe spatial depth. Refer to the several principles referenced below (e.g., overlapping shapes, diminution, convergence, etc.)
* Open Inkscape and navigate to “File -> Document Properties.” Change the preferred units (i.e., inches) and change paper size to Tabloid and orientation to Landscape.
* Create the border with the “Rectangle” tool. Open “Object -> Fill and Stroke” and select no fill and a stroke width of 0.9mm.
* Create your lines composition with the “Bezier” tool. Use Layers to maintain structure and order.
* Use three-line widths to support your composition (e.g., 0.25mm, 0.5mm and 0.7mm).
* Save file as either Inkscape or Plain SVG as you work.
* When complete, “File -> Export PNG File” and name the file and location. Make sure to additionally select the **Export** button.

### Video

<Insert Figure 2.3.1\_oneHundredLinesVideo>

Figure 2.3.1: Video Still. How to Draw the One Hundred Lines Assignment

### Tips

* Inkscape is an open-source vector graphics editor, with capabilities similar to Adobe Illustrator. Accessed 3 Feb 2021. https://inkscape.org
* In his book Architectural Drawing, Rendow Yee covers several perspective cues we can use to create spatial depth on the paper. (Yee 2007, 228–29)

1. Diminution
2. Overlapping Shapes
3. Convergence
4. Foreshortening

* Many of the processes in digital drawing are iterative. Since you repeat the same commands often, it is very useful to learn keyboard shortcuts.

### Criteria

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DLO | Advanced (4 pts) | Proficient (3 pts) | Developing (2 pts) | Beginner (1 pt) |
| Craft | Illustrator demonstrates exemplary attention to work product and excellence. | Illustrator demonstrates good attention and care towards work product. | Illustrator completes work, but the product seems rushed to completion. | Illustrator demonstrates attention towards work product, but work quality is |
| Rendering | Illustrator uses line to hold the viewer's attention. Image is controlled and evokes both power and subtlety. Image is descriptive and/or symbolic and supports compositional goals. | Illustrator's line work demonstrates several professional attributes. Rendering style does not distract the viewer and generally supports compositional objectives. | Illustrator's use of line is somewhat effective. Rendering style is consistent and competent. There are some non-contributing attributes. | Illustrator attempts to use line descriptively. Rendering is inconsistent and lacks attention to craft. |
| Professionalism | Student completes the work on time. Work demonstrates exemplary attention to learning objectives. | Student completes the work on time and demonstrates a good work ethic. | Student generally completes the work at a minimum level of expectation. | Student is missing parts of the work and makes a plan for completion of the remaining assignment. |

### Related Assignment

* Exercise One. Breathing Lines

## Vector and Raster Graphics

For most of us, the first drawing program on the computer we encounter is a raster painting application such as Adobe Photoshop or GIMP. Vector based drawing apps are often considered more advanced and drawing vector art a skill learned later in our development. This course takes a different approach. We start with a vector line art program, (e.g., Inkscape or Adobe Illustrator) because it serves many immediate needs in the studio.

Raster images are binary files on our computer with suffixes like tif, jpg, png, etc. They are sometimes known by the descriptive term bitmaps. It is analogous to think of a bitmap image as a map that bridges the divide between the bits of a computer (i.e., the smallest increment of data holding a value of “0” or “1”) and a rectangular grid of pixels mapped over the extent of the scene you want to capture. Each pixel’s color is specified by a number of bits. We project these image maps at different resolutions, usually by downscaling a digitally stored master captured by either the sensor of a camera or defined at the beginning of the process of creating a pixel painting in a program. We subsequently down sample for projecting on a screen (i.e., 72 ppi) or printing to paper (i.e., 300 dpi.)

The CCD sensor of the Nikon D850 full frame DSLR camera is 45.4 megapixels (MP), and this measures 8256 pixels x 5504 pixels (px) with a 3:2 crop ratio. If you want to project this image onto a 1920 x 1080 computer screen, then it is most efficient to down sample the image (~20% of original capture,) in order to not overstrain the computer. If you wanted to print this on a high-resolution poster to hang on your wall, then you could down sample the original image to, let’s say, 24“x18” (610mm x 457mm) at a resolution of 300dpi (~12 ppm) with a raster image dimension of 7200px x 5400px.

Vector images are a fundamentally different file type. Instead of a binary file like raster images, vector art is commonly saved in a text file. Two common suffixes for vector files are svg and pdf. The text files are human-readable like a set of instructions, a process, and a script of geometric movements on a cartesian coordinate system. These scripts describe straight and curved paths and include attributes. The greatest advantages of vector line art from our perspective are two-fold: precision input and infinite scalability independent of resolution. Depending on your need, the final step in projecting or printing a vector image is to convert to a raster format. This conversion is usually optimized automatically by the output device for the best resolution. Here is an example excerpt of an svg file drawn in **Inkscape**. It is a 10mm square with a 0.25mm black stroke and no fill.

<rect style="fill:none;stroke:#000000;stroke-width:0.0980247;stroke-miterlimit:4;stroke-dasharray:none;stroke-opacity:1"

id="rect833"

width="9.9019756"

height="9.9019756"

x="0.049012303"

y="0.049012303" />

Since the raster image is dimensionally defined by the width and height of the image in pixels, then the number of bits per pixel only comes into play when considering the output (e.g., projection and printing) requirements. The vector image treats everything as objects, and we will first use the program as a way to composite photographs (i.e., raster images) of our hand-drawn artwork together onto one poster. There are several filters available for making simple edits to our photographs. Finally, there is a easy cropping tool available.

## Graphic Design Principles for Architectural Illustration

Over the course of these studies, you will learn graphic design principles for architectural illustration. We have to start with something simpler for now, and so let’s discuss the elements of this idea. It is certainly an oversimplification to say that the fundamental design impulse is the juxtaposition of tension and release. This work will often use analogy to talk about complex subjects in an effort to provide an entry point for your understanding. Music is a universal analogy.

In Western music it is common to talk about *cadence*. This word can mean the beat or time or rhythm, variously. It has another more interesting and specific meaning: the harmonic relationship and movement between the dominant chord and the tonic chord. Since this is not a music theory book, let us say only that the dominant chord can feel unsteady and in need of resolution (i.e., tension,) and it *moves* toward a resolution and the stability of the harmony that feels like *home*. Think about all the songs you know and how unique each one is. Now consider that, in the Western canon, music is dominated by twelve unique notes of which the most common groupings or scales mostly use seven individual notes at a time not counting repeating notes an octave above or below the base seven notes. Finally, consider that the essential harmonic movement is from the dominant chord to the tonic chord. One generalization we can make from this analogy: Tension and release creates aesthetic excitement from the simplest of rules.

Here then are some simple rules we can setup as graphic design tension and release movements, or to borrow a phrase, *cadences*. Let’s first name the seven *notes* of our scale or elements of design as reinterpreted from the 1941 book, *The Art of Color and Design*. (Graves 1941, xv-xvi)

1. Line
2. Direction
3. Shape
4. Proportion
5. Texture
6. Value
7. Color

The essential movements from tension and release that we can make in infinite combinatory possibilities include at least these structural relationships in order from low to high contrast:

* **Repetition** of like elements separated by space
* **Harmony** or similarity of some elements and their properties
* **Gradation** and transition toward contrast and tension
* **Contrast** and discord, especially a lack of similarity

**Unity** is the balancing principle that exemplifies an aesthetic gestalt of tension and release, an organized system that is experienced as more than the sum of its parts.

## Taking Control of Your Digital Files

We will be making extensive use of digital files in this course. Before the desktop computer, architectural and engineering firms had elaborate data management systems. A favorite choice for the project architect or project manager was a three-ring binder that lay on top of the desk at the side and at hand. Each member of the team knew they could come over and consult the project file that was tabbed with the different sections:

* General conditions, project number and schedule and budget
* Contacts list, faxes and letters from clients, builders, administrators, consultants and vendors
* Site conditions, Field sketches and photographs
* As built drawings folded in a special way to fit the binder
* Cut sheets of materials, furniture and fixtures, etc.

As the binders were filled, another was started and made available to the team. At no time was the binder to leave the project manager’s area! Some managers preferred file cabinets with manilla folders instead of a binder. Also at the manager’s desk was the latest full-sized document set, inclusive of blueline prints and the construction specifications. Again, not a good idea to take them back to your desk. The project manager had a primary role to be the custodian of the project file, the librarian.

In the digital age many of these ideas remain and others have changed drastically. The categories are no longer tabbed inserts in the binder; rather, they are folders on a disk drive with shared network access. Version control of this virtual project file is very challenging and critical to the team. The most important thing is not which system the project manager necessarily uses. It is most important that the manager communicates to the team how and where files will be stored and accessed and above all, backed up each and every night at the least.

So, what is your system? This is not optional! You must develop a system that works for you and be consistent in how you use it. Here is an example that you can build upon for our work:

1. Sketchbook (Your project file!)
   * Sketch assignments
   * Course notes
   * Project schedule, handwritten with annotations
   * Printed examples glued onto blank pages with annotations
2. Top Level Folder on your computer’s hard drive
   * **Architectural Skills**
   * Subfolder: *Documents* for finished and scanned work
   * Subfolder: *Images* for photographs and collected reference work
   * Subfolder: *Movies* reference videos and demonstrations
3. USB drive duplicated and synchronized to your computer hard drive structure
4. Cloud drive automatically backing up your computer hard drive folder
5. Naming system for files (Be descriptive)

* YYMMDD\_projectNameAuthor.ext is a good model
* 230901\_exerciseTwoInglert.svg is a name that implies the following:
  + - Due on 1 September 2023
    - Project: Exercise Two
    - Author: Inglert
    - Type: Scalable Vector Graphics

One final word: A working file, an archive and a backup are three separate entities that are related to each other and are in sum the bare minimum model from which to build your own system. There is a high probability that one of three things will happen to you over your studies. A hard drive will fail. An external cloud server will go offline. Or a USB stick will be lost. The probability that all three will happen simultaneously is extremely low. Protect your work!

## Exercise Three. Contour Drawing of Still Life from Direct Observation

### Introduction

<Insert Figure 2.4>

Figure 2.4: Exercise Three. Contour Drawing of a Still Life

A contour drawing is an outline that describes the mass and shape of objects. In our usage the primary outline is called the silhouette, and it circumscribes the outermost shape of the composite of objects. In Sketch A. Contour Line Drawings of Fifty Hands and Feet we started with five “Blind” contour drawings where we focused only on the object and never looked at the drawing. Modified contour drawings are freehand drawings that split time between looking at the object and looking at the drawing.

“Drawing is the key to effective seeing, and seeing is the key to effective drawing.” (Laseau 2004, 10)

“There is only one way to learn to draw and that is a perfectly natural way. It has nothing to do with artifice or technique. It has nothing to do with aesthetics or conception. It has only to do with the act of correct observation and by that I mean a physical contact with all sorts of objects through all the senses…. Learning to draw is really a matter of learning to see – to see correctly – and that means a good deal more than merely looking with the eye. The sort of seeing I mean is an observation that utilizes as many of the five senses as can reach through the eye at one time.” (Nicolaides 1969, xiii & 5)

“You have to measure, first of all, with your eyes; and by studying the model judge the comparative measurements of its several masses. Then measure mechanically. When measuring mechanically, hold your charcoal or pencil between the thumb and fingers and use the first finger and the tip of your charcoal to mark the extremities of the measurement you are taking.” (Bridgman 2017, 12)

In this drawing select a personal object of a relatively small scale (bag, shoe, etc.) and draw a modified contour drawing of the object on a 9x12 sheet of quality drawing paper. Do not shade or render. Focus on observation, clean, crisp lines, and composition of the drawing on the page.

### Learning

This assignment module contributes to the following design learning outcomes, which finish the sentence “As a successful student in this course, I am now able…”

* … to directly observe shape and forms and measure and translate the spatial scene accurately from an implied image plane to a proportionally scaled drawn surface.
* … to control line weight and consistency (e.g., width, continuity and control.)

### Scenario

As we learned in *Exercise One: Breathing Lines* a common anxiety many of us share is an inaccurate belief about our ability to draw. We learned that it was really a problem of how we *see*. When we concentrate on drawing what we observe rather than what we think something should look like, we are then better able to draw accurately.

In *Exercise Two: One Hundred Lines*, we learned that it was possible to convey spatial depth with depth cues. These ideas can be strengthened through a system of line weight or thickness. If you have had studied mechanical drafting, then you are aware of the line weight system for making a drawing look more professional. When we study architectural floor plans and building sections, then we will learn a similar line weight system. Unless you are drafting such an architectural drawing, let’s propose to follow a simple heuristic for line weight with three rules with one special condition: 1. Lines that define the boundary between space and object are heavy/thick. (0.7mm.) 1. Lines that mark the boundary between two planes are medium (0.5mm.) 1. Lines that are either textural or define two materials that are flush are thin (0.25mm.)

* Special condition: If it looks good, then consider making the silhouette discussed above the thickest line of all (i.e., 0.9mm)

### Materials

* Pencil or felt-tip pen (0.25, 0.50mm, 0.70mm or 0.9mm)
* 11" x 14" (279x356mm) sheet
* drafting tape

### Steps

1. Since you are going to be looking very closely at your still life, find objects that interest you personally. Assemble your composition with overlapping shapes and take time to *create a narrative* between the objects. Creating a story can mean setting up several *episodes* of tension-and-release. Hard objects and soft. Textural and smooth. Geometric shapes and natural.
2. Setup your drawing in a place both where it can stay for the duration of this long drawing and where you have a good view of the still life. Since this is a contour drawing, then even lighting is best. No shade and shadow shall be rendered.
3. Begin by closing one eye to remove stereoscopic vision, hold your pencil or pen at arm’s length, first vertical and then horizontal, and locate the *centroid* of your composition. Since your paper is a rectangle, then take your long metal ruler and lightly draw two diagonals to geometrically locate the center of your paper. Finish this step by drawing in freehand and very lightly a vertical line that passes through this center and a light horizontal through the same center. These are measuring lines for the following steps. Each one a datum of reference.
4. Continue by concentrating on the circumscribing simple shape. Challenge yourself to draw a descriptive polygon of the fewest essential sides and focus on getting the proportion right. This is the most important step, because all measurements are derived from relationships to this shape and the centerlines.
5. Take your time and, still with light lines, define the sub shapes of each object remembering to check your measurements against your centerlines and your circumscribing polygon. If you are comfortable with what you have through hard work and close observation transferred to the page, then you are ready to render.
6. Rendering linework in a contour line drawing is surprisingly the easiest part, because we have defined a heuristic above and a language of line type: heavy, medium and light. Enjoy the process and aim for consistency.
7. One final step is defining and scribing the silhouette line. Silhouette is the most important reading of shape and form from the perspective of the viewer. This thickest of lines should be bold and confident in its rendering. Oftentimes it also can appear as a continuous line around the still life.

### Video

<Insert Figure 2.4\_contourStillLife>

Figure 2.4.1: Video Still. How to Draw Contour Still Life Assignment

### Tips

* The described method borrows much from a technique called *Sight Sizing*. It differs in one important respect, although this assignment could be done as a true sight sizing exercise. Our modified version is more accurately thought of as a relative sizing method.
* Resist the urge to use technology as a guide for this project. Photography or drawing from image resources may seem like a good shortcut. Would it not be easier just to make a tracing? Remember that the goal here is to learn how to see, and little is learned by tracing or using an image reference.

### Criteria

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DLO | Advanced (4 pts) | Proficient (3 pts) | Developing (2 pts) | Beginner (1 pt) |
| Craft | Illustrator demonstrates exemplary attention to work product and excellence. | Illustrator demonstrates good attention and care towards work product. | Illustrator completes work, but the product seems rushed to completion. | Illustrator demonstrates attention towards work product, but work quality is |
| Rendering | Illustrator uses line to hold the viewer's attention. Image is controlled and evokes both power and subtlety. Image is descriptive and/or symbolic and supports compositional goals. | Illustrator's line work demonstrates several professional attributes. Rendering style does not distract the viewer and generally supports compositional objectives. | Illustrator's use of line is somewhat effective. Rendering style is consistent and competent. There are some non-contributing attributes. | Illustrator attempts to use line descriptively. Rendering is inconsistent and lacks attention to craft. |
| Professionalism | Student completes the work on time. Work demonstrates exemplary attention to learning objectives. | Student completes the work on time and demonstrates a good work ethic. | Student generally completes the work at a minimum level of expectation. | Student is missing parts of the work and makes a plan for completion of the remaining assignment. |

### Related Assignments

* Exercise Two. One Hundred Lines
* Sketch A. Contour Line Drawings of Fifty Hands and Feet

## Contour Drawing Defines Form

The silhouette of a form is the dominant reading on first encountering a new object. The inner contours of the object reveal the three-dimensional qualities of positive and negative space and allow us to make sense of the object in space. Contour drawings of form are some of the first and arguably the most important architectural drawings students learn. Following a systematic, hands-on and learnable technique, analytical drawing is an iterative heuristic enabling students to discover and learn about essential form.

Geometry is a formative idea in architecture… [, and] is the single most common determinant or characteristic in buildings. [The primary purpose of contour drawing] is to develop visual acuity and sensitivity to qualities of surface and form … [and is] best done with … a single incisive line. This fosters a feeling of precision that corresponds to the acuity of vision which contour drawing promotes. Shape is the characteristic outline or surface configuration … that we organize and identify what we see …. A shape can never exist alone. It can only be seen in relation to other shapes or the space surrounding it. (Ching 1998, 17-8, 23)

…[A]rchitecture is engaged with fundamental existential questions. All experience implies the acts of recollecting, remembering and comparing. An embodied memory has an essential role as the basis of remembering a space or a place… Architecture is the art of reconciliation between ourselves and the world, and this mediation takes place through the senses. (Pallasmaa 2005, 72)

Defining Lines: Thick = Spatial, Medium = Planar and Thin = Flush

A building photograph includes visual noise, which obscures a critical appreciation of architectural form. As we view architecture in context or in a photograph it can be difficult to clarify the shapes of the planes, openings and the overall silhouette. (Inglert 2014, 319) An analytical drawing method can reveal the most essential formal qualities of architecture. This method filters out the confusing details of texture, tone and color and brings to the forefront the formal elements: silhouette and shapes.

Form is the primary tool of the architect. Ching presented the elements of form as point, line, plane and volume. (Ching1979, 18) A strong property of both plane and form is shape, a plane’s primary identifying characteristic. (34) Continuing, Ching wrote, “[f]orm is the primary identifying characteristic of a volume.” (44) The silhouette of a form may imply solid mass or void space. The silhouette, or edge contour of a volume “… is the primary means by which we recognize and identify the form…” of architecture. (52) However, this most elemental appreciation of architecture may be too elusive for students when viewed from the busy street or, second-hand, in a photograph.

Students new to architecture tend to over emphasize the importance of architectural style and oversimplify the role of the architect and the relevance of foundational design principles. An effective *analytique* drawing grounds a student in a critical view toward the built environment. This kind of formal contour drawing is an important element of training future architects. This familiar hand-drawn analytical drawing process, rooted in a Modernist, contour technique, emphasizes a grammar of line weight, which reliably represents three-dimensional space and the geometry of form. An example of the clarifying effect of varying line weight alone illustrates the utility of the method.

There are of course other analytical methods for revealing formal attributes, like tone-value studies. These will be covered in other chapters. There are also reasons to combine the two basic *analytique* types, contour and tone-value, into one drawing.

If a sketch consists of nothing more than the outlines of buildings…it will communicate a certain amount of information regarding shape, structure, and perhaps even depth…the sketch will be limited in its ability to convey form and depth of space. (Brehm 2012, 77)

The ease of taking photographs from our phone cameras can be a tempting shortcut for documenting our built environment. Photographs are an important record and are encouraged as part of this process. In understanding design principles, it can be difficult to clarify the shapes of the planes, openings and the overall silhouette from the *noise* that is captured in a photograph. A clear method and syntax of analytical drawing helps a student discover the architectural signals from the contextual noise of the image.

## Direct Observation vs. Image Resource

As with many of the didactic *arguments* made in this textbook, we’ll start with a rhetorical device known as a *false dichotomy*. It is not false in the sense that it is uncommon to hear or that it is provably incorrect. On the contrary, just like in the previous section with our discussion of line weight being *better* in hand drawings than on the computer, this prejudice is often heard in the office or the art studio and coming from the lectures of professors. It goes something like this: “drawing from direct observation is superior to using an image resource.” What makes this a false dichotomy is the inference that one must choose only one of these options. Why should we have to choose? Is there a hybrid approach that takes advantage of both processes? In what circumstances would we want to use each? Let’s explore these questions.

It is an exciting experience to be an architectural designer and illustrator now. Not only do we have at hand the traditional ways of drawing, but we can also avail ourselves of great digital technologies. One of the most understated, ubiquitous and maybe overlooked tools is the *supercomputer* and high-end camera in your pocket. The advent of high-resolution photography on a phone has improved the observational and documentary processes of the architect in a profound way. As with many tools, it can also be said that we can come to rely too much on it.

Learning to draw from direct observation is one of the most important skills to develop as an artist. The challenge of translating three-dimensional space onto a two-dimensional surface is perhaps one of the most important innovations of the Renaissance artists. Yet, the development of mathematical perspective should be considered in the same light as the photograph today. Perspective systems are tools to aid the draftsperson. The object of the exercise is still to translate the environment to the page. Many perspective systems can seem just as awkwardly unreal as making a tracing from a photograph when followed too obediently.

The classic model for teaching direct observation in the atelier is sight sizing. The artist would set up a drawing board directly in line with the model subject, stand back and visually and mentally make measurement and translate them to the drawing board. It is painstaking work and a very rewarding challenge. Of course, this would be inconvenient with landscapes and buildings! A variation of this method is known as relative sizing. Using a process of working from major shapes in the scenes to smaller shapes, the artist compares objects relative sizes, estimates these relationships onto an imaginary image plane between the scene and the artist, and sometimes employs helpful tools to guide this work, such as using a pen as a measuring device, squinting the eyes to simplify shapes and closing one eye to minimize the distortions of binocular vision (i.e., parallax.) The downside of either of these methods, of course, is that each is difficult to master and takes much deliberate practice. In a practiced hand though there is great vision and power in images made from direct observation.

A tempting antidote to this difficult prescription is to use photography. Advantages of photography include helping the artist to translate a three-dimensional scene onto an image plane, the representational accuracy of the proportional relationships and the ability to crop the image at any time during the exercise, to name only a few.

Where does this leave us in the decision between direct observation versus image resources? The purist may insist on challenging the architectural vision using only the well-earned skills of sketching *en plein air*. The pragmatist may come to rely on the photograph image reference as an expedient and effective means to an end.

The middle way takes advantage of both processes. In Exercise Three, you learned of a method for combining direct observation and photographic resources. In the first step you find a dynamic viewpoint and context that concentrates on a primary facade (i.e., two-thirds) of the composition and that also includes a secondary facade. We call this an oblique view. Sketch the silhouette, the major shapes and the minor shapes using the direct observation techniques discussed. Once you have a grasp on this composition, then take a photograph using the largest lens option. In the second step, either on site or back in the studio, make proportional corrections and revisions while adding any contributing details that you see in the photograph (i.e., image resource). Revision and redrawing are the most important investments you can make in your development. During this step you may find it helpful to overlay a piece of tracing paper on your drawing to clarify your work. In the final step you can render in line weight as discussed in the previous section. It can be useful to keep these three steps distinct, as it focuses our efforts and makes the whole exercise less overwhelming.

## Sketch A. 50 Contour Drawings of Hands and Feet

### Introduction

<Insert Figure 2.4.4>

Figure 2.4.4: Sketch A. Contour Line Drawings of Fifty Hands and Feet

Draw 50 contour drawings of hands and feet. Each should be done from a different viewpoint and with different hands/feet. The first five sketches will be blind-contour drawings of hands as a warm-up for the 45 modified contour drawings. Each drawing should take approximately 3 minutes (i.e., 2.5 hours for 50 dwgs.)

In the hand are four bones, continuous with those of the fingers, called metacarpals (meta, beyond, carpus, wrist). They are covered by tendons on the back and on the front by tendons, the muscles of the thumb and little finger, and skin pads. (Bridgman 2017, 209)

Repetition serves as a handprint of human intent. A phrase that might have sounded arbitrary the first time might come to sound purposefully shaped and communicative the second. (Margulis 2014)

The main purpose of this assignment is to gain facility with direct observation through deliberate practice. That said, as an experiment you may emulate no more than five “drawings” from a master artist from source material. It can also be useful to learn to draw from other’s drawings. May I suggest the image tab from a Google search such as drawings anatomy hands?

### Learning

This assignment module contributes to the following design learning outcomes, which finish the sentence “As a successful student in this course, I am now able…”

* … to directly observe shape and forms and measure and translate the spatial scene accurately from an implied image plane to a proportionally scaled drawn surface.

### Scenario

Gaining confidence in drawing from observation has more to do with learning to see effectively than it does with the mechanics of drawing well. It may be confusing for a new student to parse that line of text, because the connection between seeing and drawing is underappreciated. You proved in **Exercise One. Breathing Lines** that you can easily master the mechanics of drawing lines after a relatively short amount of practice.

Drawing from memory can be a great creative activity for a practiced artist. For someone who is new to this, drawing from memory can be the greatest hindrance to our development. The reason for this involves a *perception prejudice*. It is easier for the brain to prejudge what a hand is *supposed* to look like, than it is to actually perceive it *correctly* enough to draw well. Close your eyes and imagine a square. Open your eyes and draw that square. No problem, right? Close your eyes again and imagine an eye in someone’s face. Open your eyes again and draw the eye. Does it look real? Not sure? Let’s try again. Close your eyes and imagine a town square teeming with people on market day with tables set up with fruits and vegetables. Draw what you see. Stressed yet?

A learned signifier for a square shape presents us with very few differences between an actual shape that we perceive and the drawing we made. A square is a generalization. A human eye contains relatively fewer attributes than a crowded town square. Our generalization about an eye may be good enough most days to make our drawing believable. On the other hand, a crowded town square is not easily generalized with our library of signifiers in our head. It therefore seems much more difficult to draw.

If an artist draws directly from observation, then the square shape, the human eye and the town square are really the same problem. The difference in complexity of course means that the town square drawing may take longer to complete. Technically it is no more difficult! You probably don’t believe me yet. That’s OK.

“…drawing is always the same task: to see clearly what is before your eyes. Sighting is an apt renamed skill. You take a sight; you see the thing-as-it-is…” (Edwards 1979, 130)

This assignment reminds us of playing our scales on the piano. If you had lessons when you were young, then you remember that after several repetitions, your hands knew where to move. The sounds you made become more confident. While not a beautiful sonata or Broadway show tune, your scales resembled music. You may have understood how you could *scale up* this activity to making real music.

Let’s learn how to see better. It is not an easy process to master and has taken this author a lifetime of practice to develop confidence. Let’s remember that our goal is not mastery; rather, we intend to build confidence and professionalism in our skills.

### Materials

* Pencil
* 9" x 12" (229x304mm) sketchbook

### Steps

1. Warm up: For your first five drawings, use the blind-contour method. Look only at the hand or foot you are drawing. Slowly circumscribe your subject first in your mind’s eye and then on the paper. Never look at your paper to check your progress. This will instill a deep focus for observation, and maybe a little embarrassment! That is OK…keep going!
2. The next 45 drawings use a modified contour drawing method. Look at your object for about 90% of your time and check your progress by looking at your sketchbook for only 10% of your drawing time. Each drawing should be a quick sketch and take between 3-5 minutes to complete.
3. Keep moving your hands and feet into new poses: back of hand, fist, palm, holding an object, top of foot, and if flexible enough, bottom of foot. Use a mirror.
4. Are you right or left-handed? Draw one of your dominant hands with your non-dominant hand. Is it shaky? Does it look better than your blind contour?
5. Compose two or three hands to each sketchbook page. Allow them to overlap. Draw larger than you would initially think.
6. When completed with your sketchbook pages, photograph each page and import them into an Inkscape file with “Document Properties” set to an 11" x 17" (279mm x 432mm) page. Compose and scale all your drawings to fit together on this one page.
7. Export the drawing as a PNG file at 72 ppi for submission.

### Video

<Insert Figure 2.4.4\_fiftyHandsFeet>

Figure 2.4.4: Video Still. How to Draw Fifty Hands and Feet

### Tips

* The described method borrows much from a technique called Sight Sizing. It differs in one important respect, although this assignment could be done as a true sight sizing exercise. Our modified version is more accurately thought of as a relative sizing method.
* Resist the urge to use technology as a guide for this project. Photography or drawing from image resources may seem like a good shortcut. Would it not be easier just to make a tracing? Remember that the goal here is to learn how to see, and little is learned by tracing or using an image reference.

### Criteria

| DLO | Advanced (4 pts) | Proficient (3 pts) | Developing (2 pts) | Beginner (1 pt) |
| --- | --- | --- | --- | --- |
| Craft | Illustrator demonstrates exemplary attention to work product and excellence. | Illustrator demonstrates good attention and care towards work product. | Illustrator completes work, but the product seems rushed to completion. | Illustrator demonstrates attention towards work product, but work quality is |
| Rendering | Illustrator uses line to hold the viewer's attention. Image is controlled and evokes both power and subtlety. Image is descriptive and/or symbolic and supports compositional goals. | Illustrator's line work demonstrates several professional attributes. Rendering style does not distract the viewer and generally supports compositional objectives. | Illustrator's use of line is somewhat effective. Rendering style is consistent and competent. There are some non-contributing attributes. | Illustrator attempts to use line descriptively. Rendering is inconsistent and lacks attention to craft. |
| Professionalism | Student completes the work on time. Work demonstrates exemplary attention to learning objectives. | Student completes the work on time and demonstrates a good work ethic. | Student generally completes the work at a minimum level of expectation. | Student is missing parts of the work and makes a plan for completion of the remaining assignment. |

### Related Assignments

* Exercise One. Breathing Lines
* Exercise Three. Contour Drawing of a Still Life

## How to Make a Composite Drawing for your Portfolio

One of the fundamental skills architectural students must learn is how to combine multiple drawings, images, etc. into visual sets that are composed graphically onto a single larger board. A common phrase to hear from both architects and students is “I’m working on a presentation board.” This can be contrasted to the business student or educator who gives a slide presentation. Complex and creative concepts deserve a dialogue that goes well beyond an exposition. Architectural presentations more often use a different approach than slides.

There are several ways to communicate ideas. Nonfiction books often proceed serially from a constructed argument formatted as claim statements that are backed by facts. We can simplify this as thinking that progresses along an analysis (deconstruction) to a synthesis (reconstruction) path. Along this track we hope to transfer ourselves to a place of new understanding. Your lab report in a science class can be a very structured type of this argumentation method. A hypothesis (claim) is tested and reported (data) and combined with logic and observations (methodology) to make a conclusion about the validity of the hypothesis. This kind of accumulated knowledge is easier to deliver in a linear (serial) process. As the complexity and interconnectedness of ideas increases, it becomes increasingly difficult to reduce the ideas that we want to communicate into discrete and testable concepts. It is important to be able to see and appreciate the entire presentation at a glance, and to zoom in on particular details, and to revisit complex ideas at the request of the client.

In order to take advantage of our capacity to recognize patterns from within complex systems, we need a way to see everything at once and the smallest of details almost simultaneously. We say almost, because it is unlikely that the human brain can multi-task effectively like a parallel processing computer; rather, we can at best hope to do multiple things, poorly, at the same time. Business presentations often rely on a narration given in front of a linear sequence of images sometimes known as slides. This is also a common approach in education and a favorite of many professors. The predominant software innovation for making this presentation is known as PowerPoint.

There are several options available to the architectural designer for compositing visual sets together into a larger presentation board. The most obvious method is to map the information directly to a board and draw the information directly. With the advent of several software solutions, most of us take advantage of the layering and transform tools in the computer. It is important to remain agnostic in this textbook when explaining what we might think of as recipes for processes. Therefore, Sketch A Fifty Hands and Feet uses an open source and free software known as Inkscape. Another good open-source choice is GIMP.

### How to Make a Composite Drawing for your Portfolio

1. Download Inkscape from https://inkscape.org/
2. Collect image assets into a folder on your computer (i.e., ./project/images)
3. Open new document in Inkscape and save with new name in project folder (i.e., newBoard.svg)
4. File –> Document Properties Change display units and page size and orientation and close the dialogue box.
5. Open Layers and create a hierarchy of layers. Some suggestions are "drawings, photos, text, etc. Remember to change to the correct layer before importing assets.
6. File –> Import and hold the Ctrl button and select an arrow to scale the image uniformly.
7. Wash, rinse and repeat…and save often!

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Chapter Three: Documentation and Drafting

Eric Todd Inglert, AIA

31 May 2021

## Taking the Measure of our World

Many find it useful to draw as a means to understanding. The act of recording something to paper is a great way to remember an experience. Drawing can also uncover hidden relationships and concepts. If you look up the word measure and trace it to its Latin and Greek origins, you will find that measure is related to the word meter. Both words imply an idea of a system of understanding through standardized intervals and bounds. There is comfort in the control that comes from circumscribing an object and from relating that object’s size and proportion to other objects in a way that we can communicate with others.

This chapter covers several systems for taking the measure of our world. You will come to understand multi-view drawings, parallel line drawings and the systems of measure that we use to describe in technical detail complex ideas. From design to construction, the hallmark of the built environment professional, whether an architect, engineer or constructor is the skill that we bring to imagining and translating ideas to paper in a precise language of measured drawing. Let’s begin with something very abstract that gets at this idea of circumscribing an object. In several exercises and sketches in this book, you will read about the *Cuboid Generalization Analogy*. It is implied below in the isometric grids of Sketch B. Field Sketch of a Chair. Let’s construct a more explicit definition of this phrase:

#### First Principles of Static Objects

1. A point is infinitely small and has one attribute, a location in an (x,y,z) three-axis Cartesian coordinate system. For each triple let’s apply a shorthand of (x,y,z)=[A] that describes a point coordinate.
2. A line extends a point in one of the three axes. If it is a segment, then it can be can be defined by a tuple of point coordinates [A,B].
3. If that line [A,B] is extruded perpendicular to itself, such that it is a planar segment, then we can locate it in space with a shorthand of [(A,B)(C,D)]. For each one of the three coordinate directions, let’s apply three planar assignments of [XY] or [XZ] or [YZ].
4. A cuboid extrudes a plane perpendicular to its face, and if it is similarly bounded in space, then we can locate it in space with a triple: [(XY),(XZ),(YZ)].

#### Generalizations

1. A generalization abstracts and models a more complex system, reduces attributes, and distills objects to essential elements.
2. If we circumscribe an object, it is meant that we draw a figure around the object and touch it at several points and never cut into that object.
3. Four figures (e.g., shapes and volumes) are most often used to circumscribe another object: circle and rectangle in two-dimensions; and the sphere and cube in three-dimensions.
4. Since the Cartesian Coordinate System is represented as a cubic grid, then a cube is a useful generalization of a complex volumetric form.
5. Since a cube is strictly uniform in its dimensions, then a cuboid may be a more refined generalization for circumscribing complex non-uniform volumetric forms.

#### Cuboid Generalization Analogy

When first encountering a complex volumetric form, it is useful to circumscribe it in a primary box, known as a cuboid, that has three pairs of perpendicular planar faces that can be easily measured. Subsequent iterative analysis may suggest grouping the complex volumetric sub-elements into subsets of cuboid boxes and proceeding toward greater levels of resolution. Since most students easily grasp techniques for drawing realistic looking three-dimensional boxes, then this structural generalization has great utility in the architectural studio.

Can you apply two iterations of this Cuboid Generalization Analogy to your complex chair? If you were effective during your field measurements in Sketch B. Field Sketch of a Chair, then that is the method you followed. It should be easier to project the three views you constructed in the isometric to each of the three planes: Top view is [XY], front view is [XZ] and the side view is [YZ]. In fact, it may be easiest to begin the final drawing by first placing the three rectangle projection boxes on the page in a light construction line. See the step-by-step directions below for more detail.

### The Language of Line Type for Construction

We learned in Chapter 2 that rendering line weight in our contour drawings makes them readable. That system proposed that spatial edges should be thick. Planar edge conditions should be medium line weight. Flush edges and defining detail should be thin. There is a slightly different line weight system for parallel projection drawings that we sometimes call construction drawings. These include drawings you may know as plans, elevations, sections, axonometrics, etc. Many of the more technically minded students may find these rules comforting, because of the defined quality. Indeed, we will be using specific preferred widths that may vary from only slightly in different professional offices. The principle remains the same as the contour line drawing line weight system, to allow greater legibility and understanding.

Lines that are cut through by the sectioning plane are drawn with a thick line. If you are drafting by hand, then the most consistent way to achieve a thick line width of 0.7mm is with a mechanical pencil, technical pen or similar “graded” thickness instrument. Clutch pencils may be used and require much practice to achieve a consistently thick line width. As with all line widths discussed here, in a digital environment it is important to define the line thickness as a parameter for the printer to produce consistent results. These are sometimes known as styles in the digital environment. Profiled elements in plans and elevations, except for the outermost profile and silhouette (0.7mm), should be drawn with a 0.5mm medium width. This is also a good line width for notes and text that is otherwise not a caption or title. The text height for notes typically 3/32" (2.4mm) to 1/8" (3.2mm) high, and the 0.5mm medium width looks balanced. Thin lines are used for dimension strings, notes leaders, and defining shape elements and objects in the view that may be less emphasized. Examples of these elements include furniture, entourage, material detail, door swings, to name a few. Thin lines are drawn from 0.25mm to 0.35mm thickness.

It can be a struggle to learn a new office’s drawing standards. It is difficult to find the specifics of line weight within other textbooks. In doing professional work on three continents this author has found surprising level of consistency with these standards.

## Sketch B. Field Sketch of a Chair

### Introduction

<Insert Figure 3.1.1>

Figure 3.1.1: Sketch B. Field Sketch of a Chair

Select a chair to document in a drafted plan, front elevation, and side elevation. Begin by measuring the chair and recording the dimensions in your sketchbook. Make quick sketches and detail views to record important information. Use these “working drawings” to develop the final drafted views.

### Learning

This assignment module contributes to the following design learning outcomes, which finish the sentence “As a successful student in this course, I am now able…”

… to analyze the built environment and apply measured drawing skills that include plans and elevations, illustrating line quality, drawing notation and dimensioning.

### Scenario

Going out to the field and measuring existing conditions is one of the most common activities in a professional design office. The first step in most projects is to photograph, measure and make drawings with notes. These field notes are a valuable resource back in the office when we begin to make the technical drawings.

Since most technical drawings that designers produce for construction are orthographic, then a good skill to develop is the translation through drawing of three-dimensional spatial conditions to two-dimensional projections, such as plans, sections and elevations.

As a professional architect who teaches architecture and engineering students, I am often asked by people outside of the profession why we still learn drawing by hand. In an age of computer-aided drawing, why would a student want to know how to draw by hand when the computer is so excellent? There are so many answers to this question, and we’ll talk about one of them now. The field sketch of existing conditions is the most efficient, effective and inexpensive method for verifying and beginning a construction project. These field sketches and early photographs are so important to the project, that they are kept in the official job file, not to be discarded. They are an important component of the construction documents and are legal documents in practice. We should learn together how to gather good documentation and make effective sketches.

In this assignment, we’ll work on a single object: a complex chair. In several assignments coming up, we’ll apply these skills to room plans, elevations and sections in preparation for our first construction document drawing.

### Materials

* Phone camera or digital camera
* Pencil
* Tape measure
* Sketchbook
* 1:96 Isometric Grid Paper
* 1:48 Grid Paper

### Steps

1. Select a complex chair. A good source for your selection is an office chair with rolling casters. This offers the challenge of non-uniform shapes and complex mechanisms that make your drawing a more rewarding challenge than a three-legged stool for instance.
2. With a tape measure, identify the overall height, width and chair dimensions. Construct a three-dimensional box of these lengths using the provided isometric grid. Drawing this grid freehand and with the isometric grid promotes sketching precision without the need for drafting tools.
3. Photograph your chair from approximately the same oblique view that you drew the isometric container box. It is useful to also photograph a top view and front and side views, because these are the views you will draft in the related assignment, Exercise Four. Hand Drafting an Orthographic Multi-view Projection of Complex Chair.
4. Transfer the silhouette (outline) of the projected view for each of three drawings: top view, front elevation and side elevation. Concentrate on the proportions of the silhouette. Sketch these on each of the visible faces of the isometric box. Recall that these are orthographic drawings, and that no perspective distortion should be evident.
5. Redraw the three views on the 1:48 grid paper. The experience should be one of flattening the three-dimensional chair as a projection first on the box, and then enlarging that map at twice the scale. Make several notes as to materials and relevant descriptive ideas about the chair.
6. Taking our analysis from the general to the specific, use the tape measure and take important inner dimensions and note important relationships. We are learning to see the chair objectively. Include dimensional information about the inner elements and details. When we do our final drawing project for the chair in Exercise Four, we will again redraw the three views and enlarge them to 1:12 scale.
7. Collect all sketches and photographs together. Digitize all of the imagery you have made and analyses that you documented and compose them together onto one board. The final submission should be saved as a raster image with pixel dimensions 1224 px by 792 px.

### Video

<Insert Figure 3.1.2\_fieldSketchChair>

Figure 3.1.2: Video Still. Field Sketch of a Chair

### Tips

* Recall that these are orthographic drawings, and that no perspective distortion should be evident.
* Taking a large clipboard to the field is useful in providing a mobile and hard surface to draw.
* Photograph everything about the chair. You will be glad to have the information when back in the studio.

### Criteria

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DLO | Advanced (4 pts) | Proficient (3 pts) | Developing (2 pts) | Beginner (1 pt) |
| Craft | Illustrator demonstrates exemplary attention to work product and excellence. | Illustrator demonstrates good attention and care towards work product. | Illustrator completes work, but the product seems rushed to completion. | Illustrator demonstrates attention towards work product, but work quality is |
| Rendering | Illustrator uses line to hold the viewer's attention. Image is controlled and evokes both power and subtlety. Image is descriptive and/or symbolic and supports compositional goals. | Illustrator's line work demonstrates several professional attributes. Rendering style does not distract the viewer and generally supports compositional objectives. | Illustrator's use of line is somewhat effective. Rendering style is consistent and competent. There are some non-contributing attributes. | Illustrator attempts to use line descriptively. Rendering is inconsistent and lacks attention to craft. |
| Technical | Illustrator observes and analyzes object data and translates it to a meaningful graphic representation. Professional conventions are followed, inclusive of line weight, orthographic and dimensional information. | Illustrator observes and analyzes object data and translates it to a meaningful graphic representation. Most professional conventions are followed, and some information is missing. | Illustrator is challenged to observe and analyze object data correctly. Few professional conventions are followed, and some information is missing. | Illustrator attempts to observe and analyze object data and representation is inconsistent. Professional drawing conventions are not followed. |
| Professionalism | Student completes the work on time. Work demonstrates exemplary attention to learning objectives. | Student completes the work on time and demonstrates a good work ethic. | Student generally completes the work at a minimum level of expectation. | Student is missing parts of the work and makes a plan for completion of the remaining assignment. |

### Related Assignments

* Exercise Four. Hand Drafting an Orthographic Multi-view Projection of Complex Chair
* Sketch C. Field Sketches of Floor Plans of Five Large Rooms
* Sketch D. Field Sketches of Two Exterior Elevations of Large Buildings
* Sketch E. Field Sketches of Two Interior Elevations of Large Rooms
* Sketch F. Field Sketches of Five Partial Interior Sections of Large Room
* Exercise Seven. Interior Construction Drawing. Floor Plan and Interior Elevations

## Geometric Transformation One: Parallel Projection

A projection system allows for the important transformation of the real physical world into the designer’s world of the documentation and imagination of environments onto paper and screen. The two primary geometric transformations designers and constructors use to communicate are parallel projection and perspective projection.

By this point it may sound obvious that the activity of drawing is the recording of a projection of the physical three-dimensional world onto a two-dimensional plane. As we move through a spatial environment, our eyes take a seemingly infinite number of snapshot projections capturing light reflections onto a sensitive layer of cells called the retina. In turn these are converted to neural signals. Our eyes capture our environment, not literally like a net; rather, we can think of this capture as a transformation from the physical state of *objectness* to a geometric projection and ultimately to an idea.

Since a camera is a useful analogue for our eyes, let’s use the analogy to understand what is meant by geometric projection. When we take a photograph with a camera, light passes through the lens and ultimately onto a sensor “plane.” Before the advent of digital image sensors, this projection was made directly onto light sensitive film. As we will see with a geometric projection in a later section called Perspective Projection, the image sensor of the camera is literally a scaled mapping of points of light reflecting onto an array of electrical receptors. Depending on the distortions introduced by the camera lens, the results are a very convincing and proportionate reproduction of what our eyes perceive as reality.

Thus far our camera analogy does a good job of approximating a perspective projection. We will explore this analogy further in the next chapter. Let’s turn our attention to what is meant by parallel projection. A parallel projection is distinct from perspective projection in that we can conceptualize in the mind’s eye an ideal model of our object. This model can be scaled and sliced through shared transformation systems that have developed over the history of design and construction.

The geometric transformation known as parallel projection encompasses two seemingly different ideas: orthographic projection and paraline projection. They are combined here because parallel lines in the actual object are drawn (i.e., drafted) with parallel lines on the image. Perspective projections as we will discover are distinguished by representing parallel lines as converging lines to a vanishing point on the image.

Ching (Ching 1998, 114) describes three pictorial systems: orthographic, oblique and perspective. Orthographic drawings are called multiview (e.g., plans, sections and elevations) and paraline are both axonometric and oblique projections. If a perspective projection is a remapping of the three-dimensional world to a two-dimensional image, then it is of essence a documentation of how we naturally see the image. Parallel projections by contrast are a construct of the imagination.

A system of rules is followed for each paraline drawing. Floor plans are constructed with the conceit that a sliced plane is made to a building at or around 3’-4" (one meter) above the finish floor, such that we can view inside the building and make scaled measurements of shapes relative to the actual building and its components. This view is good for building elements that can be described in the “x-y coordinate system.” Vertical section drawings have imaginary planes that cut through the interior of the building at the discretion of the drafts person and show variously the “x-z” and the “y-z” coordinate systems. Elevations move the move the cutting plane outside of the building, in order to show the faces of the building. Axonometric and oblique projections construct an “x-y-z” grid system that assures each of the three coordinate planes has a parallel linear relationship on the image plane consistent with parallel lines in the actual object.

Some clients and non-professional observers of paraline projections drawings have difficulty understanding these drawings. The distortions caused by the rigor of drawing all parallel lines does not match up with the converging lines we interpret on our retina. Paraline projections are very useful to the designer and to the constructor. The ability to make direct interpretations of measurements on a scaled drawing allows the designer to communicate the design intent to the constructor with great fidelity.

## Exercise Four. Hand Drafting an Orthographic Multi-view Projection of Complex Chair

### Introduction

<Insert Figure 3.3>

Figure 3.3: Exercise Four. Hand Drafting an Orthographic Multi-view Projection of Complex Chair

In Sketch B. Field Sketch of a Chair, you selected a chair to document in several field sketches that included a plan, front elevation, and side elevation. From the recorded dimensions in your sketchbook develop the final three technical views. Draw a plan, front elevation, and side elevation of the chair at 1” = 1’-0” (1:12) on a 12x18 sheet. Compose the three views so that they have a clear relationship to each other on the page. Focus on quality of linework and composition of the page. Use line weight to communicate a hierarchy of outline, edge, and detail of the object. Do not shade or render.

### Learning

This assignment module contributes to the following design learning outcomes, which finish the sentence “As a successful student in this course, I am now able…”

… to analyze the built environment and apply measured drawing skills that include plans and elevations, illustrating line quality, drawing notation and dimensioning.

### Scenario

Since most technical drawings that designers produce for construction are orthographic, then a good skill to develop is the translation through drawing of three-dimensional spatial conditions to two-dimensional projections, such as plans, sections and elevations.

In orthographic projection the picture plane intercepts parallel projection rays from the frontal plane of the object. The projection rays are always perpendicular to the picture plane…. Multiview projection is most often used in product design, in which accurate measurement and exact image representation are required…. In architecture…[a] top view is the same as a plan, and section and elevation are equivalent to a side view. (Wang 1979, 8–9)

The main advantage of this type of drawing, and the reason why it is used in building construction, is that building elements are seen in true size (to scale), shape, and orientation when viewed from a perpendicular aspect. (Ching and Adams 1991, 2.2)

In this assignment, we’ll work on a single object: a complex chair. In several assignments coming up, we’ll apply these skills to room plans, elevations and sections in preparation for our first construction document drawing.

### Materials

* Mechanical Pencils (0.25mm), (0.5mm) and (0.7mm)
* Architect’s scale
* 12x18 sheet
* 1:12 Grid Paper
* Field Sketches

Steps

1. Translate the 1:48 grid drawings from Sketch B. Field Sketch of a Chair to 1:12 size.
2. Draw a small 2“x3” (50mm x 75mm) thumbnail of the compositional design of the page. Organize the top view and the front view in one column. Provide three equal gutter rows between the two views. Likewise, organize the front view and the side view in an aligned row with each other. Again, provide three equal gutter columns between the two views. Remember to leave room for dimensioning (see next step) and captions for each drawing.
3. In a light construction line, draw the bounding boxes for each of the three views as described above in Scenario. Leave 3/8" (10mm) space between the bounding box and first dimension line. Skip another 3/8" and draw a second dimension line. There will be two levels of dimensions for our drawing. Skip another 3/8" space to find the top guideline of the caption title. The title text is 3/16" (5mm) in height. Below that the scale text is 3/32" (3mm) height.
4. Proceed to develop the details of each view from the field notes and measurements. Since we are using a freehand drafting style with a grid as guidance, we must take special care to draw with our light construction lines to be as precise with our linework as possible.
5. The curved angles of the chair may present challenges. Take it slowly and deliberately. When you have an accurate outline of the proportions and substructures of the chair, then proceed to render the line work.
6. Profiles are a thicker line (0.7mm), important planar lines are medium thickness (0.5mm) and textures are a finer thickness (0.25mm). Dimension lines are 0.25mm. Dimension hatch marks are thick (0.7mm). All text can be made with the medium 0.5mm thick pencil.
7. Photograph or scan the full sheet when completed. The final submission should be saved as a raster image with pixel dimensions 1296 px by 864 px.

### Criteria

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DLO | Advanced (4 pts) | Proficient (3 pts) | Developing (2 pts) | Beginner (1 pt) |  |
| Craft | Illustrator demonstrates exemplary attention to work product and excellence. | Illustrator demonstrates good attention and care towards work product. | Illustrator completes work, but the product seems rushed to completion. | Illustrator demonstrates attention towards work product, but work quality is |  |
| Rendering | Illustrator uses line to hold the viewer's attention. Image is controlled and evokes both power and subtlety. Image is descriptive and/or symbolic and supports compositional goals. | Illustrator's line work demonstrates several professional attributes. Rendering style does not distract the viewer and generally supports compositional objectives. | Illustrator's use of line is somewhat effective. Rendering style is consistent and competent. There are some non-contributing attributes. | Illustrator attempts to use line descriptively. Rendering is inconsistent and lacks attention to craft. |  |
| Technical | Illustrator observes and analyzes object data and translates it to a meaningful graphic representation. Professional conventions are followed, inclusive of line weight, orthographic and dimensional information. | Illustrator observes and analyzes object data and translates it to a meaningful graphic representation. Most professional conventions are followed, and some information is missing. | Illustrator is challenged to observe and analyze object data correctly. Few professional conventions are followed, and some information is missing. | Illustrator attempts to observe and analyze object data and representation is inconsistent. Professional drawing conventions are not followed. |  |
| Professionalism | Student completes the work on time. Work demonstrates exemplary attention to learning objectives. | Student completes the work on time and demonstrates a good work ethic. | Student generally completes the work at a minimum level of expectation. | Student is missing parts of the work and makes a plan for completion of the remaining assignment. |  |

### Related Assignments

* Sketch B. Field Sketch of a Chair
* Sketch C. Field Sketches of Floor Plans of Five Large Rooms
* Sketch D. Field Sketches of Two Exterior Elevations of Large Buildings
* Sketch E. Field Sketches of Two Interior Elevations of Large Rooms
* Sketch F. Field Sketches of Five Partial Interior Sections of Large Room
* Exercise Seven. Interior Construction Drawing. Floor Plan and Interior Elevations

## Exercise Five. Axonometric Projection Contour Model of a Small Guest House

### Introduction

<Insert Figure 3.4>

Figure 3.4: Exercise Five. Axonometric Projection Contour Model of a Small Guest House

An “axonometric” is an orthographic paraline drawing. “Axons” are used to describe three-dimensional characteristics of an object or spatial relationship. Parallel lines don’t converge to a vanishing point as in a perspective drawing; rather, each line is drawn parallel. These drawings are useful during the early visualization process of design and are easily constructed with our studio drafting kit and a provided isometric grid. Lines that are parallel in space are drawn parallel in the illustration. You can measure dimensions for all axial lines – those parallel to any of the three principal axes. In order to draw non-axial lines, first locate endpoints using axial measurements, then connect the points together – remember, non-axial lines are not measurable.

### Learning

This assignment module contributes to the following design learning outcomes, which finish the sentence “As a successful student in this course, I am now able…”

… to analyze the built environment and apply measured drawing skills that include plans and elevations, illustrating line quality, drawing notation and dimensioning.

### Scenario

For many students who struggle to effectively represent their architectural design ideas in three-dimensional perspective drawings, it is tempting to instead build a physical model or learn an electronic modeling computer program. In this course we will learn all three of these skills. Each has its place. A perspective drawing is the most efficient and effective design tool due to its relative speed to draw and also for its ready acceptance to our clients. It more closely resembles what we see with our eyes and in photographs. It also requires the greatest amount of skill and sustained practice from a student, in order for your drawing to be an effective representation of your design idea. Perspective drawing is intimidating for the new architecture student.

Physical models are well loved by students and our future clients alike. Building a physical model rewards our patience and close scrutiny of the design, due to it being the slowest and most resource intensive of all the representation skills. Electronic modeling is both the current state-of-the-art and the most common activity of a designer in the studio. Students spend many late hours building beautiful models to study in multiple views and to render in light-ray tracing programs. These electronic models are very satisfying, rewarding and also…very slow to produce.

As a student and before a time of computer modeling, I was introduced early to an easy to produce and highly prized drawing in the academic studio: the axonometric projection. These three-dimensional representations did not exactly look like a perspective, and yet were as easy to reproduce as straight-line plans, elevations and sections that we were already doing. It was empowering!

Paraline axonometrics…exhibit projectors that are perpendicular to the picture plane and parallel to each other…vertical front edge and nonconverging side planes. (Yee 2013, 175)

Other schematic drawing types include the “paraline” pictorial drawings: axonometric (isometric, dimetric, trimetric) and various versions of oblique. Of these, the isometric is probably the most popular design and presentation device – especially for small objects such as products and for schematized views of larger projects. (Oles 1979, 15)

As mentioned above, axonometric drawings are highly regarded in an academic setting such as the architectural studio. Relationships between architectural elements can be measured directly, unlike a perspective drawing due to convergence and distortion. In particular, the isometric exhibits a 1:1:1 measured relationship between the three axes (x, y & z). Another valued attribute of axonometrics is the schematic and three-dimensional diagram quality. These types of drawings are about big ideas, and axonometrics can variously clarify problematic formal and organizational issues and amplify the essential qualities of your projects. As we will see in a later exercise, these drawings can be made as exploded axonometrics and further describe the schematic qualities of our designs. These are truly working drawings.

The 1:96 Isometric Grid Paper provided as a guide in this exercise will allow you to draw directly in an iterative way and follow the forms around until you have an accurate representation of your project. Like a puzzle, it is a relaxing journey with a very satisfying finish. Take your time, check yourself with an architect’s scale often, and work the problem until you have a correct axonometric projection. Once you are satisfied, place the image underneath and centered in the left half of the page and render the linework with line weight.

### Materials

* Mechanical Pencils (0.25mm), (0.5mm) and (0.7mm)
* Architect’s scale
* 12x18 sheet
* 1:96 Isometric Grid Paper
* Design Sketch

### Steps

1. Begin by creating a 1" border around your drawing sheet. Divide the sheet into two halves. Begin drawing 4.1 in the left half. Construct the view from the provided sketch and using the isometric grid you downloaded for this assignment.
2. With the provided measurements draw the complex form. Use a hierarchy of line weights to distinguish spatial, planar and surface lines. Keep the drawing space empty in the right half. This area will be used in the next Exercise.
3. All lines that are axial (x, y or z) may be directly measured either by counting grid squares or by using your architect’s scale. Non-axial lines shall be inferred from endpoint relationships with other axial elements. The two roofs are good examples of this principle, because each is made up of constructed non-axial lines.
4. Once the sketch is completed on the grid paper, you can slide the sketch underneath your final tracing paper. This is the rendering stage when you concentrate on line weight: spatial lines are thick (0.7mm,) planar lines are medium (0.5mm) and flush texture lines are thin (0.25mm.)
5. Photograph or scan the full sheet when completed. The final submission should be saved as a raster image with pixel dimensions 1296 px by 864 px.

### Criteria

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DLO | Advanced (4 pts) | Proficient (3 pts) | Developing (2 pts) | Beginner (1 pt) |  |
| Craft | Illustrator demonstrates exemplary attention to work product and excellence. | Illustrator demonstrates good attention and care towards work product. | Illustrator completes work, but the product seems rushed to completion. | Illustrator demonstrates attention towards work product, but work quality is |  |
| Rendering | Illustrator uses line to hold the viewer's attention. Image is controlled and evokes both power and subtlety. Image is descriptive and/or symbolic and supports compositional goals. | Illustrator's line work demonstrates several professional attributes. Rendering style does not distract the viewer and generally supports compositional objectives. | Illustrator's use of line is somewhat effective. Rendering style is consistent and competent. There are some non-contributing attributes. | Illustrator attempts to use line descriptively. Rendering is inconsistent and lacks attention to craft. |  |
| Technical | Illustrator observes and analyzes object data and translates it to a meaningful graphic representation. Professional conventions are followed, inclusive of line weight, orthographic and dimensional information. | Illustrator observes and analyzes object data and translates it to a meaningful graphic representation. Most professional conventions are followed, and some information is missing. | Illustrator is challenged to observe and analyze object data correctly. Few professional conventions are followed, and some information is missing. | Illustrator attempts to observe and analyze object data and representation is inconsistent. Professional drawing conventions are not followed. |  |
| Professionalism | Student completes the work on time. Work demonstrates exemplary attention to learning objectives. | Student completes the work on time and demonstrates a good work ethic. | Student generally completes the work at a minimum level of expectation. | Student is missing parts of the work and makes a plan for completion of the remaining assignment. |  |

### Related Assignments

* Sketch B. Field Sketch of a Chair
* Sketch C. Field Sketches of Floor Plans of Five Large Rooms
* Sketch D. Field Sketches of Two Exterior Elevations of Large Buildings
* Sketch E. Field Sketches of Two Interior Elevations of Large Rooms
* Sketch F. Field Sketches of Five Partial Interior Sections of Large Room
* Exercise Seven. Interior Construction Drawing. Floor Plan and Interior Elevations

## References

Ching, F., and C. Adams. 1991. Building Construction Illustrated: Second Edition. NY: Van Nostrand Reinhold.

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Oles, PS. 1979. Architectural Illustration. The Value Delineation Process. NY: Van Nostrand Reinhold.

Pallasmaa, J. 2005. The Eyes of the Skin. Architecture and the Senses. Chicester, England: John Wiley and Sons, Inc.

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Yee, Rendow. 2013. Architectural Drawing. A Visual Compendium of Types and Methods. Fourth. Hoboken, NJ: John Wiley & Sons, Inc.