CHAPTER 5

Subjective representation: perspective

This chapter introduces the techniques of perspective construction, its historical importance, and its use over time.

Filippo Brunelleschi, in the 15th century, demonstrated perspective construction through the implementation of a mirror and painting at the Duomo in Florence. Though the exact representations used by Brunelleschi are unknown, it is speculated that he was one of the first to apply linear perspective construction to depict three-dimensional space. Leon Battista Alberti, one of the greatest scholars of the Renaissance, later wrote a treatise on linear perspective construction, *Della Pittura*, making the method available to others.

Perspective construction translates three-dimensional space onto a two-dimensional surface. It is a subjective representation that mimics through a two-dimensional drawing the experience of a space, building, or object. Its construction follows a series of set rules that is applicable to the various types, including 1-point, 2-point, or 3-point perspectives.

Taken from the point of view of a person, the perspective depicts visual experience and perception of space. It is a prescriptive single point of view. In trying to demonstrate the view of an occupant, perspectives, as in photography, cannot mimic the complexity of the human eye, which includes peripheral and binocular vision. Nevertheless, perspective is an accepted representational tool that closely approximates human vision.
Perspective concepts

Perspectives allow you to represent the three-dimensional realm on a two-dimensional surface. They provide an excellent drawing method to visualize architectural design ideas.

The three-dimensional realm can be graphically described through perspective drawings. These differ from other three-dimensional drawings, such as the axonometric, in that they are subjective. A perspective is constructed from the eye level of a viewer, looking in a particular direction from a single stationary point. As described in Unit 19, the axonometric is an objective, abstract, three-dimensional image not representative of real world conditions. Its lines remain parallel to one another, thus maintaining objective neutrality in the drawing. In contrast, parallel lines in perspective converge toward a single point, mimicking a particular view of the world. In perspective construction, elements of the same height that are further away from the observer appear to be smaller than elements that are closer. In addition, lines of an object that are not parallel to the observer are compressed to convey depth. These variations that affect the perspective image have no influence on the axonometric drawing.

The type of perspective is based on the relationship between the viewer and the object being viewed, and on the angle of view from the observer toward the object.

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**Key concepts**

This depiction by Albrecht Dürer demonstrates some of the key concepts you need to construct perspective drawings. Where the sight lines cross the picture plane establishes where the image will be cast on the two-dimensional surface.

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**Design application**

Perspective drawings are tools that can be used to develop designs. By using trace overlays on top of constructed perspectives, photographs, or digital images, you can manipulate elements and spaces in relation to the experience of the viewer. Learning how to oscillate between plan and perspective, or orthographic drawings and three-dimensional representations, is key to making architectural designs that are grounded in the reality of the occupants. While manipulating the perspective you are manipulating views as seen in three-dimensional space in contrast to abstract representations such as the plan and section.
Visible construction lines
This pencil on vellum perspective shows construction lines. Leaving these lines visible enables you to find any construction mistakes easily. These lines also reinforce the hand-drawn character of the perspective.

Scale figures
Copies of the Thomas Eakins rowers are collaged into this pencil perspective to provide scale and context. The orientation of the wood ceiling emphasizes the movement of the rowers.

Paired images
These perspectives emphasize two elements: the glazing and the ramp. The image on the left is a 1-point perspective, while the image on the right is a 2-point, providing a greater emphasis on the glazed surface. By pairing up images in a series, you can depict movement through a space seen through key vistas and orchestrated visual sequences.

Perspective terminology

Station point (SP)
Location of the observer in space.

Picture plane (PP)
A transparent plane, intersecting the cone of vision, that receives the projected perspective image and is perpendicular to the viewer. The PP is translated onto the 2-D drawing as a horizontal line that intersects the plan. Its location on the plan in relation to the SP impacts on the size of the drawing.

Sightline (SL)
A line that extends from the SP at eye level, through the PP, to the object. (See Dürer image, opposite.) The perspectival image occurs where the sightlines cross the PP.

Horizon line (HL)
This line depicts the eye level of an average-height viewer. Conventionally, this is established 5 ft (1.52 m) above the ground plane. It can be exaggerated to emphasize the eye level of a child’s perspective, for example. It is always a relative distance from the viewer’s eye to the ground line; for someone standing, the HL is at 5 ft (1.52 m), someone sitting in a chair has a HL of 3 ft (91 cm), while someone on a second-floor balcony has a HL of 15 ft (4.57 m)—10 ft (3 m) for the first floor + 5 ft (1.52 m) from the second floor to eye level.

Cone of vision (CV)
The conical volume that depicts the viewable area from the SP. This visual field is typically considered to be a 60-degree cone from the eye. Replicating vision is difficult due to the fact that humans have binocular vision, while the perspective image is taken from monocular vision. Therefore the CV is only a guide to constructing the perspective image. Lines or elements of the drawing constructed outside the 60-degree CV will be distorted.

Measuring line (ML)
This is the only line that can be measured as a true dimension. Any vertical measurement can be accessed from this line. It is typically marked as a vertical line at the intersection of the picture plane and the plan.

Vanishing point (VP)
A point on the horizon line where parallel horizontal lines converge. Each set of orthogonal lines can have one, two, or three vanishing points. (In 3-point perspective construction, the third vanishing point related to vertical line construction is not located on the horizon line [HL], but remains on the picture plane.) In a 2-point perspective, each set of orthogonal lines, positioned non-parallel to the horizon line, has two vanishing points. Any lines that are parallel to the orthogonal lines recede to the same vanishing points. Any lines that are not parallel will have a different set of vanishing points. Locate non-parallel elements using new vanishing points or by translating points on the plan, locating each corner and connecting the points. This method works well for curved elements or small single orthogonal objects in the plan.
PORTFOLIO

Presenting perspective

The variety of design interpretations to any given program is what makes architecture such an interesting and rich profession. Each designer responds to the client, program, site, and building codes in unique ways.

Each project can be represented by a number of different drawing techniques, including plans, sections, models, axons, and perspectives. This allows each project to be represented in a portfolio layout using any number of drawing types. Perspective drawings, in particular, closely replicate what our eye sees. When choosing the type of perspectives to draw, you can choose between 1-point, 2-point, or 3-point perspectives. One-point perspectives are typically used to emphasize a strong space along a single axis, while 2-point perspectives provide ways to see spaces and objects more dynamically. Three-point perspectives are typically used to represent tall buildings or spaces such as skyscrapers. Choosing the right type of perspective to represent the architectural intention is an extremely important decision.

A selection of student portfolios demonstrates how to utilize perspective in the design process and final presentation materials. Each student was asked to design a room for repose; a space for a traveler during an airport layover. The program included a place to rest, to hang your clothes, to work, and to clean up. Terminology such as “bathroom” and “bed” was removed, with the aim of challenging preconceived notions of these everyday spaces while encouraging invention and new interpretations (see page 120 for this assignment).

Different types of perspective drawings can be used to represent each project’s intention. The perspective techniques include sketching, constructed views, and evocative drawings like charcoal sketches. Perspectives require key decisions before the drawing begins:

- where to stand
- what to look at (cone of vision limits the drawing distortion).

► Using 1-point perspective to reinforce axial organization

A single 1-point perspective is able to describe the whole space while reinforcing the axial organization of the plan. The project culminates in the cleansing area along the main axis, which is reinforced in the 1-point perspective drawing. This project sets up a particular sequence of events along a single axis through the space. The student subdivided the room into wet and dry zones and used light to differentiate space, which can be seen in the section. This eliminates any desire for full wall partitions that would obstruct the view through the whole space.

1-point perspective shows entire space

sections

model, axial view of space

section model

Read this!

Gruzdys, Sophie
“Drawing: The Creative Link.”

Rylander, Mark
“The Importance of Perspective Drawing in the Design Process: Philip Grausman’s drawing class at Yale.”
This project was to design a room that would accommodate one person for a few hours during a flight delay at an airport. The room is on the top floor and one wall is exposed to the outside. A shower, sauna, desk, lounge, sink, and toilet are required.

One continuous object flows through the room to serve the functions for these programs, as well as create thresholds for these programs. As one enters the door, the sauna is celebrated in full view. As they walk through the room, the flowing object becomes a desk, shower, sink, lounge, and toilet.

The walls are poured in place concrete, the floors are wood, and the centerpiece is bent plywood. The use of plywood and its suspension over the floor gives the main piece its own identity from the rest of the room.

Using 2-point perspective to show detail

Three 2-point perspectives are drawn to depict the positioning of the utilities. The perspective series illustrates three of the four corners in this rectangular room, emphasizing the most important aspects of the room: the central space and the continuous utilities strip that wraps around the room. This student pushes the utilities to the edge of the room, leaving the center space open for occupation. The center becomes the circulation area with easy access to all the key utilities.
There are a number of different methods for constructing perspectives which vary in difficulty. The method described here uses the plan as a basis for construction. The same principles can also be applied to freehand sketch perspectives and digital perspectives.

**Setting up a 2-point perspective**

One of the first things to consider when constructing a perspective is the intention of the drawing, or the focus. What do you want to convey? This will help you establish where to stand, at what height to look from, and what aspect of the design you want to emphasize.

1. Use two 30/60/90 degree triangles to establish the cone of vision. The point of the two triangles indicates the location of the SP. Tape down the plan and lay a large piece of trace or vellum overtop. Place the sheet of paper so that it covers the entire plan and leaves room at the bottom for the image.

2. Next, establish the location of the picture plane (PP). For ease of construction, this horizontal line should intersect a point on the plan, preferably a corner of the plan and one that will be seen in the perspective image.

3. Draw a vertical line from the intersection of the PP and the plan to establish the measuring line (ML). This line should extend into the white space left open for the image construction.
To determine the location of the vanishing points it is important to follow these instructions exactly. From the SP and using your adjustable triangle, draw a construction line parallel to line L of the plan that intersects the SP and crosses through the PP. Repeat on the other side for R.

Label the intersections of lines L and R with the PP L1 and R1. At R1, the intersection of the construction line and the PP, draw a vertical construction line, perpendicular to the PP into the open space of the page. Repeat at L1.

At this point, you can establish the horizon line (HL) for the drawing. The horizon line can be placed anywhere on the paper and will establish the location of the perspective image. In this case, locate the HL between the plan and the bottom of the page. This should allow you enough room to construct the perspective image. The horizon line is a horizontal line, parallel to the PP.

Where the vertical lines from the PP cross the horizon line, you will establish the vanishing points. Call them VP(R) and VP(L). The ML should also cross the horizon line. This intersection establishes the location of the eye level for the person standing at the SP. If the person is standing on the ground, the horizon line would be 5 ft (1.52 m).

Using the same scale as the plan drawing, mark a series of 1-in intervals above and below the horizon line. Indicate the ground line at 0 ft and the tallest dimension, taken from the elevation drawing, along the ML. You will use these measurements to create the heights in your perspective. Begin constructing the top and bottom of the walls to establish the framework of your space. Lines in plan parallel to line R recede to VP(L). Extend a line from 0 ft and the height of the wall (in this case 10 ft) on the ML to each VP to create the top and bottom of the wall.

To obtain vertical information, you must follow a two-step process. Draw a construction line that intersects the SP and any point on the plan and continue it through the PP (label A at the PP).
10 Draw a second construction line, starting at A (the intersection of the first construction line and the PP) perpendicular to the PP into the perspective image area. Repeat for all lines in a given element. Cross the vertical lines with height lines obtained from the ML.

11 Go back and forth between getting vertical information from the plan, measurements from the ML and surfaces that vanish to one of the VPs. Heights can only be taken along assisting planes for elements not along the ML. See “assisting planes,” page 93.

12 Repeat for each element in the room.

13 All vertical measurements must be translated along surfaces if they do not connect directly to the ML (such as the chest in this drawing). That is, an object detached from a wall touching the ML must have its vertical measurements transferred across a series of perpendicular planes (even if those planes do not exist as actual surfaces in the design).

14 Finished perspective. The CV (shown here in blue) establishes the box around the perspective.
### Plan alignments

The plan alignment relative to the SP establishes which elements get highlighted or emphasized in the perspective drawing.

### Moving picture plane

The location of the PP determines the relative distance between the vanishing points (VPs). As the PP moves away from the SP, the VP move apart. Where the PP crosses the plan determines the location of the ML. If the ML is constructed off the front of the plan, then the image recedes to the back. If the ML is constructed off the back of the plan, the image will project forward.
If the perspective is taken from a person standing outside of the room looking inside you will be able to see the perimeter conditions of the room. When the SP is located outside of a room the thickness of the walls and floors are depicted. Note: 45 degrees is only used for demonstration purposes. The plan can be rotated to any angle; the chosen angle should capture desired views.

Moving horizon line
As the location of the eye changes from 5 ft to 20 ft to -20 ft the projected image of the object changes from aerial view (+20 ft) to worm’s eye view (-20 ft). Note that all people in perspective, no matter how far away, if standing on the same ground plane, will have their eye level located along the HL.

SP location
If the perspective is taken from a person standing outside of the room looking inside you will be able to see the perimeter conditions of the room. When the SP is located outside of a room the thickness of the walls and floors are depicted. Note: 45 degrees is only used for demonstration purposes. The plan can be rotated to any angle; the chosen angle should capture desired views.
**Perspective types**
Perspective construction includes the 1-point, 2-point with both concave and convex views, and the 3-point.

**Assisting planes**
“Assisting planes” are used to translate dimensions from the ML onto other surfaces of the perspective. If wall A does not exist, but you need the height of wall B, translate the height information across the “assisting plane” (wall A) to wall B.

**Concave and convex**
In 2-point perspective construction, the alignment of receding lines is either concave or convex. Concave shows a view inside a space, while the convex shows the outside version of the space. Though the specific angles of the lines may vary, these concave and convex systems can be used to sketch any perspective view.

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**Perspective tips**
A series of relationships between the component parts of the constructed perspective establish the outcome of the drawing.

- The relationship between the SP and PP establishes the actual size of the image being drawn. The further the PP is from the SP the larger the image will be. The SP and PP can be moved independently of one another.
- Moving the SP further away from the object affects the rate of foreshortening of the object. The movement of the SP causes the VP to be further away from one another. This distance may be a physical constraint of your drawing surface.
- The orientation/rotation of the plan relative to the SP and CV establishes which elements are contained/viewed in the perspective.
- Eye level is established by the intersection of the ML with the HL. This is typically located at 5 ft (1.52 m) from the ground, but when an aerial or “bird’s eye” view is desired the HL is moved higher, or in a “worm’s eye” view the HL is much lower.
- It is best to start the perspective construction with a sketch vignette so that you have some idea of the image you are constructing. The sketch provides the basic structuring elements of the drawing.
1-point perspective construction is similar to 2-point construction. The main difference for the 1-point perspective is that lines parallel to the picture plane do not converge but extend to infinity.

Because there is no convergence due to their parallel nature, lines parallel to PP are constructed using a parallel rule. One-point perspectives are considered to be more static than 2-point perspectives, especially if they are symmetrical. They have a single focus and are good for depictions looking down a street or long space. Typically, 1-point perspectives focus on the space between the walls while 2-point perspectives focus on the surfaces that make up the space.

As in any perspective construction, it is important to establish intentions before setting up the perspective drawing. What do you want to emphasize? Which view best demonstrates the desired intention? As in the 2-point perspective, these decisions will help you establish where to stand, at what height you should look from and what part of the subject you want to view.

In a 1-point perspective the plan is placed parallel to the picture plane and only one VP exists that aligns with the SP. Your point of view is aimed into a space perpendicular to the picture plane.

### Constructing a 1-point perspective

1. Rotate the plan so that the wall you want to view is parallel to the PP. Establish your SP and the cone of vision—what do you want to view and how much of it will you see? How far back in the space do you want to stand? Set up your paper in the same manner as the 2-point perspective (see page 88). Lay trace or vellum over the secured plan.

2. Draw the PP to coincide with the back elevation for ease of construction. That is, the horizontal line demarcating the PP should cross the front edge of the wall. Blue lines indicate the cone of vision (CV).

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**Read this!**
Panofsky, Erwin
*Perspective as Symbolic Form*
Zone Books, 1993
3 Locate your HL and VP on the elevation. The VP should correspond to the appropriate height of a viewer’s eyes looking into the space and can be located directly in line with your SP. The SP and VP vertically align since this is a single-view perspective with one focus.

4 Construct the back wall elevation that corresponds to the location of the PP at the same scale as the plan. Draw this in the open space below the plan. This will serve as your ML, or in this case your measuring plane (MP).

Note
All lines perpendicular to the picture plane converge at the one vanishing point (VP). All lines parallel to the picture plane should be constructed using a parallel rule.

5 Start the drawing by connecting the VP to each of the four corners of the elevation. Extend these lines beyond the limits of the elevation. This will provide the parameters of the room: walls, floor, and ceiling.

6 Vertical lines are obtained through the same method as the 2-point perspective (see page 90). Method: SP to the point on the plan, where the line crosses the PP drop a vertical line down.
7 Continue depicting vertical data through the previously described method (see page 95). Use the assisting planes to find the heights of the elements not connected to the ML/MP.

8 Remember to translate vertical heights from the MP to the objects not directly adjacent to it.

9 Show the depth of the wall at the window opening. Extend a line from the SP through a point on the plan to where it crosses the PP and drop a vertical line down. Use measurements from the MP to draw the corners receding to the VP.

10 The finished perspective. The CV sets the parameters of the box.
Reducing vanishing points
Understanding how the vanishing points work in a 2-point perspective provides the foundation for understanding why a 1-point perspective only has one vanishing point. This image depicts the rotating vanishing points of a 2-point perspective to a 1-point perspective.

Sectional perspective of a printing press
This sectional perspective for a printing press is intended to convey the programmatic relationship between the printing press room on the left and the office space on the right through the courtyard in the center. While visually connecting the two spaces, it also provides an acoustic and thermal barrier. The green poche emphasizes the cut line and indicates structural systems including precast concrete and light timber framing.

Aerial perspective
The plan perspective emphasizes an aerial view into a space. This 1-point perspective for a traveler’s room shows that the service spaces are tucked into two thickened “poche” zones.
Always leave the horizon line in your drawing, even as a light construction line. It establishes where the ground stops and where the sky begins. The horizon line gives the page a bottom and a top.

When finishing your perspective drawing, consider page composition in relation to your design and representational intentions. Should the paper be cropped or cut to meet the perspective or should a box be drawn around the perspective to contain it? Where are the limits of the cone of vision? Vertically? Horizontally? Ultimately you want to ensure you leave enough room on the paper so that the perspective image is not compromised.

**Cropping an image**
The image on the near right is cropped too short—the viewer does not feel like part of the space. The cone of vision (CV) marks the limits of the top and bottom of the image, but there is flexibility in marking these limits. The emphasis of the view on the far right is transferred from the columns to the connection between indoor and outdoor space.

**Drawings limits of the perspective**
These two images, depicting views inside a natatorium, were drawn using pencil on vellum with construction lines left in place and cropped in different ways. A perimeter box defines the limits of the view for both images.
**Vertical extension**
A 3-point perspective is constructed in a similar manner to a 2-point perspective, except that all the vertical lines converge to a distant vanishing point. This technique is useful when constructing views looking up at a tall building or looking down into deep spaces. In each case, either the picture plane is tilted or the object is tilted relative to the picture plane. In a sense, all three axes are oblique to the picture plane.

**Replicating experience**
Perspective drawings are not solely used as presentation drawings for clients, planning, or academic reviewers. They are necessary throughout the design process to verify plan and section ideas against spatial and experiential ones. They are design tools that aid in developing your ideas. Design changes can easily be made between the perspective and the plan. Familiarize yourself with the techniques of perspective construction so that you can understand and manipulate the variety of images capable of being drawn.

While plans and sections help create space, only perspective images replicate experience of that space.

**Digital modeling**
Digital modeling provides designers with an adaptable process for constructing three-dimensional representations of their developing designs. In programs like SketchUp, Form Z, Rhino, and Revit, you can translate two-dimensional information into three-dimensional models and generate infinite views. Due to its ease of use, SketchUp is often used during the design process for form generation and manipulation, single view perspective, and as an underlay for freehand sketching. The other programs tend to be more complex with a wider range of capabilities, especially for complex geometries. In addition, they are often used for presentation-quality representations due to their superior rendering capabilities. Other three-dimensional modeling programs like Revit represent recent initiatives in Building Information Modeling (BIM) and tie together the entire model so that changes in one view will automatically be updated in all views.

Three-dimensional models can also serve as the basis for digital animations, closely mimicking the experience of someone walking through the design.

Although not a common practice, single perspectives can also be created with any of the two-dimensional programs like Autocad and Vector Works in the same fashion as construction by hand—you simply treat the monitor as a virtual drawing board. When creating still images with digital programs like Form Z or SketchUp, it is important to maintain a critical level of observation to preserve the desired intentions for each representation. It is also necessary to control the CV to ensure that space is not distorted.

No matter which program you learn to draw and model with, it is important to understand the relationships between drawing types developed in both digital and manual representation. Skills training in hand drawing provides a solid foundation with which to consciously and willfully design using digital media.

**Spatial expression**
This K-8 school was modeled in Revit 9.1 and then rendered with Mental Ray in 3DS Max 9. The role of the sectional perspective is to express, using color, the spatial relationship between the pool, the gymnasium, and the library. Structural elements depict boundaries and light qualities in the space. It provides the viewer with the ability to see multiple spaces simultaneously.
By designing a single architectural element you will become aware of the many design decisions involved in each component part of the element and in the relationships of those component parts in creating the overall project.

**Framing a view**
Openings are abstract thresholds between elements. At Arches National Park in Utah, this single arch frames a view of the distant mountains.

**Precedents**
The Villa Savoye by Le Corbusier juxtaposes a glazed strip or ribbon window with similar sized unglazed openings. An opening on the roof terrace acts as the focal point of the circulation sequence through the house, framing a view of the adjacent landscape.

**Reconsidering worlds**
A television is not typically considered an opening, but it can be reconsidered as a window on a world of sound and moving pictures.

**Getting started**
Most designs are not created in a vacuum. Ideas, inspirations, and responses can be drawn from the existing conditions on the site of the project. The various scales of the existing conditions can be investigated. That is, a site might be a room within a building, within a neighborhood, within a district, or within a city. Each of these existing conditions can influence the design. The existing conditions can also expand to neighboring sites, context, and histories. Always consider what is around the site, not just the physical elements like buildings, trees, open space, and transportation networks, but the cultural ones as well. The existing conditions, along with the rules of the program—whether they are code considerations or rules created in an academic setting—need to be considered when brainstorming the project.

**Precedent research**
Typological precedents—those designs that have come before with the same program—are excellent places to start your research. This is especially important for beginning design students, as what they bring to the design process is intuitive and limited by personal experience. To broaden your knowledge base, familiarize yourself with historical precedents and the meanings behind the designs.
The design problem
When confronting design issues, it is important to challenge preconceived notions and critically evaluate the essence of the design problem. Step back from everyday language and think more conceptually about the problem.

The term “opening” as it relates to architecture is used to define everyday building elements like windows and doors. Opening, as defined by Webster’s New World Dictionary, is an open place or part, hole, gap, or aperture. From this definition the term “opening” can be disassociated from the familiar term “window.”

Openings are thresholds between two sides. These sides can be unique or similar depending on the context in which you are operating. Regardless of the type of side, the opening participates in both realms simultaneously and independently. The opening affects the experience of a space depending on its size, shape, material, texture, transparency, and so forth. Openings are not neutral elements. Even conventional openings make a statement about their use; for example, residential windows, often of a typical size and scale, are recognizable as different from commercial window types.

Possible functions of an opening
• to let light in
• to frame a view in
• to frame a view out
• to provide a place of occupation
• to demonstrate the thickness of the wall

ASSIGNMENT: 16
Design an opening
You will be examining the nature of an opening in detail by exploring issues of light, ventilation, significance, size, scale, materiality, proportion, privacy, view, point of view, space, place, security, and control. The project is small, but involves complex decision-making. This is clear from the list of issues mentioned, especially when each issue is considered as a threshold between one side and another.

Brief
You are asked to design an opening for an existing room. The site is an existing corner room on the second floor of a building with given dimensions and sun orientation (see diagram).

• The opening(s) can only be placed on the two indicated surfaces, the south and west walls, in the selected areas. Multiple openings can be located on both walls.
• The ceiling height in each space is different—a dotted line on the plan indicates where the change in ceiling height takes place. One ceiling height is 10 ft (3 m) and the other is 12 ft (3.65 m). Choose which ceiling plane is higher than the other based on your conceptual design ideas.
• A door must be added to the plan along the north wall. Consider the type, size, and method of operating the door relative to the experience of the user in the room, and its relationship to the opening design.
• The opening can take up to a maximum

The room
You are asked to intervene into an existing room. The program of the room is left ambiguous (it is not a bedroom or a living room) so that the focus of the design is based on the proportions of the room and room orientation.

of 35% of the total surface area of the two exterior walls indicated on the plan.
• Each wall has a different thickness.
• The opening cannot penetrate the roof (no skylights).
• Glass used may be clear, colored, or frosted; no glass block or other types of specialty glass may be used.

Think back to Unit 1 (page 12), and remember that architecture is not a purely practical discipline. Design involves creating a narrative that defines the meaning behind the physical moves of design. Solutions for design should be both practically and poetically driven.

Strong ideas
• The simpler the idea, the stronger the project will be. Simple does not mean mundane or boring. Simple means that an idea is honed down to its essence. It has clarity.
• Architectural moves should support more than one idea. Ideas that have multiple influences strengthen the project.

Process: research
Find three precedent examples that could provide inspiration for your own design. Do not limit yourself to the preconception that opening = window.

Remember that the process of design is iterative. You will start the process, evaluate your initial solutions, and redesign based on the clarity of the narrative relative to the articulation of the idea. You will repeat this process over and over again. Understand that the initial idea you produce is the generator of the architecture and will be manipulated over time. Your initial sketches may not look like the final outcome of the project. This is fine; through the iterative process you will learn to develop your ideas. This takes experience and time.

Sketch initial ideas, including your initial reactions to the assignment and precedent research, in your sketchbook. Any idea that comes to mind should be recorded. Do not try to use all of your ideas in one project. Learn to edit your ideas—too many ideas are just as bad as too few.
Translating ideas to paper or models
- Create three study models at 1/8 scale to investigate the conceptual thinking recorded in your sketchbook. What is the intention of the opening? How does it react to the existing conditions? Is it about light? What quality of light? If it is about view, what is the nature of the view? Is it directional? Is it about viewing out at an object or in at those occupying the space?
- Hardline a plan and section of the room on trace without any design elements at 1/4 scale. Use this as an underlay for freehand orthographic sketches.
- Review how to draw glass in plan and section. Typically, glass is drawn using two lines as close together as possible while still maintaining two distinct lines. Remember all materials have thickness. At 1/8 scale glass is represented with two lines roughly 1/2 in (1.2 cm) apart to scale; at 1/4 scale this might be 1 in (2.5 cm) apart. The two lines representing the glass should never be further apart than 1 in (2.5 cm).

Consider the location of the plane of the glass in the wall thickness. Should the glass be centered in the wall, flush to one side, or asymmetrical? What does it mean to have glass that is flush versus centered?

Developing the initial design
Select one of your original study models as the basis for your design. Develop your opening ideas, using the hardline drawings as underlays to make changes and modifications to your design. As you continue to think and sketch, create a new study model to explore your ideas at a larger scale. This new study model should be twice as big as the first study model, at 1/2 scale. An increase in scale requires an increase in detail in both drawings and models.

Using perspective drawings
At this time in the process, it is good to construct a few perspectives to investigate how your ideas in plan and section are executed through the experience of someone looking at or occupying the opening. Use the perspectives as a design tool. You can manipulate elements of the perspective, such as the height of a wall, the location of an edge, or the size of a form, which can then be modified in plan. In addition, use the perspectives to represent floor, wall, and ceiling materials to begin to characterize the space.

Using charcoal drawings
Create charcoal drawings of the opening design to experiment with the way light moves and changes throughout the day. This is a critical design tool that documents how light enters the room through your opening.

To understand how light moves in space, place your study model on a work surface and use a desk lamp to cast light through the space. Or take your model outside. Sunlight is scaleless, so shadows cast on the model replicate built conditions.

Image folder exercise
Find window precedents and add to your image folder.

- Le Corbusier
  - La Tourette, Ronchamp, Villa Savoye, La Roche-Jeanneret
- Frank Lloyd Wright
  - Fallingwater
- Steven Holl
  - The Chapel of St. Ignatius
- Marcel Breuer
  - Whitney Museum
- Tadao Ando
  - Koshino House, Church of Light, Church on the Water, Vitra Museum
- Clark and Menefee
  - Middleton Inn
- Louis I. Kahn
  - Salk Institute, Esherick House
- Konstantin Melnikov
  - House in Moscow
  - Brion Cemetery, Canova Cast Museum
- Carlo Scarpa
  - Bauhaus
- Walter Gropius
  - Faculty of Architecture, Faculty of Journalism, Galician Center of Contemporary Art, The Serralves Foundation, Vieira de Castro House
- Alvaro Siza
  - Casa del Fascio
- Herzog & de Meuron
  - Roche Pharma Research Institute
- Jean Nouvel
  - L’Institut du Monde Arabe

The Palm House at the Royal Botanic Gardens, Kew, in London, UK
### Exploded axon
This exploded axonometric drawing, on 90lb hot press Arches watercolor paper, emphasizes the layered elements that make up the system of the window. The window wall is pulled away from the space to enable a clearer sense of the component parts of the opening.

### Marcel Breuer
Marcel Breuer (Hungarian b.1902 d.1981) was one of the fathers of Modernism. He employed modular construction with simple forms. He taught at the Bauhaus with Walter Gropius and is perhaps most recognized for his furniture designs. The Wassily chair, constructed out of bent steel tubular members, was in part influenced by steel handlebars on his Adler bicycle. One of his best known buildings is the Whitney Museum in New York City. Its heavy inverted ziggurat-inspired form with a monocle-like window was once controversial. Over time, however, it has been heralded as a bold, inventive building that challenges contemporary notions of aesthetics.

### Window as object
The Whitney Museum in New York by Breuer: the single small window opening along Madison Avenue was a powerful gesture at a time when the curtain wall of glass was proliferating. This window allows you to look up at the street, not just across it.

### Using Arches paper
- It is an opaque surface: you cannot trace on this paper unless you have a light table.
- Erasing is more difficult than on vellum.
- A pencil mark leaves an indentation in the paper even after you erase it, so press lightly.
- It is expensive: this can be intimidating, although you can draw on the back.
- It comes in pre-sized sheets, so offers less flexibility than a vellum roll.

### Charcoal drawing
This charcoal drawing for the opening assignment emphasizes contrasts between dark and light. The sharp light casting across the space is representative of the setting sunlight in the western sky. Note the reflective quality of the walls around the openings.

The material palette in the space, concrete walls and ceilings along with wood flooring, can influence the design of the project.
The kit of parts project dates back to the 1950s with the introduction of the nine-square grid problem by John Hejduk at the University of Texas. Along with fellow academics Colin Rowe, Robert Slutsky, and others, Hejduk was part of a new trajectory in architectural education that promoted design as a formal issue. The original “kit of parts” problem included a reduction and simplification in the number and type of formal elements, often repeated, that led to a focus on threshold, enfilade, space, vistas, and movement. These limited parameters allow you to concentrate on developing the narrative as it relates to the composition of spaces and the sequence associated with those spaces. Compositional design strategies make up the core of the kit of parts problem. Composition is the active arrangement of parts to create a whole; to establish order. Even with the limited number of parts, a myriad number of solutions is possible. As problem solvers, architects deal with their own kit of parts in the building codes, zoning codes, covenants, and program requirements.

This exercise challenges you to compose a series of spaces, using a prescribed kit of parts, to orchestrate an experience, based on five themes.

Assignment: 17

Using the kit of parts

Your site is a solid plinth, measuring 2 ft 6 in (76 cm) high, by 80 ft (24.40 m) long, by 32 ft (9.75 m) wide. The plinth is delineated by a 4 x 4 ft (1.22 x 1.22 m) grid.

Brief

• Locate two shallow reflecting pools:
  one measuring 1 x 38 x 18 ft (0.3 x 11.58 x 5.50 m), and another measuring 1 x 22 x 10 ft (0.3 x 6.70 x 3 m) wide. You may place the pools anywhere, as long as at least two edges of each align with the grid. They must remain rectangular and may not be placed on the very edge of the plinth.

• Subtract a volume 2 ft 6 in (76 cm) high by 6 ft (1.82 m) wide by at least 10 ft (3 m) long to accommodate an entry stair.

• Define a sequence through the site using eight 6-in (15-cm) columns and five walls measuring 10 ft x 12 ft, 16 ft, 22 ft, 36 ft, and 40 ft (3 m x 3.7 m, 4.9 m, 6.7 m, 11.0 m, and 12.2 m). Place columns at grid intersections and align the centerline of walls with a grid line, except at the perimeter of the plinth where the edge of the wall must align with a grid line. Do not place columns inside the pools.

These basswood models capture the sharp light cast into the space.
Mies van der Rohe

Ludwig Mies van der Rohe (German-American b.1886 d.1969) is considered to be one of the most influential of the early Modernists. After establishing himself at IIT in Chicago, Mies went on to create a number of influential buildings in the U.S.. His buildings aspired to establish a new style to embody the spirit of the times. Perhaps the first to do this was the German pavilion for the World Exhibition in Barcelona in 1928–1929, the Barcelona Pavilion. It embodied the streamlined aesthetics of the era. The Barcelona Pavilion was an exercise in harmonious proportions and exquisite composition of materials. The expression “Less is more” has been attributed to Mies.

Process
You will design several spatial compositions using all of the parts in your kit. Use a soft pencil (2B or 4B) or felt-tip pen to freehand trace over a hardline plan of your site (the plinth). Generate at least 12 different spatial compositions based on the following themes:

- ceremony
- contemplation
- dialogue
- imbalance
- tension

Explore each theme at least once. This allows you to be selective about which ideas you develop and clarifies your thought process. Record the definitions of each word along with your own interpretations of them. Brainstorm the meanings of these words. This will provide a foundation for your design.

While sketching in plan, think three-dimensionally about your design. For each plan draw a series of four small perspective sketches that represents the sequence of movement through your design. Do the sketches reinforce the idea? If not, revise the sketch (use trace), then return to the plan and modify it based on the perspective changes. Draw plans and sections at ⅛ scale so that relationships between the two can be exploited.

Make a model to help establish the sequencing strategy and provide opportunities to study the light qualities of the spaces. In addition, creating a series of charcoal drawings will demonstrate light interacting with the kit elements. Charcoal drawings should be drawn to showcase the character of the materials, textures, and space as light changes throughout the day.

Final representations
- Plans and sections at ⅛ scale (1 longitudinal section and 2 cross-sections)
- 3 constructed perspectives
- 1 basswood model
- 2 charcoal drawings
- Final presentation images including perspective drawings, diagrams, orthographic projections, and final models.