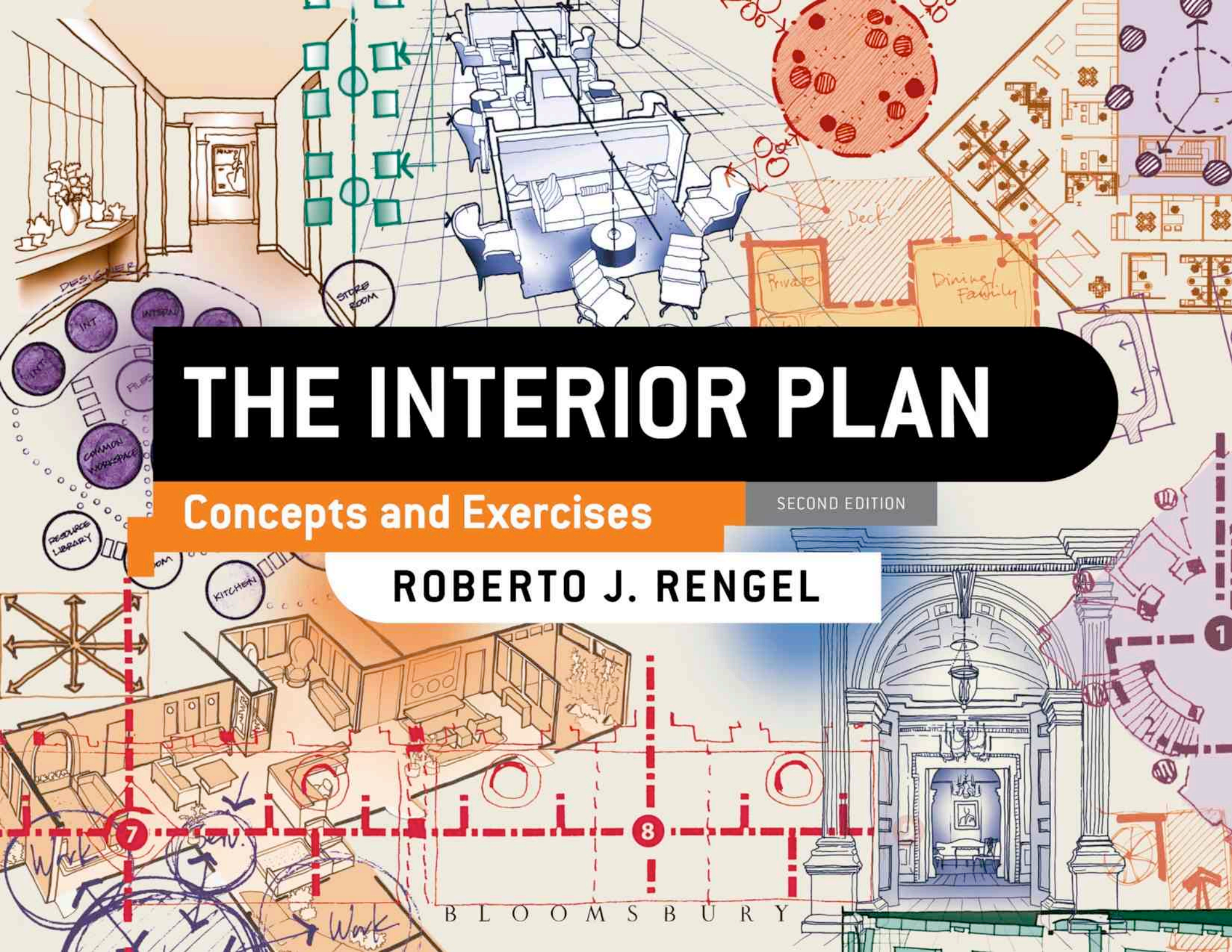

THE INTERIOR PLAN

Concepts and Exercises

SECOND EDITION

ROBERTO J. RENGEL

BLOOMSBURY

The Interior Plan

CONCEPTS AND EXERCISES, 2E

Roberto J. Rengel
University of Wisconsin—Madison

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EXTENDED CONTENTS

Preface

This is an introductory-level text about the planning of interior environments. It addresses both the contents of interior environments and the process of interior planning. The book covers topics such as laying out rooms, designing effective spatial sequences, relating project parts, arranging furniture, planning effective circulation systems, creating spaces that are accessible, and designing safe environments for people.

My goal has been to produce a user-friendly book with much useful information for the beginning design student. In presenting information, I have favored a simple and direct approach over the complex and abstract approach often used in the world of design. In terms of language, the book consciously uses the basic language of design—the drawing—as its principal language. It also consciously uses a loose drawing technique and avoids the overly rigid look of finished drawings, in part as a reminder that design problem solving is a fluid process. The looseness of the style is also a way of encouraging students to use manual sketching and diagramming during the early design stages, a practice that has been affected by the prevalence of computer drafting.

The basic unit of the text is the "example." Through the inclusion of abundant examples of what to do and what to avoid, I hope to help students become better designers. The book presents many examples, from individual rooms to entire projects, and includes both good and not-so-good design solutions to help students understand the differences. The examples shown come from real executed projects as well as student work. Many of the projects chosen to illustrate ideas are from the past, some from the modern tradition of the twentieth century, and some even from classical architecture. These were chosen because of their straightforward approach, which results in clarity for the student. Numerous exercises throughout the book are meant to facilitate learning by encouraging students to apply ideas and concepts immediately after reading about them.

I have received much good feedback on the Interior Plan since the publication of the first edition. I am pleased that instructors and, most important, their students, are using the book and finding it helpful. It is hard to predict how different instructors will use a book like this. Some use it in their studio courses and others for other courses. One of the goals for this book has been making it useful in a variety of settings, which makes it possible for instructors to pick and choose the relevant content and the best sequence of dissemination for their specific course. That is still the intent with this second edition.

Based on feedback from some reviewers, I have reorganized the order of the chapters in this edition. This is always a tricky endeavor because any sequence chosen is sure to please some and upset others. Some instructors prefer a strict arrangement that goes well with the existing sequence of their courses. Others feel comfortable going back and forth in a custom sequence that suits their needs.

"My goal has been to produce a user-friendly book with much useful information for the beginning design student."

The main change is that the chapters dealing with design for people and the design process have been moved up front, following the introduction chapter. This places these fundamental topics early in the going, which seemed to make sense. The chapters that present interior spaces from the single unit (the room) to the totality (the project) follow. The chapters "Residential Design" and "Nonresidential Design" are still at the end.

The new structure looks like this:

1. Introduction
2. Design Is for People (formerly Chapter 6)
3. Design Process (formerly Chapter 5)
4. The Room (formerly Chapter 2)
5. Beyond the Room (formerly Chapter 3)
6. The Project (formerly Chapter 4)
7. Residential Design
8. Nonresidential design

Users seemed pleased with the contents of the book. For that reason, most of the original material is still there. However, I have added more than a dozen new spreads with new content about design process, iterative design, and so on. In order to do this without making the text longer, I had to delete a few of the original spreads.

The drawings and exercises still follow the original approach. I have avoided the use of color and finished pictures of projects as I continue to stress the premises that drawings are the language of design process, and that loose, free-hand drawings are an important tool, as they are efficient and promote a more direct contact between the brain and the paper. We noticed that some images could be improved, so we did upgrade a number of images to increase their clarity and overall quality. In keeping with current practices by Fairchild Books, a glossary containing key terms and definitions has been added at the end of the book.

Acknowledgments

Once again, the production of this edition has been a team effort. I am indebted to the entire staff at Fairchild Books for their continued support and expertise. Very special thanks go to Priscilla McGeehon and Joseph Miranda for their leadership, and Edie Weinberg for working with the artwork of this edition. My gratitude also goes to the professionals who provided valuable feedback about the direction of the new edition: William Furman, Winthrop University; Crandon Gustafson, Boston Architectural College; Jim Dawkins, Florida State University; Marciann Patton, Missouri State University; Rebecca Graaff, De Montfort University, UK; Belinda Mitchell, Portsmouth University, UK; and to the many students and educators who have used the previous editions and have approached me with useful comments and recommendations.

Finally, a very special thanks goes to Julie Foote, who continues to be my right-hand person during production and provided immeasurable help with the artwork and layout of the book pages.

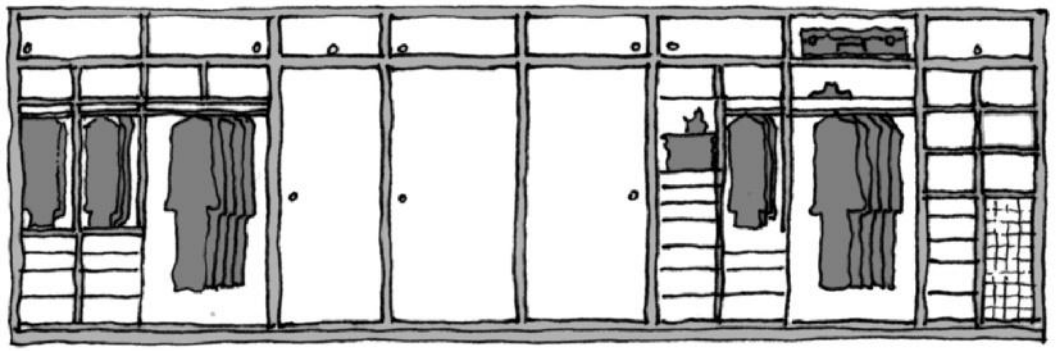
1 Introduction to Interior Planning

Interiors: Content and Organization

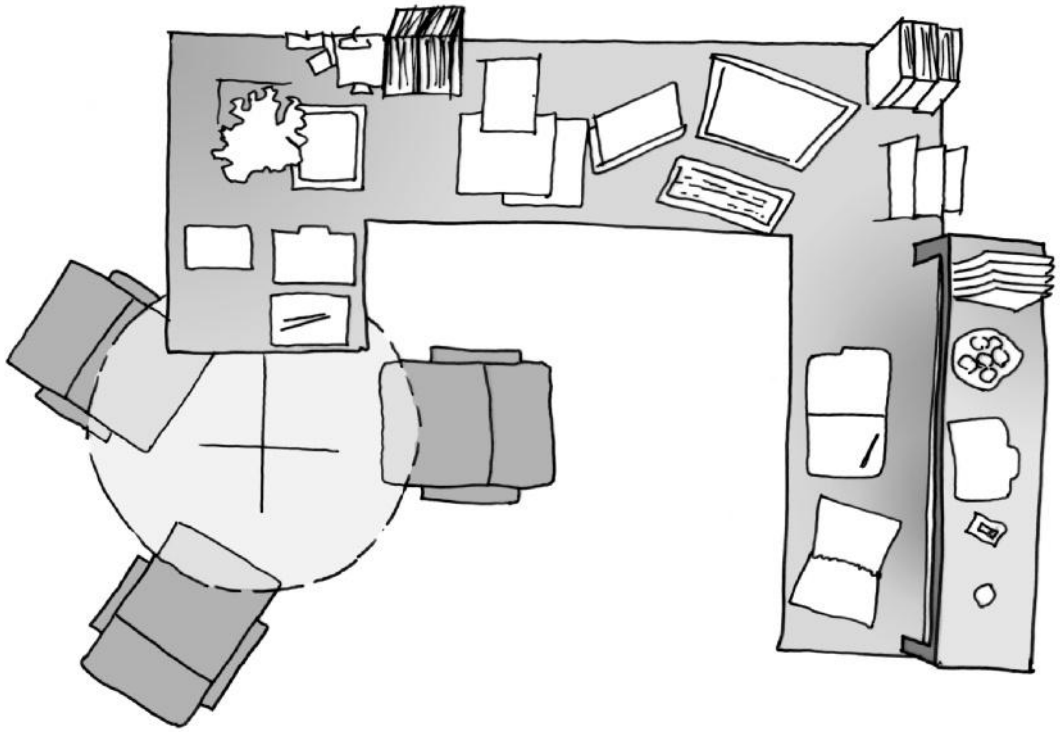
At a general level, designing interiors entails two basic kinds of knowledge: knowing what things need to be included (partitions, rooms, furnishings, accessories) and knowing how to organize those things to achieve a functional and perceptually good solution. The main goals of this text are to increase your awareness of the things that are included in interior projects and to show you some of the ways of arranging them successfully.

Think of the things included in projects in terms of (1) **fixed architectural elements** (these are usually given and cannot be changed, e.g., a row of structural columns); (2) **interior architectural elements** (e.g., partitions, doors, and so on); and (3) **furnishings** (this category, commonly referred to as ff&e, includes fixtures, e.g., lighting and other decorative fixtures, and equipment, e.g., laboratory equipment for a hospital or exercise equipment for a health club). Your task as a designer is to arrange these three sets of elements efficiently and harmoniously. The interior architectural elements and the furnishings become your kit of parts.

There is another category of things you must also be aware of: the user things that require accommodation. These include everything from food items that need to be stored in cabinets, to neatly folded shirts that need to be placed in drawers, to piles of papers that need to be arranged in trays on a desk. Think about it this way: you provide containers and placeholders for all the things people bring to a space (e.g., cabinets, closets, desks), and then you make spaces for these containers and placeholders. In addition, you create areas that serve as a stage for people and their interactions. In a nutshell, you provide places for people and their things.



Clothes and things in closet

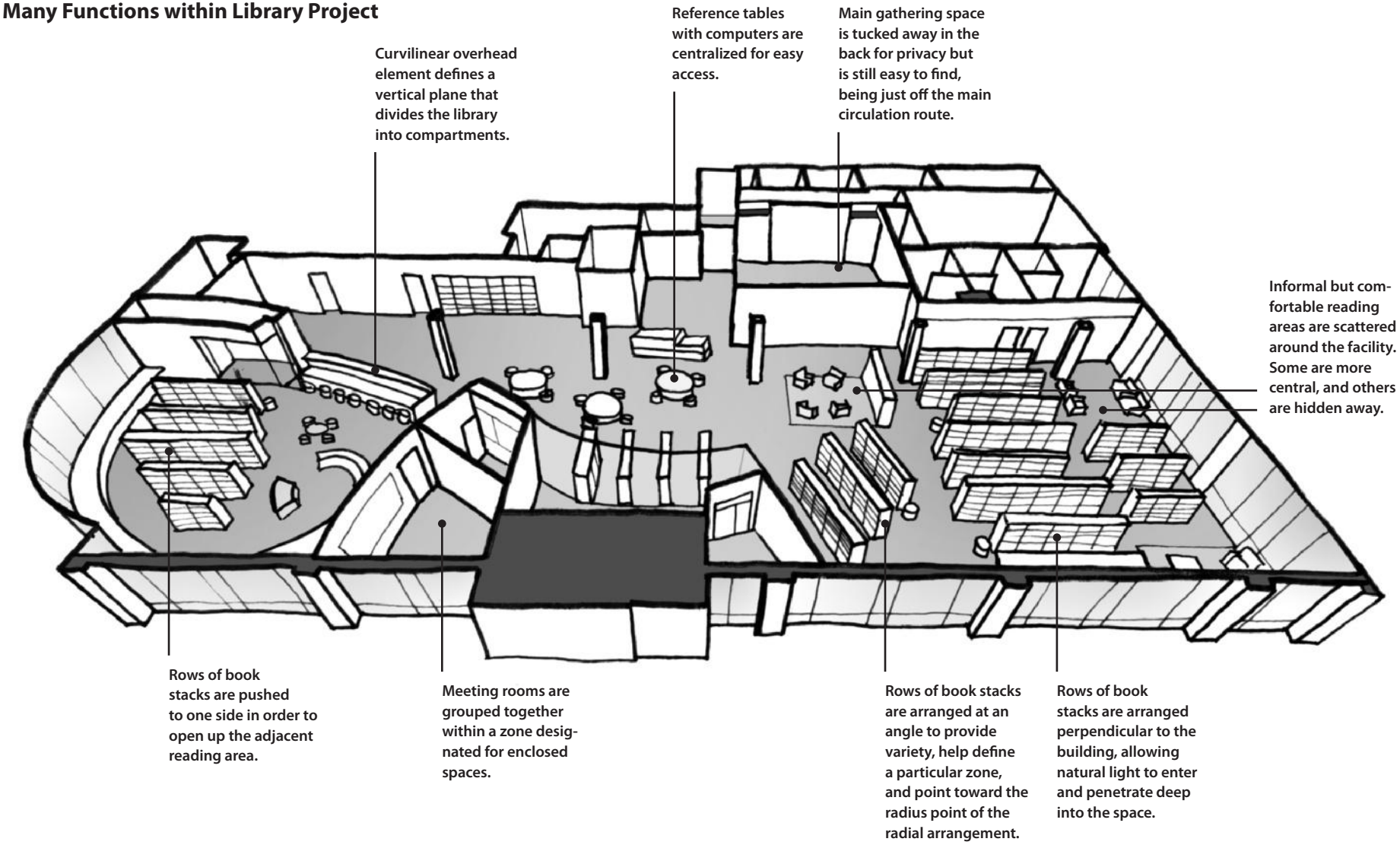


Accessories and supplies on desk

One of the most elemental tasks for novice designers is to become familiar with the basic contents of interior spaces. The product offerings in the furniture category alone are endless. For initial planning purposes, you don't need to think in terms of brands and models, but you do need to have a sense of what kinds of pieces may be adequate for a given circumstance, their size, how to combine various pieces into groups, and how to do that within a space (e.g., a room), such that people can get to the pieces, move around them, and so on.

The images on these pages show some examples of various scales of things ("stuff") and how they are contained and arranged in a closet, on a desk, and, on a larger scale, within the bounding walls of an entire project.

Many Functions within Library Project

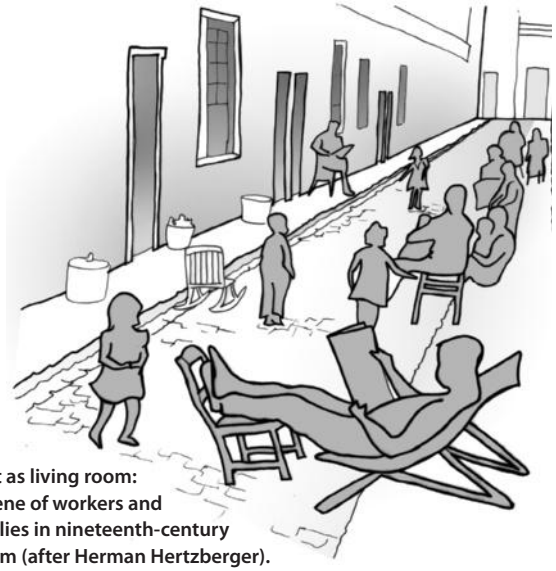


Concepts of Accommodation

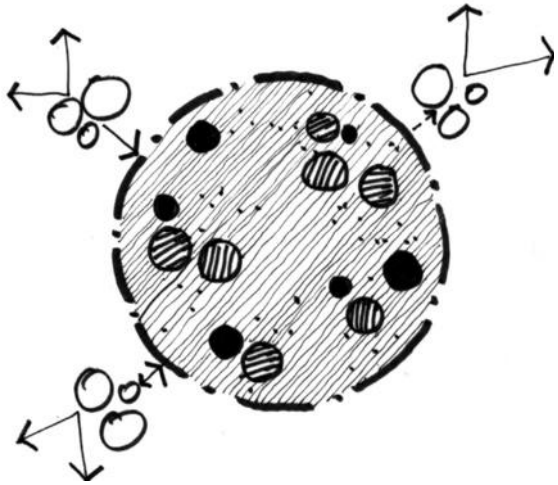
Accommodating humans and all their needs is a complex task. Not only are people different from other people, but the same person is often different in different settings and roles as well. Moreover, the needs of a home are different from the needs of an office, a library, and so on. As a designer, you have to be constantly making choices among the different ways of doing things in order to address user needs.

Here, we present seven universal concepts related to the arrangement of people and their environments. As you begin to plan interiors, you will realize that these basic concepts and the choices they entail will be present in all your projects:

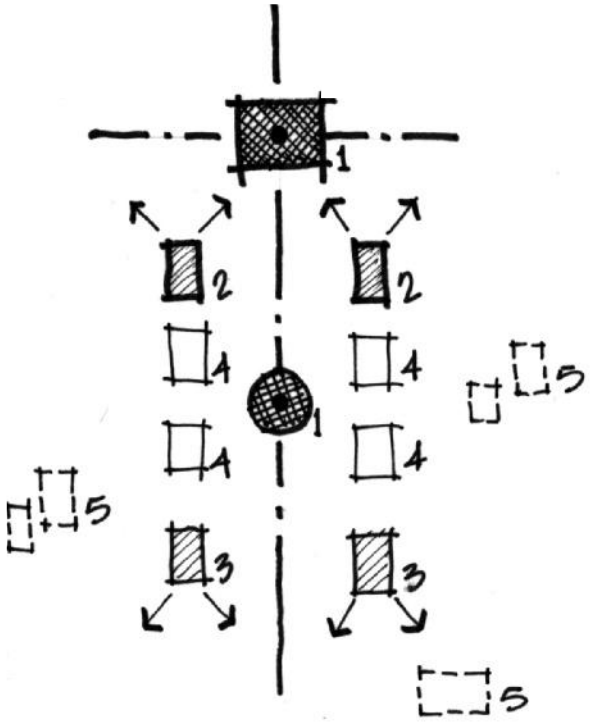
1. Insiders/Outsiders
2. Hierarchical arrangement
3. Individuals versus community
4. Invitation versus rejection
5. Openness versus enclosure
6. Integration versus segregation
7. Combination versus dispersion



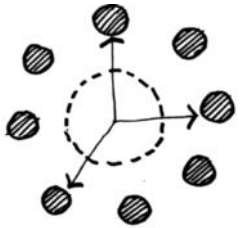
The street as living room: from a scene of workers and their families in nineteenth-century Amsterdam (after Herman Hertzberger).



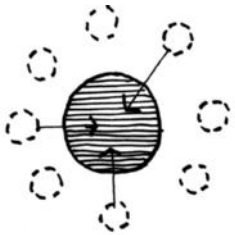
Insiders/Outsiders
Settings provide accommodations for people and their interactions. One thing all settings have in common is that they are inhabited (or controlled) by certain users. These users selectively allow access to others from the outside. Think of the home, the office, the store, the institution. In all these cases, there are people who live (or work) there and who have free access. These are the insiders (or locals). There is often a hierarchy of ownership within a group of insiders, such as the owners and employees of a store. Outsiders can be visitors who are given access at certain times, for example, to shop, or they may be unknown or undesirable people who are denied access. This duality brings up issues related to such things as the degree of enclosure/security required and access control.



Hierarchical Arrangement
Think of settings such as villages, museums, houses, and stores. Now, think about the various places within those settings. You will note that some places are more important than others and generally demand more exclusive placement. In any complex organization there is a hierarchy of places and functions. In the example of a small village at left, the main religious structure (1) is at the culminating point of the main central axis. A ceremonial gathering ring (1) is at the center of the central/communal space. Beyond those, the end huts (2 and 3) have certain prominence based on location and exposure. The average huts (4) encompass the rest of the main linear arrangement. Finally, the village is serviced from peripheral structures housing miscellaneous functions, such as sanitation and storage (5).

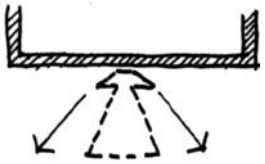


Individuals
All groups are made up of individuals. Despite their collective identity, they are people with particular needs and wants as unique human beings.

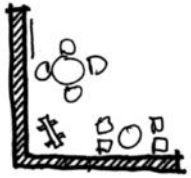


Community
Despite their singular natures, group members have shared needs and obligations at the larger community level. Group activities, such as meetings, rituals, and ceremonies have their own sets of requirements that must be accommodated.

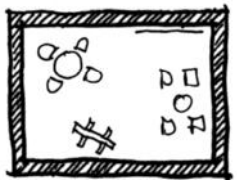
Invitation
The way a facility (or a part of it) treats its boundaries and points of access may be open and inviting, providing wide and flowing connections between "inside" and "outside."



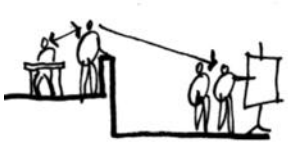
Rejection
Users usually discourage or prohibit access to the facility or parts of it. Think of a bank. You are welcomed up to the teller line but have no access to more private, back-of-the-house areas, especially the main vault.



Openness
Depending on the circumstances, you may decide that a room does not need a door or even a couple of walls. This is related to issues not only of privacy, but also of wanting a feeling of openness and connection.

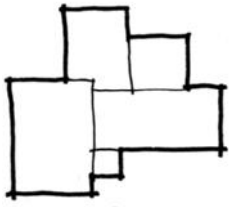


Enclosure
Even in the most open and inviting environments, there are usually spaces that require total enclosure, whether for security or privacy issues. A meeting room that needs to provide good conditions for concentration and study, for instance, often must have four walls and a door.

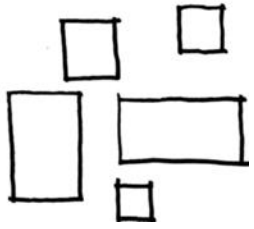


Integration
Where adjacent functions exist, they may be arranged in ways that integrate them, such that, while maintaining their individual integrity, they connect and allow visual and even functional interaction.

Segregation
The elements separating one space from the next may intentionally discourage integration. A solid wall between the two spaces will often accomplish this. There are, however, several in-between options such as selective opening/closing of moveable walls.



Combination
Where multiple elements must all be present (such as rooms), depending on the circumstances, one may choose to bring them together as a cluster. This often produces economy of space (shared walls, fewer corridors) and allows for better residual space.



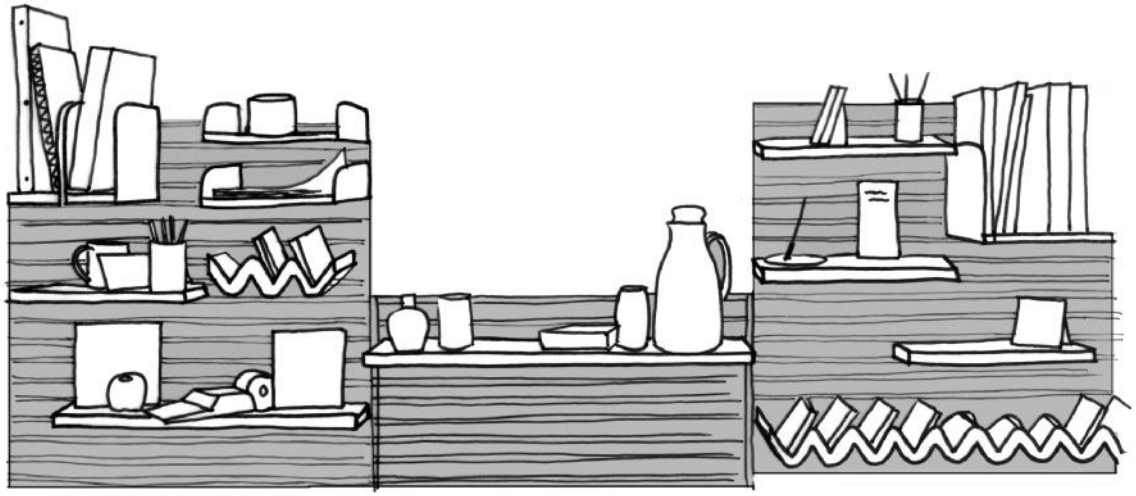
Dispersion
Sometimes, separating rooms and other elements is inevitable based on function and other needs, such as privacy and degree of autonomy. In this case, the elements are separated and dispersed within the overall setting.

Interiors: The Microscale

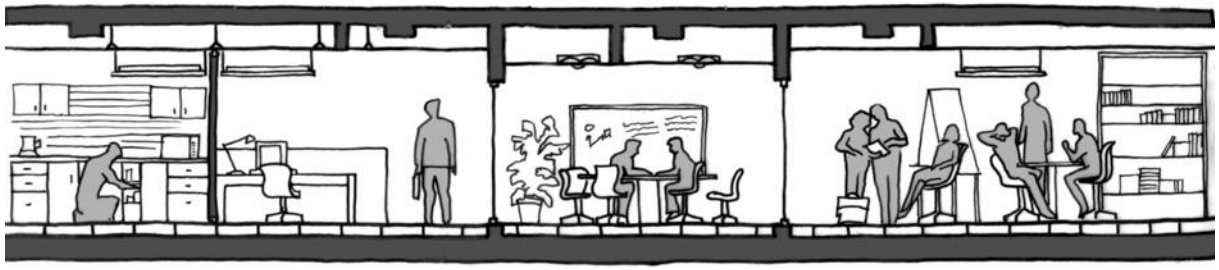
Imagine you had to design an entire house based on information from the user about a single drawer in her chest of drawers. Imagine this drawer stored the user's most valued possessions and summed up her whole approach to life and dwelling. Crazy, some may say; fascinating, others might exclaim. Planning interiors has to do with the chest of drawers, individual drawers, and even drawer compartments. It is also about the shelf, the closet, and even the hangers in the closet.

Think about the next scale up from drawers and individual shelves. It is the scale of tables, chairs, beds, desks, and cabinets. It is also the scale of small alcoves and niches and of special accessories. This is all part of the microscale of design. In the furniture category, microscale encompasses many of the objects found in interior spaces. Several of these become the final destination for users in a house or facility: the chair, the bed, the desk, the bathtub. In the architectural category, microscale encompasses some of the most meaningful and endearing components of interior environments: niches, alcoves, and cubbies.

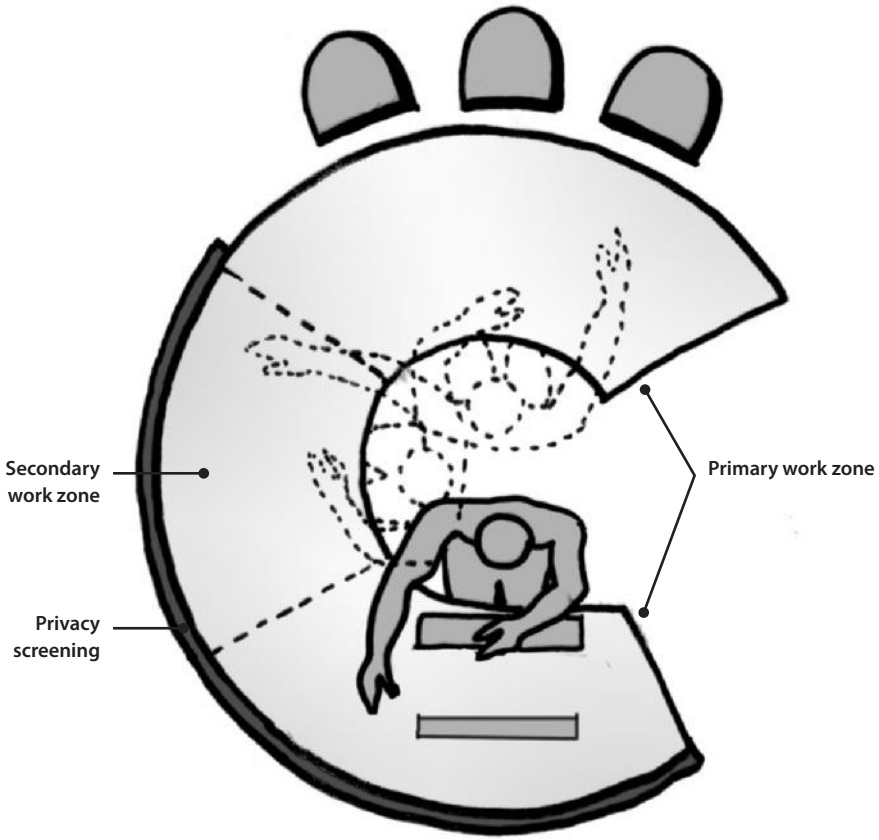
Start becoming aware of your surroundings at the microlevel. Note the little compartments that provide holding places for our notebooks and pencils, the plants, the easels, the writing surfaces, the bookshelves, the artwork, the curtains, and the details of each. Begin incorporating these into your design repertoire.



A slat wall provides convenient storage for notebooks, binders, writing objects, vases, mugs, pictures, and other personal items.

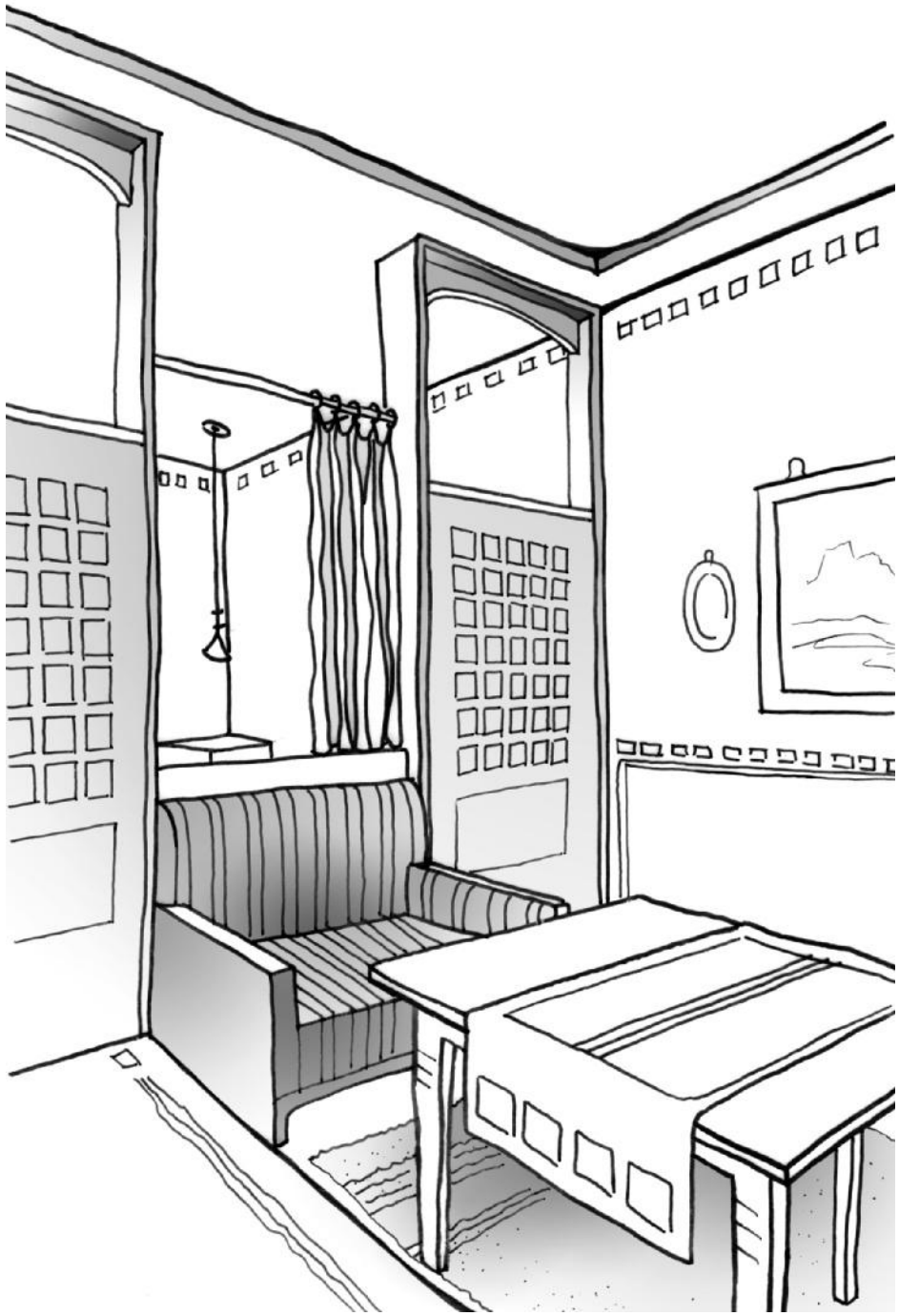


This cross-section through an office environment shows the contained objects at the microlevel. These include storage walls, cabinets, files, desks, computers, plants, whiteboards, easels, tables, and storage cabinets.



Reception desk: A desk is one of the most basic units in many environments. Designing a desk forces us to think about humans and their operational dimensions as well as functional concerns, such as how to receive visitors, privacy, equipment, and so on.

This study of a room divider and seating area by Josef Hoffmann (after Norman Diekman and John F. Pile) is a good example of design at the microscale. Note all the small details, some of them decorative; note that it is often this microscale of design that accomplishes the essential task of breaking down the scale of our living environments to a truly human one that relates to our bodies, our arms, our hands, and even our fingers.



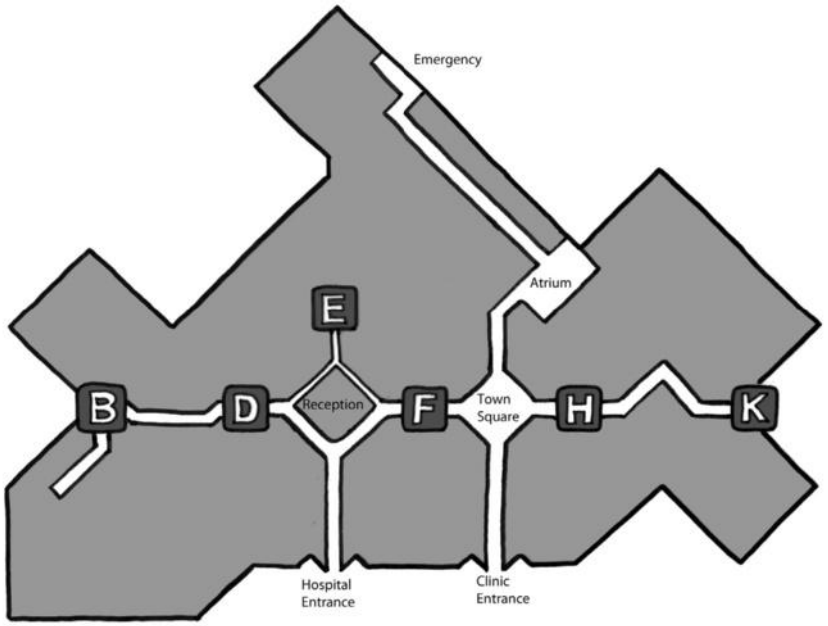
Interiors: The Macroscale

At the opposite end of the spectrum from the microscale is the macroscale of projects. This scale does not entail drawers and shelves, but rather entire floors and sometimes entire buildings and complexes. Design at this scale requires the careful planning of the many rooms and other spaces that encompass the whole project. Some projects are very large and complex (e.g., a major hospital), while most are more modest in size.

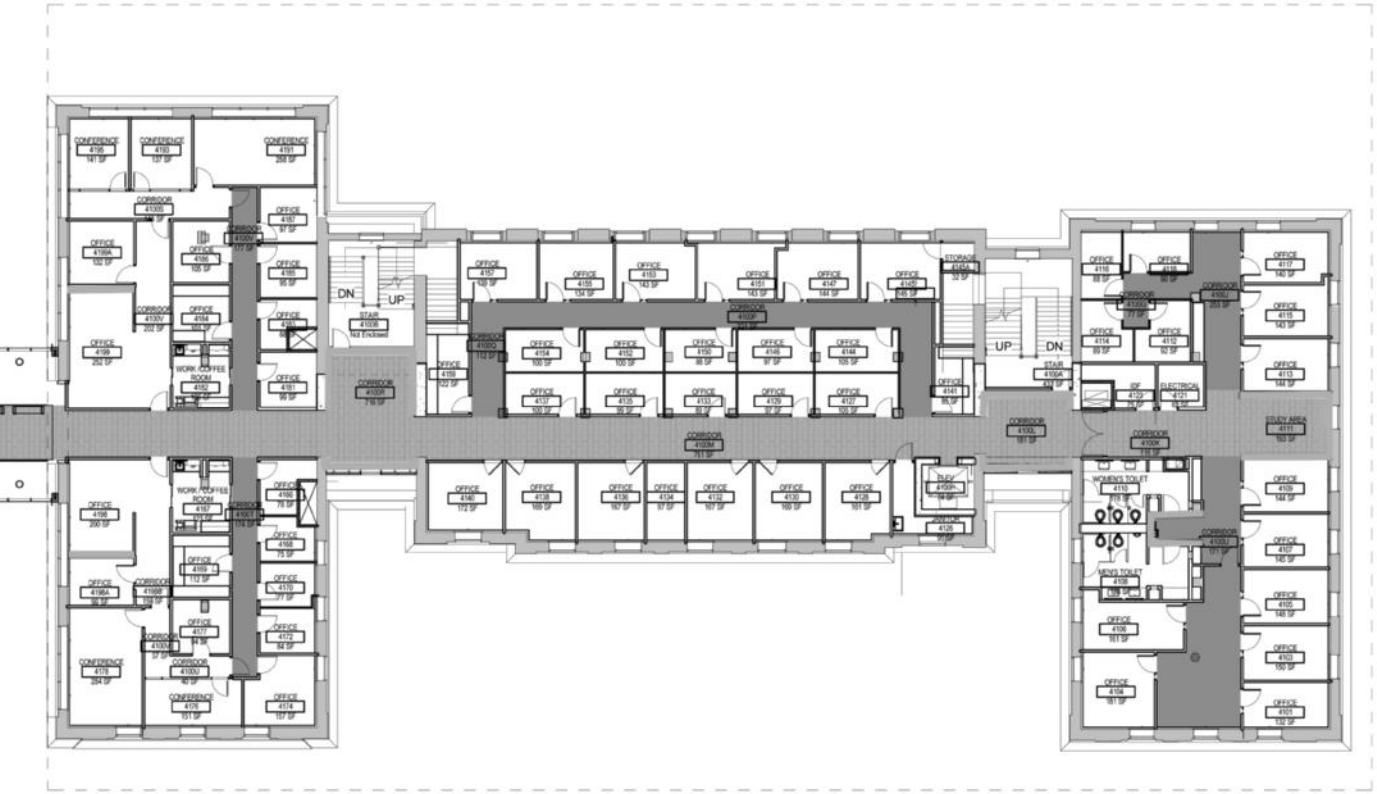
To understand the macroscale the designer has to, at first, zoom out to see the total picture. These are sometimes complex projects involving many functions and very specific requirements related to adjacencies and special relationships between the parts. Large projects can also be relatively simple, with a small set of parts that repeats many times.

Large projects begin with a master planning phase. Once decisions are made at the macrolevel, designers can concentrate on increasingly smaller units (floors, departments, zones, rooms), until they get to the microscale. An essential part of the process, however, is to work sequentially, from large to small. Even though the scales change, the basic problems at each phase are similar: accommodating parts based on given conditions, shaping them, and, ultimately, refining them.

These pages contain examples of a large hospital complex, an administrative floor of an academic building, and three floors from a stacking plan exercise for an office project. The hospital plan focuses on the main circulation system of the large facility. Along the major spine (called Main Street) are a number of cores (B, D, E, H, and K) from which users access the different hospital units, both horizontally and vertically via elevator banks at those locations.



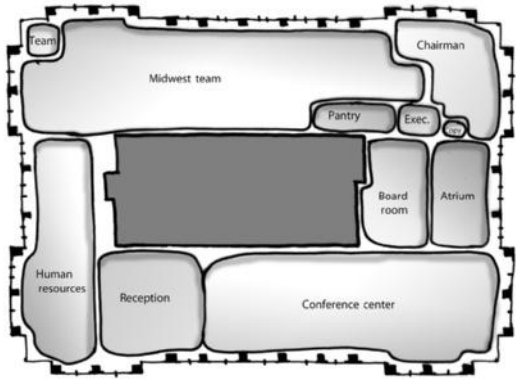
Wayfinding plan for a major hospital



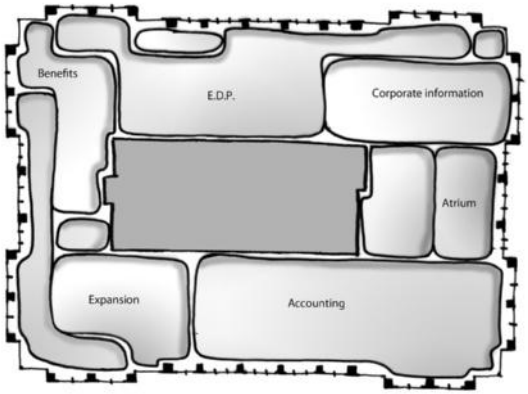
ADMINISTRATIVE HOME OF AN ACADEMIC BUILDING

The academic building on this page is made up of two adjacent structures (the original plus an addition). The main circulation is linear and direct. The floor contains a large number of small rooms (mostly private offices). These were first determined as blocks and eventually shown as rooms on the plan. As decisions were concretized, each area was studied and developed in greater detail.

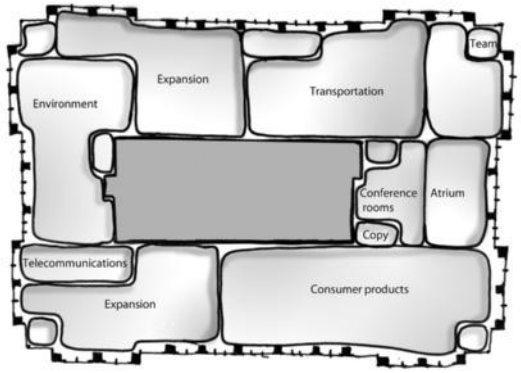
The stacking plans for a large corporate facility show three of the many floors occupied by the user. Large corporations will often occupy several floors of a multifloor building. In these cases, designers have to figure out how to allocate units, not only horizontally, within the same floor, but also vertically, from one floor to the next. That way, adjacencies are explored both within the same floor and between floors. The example is a very early study in which the gross square feet for each unit were plugged in to determine such things as how many units would fit on each floor and how many total floors would be required for the entire company.



Floor 25



Floor 24



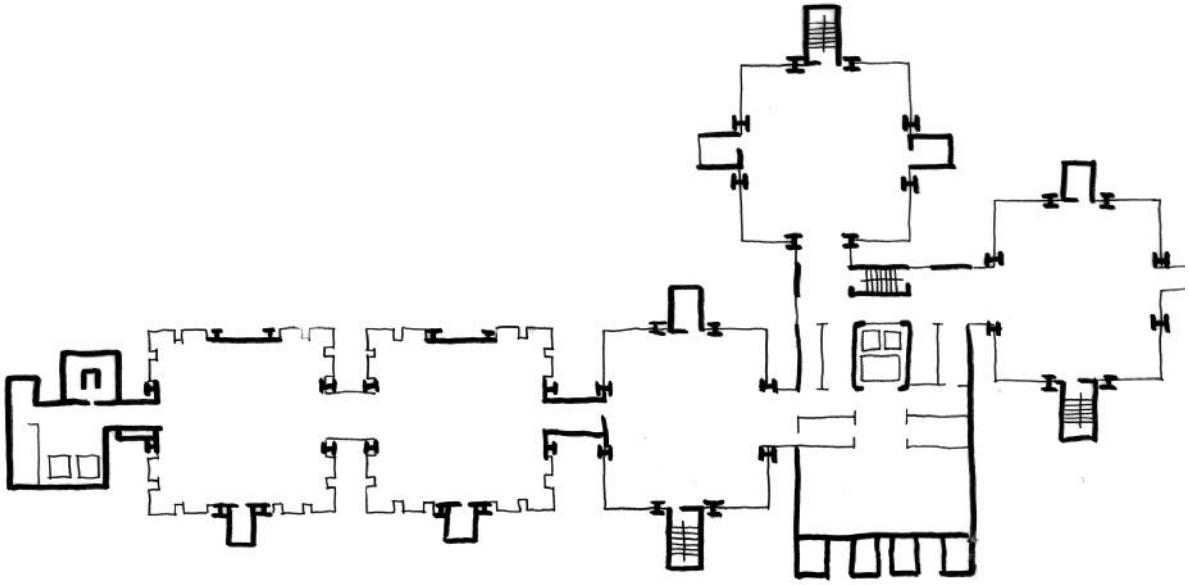
Floor 23

Stacking diagrams

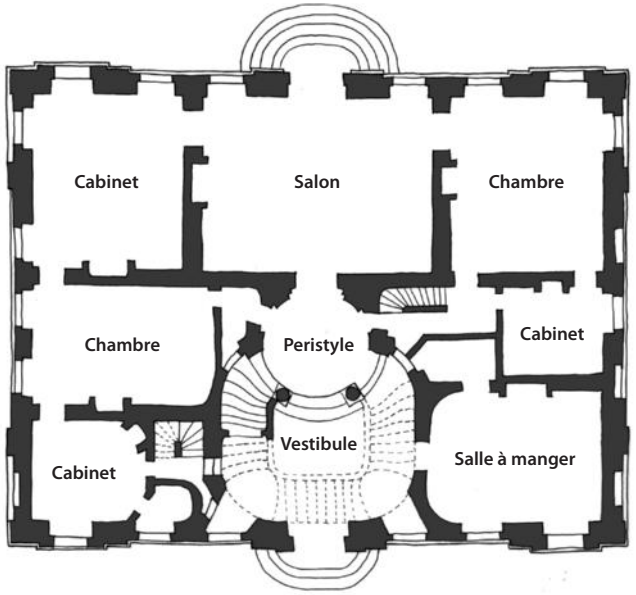
Nature of Interior Planning

The approach for interior planning in existing buildings is quite different from the planning process for new buildings. Whereas with new buildings the required spaces can have a push-pull effect and actually shape the building envelope, for most interior projects the envelope is existing and therefore not alterable. For this reason, planning interiors is more an exercise in subdividing a container into individual spaces than in adding spaces to shape the container. Think about it. You are given a certain amount of space of particular dimensions and proportions within which you must arrive at a design solution. You are also given a list of rooms and other areas that need to be arranged in the given space. Your job, then, becomes to subdivide the total footprint and assign spaces. Louis I. Kahn's Richards Medical Research Building, below left, is an example of what is possible when programmatic requirements are allowed to shape the building. In this case, the building became a series of linked square boxes extending out in linear fashion. Had the project required more spaces, the architect could have continued to add linked square boxes.

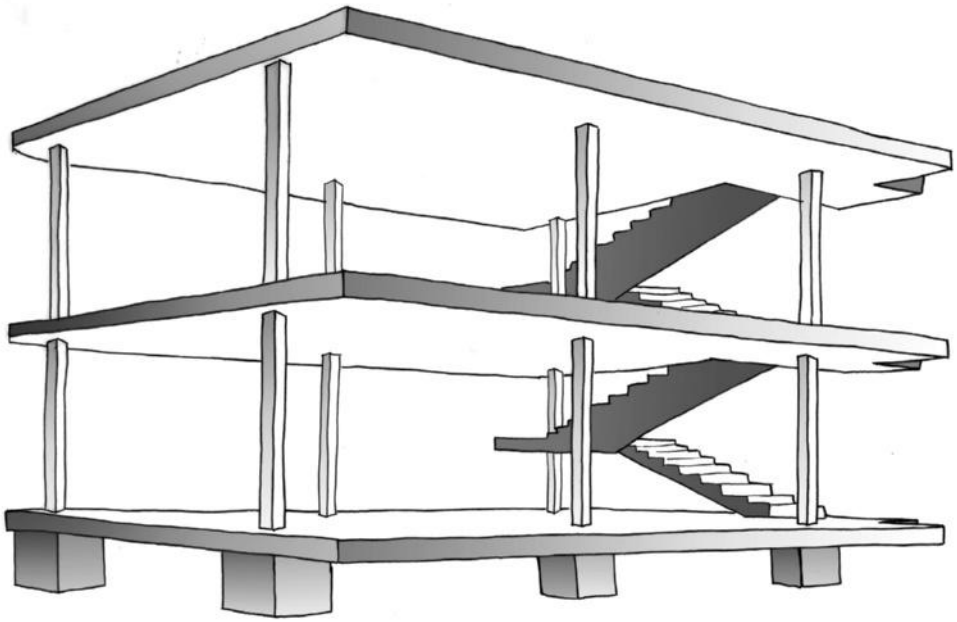
Interior projects, however, tend to be more like the one below right, a country house by Charles-Étienne Briseux, where all functions and spaces happen within a given box. The box is subdivided



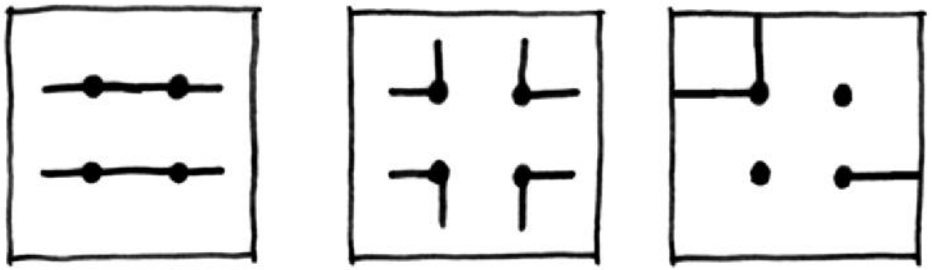
RICHARDS MEDICAL RESEARCH BUILDING, UNIVERSITY OF PENNSYLVANIA



PROJECT FOR A COUNTRY HOUSE

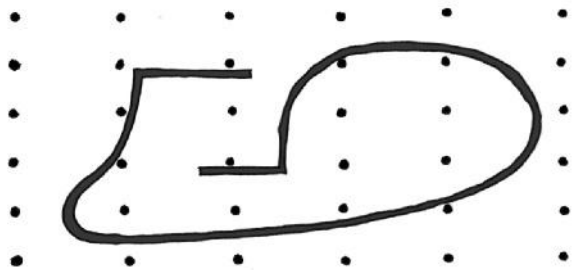


The use of columns (pilotis) facilitates and encourages the free plan.



A. **B.** **C.**

Engaging columns



Free wall around columns

as necessary to accommodate the required functions. Not all interior sites are rectangular boxes, but the principle remains the same, regardless, and so, your task becomes to subdivide and assign space.

Another important aspect of interior planning is the structural system. Because most interior projects involve existing buildings, the structural system has already been designed by others and is in place. The implications of this are enormous. This tells you that for many, if not most, interior projects, you will be dealing with nonstructural members. Your walls will not be required to support the roof above. They are free!

The various drawings on this page are diagrams with structural columns (or pilotis, as Le Corbusier, who advocated the virtues of the free plan, called them). If the existing columns are taking care of supporting the floors above and the roof, then you may work with or around them as you see fit. You may engage (meet) the columns, as some of the examples show, but you may also let your walls, partitions, and furnishings float free from the columns. The main thing to remember is this: most of your interior walls and other vertical elements are non-load-bearing; this means they have more freedom than you can imagine.

Note that the examples given are for reference and show a greater density of columns than you are likely to encounter. Also note that some project sites may not have columns—they may have load-bearing walls, which you have to respect, or other structural systems, such as long-span trusses.

Anatomy of a Space Plan

The space plan is the principal tool of the interior planner. Even the untrained person can look at one and get a sense of what goes where. A mother may point and tell her daughter that such-and-such space is her bedroom, and the child can see it. She sees the space, the desk, the bed. She may notice important adjacencies and exclaim, "Look, it's right next to the playroom!"

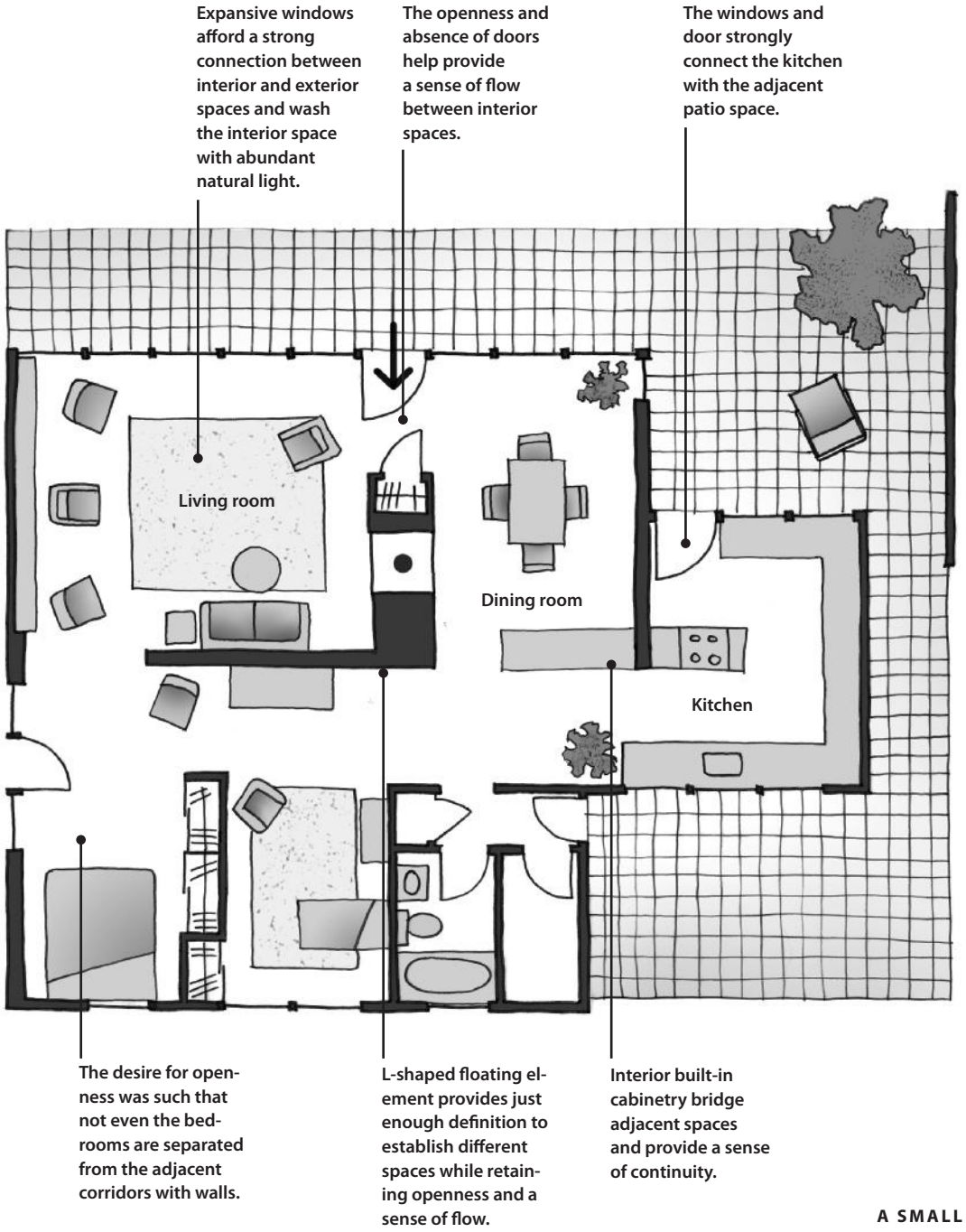
Looking at a good space plan can be very satisfying. One sees the efficiency, the flow, the correct placement of rooms. The plan may even appear easy to do. Producing a good plan is not as easy as it may seem, however; it almost always requires trial and error and many refinements before becoming a good plan.

Show people a space plan and ask them, "What do you see?" The majority will tend to speak in terms of the rooms: "Here is the kitchen, here is the dining room, and, yes, here is the living room." They may also point to the size of the rooms and complain if the bathroom seems too small or give praise if the master bedroom is "nice and spacious." What should designers see when they look at a space plan? Well, certainly more than the average, untrained person. As a designer, you should be able to identify the following:

Design elements: These include architectural elements, such as walls and doors, and nonarchitectural elements, such as furnishings and fixtures.

Spaces and rooms: These are defined by the design elements.

Relationships and locations: These describe adjacencies and geographic placement, such as the kitchen is at the center, the living and dining rooms are on the sunny side, and so on. You may also notice that a given



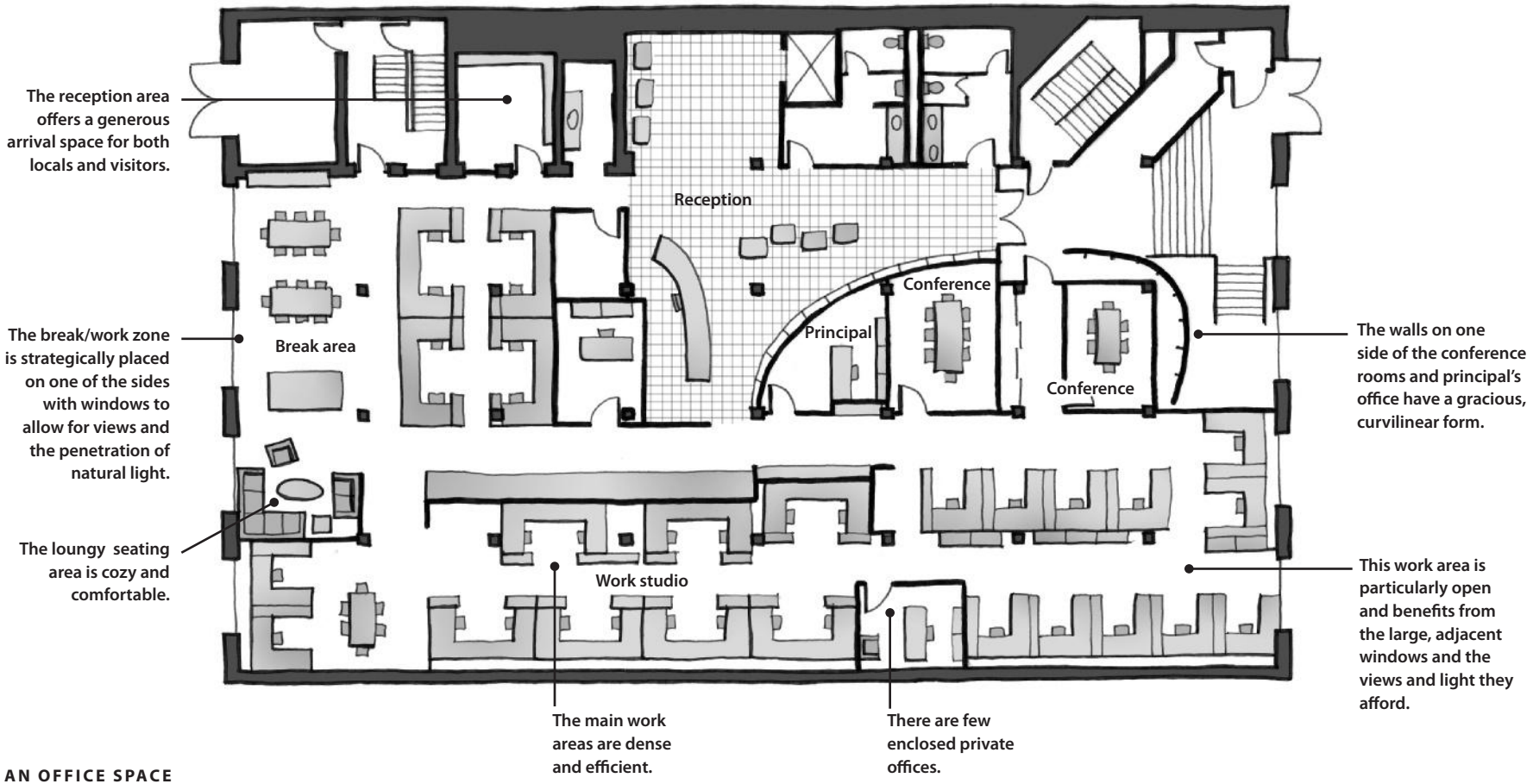
A SMALL HOUSE

space is up front and that another is all the way in the back, almost hidden.

Properties: These are concrete, observable physical characteristics. They may be described as the elongated room, the angularity of the walls, the straightness of the arrangement, or the curvature of the wall around the conference rooms.

Attributes: These are subjective qualities resulting from the design. One may talk about an open and airy feeling, the coziness or spaciousness of a room, the privacy afforded by the room in the back, the openness of a plan, or the loudness of the lobby area.

Look at the two plans shown, one of a modest two-bedroom house, and the other of an office environment. Orient yourself. See what kinds of rooms and spaces are included. Once you have a sense of the total plans and their spaces, shift your attention to the elements used. Are there many or few walls? Are there many doors? A lot of enclosed rooms? Next, pay attention to relationships. How are functions placed in relation to existing windows? What's easily accessible from the main entrance? What is in the back? Is there anything in the central area? Next, look for properties and attributes. What are some of the physical properties of the spaces? The attributes? Finally, see yourself walking through the spaces. What are the nice spots? Which spaces are public? Which spaces are private? Look at the annotations for some of the properties and attributes of these two spaces.

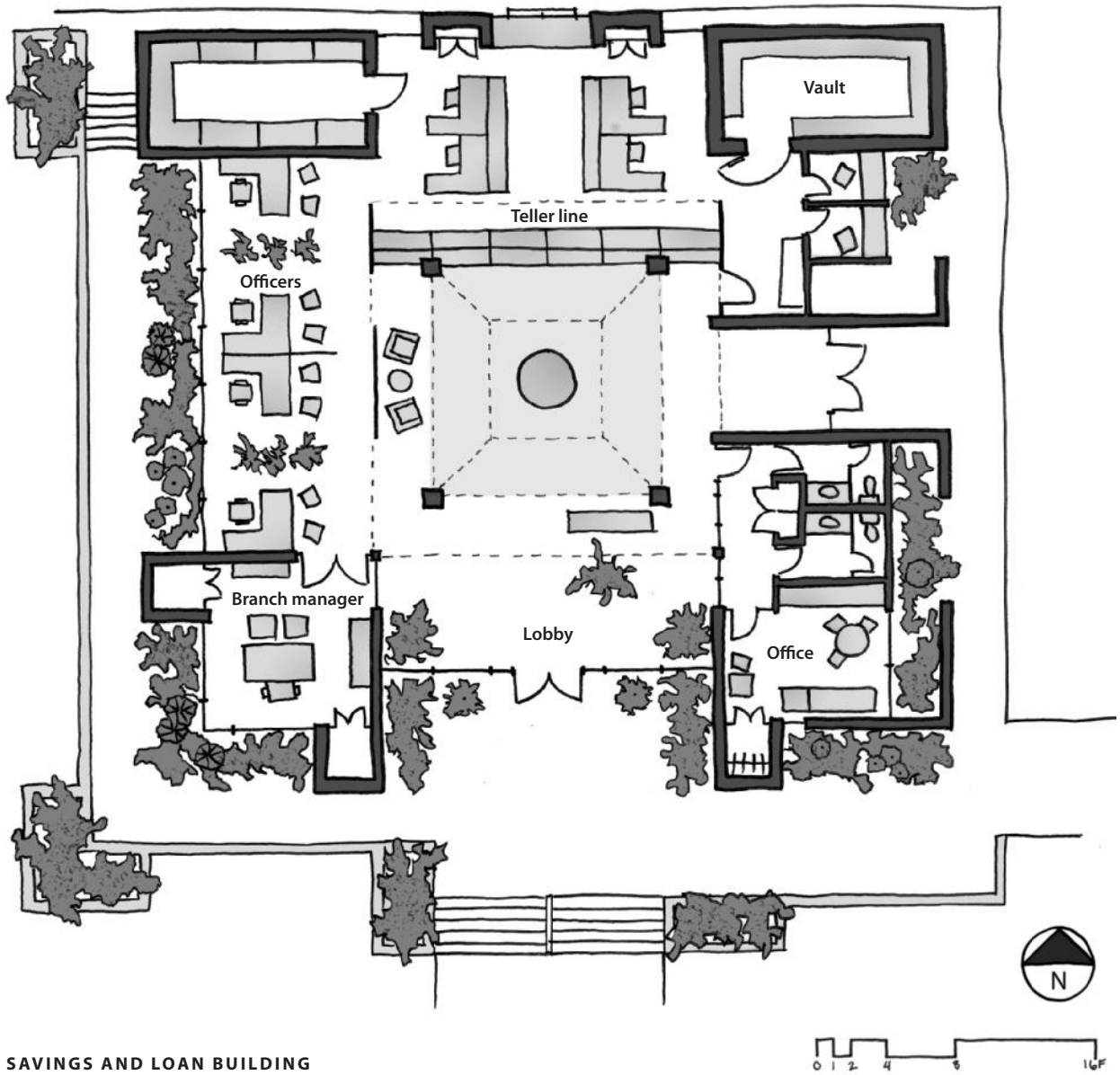


AN OFFICE SPACE

The Space Plan in Context

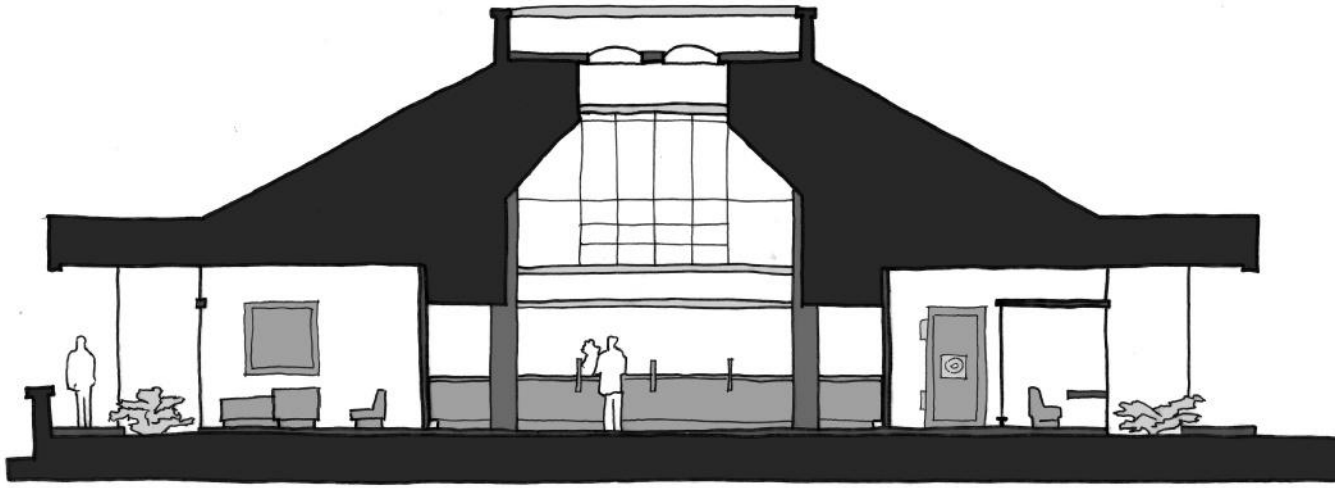
In this text we will be working almost exclusively with **space plans**. That is because the space plan is the ideal drawing for making decisions about and showing where different spaces are going, how the furniture is being placed, and so on. There is no better type of drawing for accomplishing these tasks effectively. Yet, when you plan interior spaces, what you are really designing are three-dimensional environments full of elements and qualities that floor plans can't show. A plan may show a partition, but how high is it, and what is it made of? How tall, or short, are the various spaces? Are there ceiling changes? Are there things suspended from the ceiling?

The space plan is a useful and versatile kind of drawing, but it is limited. It is a two-dimensional drawing, and it only looks down, toward the floor. When you work on design projects, both in school and beyond, you will be using the space plan and other drawings to plan, envision, and communicate a full, three-dimensional totality (see "Drawing as Design Tool," this chapter).

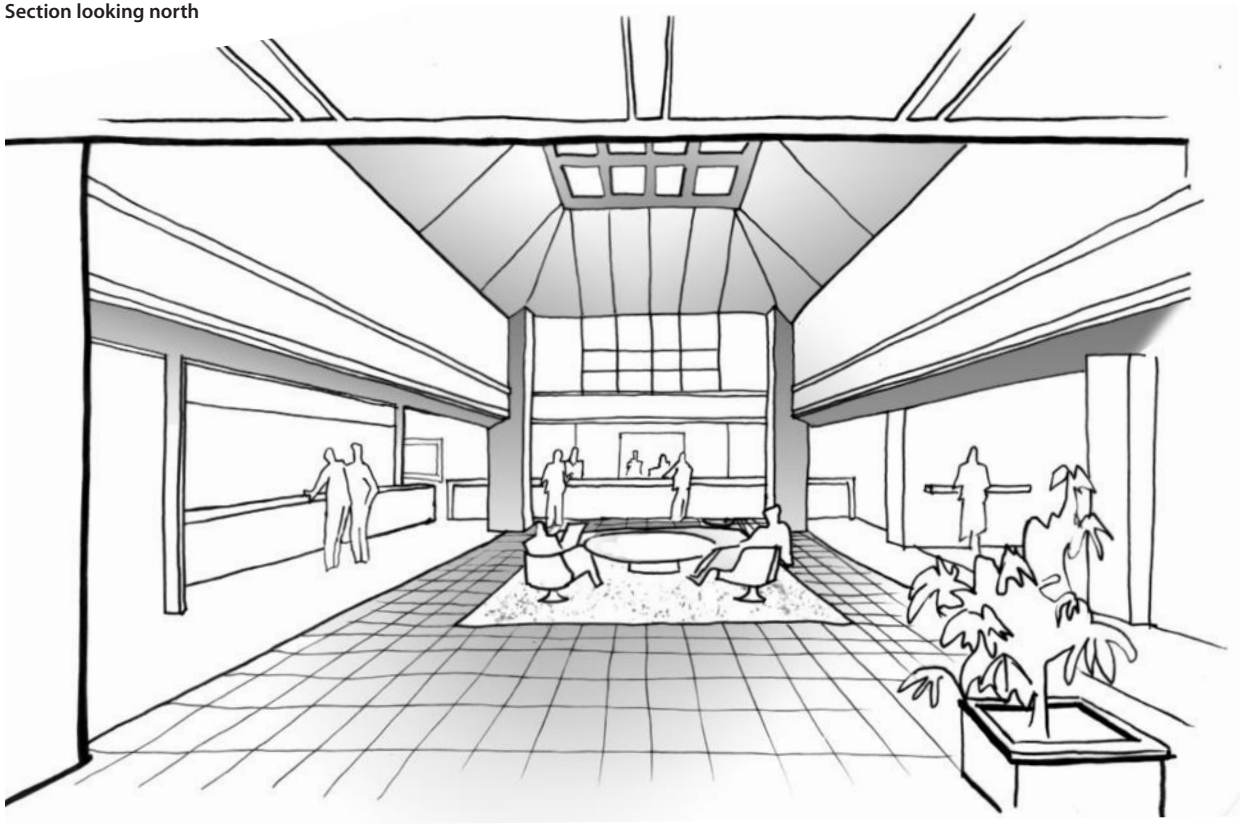


SAVINGS AND LOAN BUILDING

Presented on these pages are three drawings of the Western Savings and Loan Association, designed by Calvin C. Straub. Looking at the floor plan, one gets the basic idea of a banking lobby at the center and four solid masses at the four corners housing various required functions. One also sees the distribution of space, the placement of desks, and so on, all of it informative and helpful. The convention of showing the location of major overhead elements dashed on the plan, when used, helps to communicate that there is something of importance happening overhead. The space plan on the preceding page shows dashed lines at the center of the plan indicating the presence of architectural elements above. However, one doesn't begin to fully understand the three-dimensional presence of the space until one sees other drawings, such as the **cross-section** and the **perspective drawings** shown on this page. One would otherwise never know about the articulation of the ceiling planes, the height of the various spaces, or the configuration of the skylights above. As a designer, you need to be aware of the three-dimensional totality you are creating and to remember that it takes several types of drawings carefully coordinated to achieve this. While our emphasis is on plans and plan diagrams, you have to be thinking three-dimensionally as you design.



Section looking north



Perspective view

Drawing as Design Tool

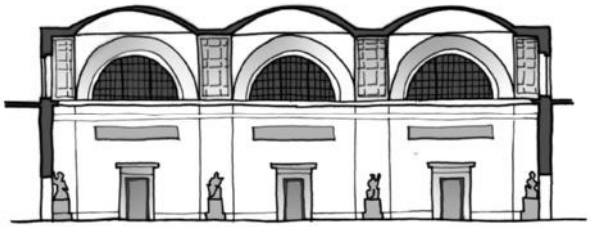
The drawing is the language of the designer. It is through drawings that the designer forms and communicates design ideas. By now, you know that the floor plan is the principal drawing you will use to plan interior spaces. You also know that the plan, without other, complementary drawings, will not help you conceive and communicate total three-dimensional environments. Additional drawings you will need to explore and communicate design ideas are interior elevations, building sections, axonometrics, and perspectives.

In these pages I present a few common drawing types you will need to use in order to explore and communicate design ideas fully. They are the architectural floor plan, the furniture plan (or space plan), the section/elevation, and the versatile three-dimensional axonometric. Use these, as well as perspectives, to get a total sense of your design creations.

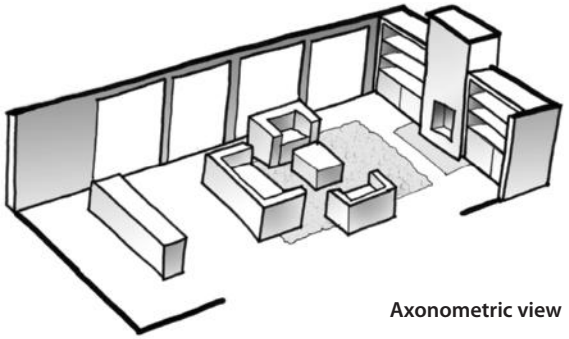
Your plans, elevations, sections, and axonometrics must be drawn to scale using an architectural scale like the one shown on the following page. Make a habit of indicating the scale of drawings under the drawings (usually below the drawing title). If the drawing will be reduced or enlarged, include a graphic scale that will shrink or grow at the same rate as the plan. Refer to the examples on the next page.

All elements, including architectural elements and furnishings, fixtures, and equipment, need to be drawn to scale. This will ensure that the various parts of the drawings have all been reduced the same way proportionally.

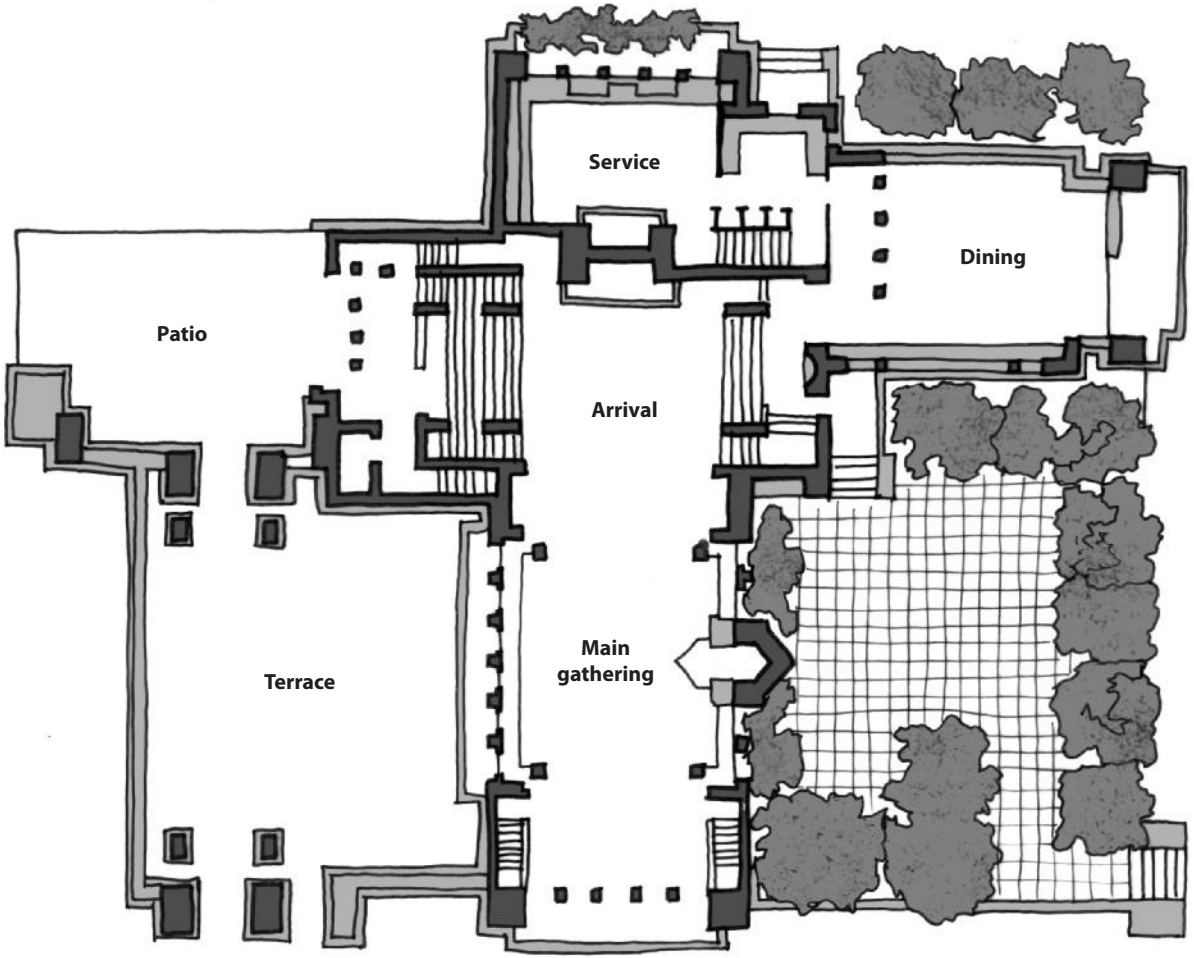
{Additionally, always know and indicate which way your building is oriented related to the cardinal points. To that end, make a habit of including a north arrow with your plans in order to illustrate which way your site is facing. Some examples are shown on the next page.



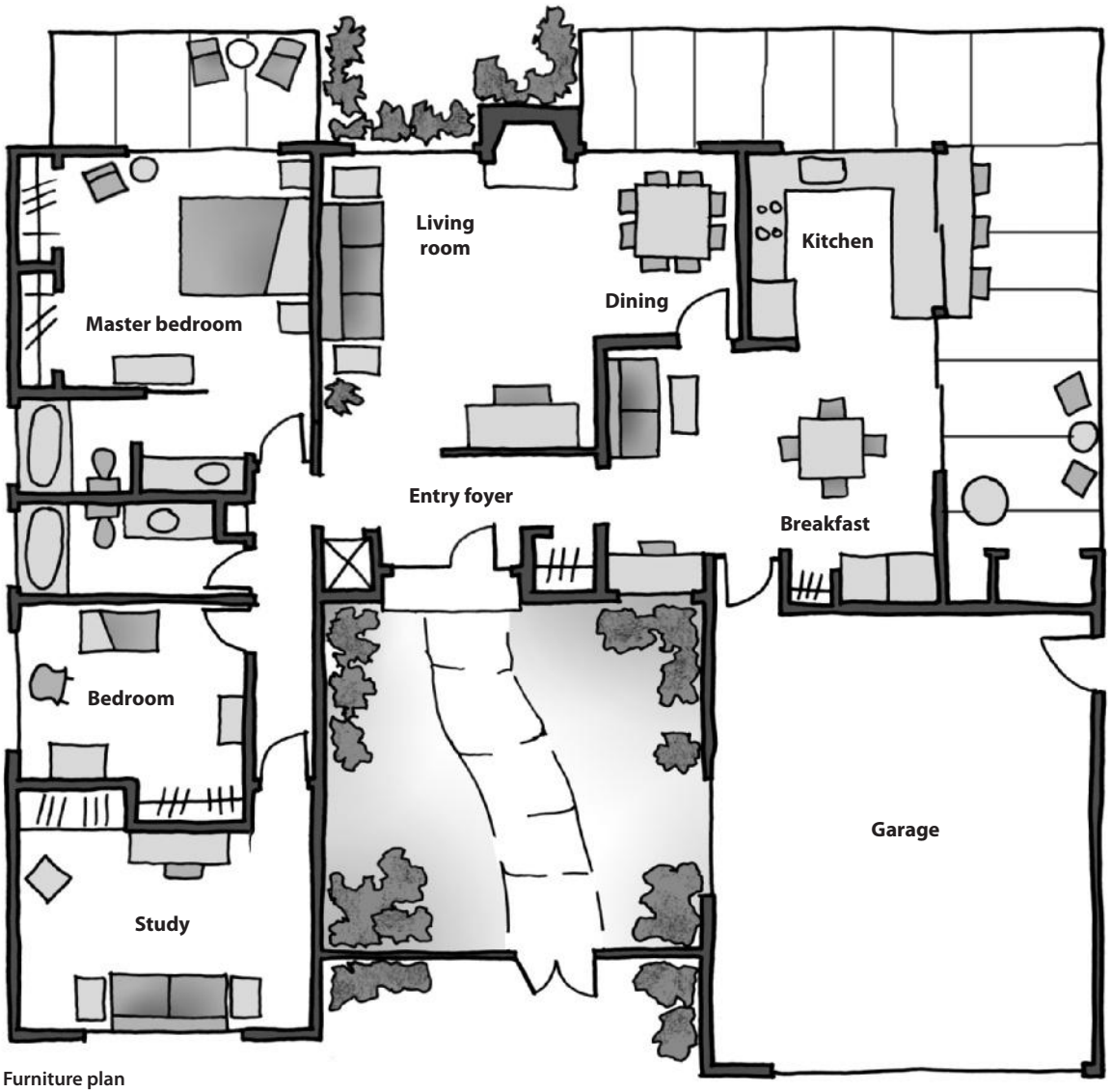
Section/Elevation



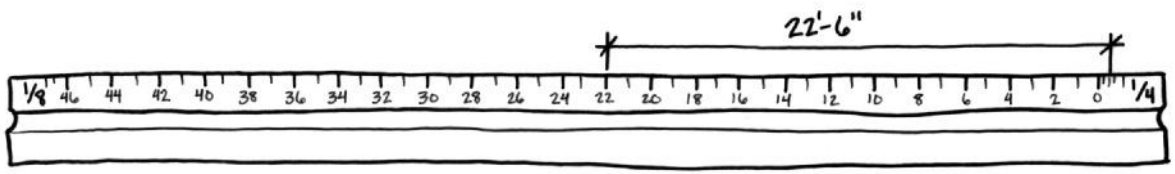
Axonometric view



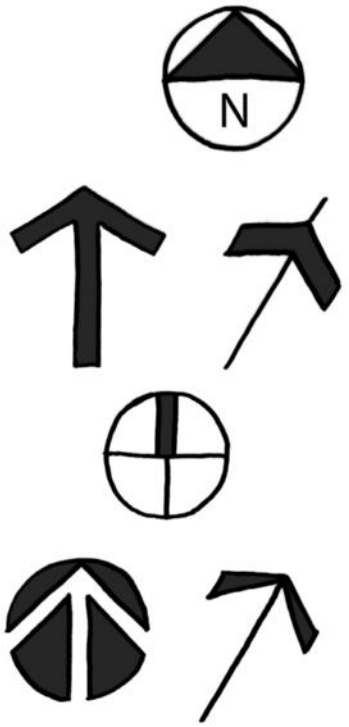
Architectural floor plan



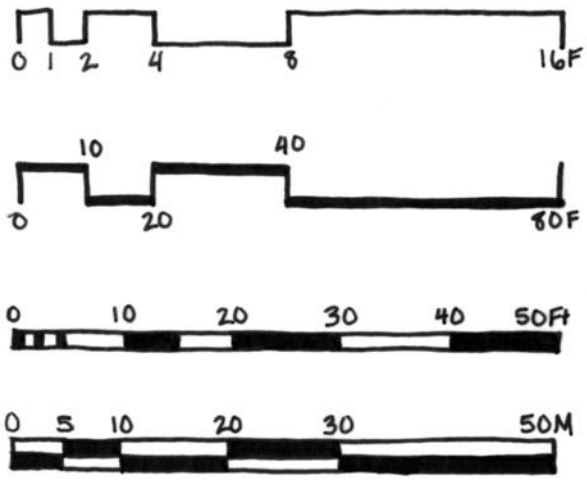
Furniture plan



Architectural scale



North arrows



Graphic scale

Diagramming as Design Tool

Often dismissed by the inexperienced designer as unnecessary doodles required by instructors, diagrams are one of the best tools of the interior space planner. Diagrams allow designers to make sense of information efficiently without much time investment. They are great for showing relationships between parts and their spatial arrangements. It is possible to plan much of an interior project with the proper doodles and diagrams. Obviously, one follows the diagrams with actual plans that are more carefully drawn and that convey the solution more formally. Yet, it is possible to have most aspects of the planning worked out just through the use of diagrams.

Look at the diagrams on these pages. Diagrams 1 and 2 show relationships between parts of a project. Diagram 2 conveys a sense of hierarchy, making clear that spaces A, B, C, and D are the most important. One can also see that the relationships (and desired levels of connection) of A with B, C, and D are particularly significant. Diagram 3 begins to allocate bubble-shaped spaces and circulation routes in specific locations on the plan. It makes note of required buffer elements, screens, and desirable views. The spaces in Diagram 4 are more blocky and less like bubbles. The arrangement starts to look like a floor plan. Finally, Diagram 5 is one step short of becoming a floor plan. Although loose and schematic, it does a pretty good job of communicating the solution in plan. (Design process diagrams and diagramming will be addressed in more detail in Chapter 3.)

Relationship Diagrams

Simple diagrams can effectively convey relationships between parts, and relationships to views and traffic patterns, effectively and efficiently. Even without any explanation you can get a pretty good idea about what these various diagrams are trying to convey.

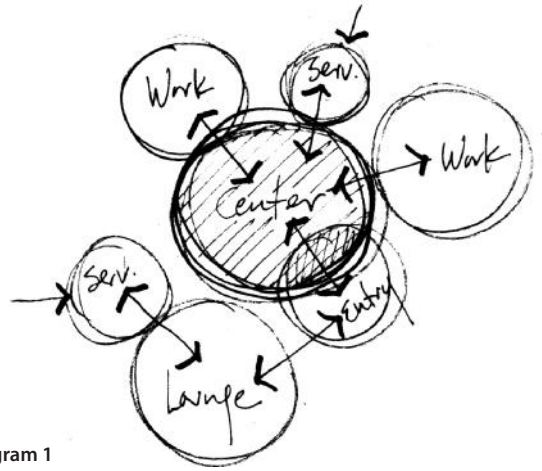


Diagram 1

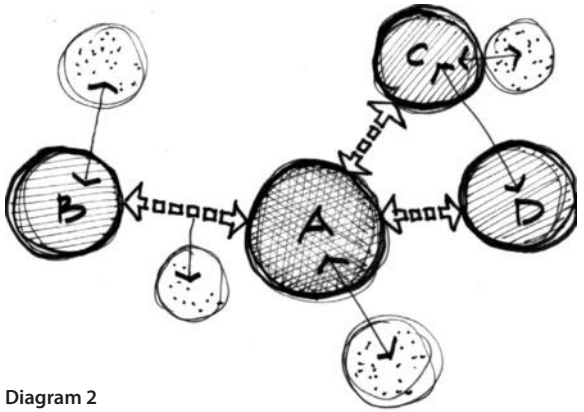


Diagram 2

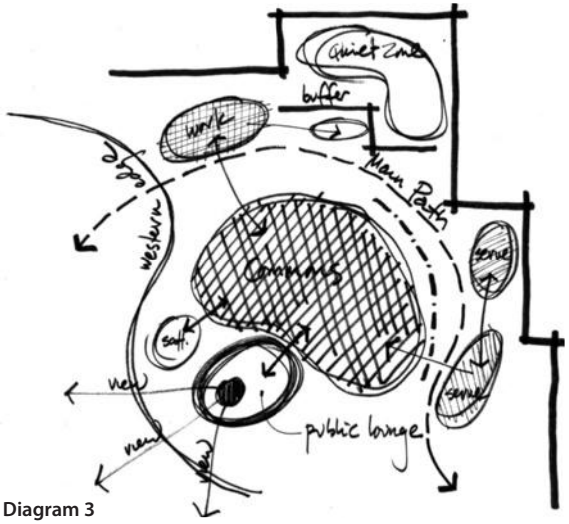


Diagram 3

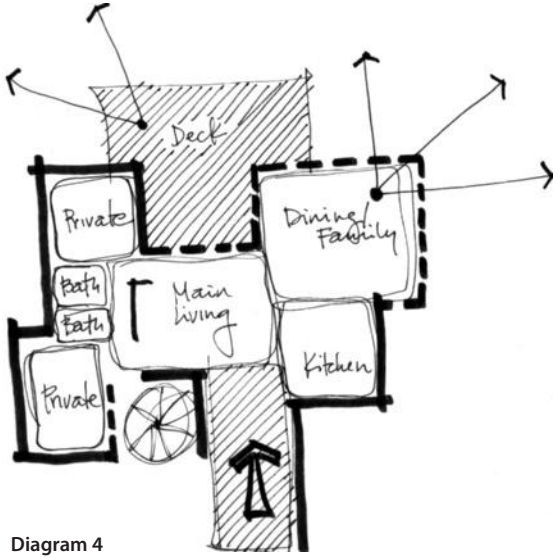
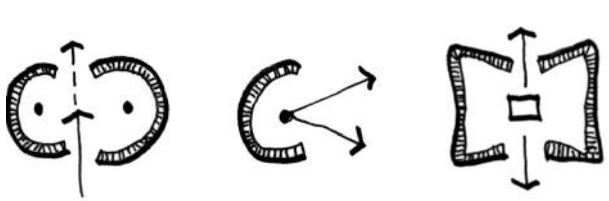


Diagram 4

Adjacency Diagrams



A. B. C. D. E.

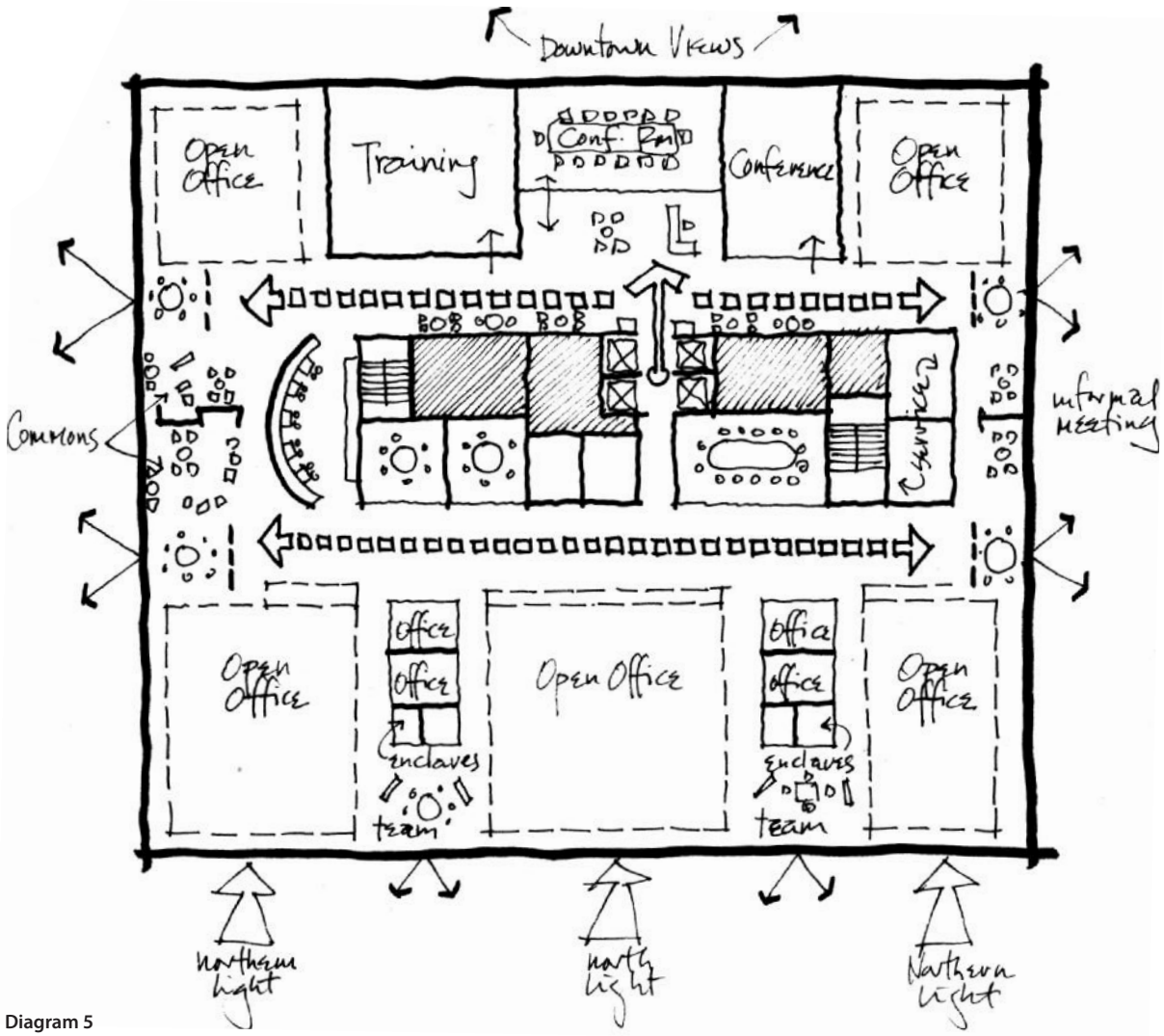
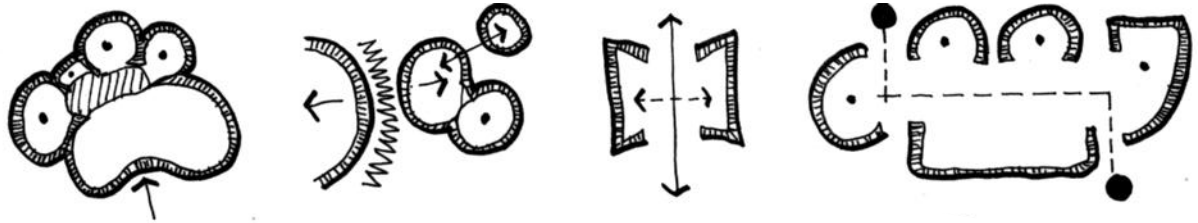


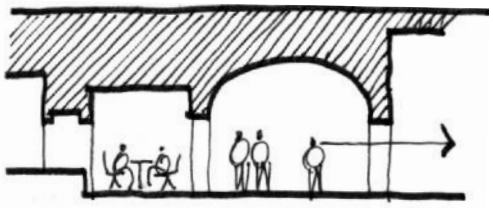
Diagram 5



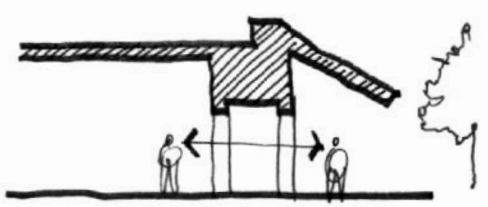
F. G. H. I.

Section Diagrams

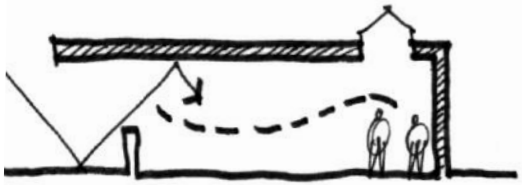
Section diagrams are great for exploring and communicating ideas related to levels, heights, edge conditions, relationships between adjacent spaces, and relationships between inside and outside.



1. Spatial transitions

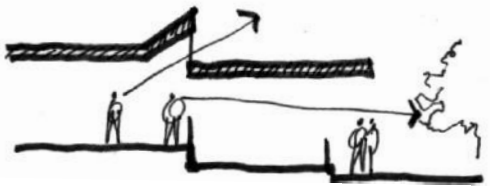


2. Inside and outside



3. Natural lighting

4. Air flow



5. Views and vistas

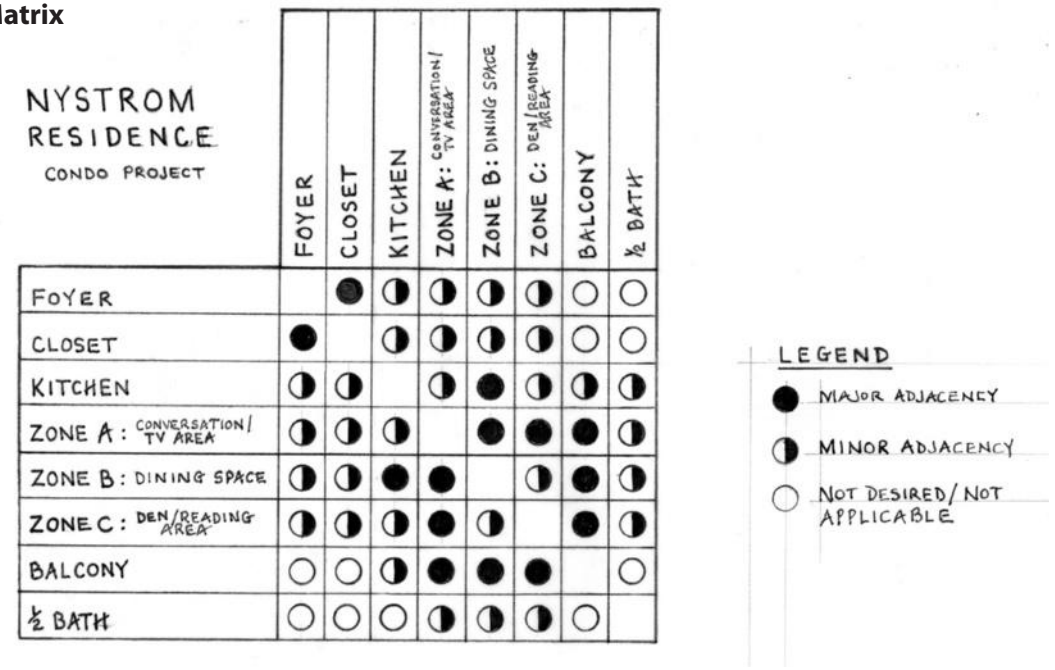
Space Planning: Basics

The process of space planning entails a number of sequential steps that result in tangible outputs. Normally you are asked to accommodate a number of functions in a given (usually existing) space. Your job is to find a good, logical spot for every functional area in the program. The ideal location for some of the functions can be fairly straightforward. For instance, the entry foyer of a house or the reception room of a doctor's office both want to be up front, by the entrance door; the loading dock of a facility wants to be by the service alley; and so on. Not every destination is as straightforward. You'll find that some of them could occur in a number of different locations. Furthermore, once you place a certain room in a given location, it is likely that certain other rooms or zones will want to be in close proximity, so you have to make sure there is space to accommodate them accordingly.

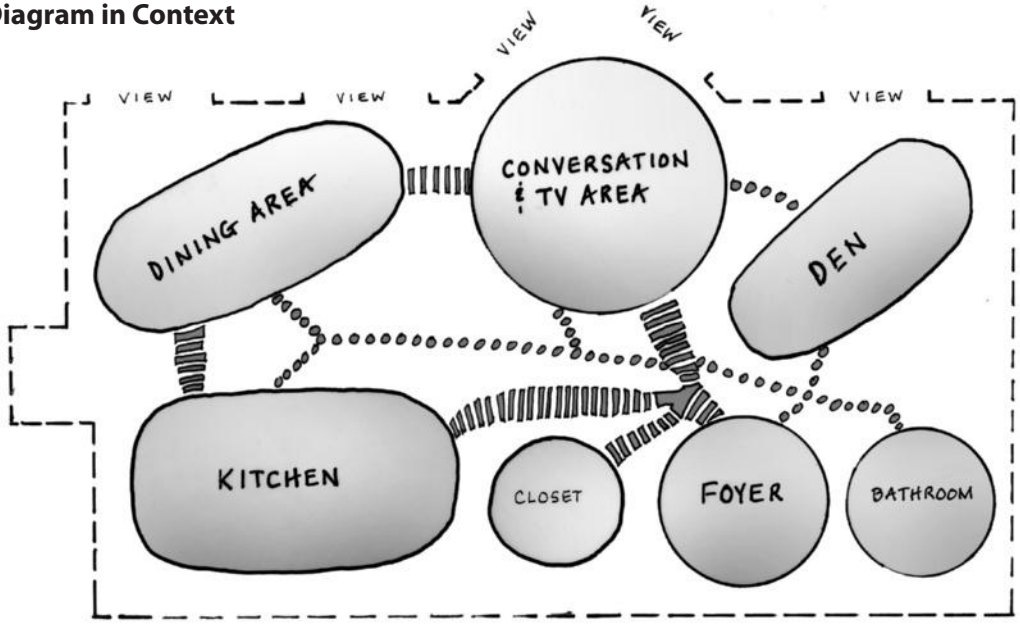
These few process drawings from a simple residential project introduce some of the steps and drawings you will be using when space planning. On this page you see a matrix diagram that is used to record the desired relationships between the spaces of the project and helps you determine what function should be next to which other function. Also on this page is a bubble diagram showing the various spaces plotted within the allocated space of the house. Normally you will do a few of these and try out different configurations.

Eventually these start evolving into actual floor plans, as shown on the next page. These are preliminary at first and eventually get refined until they are fully resolved. The refined version shows final location and configuration for each zone (including all the furniture) and starts to show more detailed features such as the floor materials.

Adjacency Matrix

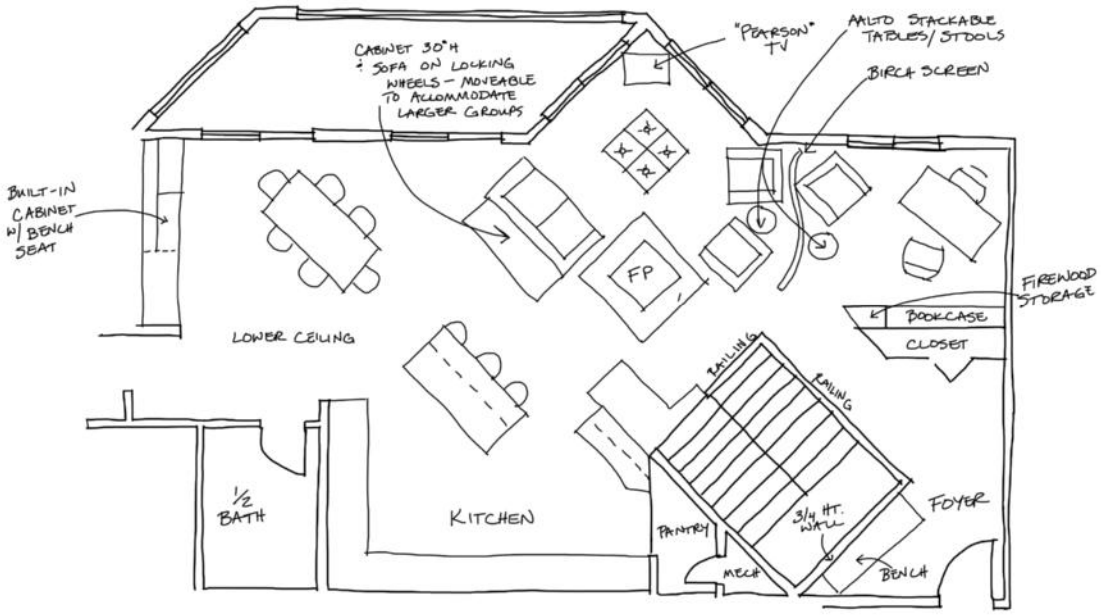


Bubble Diagram in Context



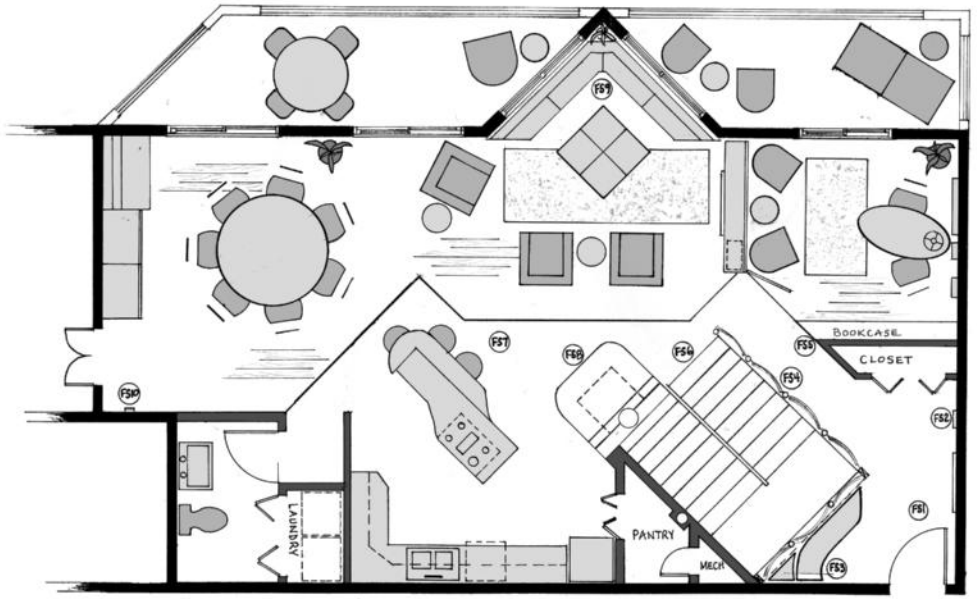
Early Loose Plan

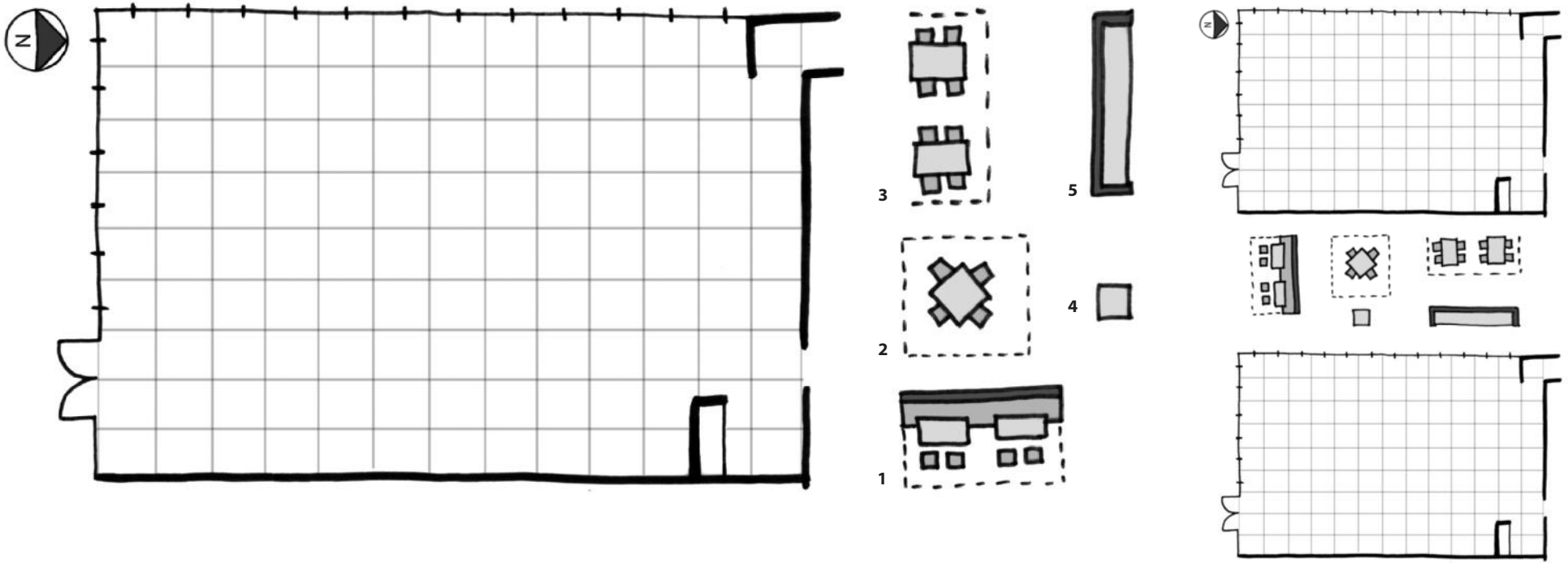
As you start translating bubbles to actual design elements and furnishings, you find that they take on a life of their own. What used to be a bubble for the dining area must now turn into a dining table, a china cabinet, and so on. What size and shape should the table be? Where exactly should it go? How should it be oriented? The same goes for the seating areas and all other parts. What if something doesn't work where you had it in your diagram? Maybe it doesn't fit or maybe it just doesn't feel right. The real search begins. On this first preliminary plan you notice specific attempts to furnish the dining, conversation, and den spaces in the desired locations. You also notice that the placement of the bathroom, kitchen, and storage closet have shifted, and that is fine.



Developed Plan

The developed plan shows how the designer arrived at different furniture configuration in the dining, conversation, and den spaces. You can also see greater development and refinement of the bathroom, kitchen, and foyer areas as well as floor material delineation. Things gain refinement and precision as the design is developed. No design works fully well on the first attempt.





Solving Design Problems I

Let's go ahead and practice planning some spaces. These will be guided exercises, so you'll be given tips and hints to help you along the way. The templates are shown at large and small scales. The two small ones are for doodling and practice. The large one is for your final solution. They all have a 4′ × 4′ (122 cm × 122 cm) grid overlay to give you a general sense of scale.

Don't think too hard. Try to work quickly and have some fun. Don't try to show how creative you are. Save that for later. Strive, for now, for a straightforward and utilitarian solution. The required furnishings and other elements are included to scale on the side for your reference and use. If you draw your furnishings at that same size, you will be working at the correct scale.

EXERCISE 1: A RESTAURANT

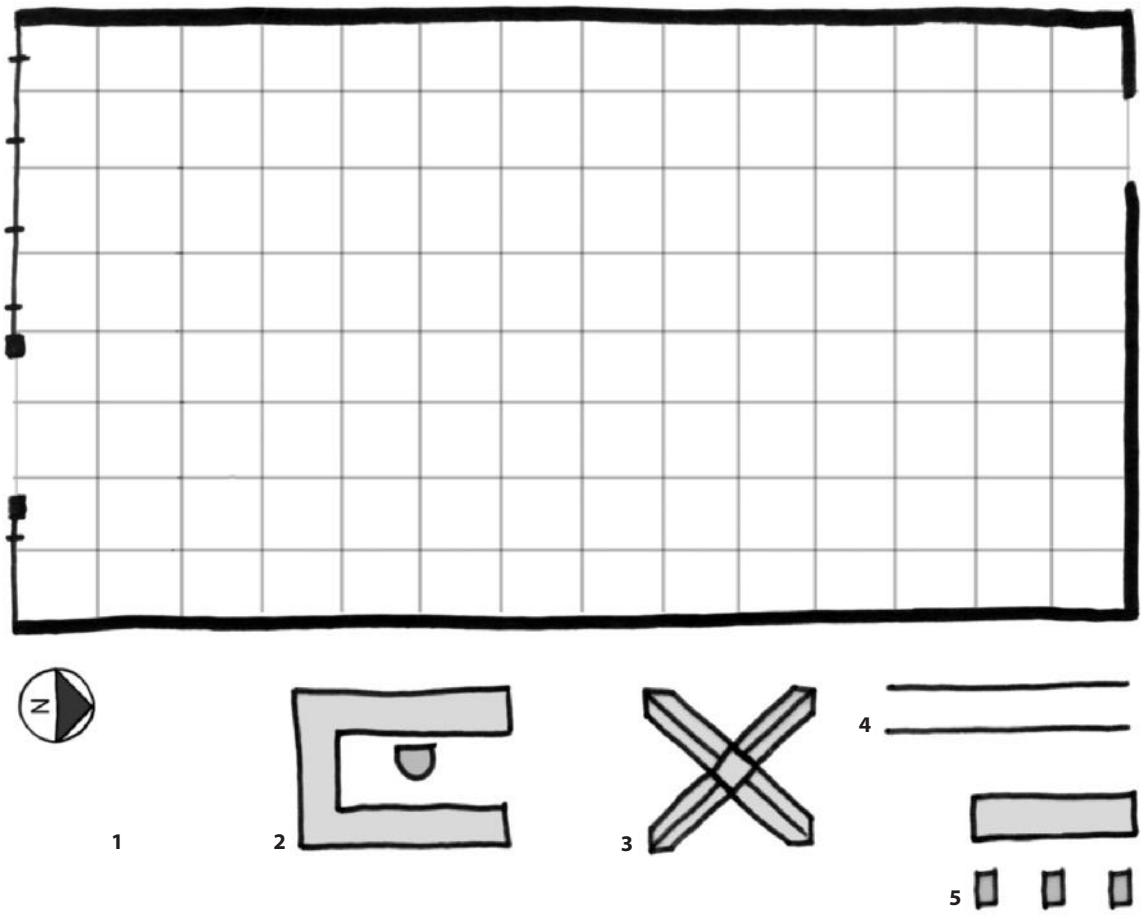
The long dimension of the space is oriented south to north. North is to the right. A corridor on the northwest corner leads to the restrooms. An opening on the northeast side leads back to the kitchen. In that same corner there is an existing small waiter station. The entrance is through the double doors on the south wall. There are nice rows of windows going almost all the way down to the floor on the south and west sides.

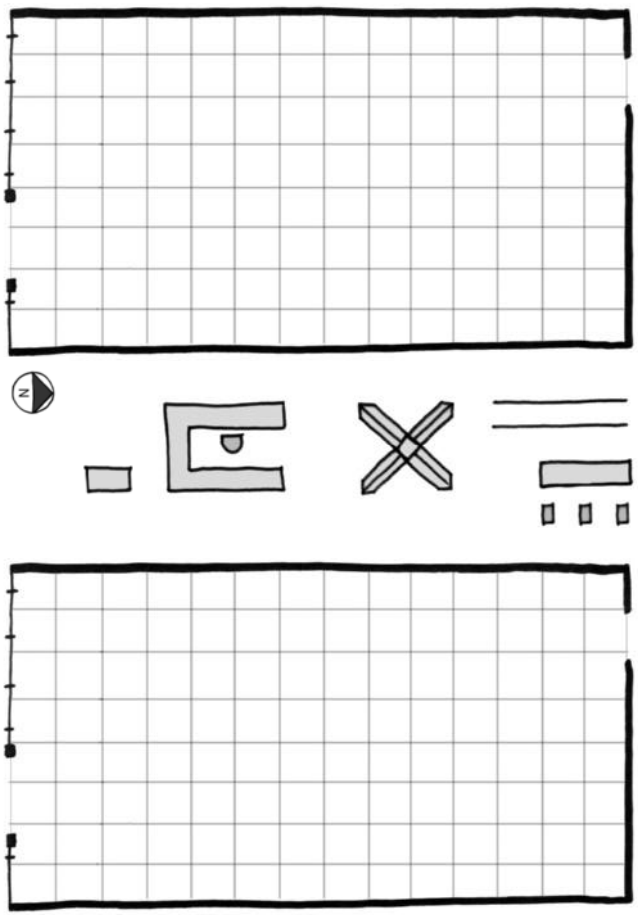
You are given five elements to use in your design:

1. is banquette seating (two tables are shown, but you can make the area longer).
2. is a typical square table placed at a 458 angle and shows the required clearances around the table (you may group several of these by butting the dashed squares next to each other).
3. shows a pair of individual tables for four with required clearances for placement against a wall or in the open.
4. shows the size of the host station up front.
5. shows a waitstaff station with a partial-height wall and a counter on the back side.

Accommodate the following:

- Three or four tables for four along the south wall
- Thirteen tables for four, in any combination of straight and angled versions
- Eight banquette seating tables along one of the walls
- The waitstaff station floating toward the back of the space, close to the kitchen
- The host station and a small bench (not shown) up front by the entrance doors





EXERCISE 2: A SHOE STORE

The floor template consists of a long space oriented along the north–south axis. North is to the right. The walls along the east, west, and north sides are solid. Only the south wall, facing the exterior, has glass. The entrance is through the opening on the south wall. The rear opening goes to the warehouse area in the back.

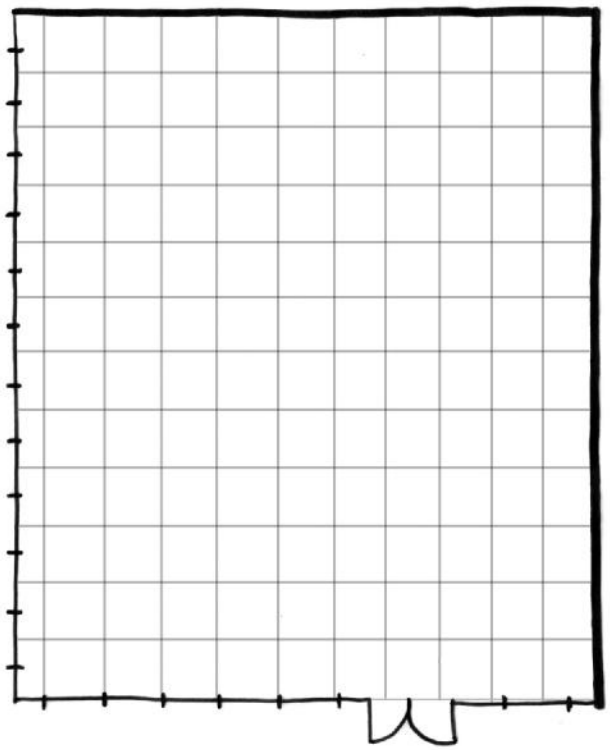
You are given five elements to use in your design:

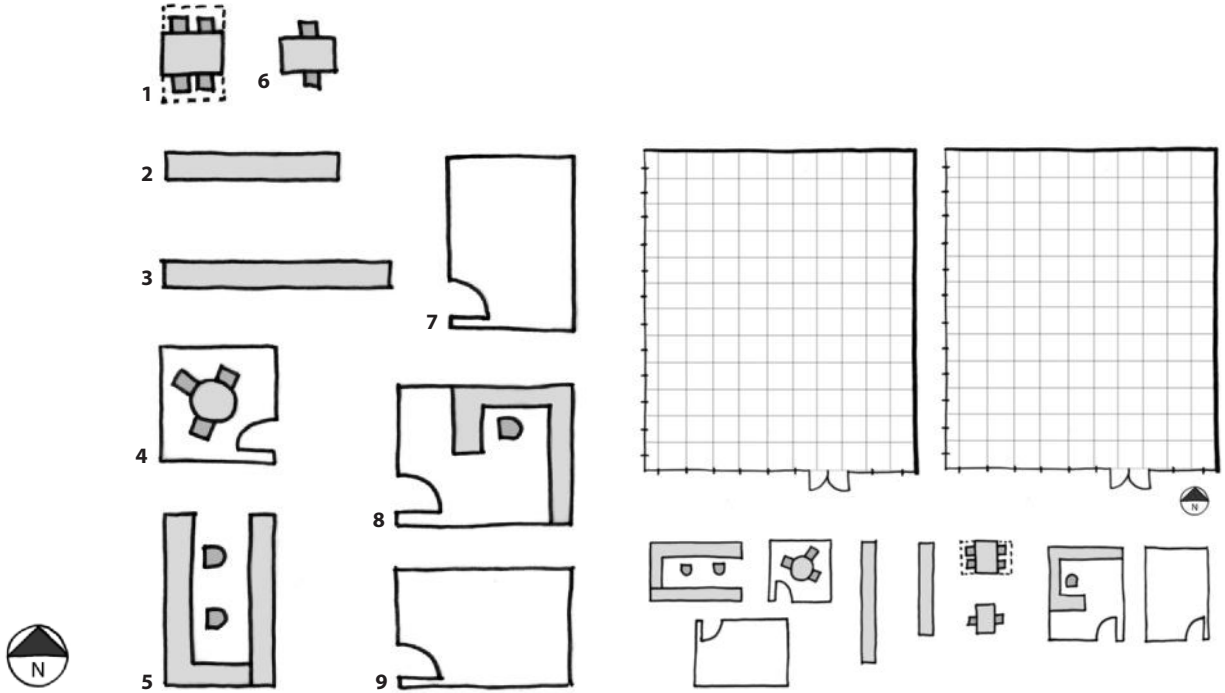
1. is a display table to show shoes.
2. is the cash wrap.
3. is an X-shaped display fixture to show shoes.
4. is the depth dimension for the display cabinets/fixtures to be used along the sidewalls and also the depth dimension for the storefront displays by the front windows.
5. is a shoe bench with three shoe try-on stools.

Accommodate the following:

- Storefront zones along the front windows
- Three of the large X-shaped display units
- Four display tables
- One shoe bench with try-on stools
- One cash wrap
- As much linear footage as possible of the side display cabinets/fixtures along the two long walls

Have fun!





Solving Design Problems II

Now, plan two more spaces. Again, these will be guided exercises, with the templates shown at large and small scales. The two small ones are for doodling and practice. The large one is for your final solution. They all have a 4′ × 4′ (122 cm × 122 cm) grid overlay to give you a general sense of scale.

As with the previous exercises, try not to think too hard. Work quickly, and have fun. Don't get too expressive. Keep it simple. Strive for straightforward and utilitarian solutions. The required furnishings and other elements are included once again beside the template. They are to scale, so copy them at that same size, and you will be working at the correct scale.

EXERCISE 1: A LIBRARY

The floor template is a rectangular space, with the long side along the north–south axis. North is up. The entrance/exit is on the south wall. There are generous glass windows along the south and west walls with window treatments that will control any potential glare problems.

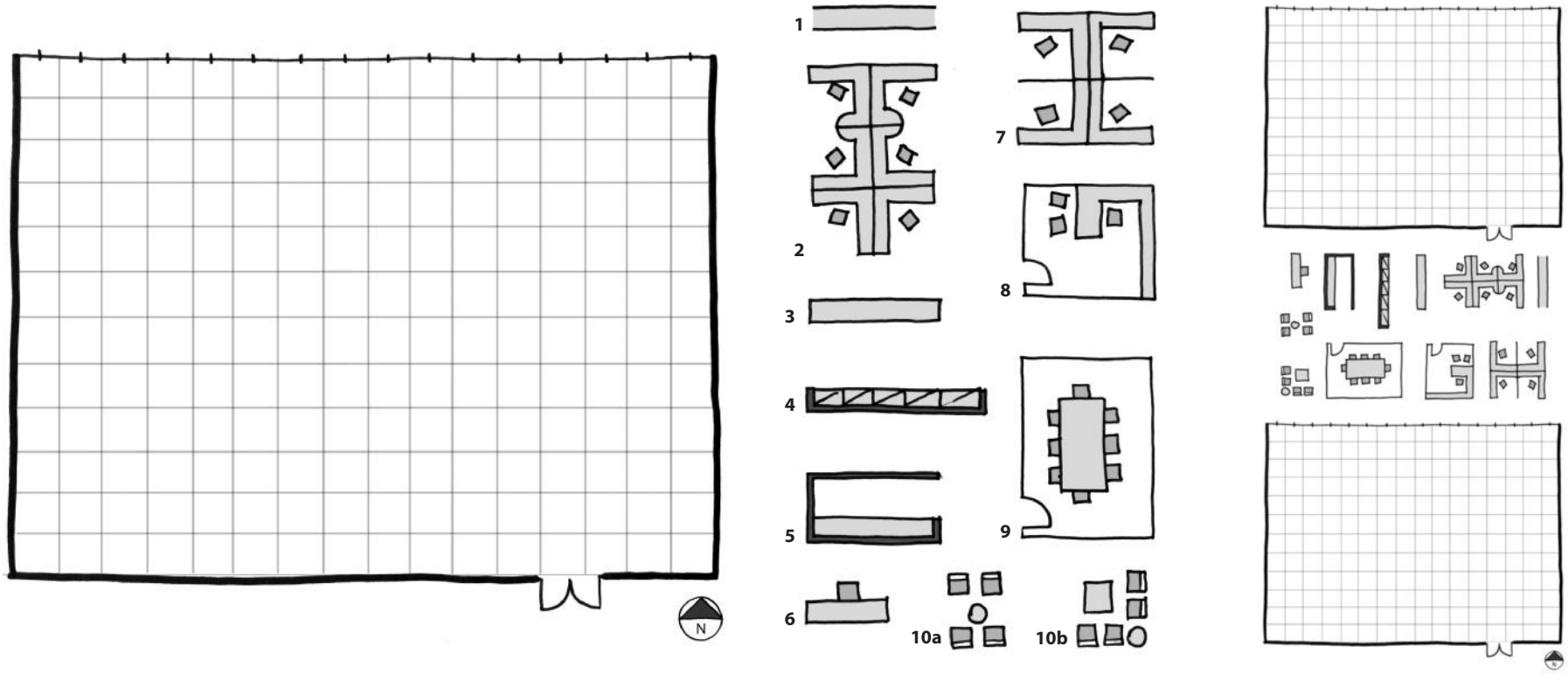
You are given nine elements to use on your design:

1. is a table for four people.
2. is a short library shelving unit (two sided).
3. is a long library shelving unit (two sided).
4. is a small meeting room.
5. is the librarian's station/counter.
6. is a two-person, back-to-back carrel.
7. is a medium-size meeting room.
8. is the librarian's office.
9. is a storage room.

7, **8**, and **9** are the same size. You may change the orientation of rooms and the location of doors.

Accommodate the following:

- Three small meeting rooms
- One medium-size meeting room
- One librarian's office
- One storage room
- One librarian's station/counter (close to the entrance/exit doors)
- Four two-person carrels
- Two four-person tables
- Two to three long shelving units
- Three to four short shelving units



EXERCISE 2: AN OFFICE

The floor template is a rectangular space, with the long side along the east–west axis. North is up. There are solid walls on the east, south, and west sides. The north wall is fully glazed. The entrance/exit is through the double doors on the south wall and leads to a public corridor system. You may need a second exit to the corridor at the other end of the south wall.

You are given ten elements to use in your design:

1. is the depth of a countertop with files underneath to be used as much as possible along solid walls.
2. is a typical cluster of six workstations.
3. is a countertop (standing height) with files underneath, floating or dividing space.
4. is a partial-height wall approximately 6′ (182 cm) high with files on one side.
5. is a long, narrow coffee/copy area (the access can be from either side).
6. is the reception desk.
7. is a typical cluster of four workstations.
8. is a private office.
9. is a conference room.
10a and **10b** are two options for the waiting area.

Accommodate the following:

- One reception area close to the entry doors with the reception desk and a waiting area
- One conference room not too far from the reception area
- One coffee/copy room convenient to the conference room
- One private office for the president (must be by a window)
- One or more space dividers (element number 4) as long as necessary to provide privacy to the work areas
- Workstations for twenty-two employees
- Floating countertops with files underneath (element number 3) to divide sections and provide storage (number and length at your discretion)
- Countertop with files underneath along solid bounding walls (as much as feasible)
- A second exit (swinging out) to the far west of the south wall

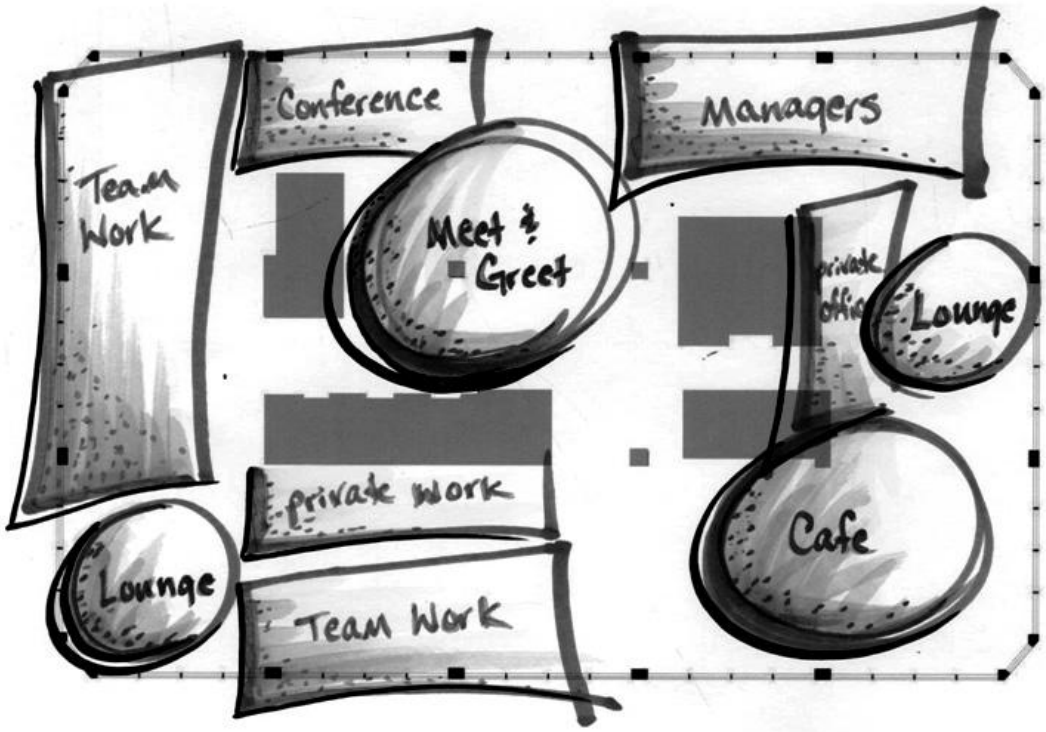
Enjoy!

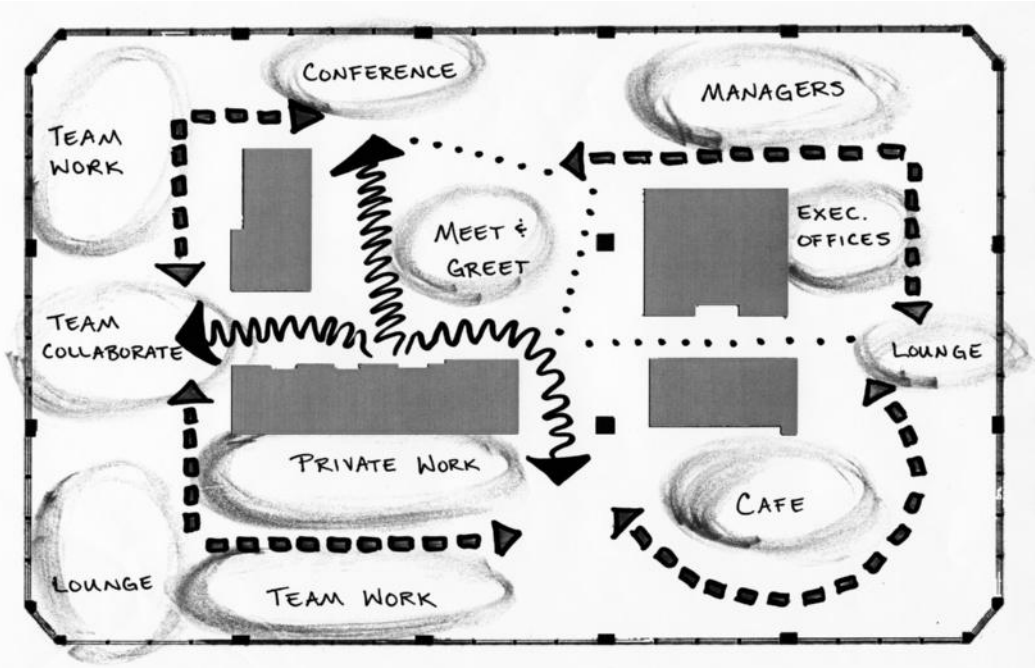
The Rest of This Book

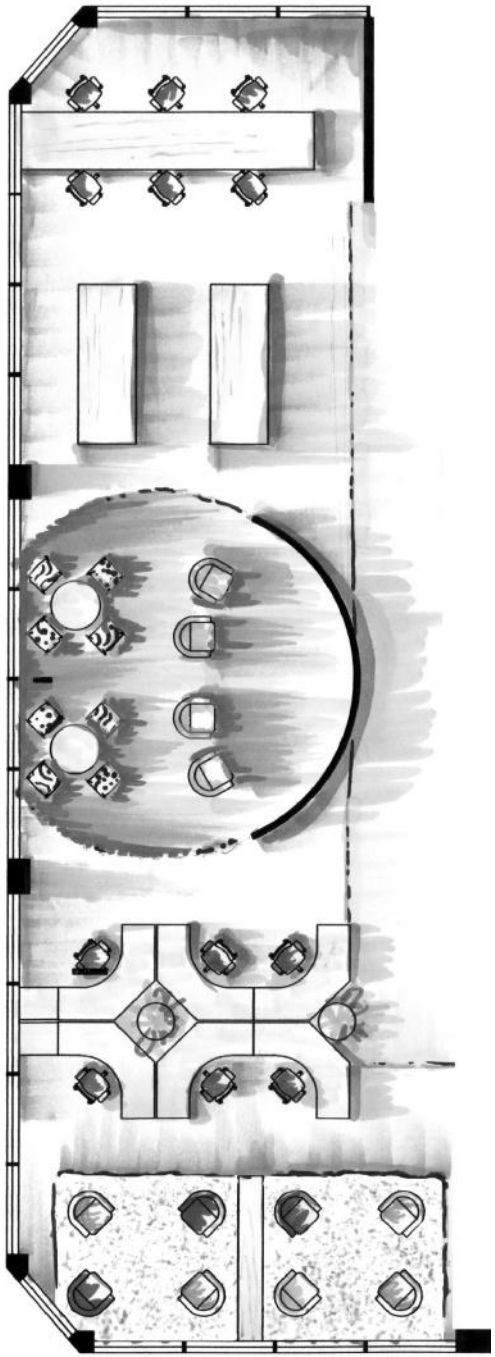
In the pages that follow I will present useful concepts and exercises to help you become a successful planner of interior environments. We will first focus on the crucial topic of users. We examine human needs in buildings, issues of accessibility and universal design, and building codes that affect interior space planning. In Chapter 3 we dive into the nuts and bolts of planning interior spaces and the design process itself, and I will show numerous examples of how to go about planning interiors. Chapter 4 focuses on the basic unit of interior space, the single room. If you learn to design a single room successfully, you will possess much of the knowledge needed to design entire projects. After the room, we will turn our attention to groups of spaces or rooms (Chapter 5) and see how those can be combined to maximize the positive interaction between them. After this we will examine entire projects (Chapter 6) and look at how they are composed of single rooms and spatial sequences. Through this sequence of chapters, you'll recognize that the principles and concerns are similar whether you are designing single rooms or entire projects. What changes is the scale and the amount of complexity.

The book concludes with chapters devoted to residential design (Chapter 7) and nonresidential design (Chapter 8). These will address specific issues and concerns related to residential, office, retail, and hospitality environments. All along the way, there will be exercises for you to practice what you have just learned.

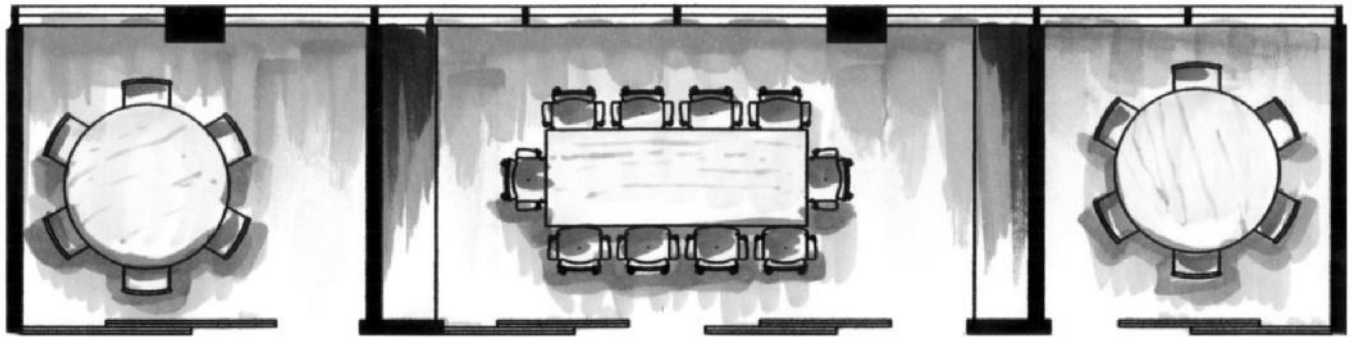
The journey has barely begun. Get ready.



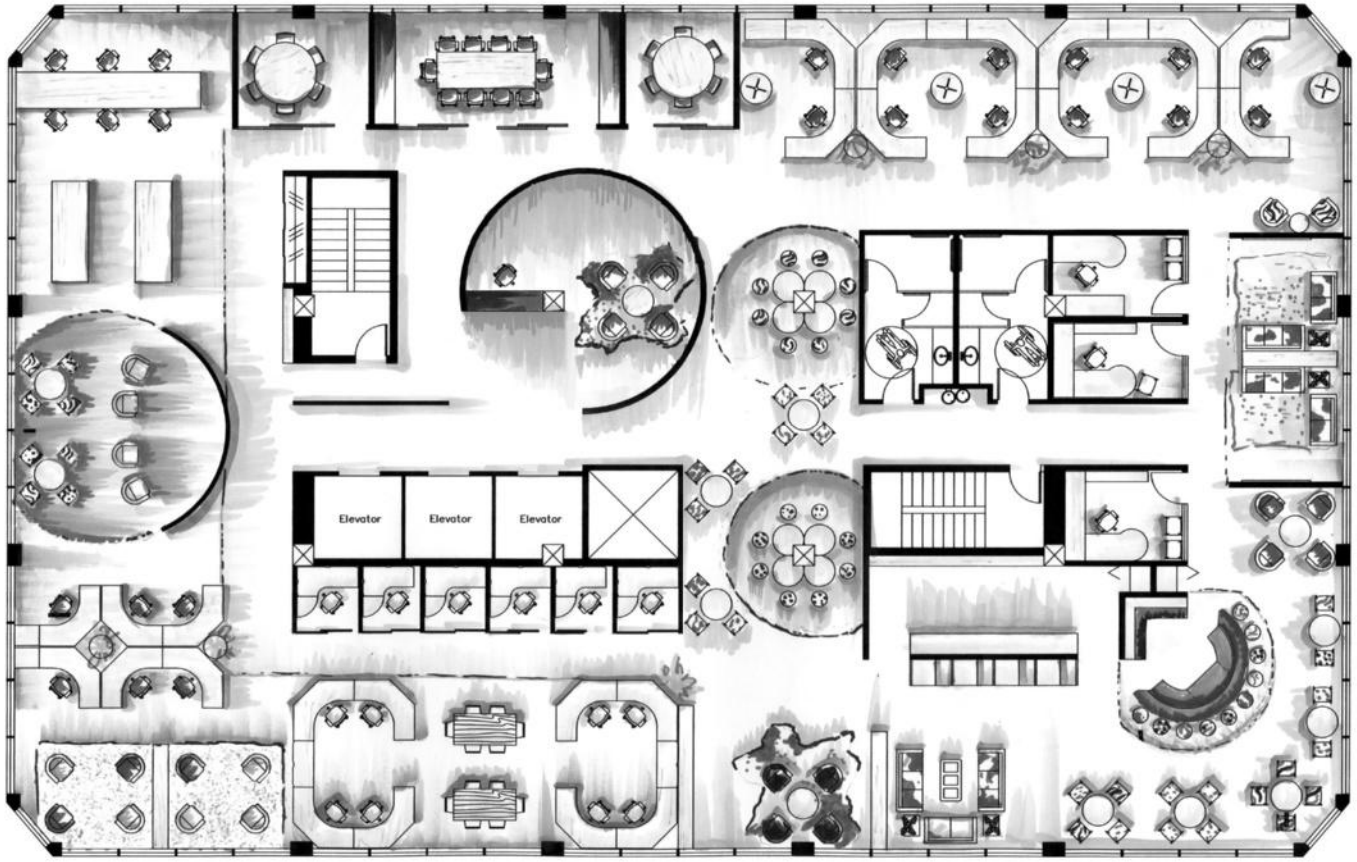




Adjoining spaces



Individual rooms



The entire project

2 Projects for People: Health, Safety, and Welfare

Basic Human Needs

In this chapter we will examine some of the characteristics of space occupants and ways to protect and enhance their health, safety, and welfare.

The landscape architect Michael Laurie explains human behavior in environments in terms of three categories of human factors: physical, physiological, and psychological.[1] **Physical factors** explore the relationships between the physical characteristics of people and the form of the environment. Researchers have studied the measurements of the human body and how it moves. This information is helpful to designers for determining the appropriate dimensions of buildings, rooms, and furnishings, from door sizes to chair heights. The second group, **physiological factors**, addresses the interaction of our biological conditions with the physical environment. Of concern here are basic needs related to survival, such as food, air, water, and livable climatic conditions. Interior environments in buildings can contribute to this set of needs by providing things like adequate shelter, clean air, and sunlight. In addition, elements controlled by building codes, such as proportions of treads and risers in stairs and handrail requirements, ensure our safety and address issues related to physical security.

The third group, **psychological factors**, encompasses human aspects related to behavior patterns and social needs. Specific personal needs in this category can vary according to such factors as age, social class, cultural background, and past experience. Laurie classifies inner human needs into five general need groups: social, stabilizing, individual, self-expression, and enrichment.

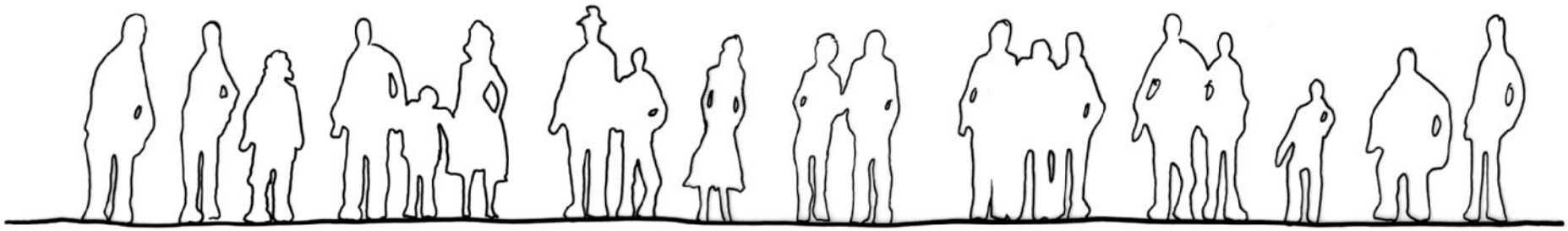
Included in **social needs** are the needs for social interaction, group affiliation, companionship, and love. Environmental attributes to address those needs may include particular arrangements that draw people together and that encourage interaction. **Stabilizing needs** address our need to be free from fear, anxiety, and danger. Included here is our need for clear environments that help us feel oriented and free from the anxiety of feeling lost. Also addressed are human needs to shape the environments and to leave a mark.

Individual needs concern the specific needs of humans as single individuals. One crucial need in this category is the need for individual privacy. In addition are needs related to self-determination, the expression of personal uniqueness in the environment, and the ability to select from available options. People have an opportunity to express their unique sense of identity when there are choices in the environment, such as a selection of seating in a public area.

Self-expression needs include the needs for self-assertion, achievement, esteem, and power. In terms of the physical environment, these often translate into issues of territoriality, which is concerned with the areas allotted to (or defined by) individuals or groups and their location. The study of how much space we need and optimal distances between ourselves and others is of relevance here. One aspect of note is that territorial and separation needs have been determined to vary somewhat based on cultural background and nationality.

Enrichment needs is the last group of human needs defined by Laurie. Included here are needs for knowledge, creativity, and aesthetic experience. Environments that are aesthetically pleasing and that promote creativity can thus make important contributions to the positive manifestation of users' enrichment needs.

Some awareness of these basic human needs can help produce more responsive environments. The thing to remember is that the manifestation of these needs will vary from individual to individual and from group to group. It is therefore important to, first, understand fully the needs of the group one is designing for and, second, provide arrangements that address those needs and that will not prevent the fulfillment of the needs of the next group of users in the future.



As a designer, seek to create environments that offer choices within a certain range of possibilities. The design of interiors requires you to make decisions that will result in environments that provide

- structure, while allowing for some freedom;
- opportunities for both social interaction and retreat;
- a sense of order, but with variety and intrigue;
- a sense of orientation, but not in rigid, military fashion;
- both stimulation and repose;
- both personal and collective expression;
- a sense of both stability and adaptability;
- security and control, but with some freedom; and
- spatial comfort without being wasteful.

There are not too many ways in which humans operate to carry on their activities. In fact, there are only six principal activity modes that designers need to address in order to accommodate users' needs: standing, sitting, walking, running, moving, and lying down. The chart below illustrates how these modes correlate with common human activities.

Think of users as beneficiaries of your good design intentions. Users rely on you to design for them a safe, healthy, and stimulating environment. At right is a brief list of what they may reasonably expect from an interior environment. Feel free to add a few more in the spaces provided.

1. Michael Laurie, *An Introduction to Landscape Architecture*. 2nd ed. (New York: Elsevier, 1986).

Activity	Standing	Sitting	Walking	Running	Moving	Lying Down/ Reclining
Thinking	✓	✓	✓	✓	✓	✓
Reading	✓	✓				✓
Watching	✓	✓	✓		✓	
Eating	✓	✓				
Cooking	✓				✓	
Serving	✓		✓		✓	
Sleeping						✓
Bath/Shower	✓	✓				✓
Shopping	✓		✓		✓	
See exhibit	✓		✓		✓	
Watch show		✓				
Dance	✓				✓	
Office work	✓	✓				
Factory work	✓	✓			✓	
Meeting		✓				
Jogging				✓	✓	
Workout	✓	✓	✓	✓	✓	✓

User's Bill of Rights

1. **Reasonable access and accommodation for people of all abilities and backgrounds**
2. **Safe space sheltered from the elements**
3. **Arrangements that facilitate required function(s)**
4. **Provisions for privacy**
5. **Some degree of control**
6. **Some degree of flexibility**
7. **Access to natural light and views**
8. **Healthy ambient conditions**
9. **Connection to other relevant parts/spaces**
10. **Safety from external threats**
11. **Clear orientation**
12. **Efficient emergency egress**
13. **Reasonable comfort**
14. **Reasonable overall convenience**
15. **A pleasant environment**
16. **You add:**

_____

17. You add:

_____

18. You add:

_____

19. You add:

_____

Humans in Buildings

Planning interior spaces requires the consideration of many human factors. Privacy, territoriality, and personal space are among the most important. Entire books have been written on interactions between humans and their environments. I encourage you to become familiar with this literature and also to become an avid observer of how people behave inside buildings. Here, I briefly introduce some important concepts that affect space planning decisions.

Privacy

We are all familiar with the concept of privacy. Privacy concerns one's ability to control environmental conditions so as to regulate the back-and-forth exposure to visual, auditory, and olfactory stimuli. There are times we don't want to be heard and there are times we don't want to hear others; sometimes, we need to control interruptions in order to concentrate on something. The scenarios are numerous. The social scientist Alan F. Westin identifies four types of privacy: solitude (being alone), intimacy (being alone with someone else), anonymity (blending in with a crowd), and reserve (using psychological barriers to control intrusion).[2] When designing environments, we use walls (thick, thin, solid, transparent), screens, distance, and other real (or symbolic) territorial demarcations to achieve various degrees of privacy.

Personal space

Personal Space

The psychologist Robert Sommer introduced the concept of personal space in 1969. Personal space is the space (or bubble) surrounding our individual body and designating the area that is off limits to all but (perhaps) our loved ones.[3] It is the zone that, when encroached by others, causes discomfort and triggers a reaction of alert. We have all experienced the awkwardness of a long ride inside a crowded elevator. The extent of the personal space zone varies from person to person and across cultures and backgrounds.

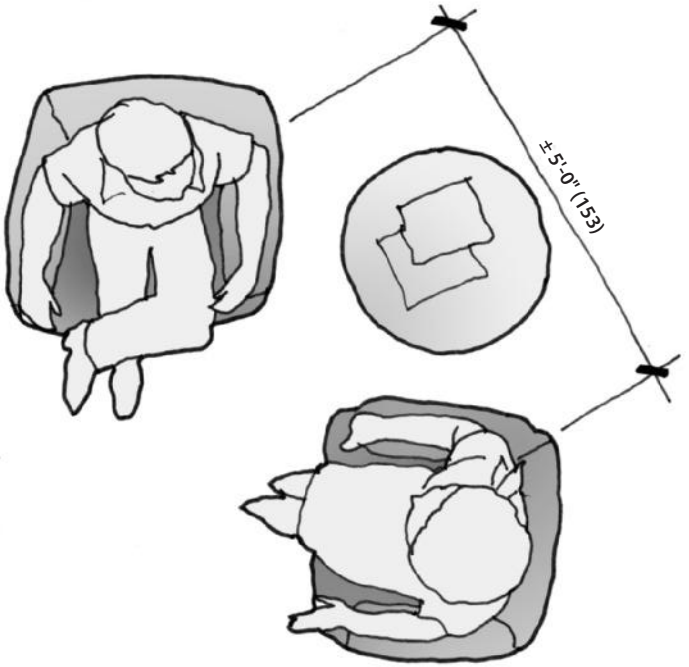
Proxemics

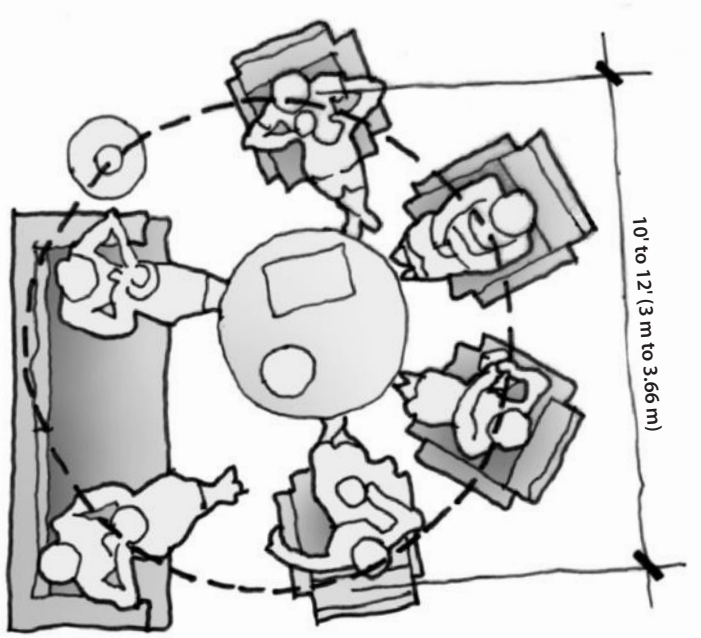
Proxemics, introduced by the anthropologist Edward T. Hall in 1966, is the study of the distances between people as they interact. Proxemics answers questions about desirable distances between, say, a receptionist and a visitor sitting across the aisle, or between two people sitting across a dining table. Hall identified four distance categories:

1. Intimate distance: 6″ to 18″ (15 cm to 46 cm)
2. Personal distance: 18″ to 48″ (46 cm to 120 cm)
3. Social distance: 4′ to 12′ (1.2 m to 3.7 m)
4. Public distance: 12′ to 25′ (3.7 m to 7.6 m) and beyond[4]

Dimensions

Knowing the recommended ranges of dimensions between people for different functions helps you plan functional arrangements that will work well. You can refer to dimensions shown in this and other reference books. In some cases involving familiar scenarios, you can do a quick mockup with the help of a few friends and a tape measure and come up with a good sense of what a certain dimension should be.





Of these, personal and social distances are the most relevant to interior designers, as most required space-planning decisions occur within those ranges.

Territoriality

A territory is a certain extent of space to which a person or group lays claim. The boundaries may be clearly marked or somewhat ambiguous, and users belonging in the territory will defend it against intrusion. The concept is important because in most situations, people need a sense of having their own territory. Examples include one's bedroom in the house, the cubicle in the office, and the particular table at the restaurant. In the case of bedrooms, houses, and offices, users often personalize the space and make it their own, which contributes to a positive sense of identity.

Hussein M. Aly El-Sharkawy's classification of four different types of territories is useful for designers.

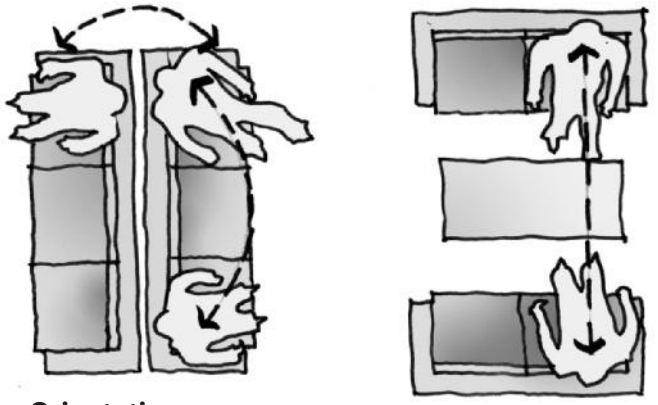
1. Attached territory refers to one's own personal space.
2. Central territories are highly personalized (a bedroom, a cubicle at work).
3. Supporting territories are shared but close to home so that people have a sense of ownership and may personalize them. Examples include common lounges and the sidewalk in front of one's house.
4. Peripheral territories are clearly public and people use them but without having a particular sense of ownership over them.[5]

Defensible Space

Defensible space, a concept introduced by the architect and city planner Oscar Newman, is an arrangement (spatial or otherwise) that increases territorial definition and opportunities for surveillance and that fosters a sense of joint ownership and control of particular territories. An example of this is a residential vestibule shared by three apartment entrances in a complex. With a clear spatial demarcation and a small window facing the vestibule, all three neighbors can keep a watchful eye on their shared territory and identify approaching people who may not belong in the area.

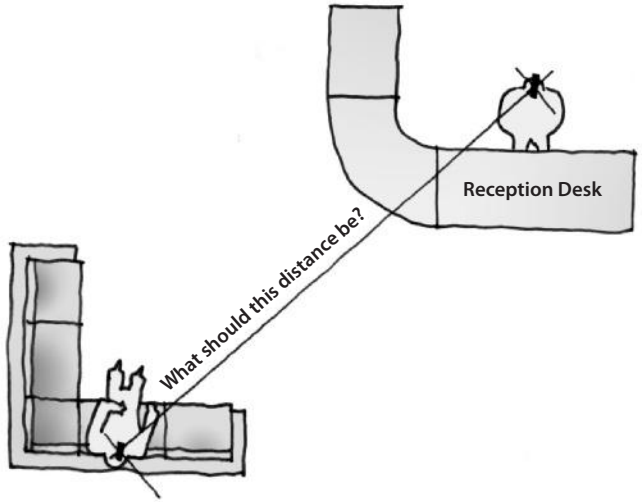
Sociopetal/Sociofugal Space

The doctor Humphrey Osmond introduced the concept of sociopetal and sociofugal arrangements in 1957. It is an important concept for interior designers, as it refers to how the orientation of adjacent spaces or furnishings may encourage or discourage interaction. In sociopetal arrangements, the elements, say seating, face each other to promote face-to-face contact. Sociofugal arrangements, such as back-to-back seating in a waiting room, allow proximity while discouraging (without preventing) interaction. The concept is simple but powerful, and its application is straightforward and easy to implement once understood.



Orientation

In addition to knowing functional distances between people in different situations it is also necessary to understand the role of orientation. In some cases, such as a living room, sociopetal orientations will be desirable. In other cases, such as a waiting room at the doctor's office or an airport, a combination of sociopetal and sociofugal arrangements will give people options, depending on their circumstances.



Seats for waiting

What do you think the distance between the receptionist and the seated visitor ought to be? Should it be within the social distance range or the public distance range?

2. Alan F. Westin, *Privacy and Freedom* (New York: Atheneum, 1976).

3. Robert Sommer, *Personal Space: The Behavioral Basis of Design* (Englewood Cliffs, NJ: Prentice-Hall, 1969).

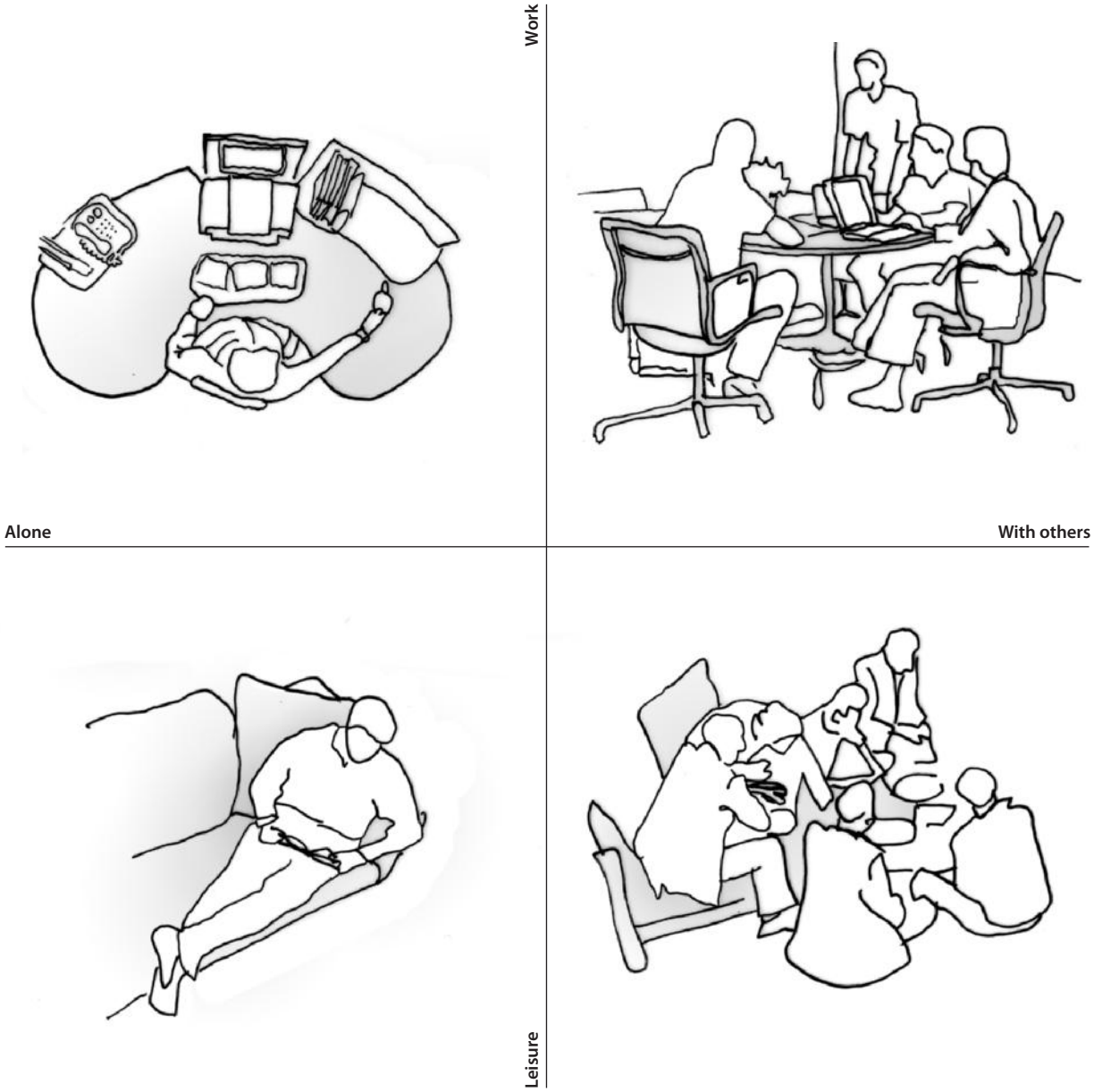
4. Edward T. Hall, *The Hidden Dimension* (Garden City, NY: Doubleday, 1966).

5. Hussein M. El-Sharkawy, Territoriality: A Model for Design, PhD diss. University of Pennsylvania, 1979.

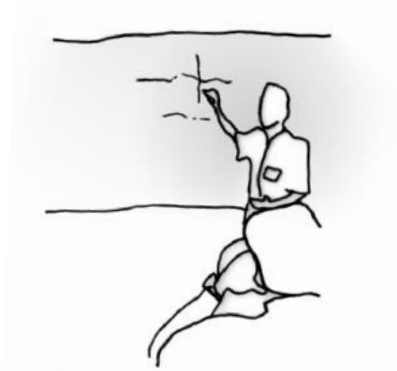
Humans in Action

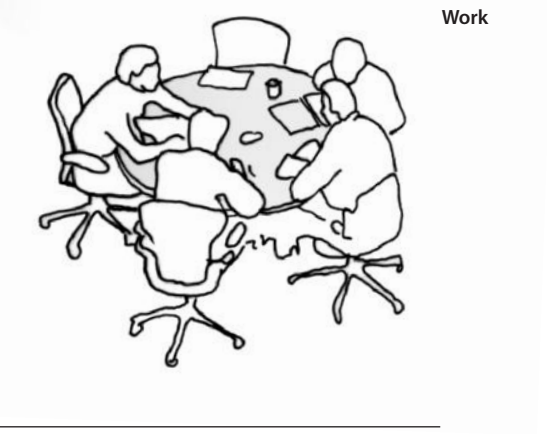
Before designers can decide the size of a room, which furniture to provide, how to arrange it, and how to relate all this to other adjacent spaces, they have to understand the nature of the activities (primary and secondary) in those spaces.

There are many ways of conceptually looking at people and their activities in interior settings. The model presented here examines people's behavior in terms of two variables: the number of people (from one to many) and the kind of activity being performed (from task-related to leisure). You can look at most conceivable scenarios (at home, at work, at a pub) in terms of these two variables. By finding out who the users of a given space are, how many there are, what activities they are performing, and how they are performing those activities, you can devise workable room and furniture scenarios to satisfy the required combinations. Similar models with different variables are also possible for addressing specific types of populations and environments.



The user/activity matrix shows possible scenarios involving one or more people performing a range of activities, from leisure to work related. Each case has specific design implications in terms of room size and characteristics, optimal level of privacy, and furniture arrangement.





Work

Informal work

Alone

Few

Several

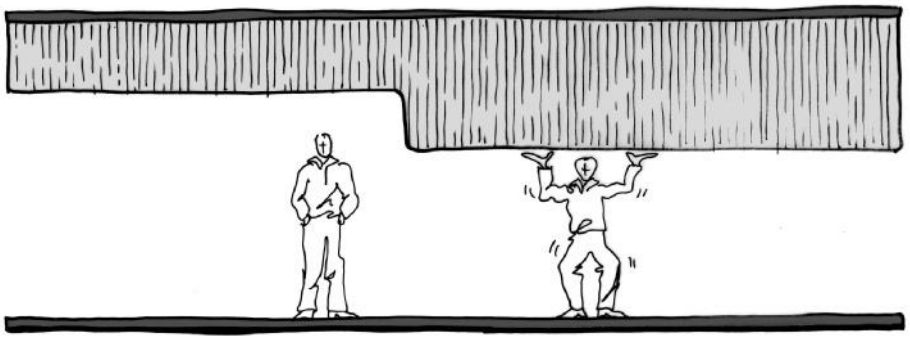
Leisure

Comfort

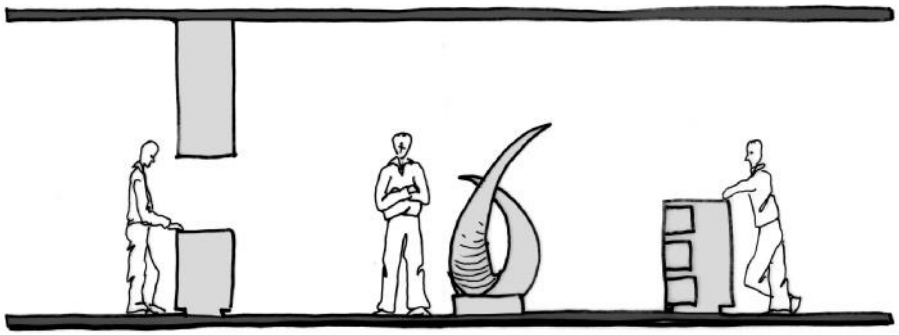
Young designers try really hard to produce expressive designs that will amuse and delight. Delight, after all, is one of the main objectives of good design. To many, the equation for good design consists of a combination of good functionality mixed with inspired beauty. Although this is somewhat true, there is an element of goodness in design that is simpler and far more innocent than the attempts by designers to be exceptionally creative and refined. I am referring to the simple but enduring pleasures of the environment.

Look at the illustration of a girl reading at right. Note the setting—a cozy space with good lighting, a comfortable chair, a vase with flowers, and a fireplace to keep things warm; add the girl, a good book, and some time to seize the moment, and you have nearly perfect conditions for producing pleasure from comfort. It doesn't take great design gestures.

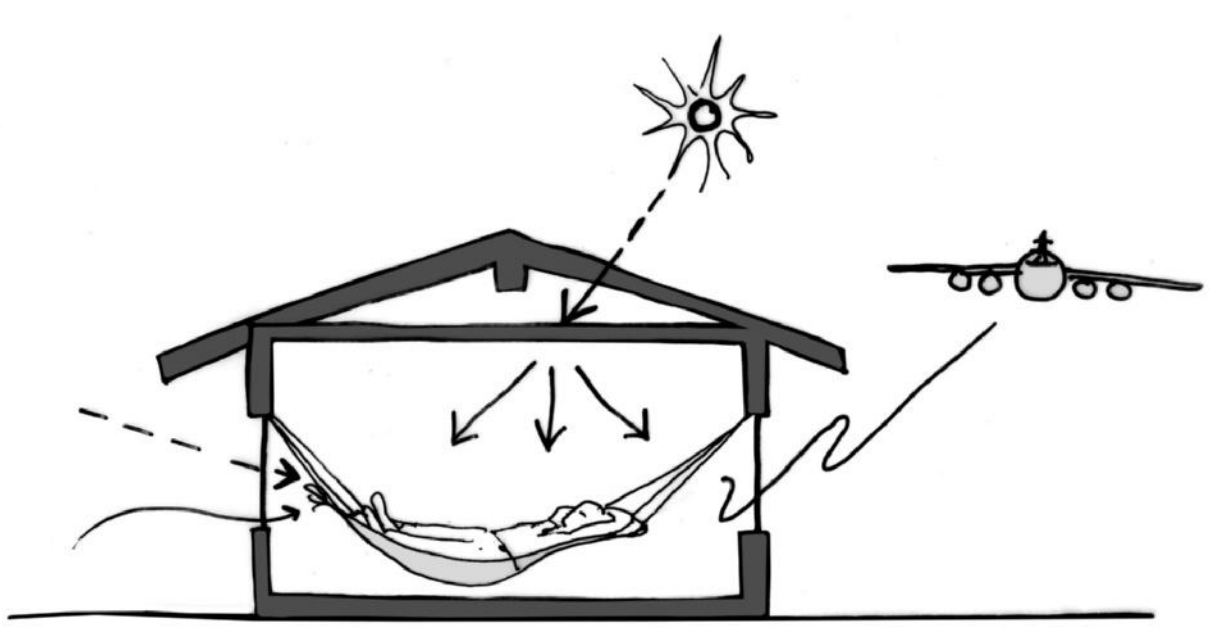
A young woman reads a book comfortably.



Seek to produce spaces of human scale.



Consider the size and height of objects and fixtures in relation to the project's users.

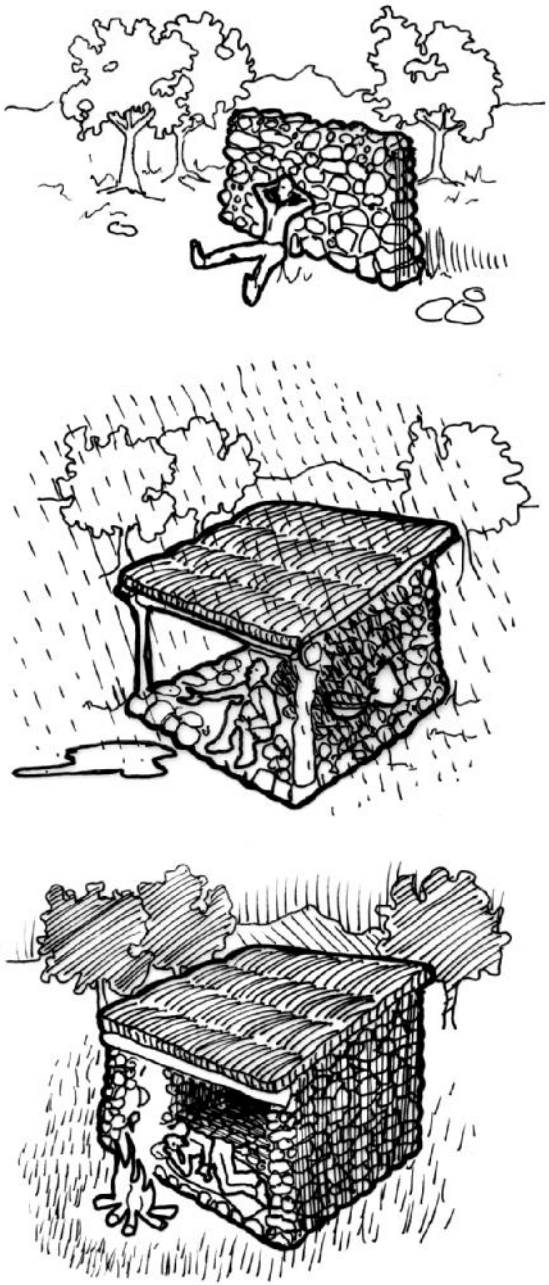


Producing comfort and delight requires recognizing and responding to external forces, such as the sun, the wind, views, smells, and noises. Doing so entails careful treatment of exterior walls and openings as well as proper distribution of rooms and functions.

While acknowledging that functionality and aesthetics play an important role in the quality of one's total experience in interior environments, let's examine other important factors:

1. Properly sized rooms having human scale; not too large, not too small
2. Good room-to-contents (e.g., furnishings) proportion
3. Properly sized objects and fixtures at comfortable heights
4. Comfortable furniture
5. Convenient routes and travel distances
6. Control of unwanted noise
7. Good natural light
8. Good artificial light
9. Good ventilation, natural and otherwise
10. Good relation to the sun (shade or sun penetration as appropriate)
11. Good exposure to external (and internal) views

Note that there is nothing fancy (or expensive) about the factors in this list. Even low-budget jobs can have these attributes and be comfortable and delightful.



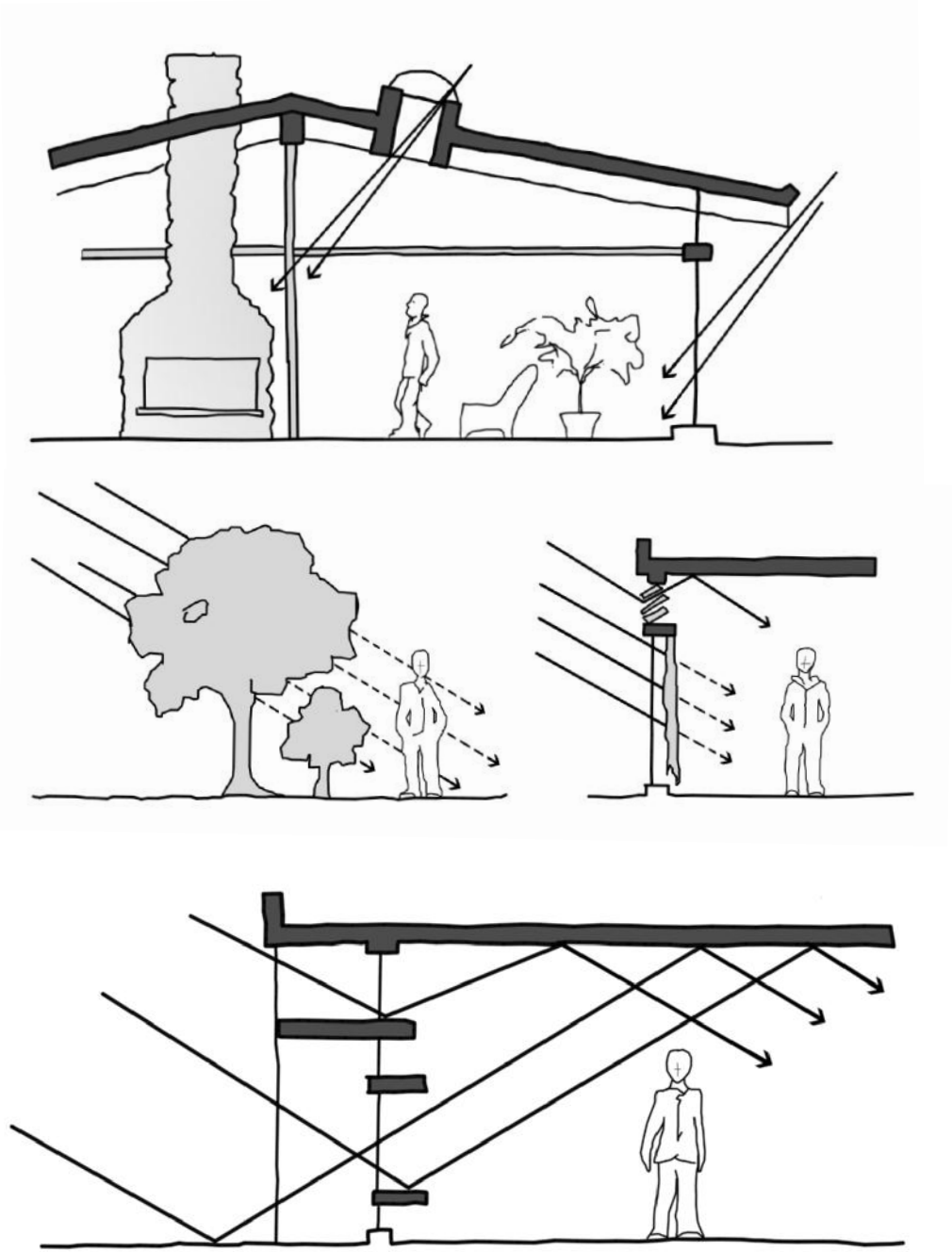
Give a man a wall, and you ground him. Give him a roof, and you protect him from the elements. Add some enclosure, warmth, and a soft pillow, and you will have given him everything he needs for a comfortable, delightful afternoon experience.

Light and Sound

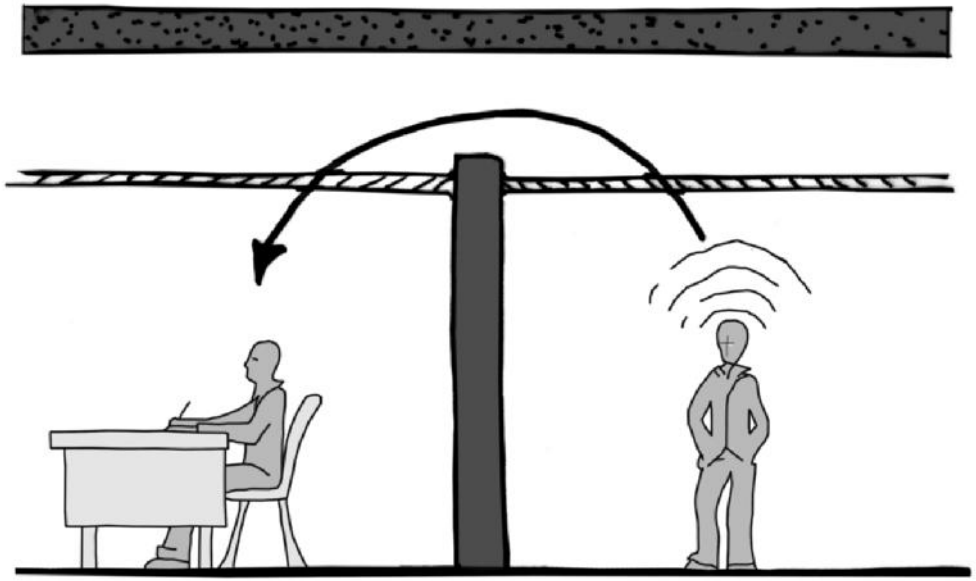
Two environmental factors are so important for a positive environmental experience that they deserve special attention: sound/noise control and the utilization of natural light. Sound in interiors is produced by many sources, some internal and some external. Sound is generally something neutral, neither good nor bad; it is only when sound is unwelcome that it becomes a problem, and then we call it **noise**. Loud sounds from equipment inside or the street outside are often objectionable and cause people to complain. A not-so-loud telephone conversation by your neighbor can be just as annoying if you are trying to concentrate. (Even if your immediate task does not require concentration, you may not be interested in hearing your neighbor's business.) In some cases, there is not much you can do, and people just have to be tolerant and learn to live together. In many cases, though, you can avoid or solve acoustical problems through proper space planning. These are some specific recommendations:

- In acoustic-sensitive areas, take dividing partitions all the way to the underside of the floor or roof above to reduce sound transmission.
- Place noisy equipment in isolated rooms.
- Place very loud equipment in rooms as far away as possible.
- Plan the location of doors carefully to reduce flanking sound transmission.
- Separate quiet rooms and loud ones into different zones away from each other or with neutral rooms providing a buffer zone between them.

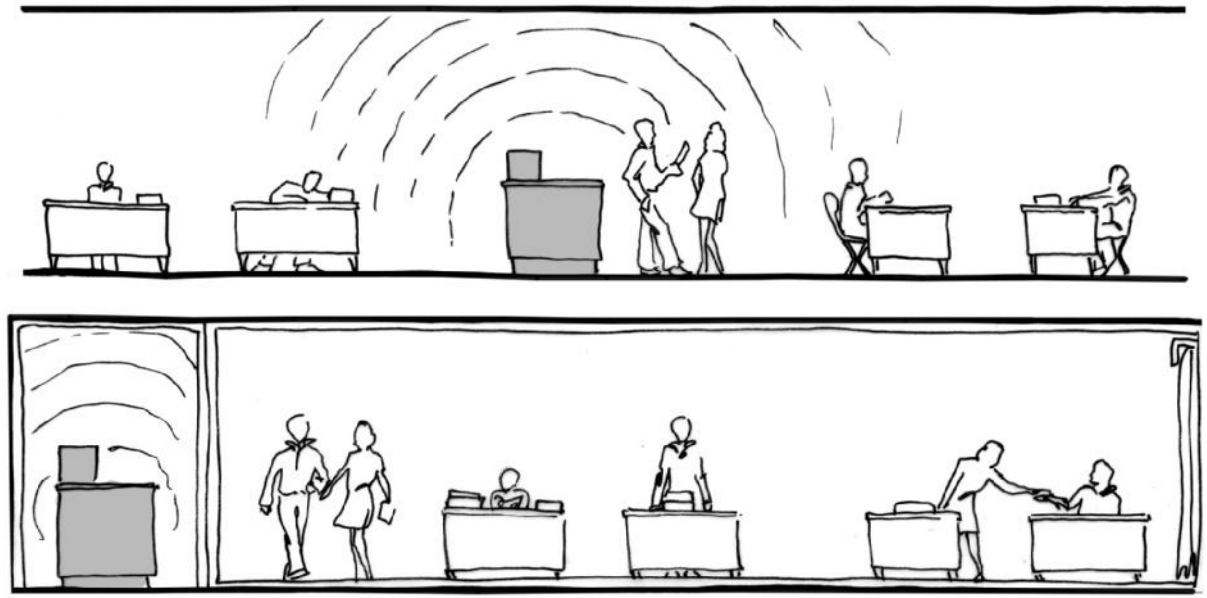
Although the building for a project, its windows, and the sun path are usually in place when you are hired to design an interior project, there are some decisions you can make concerning what functions and spaces to place on the various sides of your site as well as how to treat perimeter walls to provide shading, bounce light, and so on. Don't underestimate your ability to make the most of existing conditions. Strive to maximize natural light penetration, while controlling glare. Combine shading devices and reflective surfaces and planes to maximize the effects of natural light. Not only will you save energy by doing so, but you will also enhance the mood of the users of those rooms.



Analyze the exterior walls of your project's site in relation to the sun path, and strive to maximize the use of natural light. Place rooms needing good natural light strategically, and make sure to control glare with shading devices.

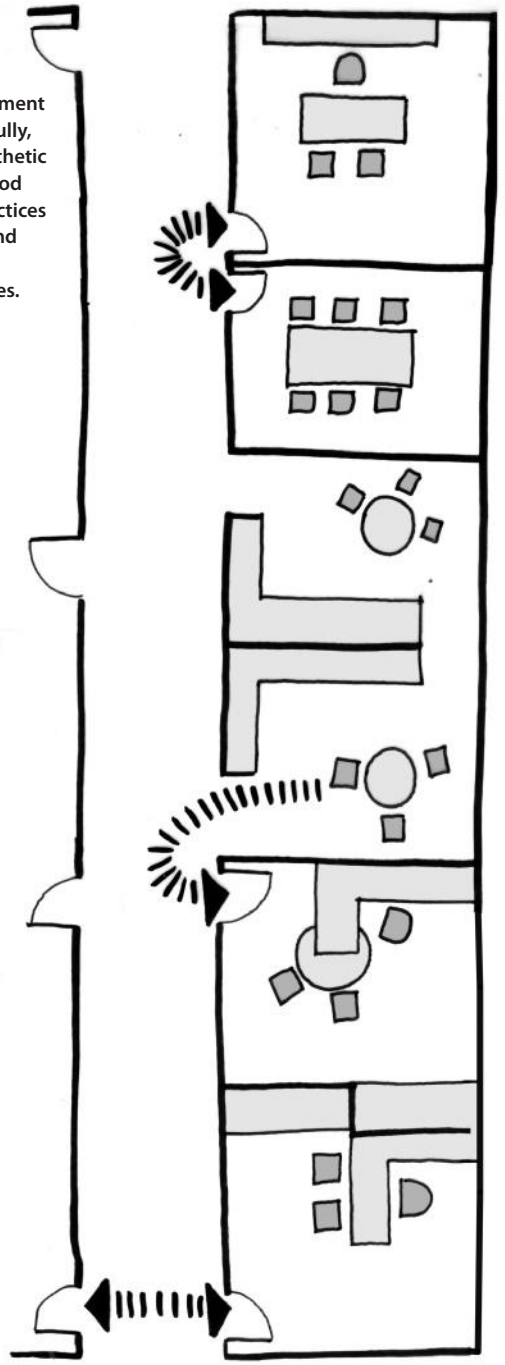


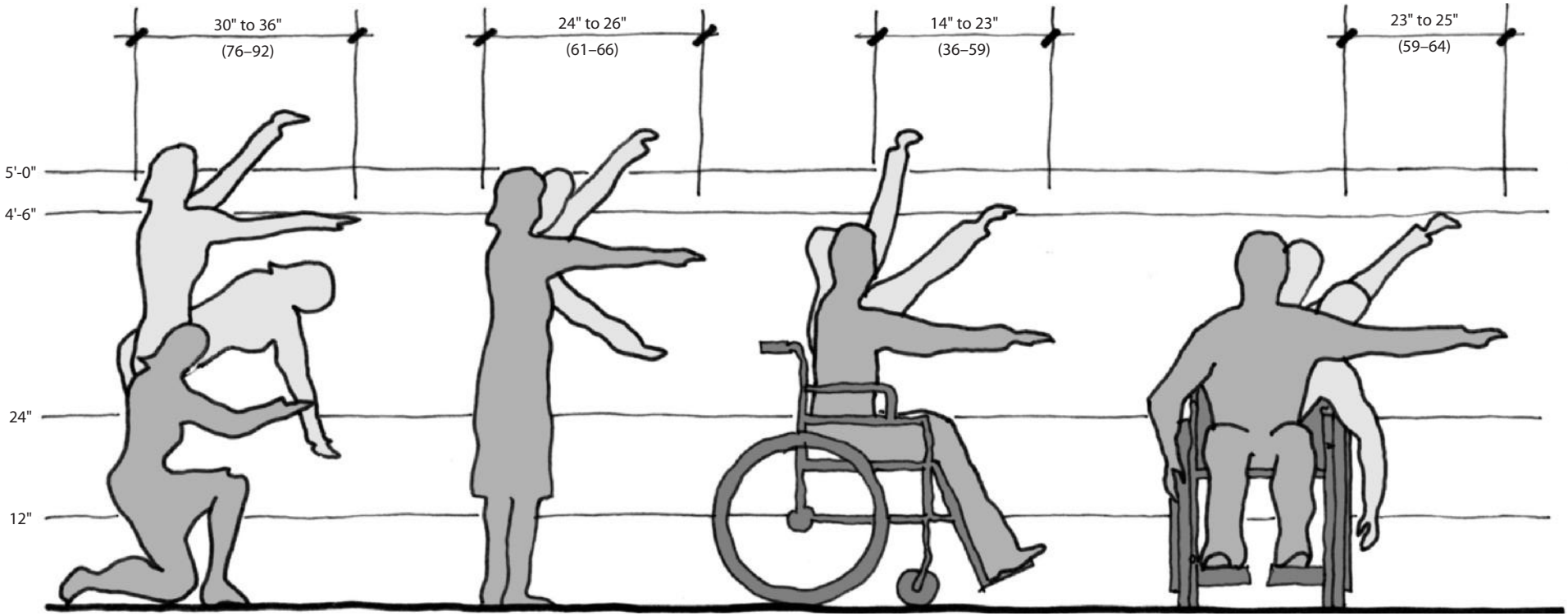
Sometimes, it is impossible to place rooms far apart. In those cases, you have to rely on partitions with a high resistance to sound transmission and, when possible, take them all the way to the underside of the floor or to the roof above.



Place offensively loud equipment in isolated rooms. Place the rooms remotely if necessary.

Plan the placement of doors carefully, balancing aesthetic needs with good acoustical practices to reduce sound transmission between spaces.

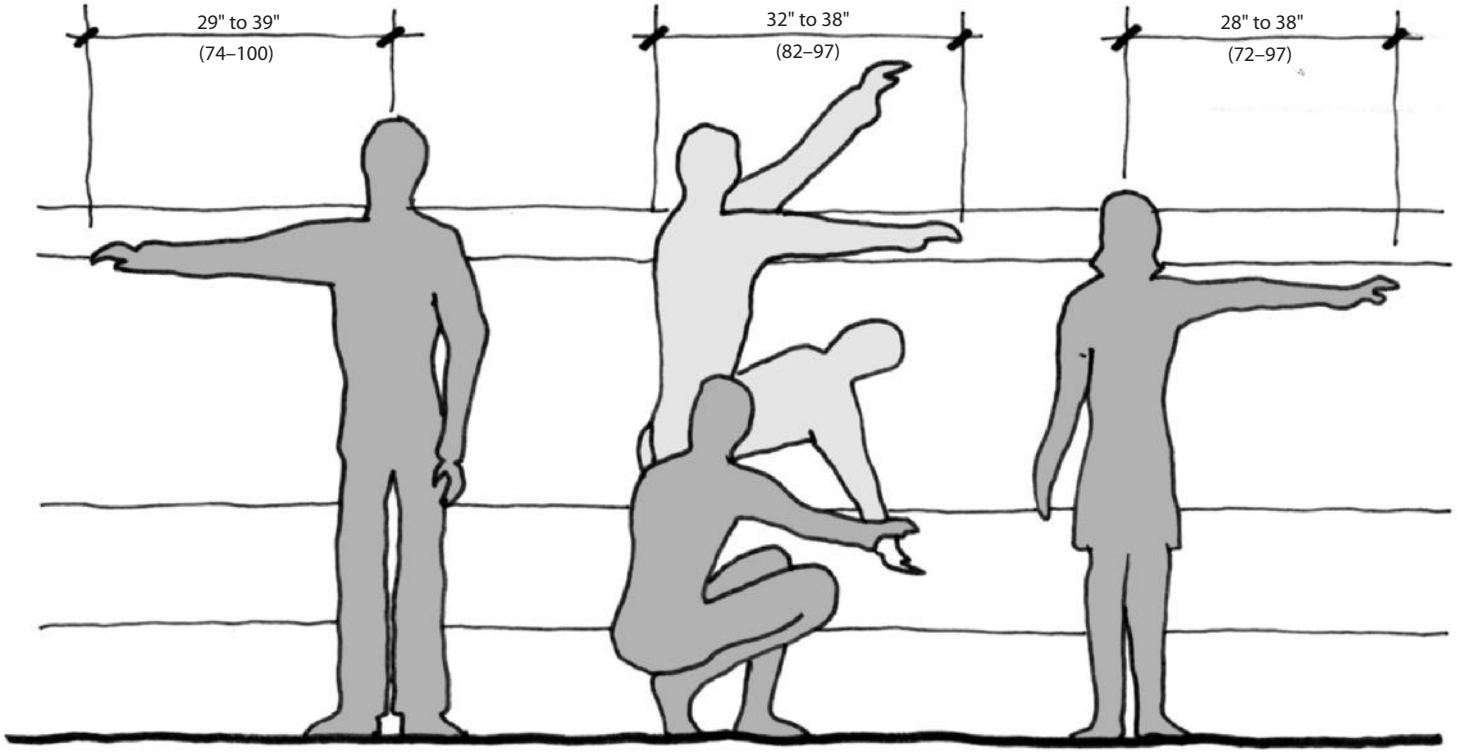




Adult female **Older female** **Adult male seated in wheelchair**

Anthropometrics

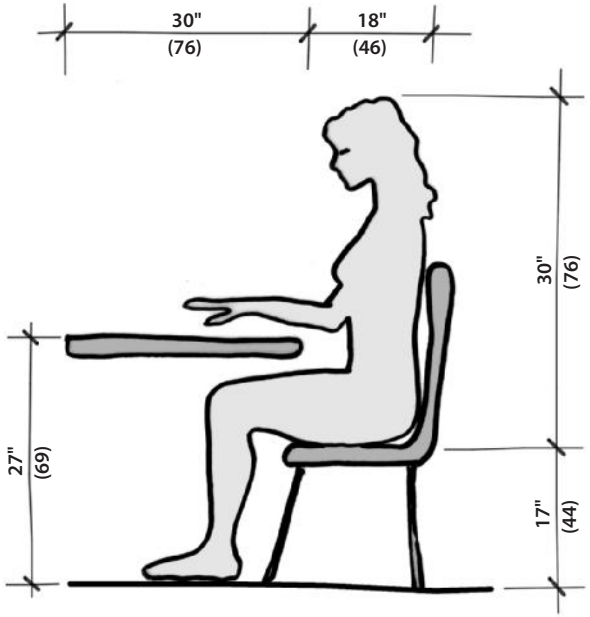
Anthropometrics are measurements of the human body used to determine design standards in relation to range of motion. Recognizing that body sizes vary widely, design standards aim at serving 90 percent of the user population, usually between the 5th percentile to the 95th percentile. Motion also affects how users perform certain activities. The ability to bend, lean, kneel, or reach is partially a function of the hinge points of the body, such as knees and elbows. A number of factors, such as weight and sex, affect the range of joint movement. Although age by itself does not significantly reduce range of motion, many older people have difficulty bending or kneeling because of stiff joints, arthritis, or dizziness associated with inner-ear problems. Wheelchair-bound space users perform activities from the seated position, which reduces their range of motion. Similarly, ambulatory users who need to use crutches or walkers to maintain balance have difficulty with low or high vertical reach.

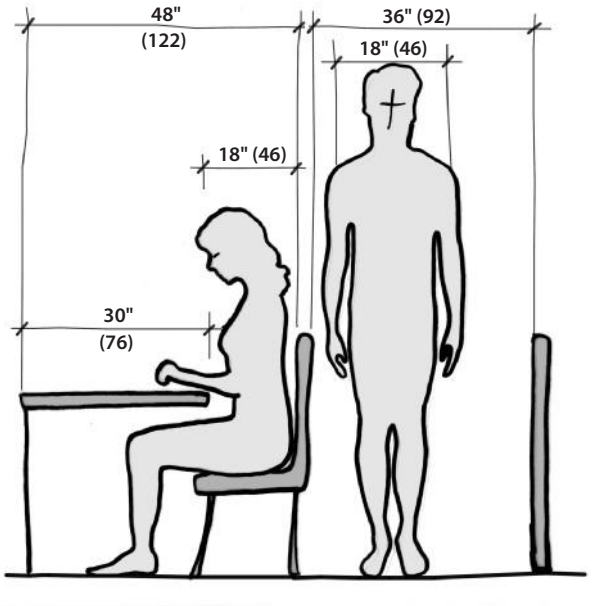


Adult male

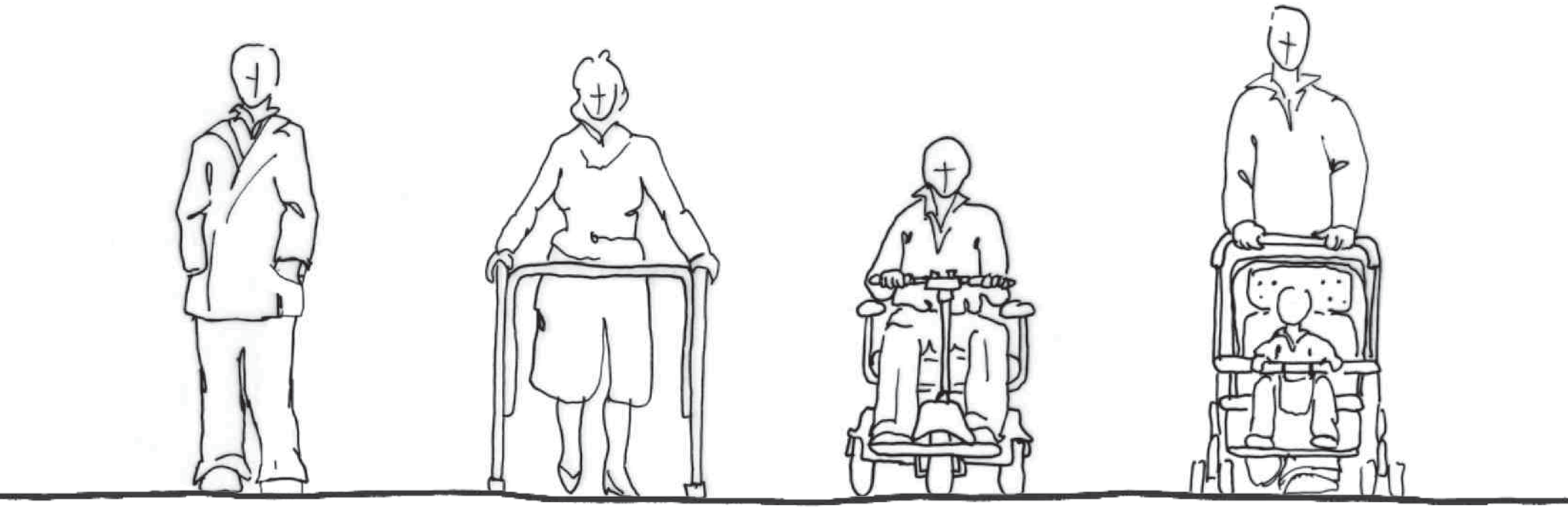
Adult female

The range of motion of space users is determined by their anthropometric measurements and their ability to bend, kneel, lean, or stretch. A vertical zone between 27" (69 cm) and 4'-6" (137 cm) and a maximum horizontal reach of 24" (61 cm) are recommended for the comfort of most users.





Basic dimensions of woman seated at work and recommended aisle behind

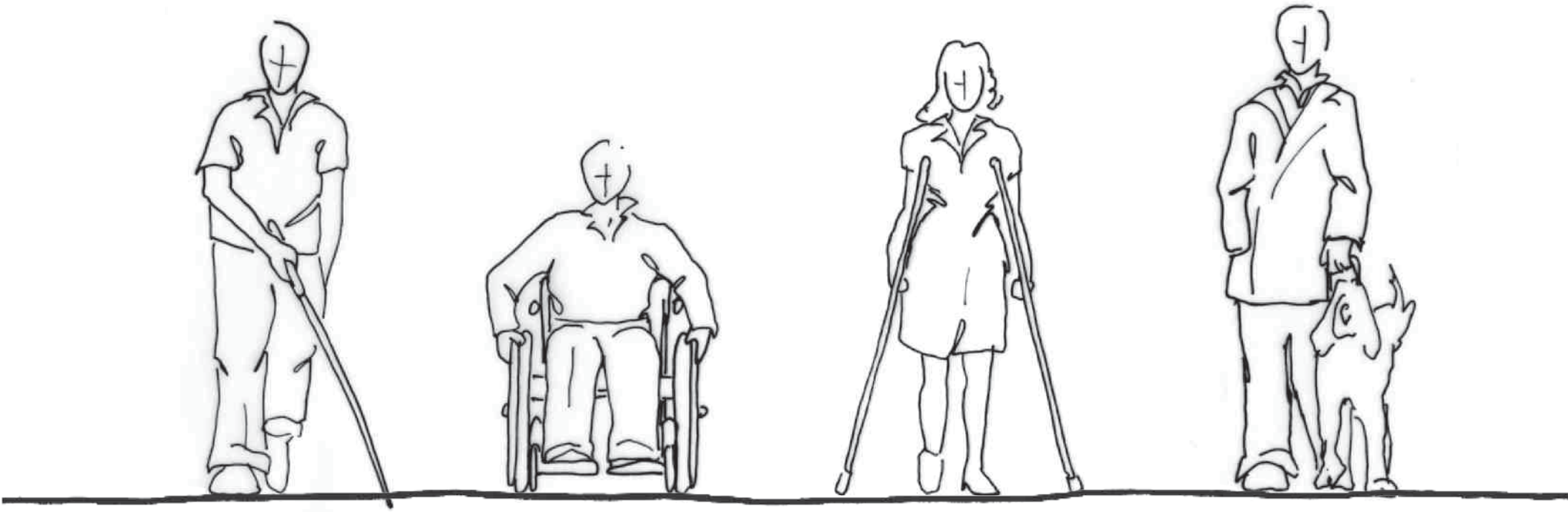


Cast of Users

Be aware that the cast of users for your projects is likely to be broad and varied and will often include people of all ages and with a wide range of abilities, both physical and cognitive. In the United States, the Americans with Disabilities Act (ADA) requires that all places of public accommodation and commercial facilities comply with its accessibility guidelines. Similar acts exist in other countries, such as the United Kingdom (Equality Act 2010) and Australia (Disability Discrimination Act), as well as in provinces within a country, such as the Accessibility for Ontarians with Disabilities Act in Ontario, Canada. Private homes do not have specific accessibility requirements dictated by law, although the practice of creating adaptable designs (designs that can be easily made accessible later) is becoming more prevalent.

The cast of users needing special accommodations is diverse. Some users have a limited range of motion. Limiting horizontal reaches to less than 24" (61 cm) and providing aids to balance such as grab bars and handrails, are among the things you can do to assist them. Some users have limited strength or stamina for performing daily living activities as a result of a medical condition or advancing age. Providing elevators, automatic doors, and seating in waiting areas and minimizing distances between destinations are some of the things you can do to address this group.

Some of the users have wheelchairs or other walking aids (crutches, canes, walkers) for mobility. Wheelchairs



can be manual or electric. A three-wheeled electric wheelchair with a single front wheel is also available. Canes are used to reduce stress on leg muscles and joints. Stairs pose problems for users with canes, and handrails are important for maintaining balance. Crutches also reduce the stress of weight bearing on the lower extremities. They are typically angled away from the body for stability, requiring additional width at doors and openings. Walkers reduce lower extremity stress and act as aids to balance. They can be large and cumbersome and also necessitate wider doors and openings and greater maneuvering room in confined spaces.

Users with restricted mobility can be assisted by doors, openings, and corridors that provide proper maneuvering clearances and ramps, elevators, and lifts for vertical transportation. Other considerations include arrangements that limit travel distances; aids to balance and wheelchair transfer, such as handrails and grab bars; and controls and switches that are within comfortable reach ranges and that do not require fine hand control or a strong grip to operate.

Some users will have impaired cognitive abilities, such as mental retardation or Alzheimer's disease. For these users, designers need to create environments that are not confusing or intimidating and that have clear circulation systems with good way-finding cues (symbols, colors, and other easily identifiable spatial cues).

Universal Design

The principles of **universal design** were compiled by the Center for Universal Design at North Carolina State University to guide a wide range of design disciplines, including environments, products, and communications. These seven principles may be applied to evaluate existing designs, guide the design process, and educate both designers and consumers about the characteristics of more usable products and environments.

The principles of universal design aim to make environments, products, and communications user-friendly to people of all abilities. The way these principles inform interior settings specifically is very similar to the ADA guidelines and other similar accessibility guidelines. On these pages are some examples of designs that are in accordance with these principles.

The Principles

Principle One: Equitable Use
The design is useful and marketable to people with diverse abilities.

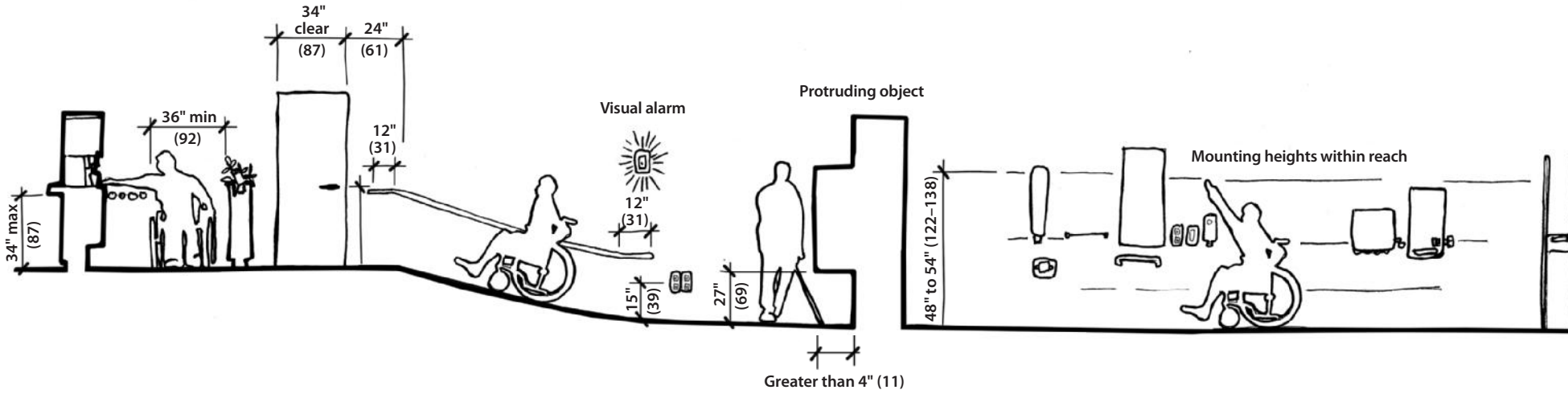
Guidelines:
1a. Provide the same means of use for all users: identical whenever possible; equivalent when not.
1b. Avoid segregating or stigmatizing any users.
1c. Provisions for privacy, security, and safety should be equally available to all users.
1d. Make the design appealing to all users.

Principle Two: Flexibility in Use
The design accommodates a wide range of individual preferences and abilities.

Guidelines:
2a. Provide choice in methods of use.
2b. Accommodate right- or left-handed access and use.
2c. Facilitate the user's accuracy and precision.
2d. Provide adaptability to the user's pace.

Principle Three: Simple and Intuitive Use
Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Guidelines:
3a. Eliminate unnecessary complexity.
3b. Be consistent with user expectations and intuition.
3c. Accommodate a wide range of literacy and language skills.
3d. Arrange information consistent with its importance.
3e. Provide effective prompting and feedback during and after task completion.



Principle Four: Perceptible Information
The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Guidelines:
4a. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
4b. Provide adequate contrast between essential information and its surroundings.
4c. Maximize "legibility" of essential information.
4d. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
4e. Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

Principle Five: Tolerance for Error
The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Guidelines:
5a. Arrange elements to minimize hazards and errors: make the most used elements the most accessible; eliminate, isolate, or shield hazardous elements.
5b. Provide warnings of hazards and errors.
5c. Provide fail-safe features.
5d. Discourage unconscious action in tasks that require vigilance.

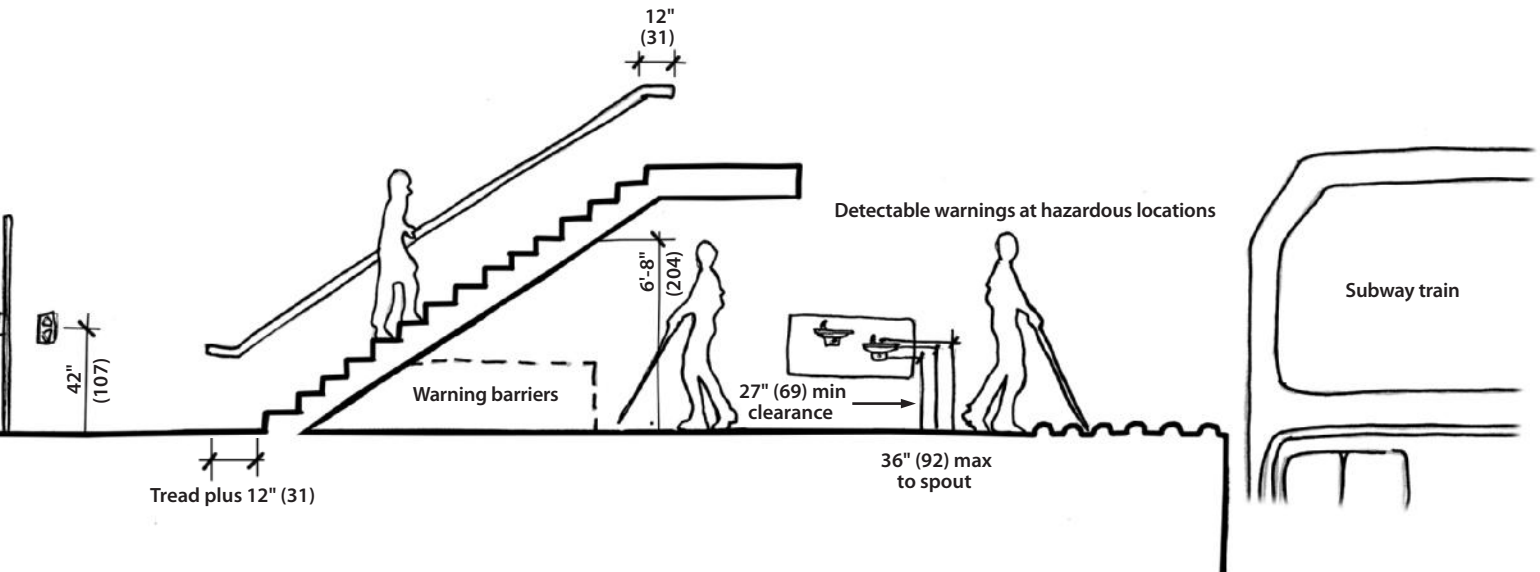
Principle Six: Low Physical Effort
The design can be used efficiently and comfortably and with a minimum of fatigue.

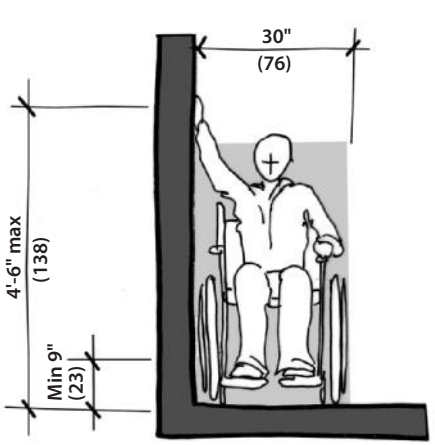
Guidelines:
6a. Allow the user to maintain a neutral body position.
6b. Use reasonable operating forces.
6c. Minimize repetitive actions.
6d. Minimize sustained physical effort.

Principle Seven: Size and Space for Approach and Use
Appropriate size and space are provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility.

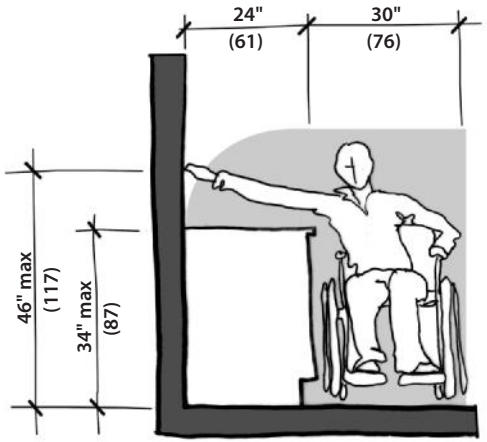
Guidelines:
7a. Provide a clear line of sight to important elements for any seated or standing user.
7b. Make reach to all components comfortable for any seated or standing user.
7c. Accommodate variations in hand and grip size.
7d. Provide adequate space for the use of assistive devices or personal assistance.

Source: "The Principles of Universal Design." Version 2.0. The Center for Universal Design, North Carolina State University, 1997. http://www.ncsu.edu/www/ncsu/design/sod5/cud/about_ud/udprinciples.htm

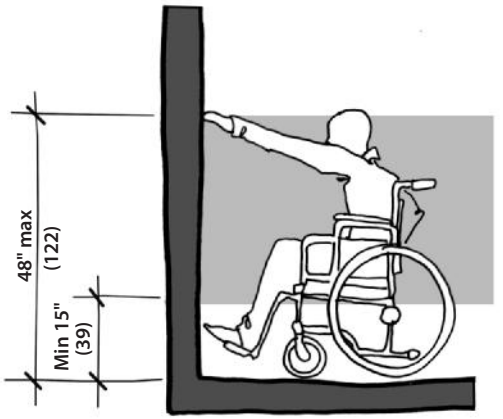




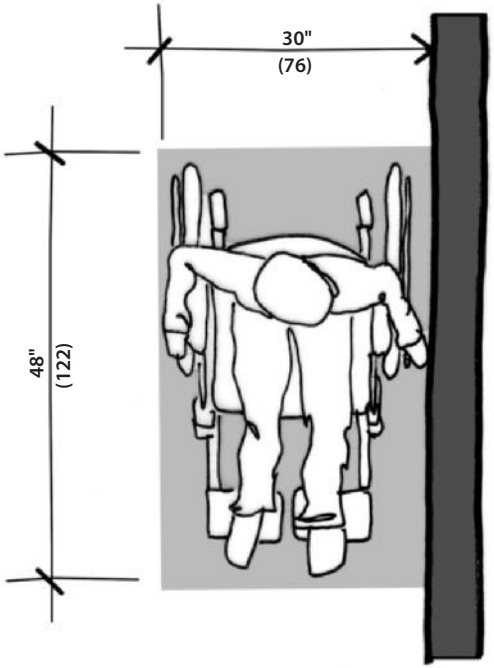
Side reaches (high and low)



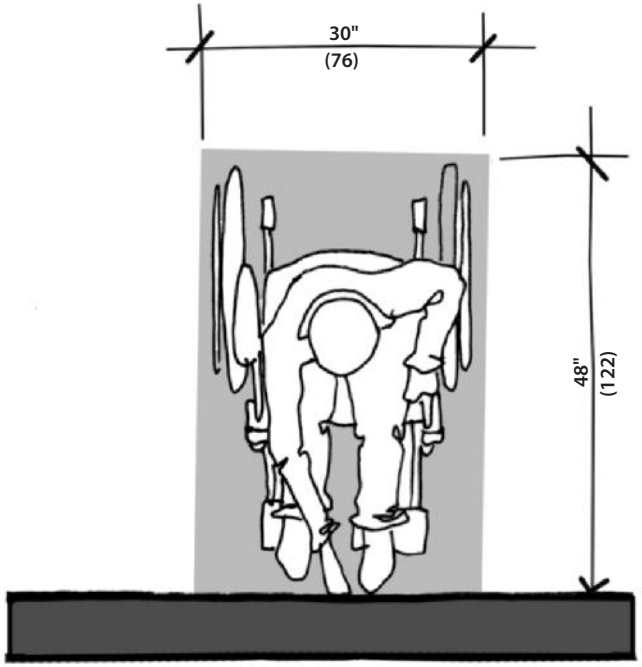
Side reach over obstruction



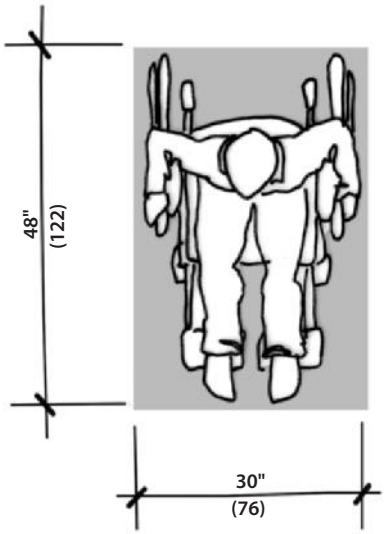
Forward reaches (high and low)



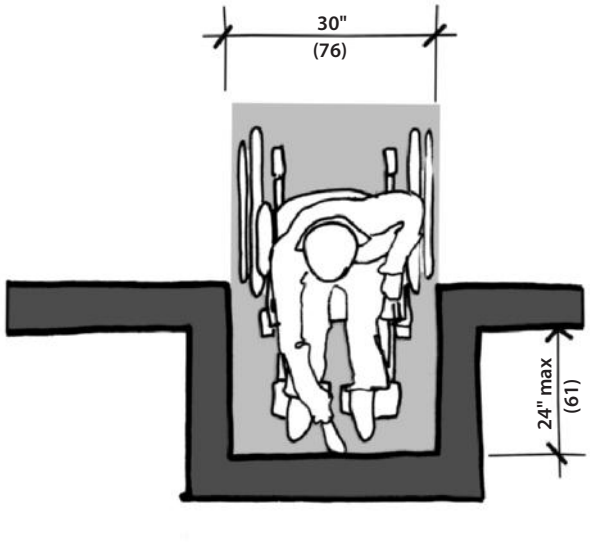
Clear floor space (parallel approach)



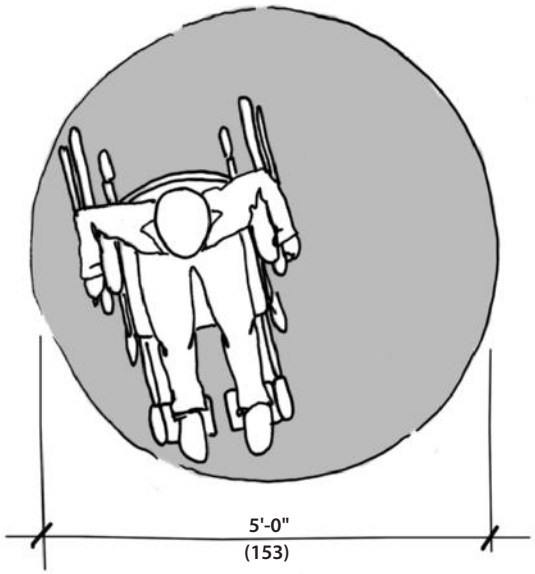
Clear floor space (forward reach)



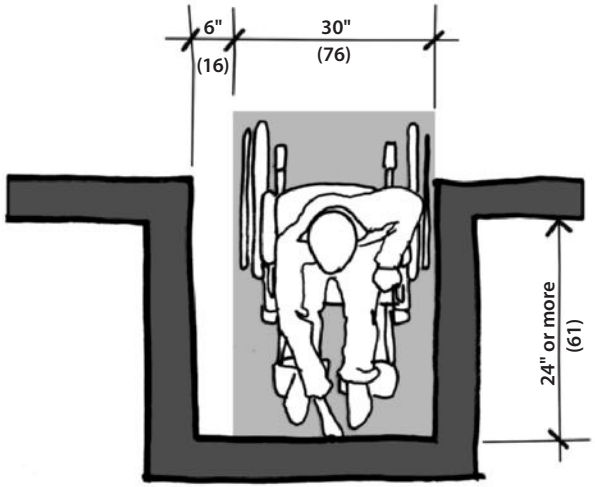
Basic wheelchair dimensions in plan



Clear floor space in alcove



Minimum turning radius



Maneuvering clearances at alcove

Wheelchairs

Users in wheelchairs have a range of movement different from that of ambulatory users. High vertical reach is restricted, because a seated position must be maintained. Low reach is more awkward, because the wheelchair must be maneuvered directly above the objective. Horizontal reach is usually easier to the side, because without a knee space, the footrests restrict forward reach. Eye level in a seated position is more than 12″ (30 cm) lower than that of most standing adults.

Wheelchairs are available in many models and sizes. In the United States, the most common wheelchairs are made of aluminum tubing, with large rear drive wheels and small front caster wheels. Wheelchairs with large front drive wheels and small rear caster wheels are popular in Europe. These are more maneuverable, but the large front wheels restrict access to desks or counters and are often less suitable for outdoor use.

The frame of the wheelchair is usually collapsible in the middle for storage and transport. Footrests and armrests are generally removable or hinged to swing to the side. Most wheelchairs are propelled with hand rims on the rear wheels.

Motorized wheelchairs are also available. These are driven by electric motors powered by batteries below the seat. They are approximately the same size as manual chairs but are heavy and less maneuverable.

Basic wheelchair dimensions and related dimensions for turning and forward and side reaches are shown on these pages.