LINDA L. NUSSBAUMER

HUMAN FACTORS IN THE BUILT ENVIRONMENT

2nd Edition

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HUMAN FACTORS IN THE BUILT ENVIRONMENT

SECOND EDITION

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PREFACE

In designing spaces, designers must focus on users and their needs; addressing the many aspects of human factors places users at the forefront to provide them with a better quality of life. Interior designers can enhance quality of life by improving performance, safety, and equal access through their designs, as well as by considering areas of privacy and interaction.

To enhance quality of life, designers must incorporate human factors in all aspects of the design. Human factors means more than just proxemics, anthropometrics, and ergonomics. Though these are vital, human factors topics cover a wide range that also includes privacy; human diversity of culture, gender, size, age, spirituality, and more; and various environmental concerns, such as lighting, air quality, noise, and so on.

Other books written on human factors focus on one or two topics, such as anthropometrics and quantitative data, or ergonomics and anthropometrics, or proxemics. Few incorporate all three topics, and many that do are either out of date or focus on quantitative subject matter. Fewer still are qualitative or design centered. Additionally, human factors theory encompasses more than these three topics. It includes the Americans with Disabilities Act (ADA), universal design, human diversity, special populations (the elderly and children), and environmental considerations. Finally, since design courses (both lecture and studio) relate to the design, providing a design-centered textbook offers greater opportunities for discussion and projects within a course focused on (or that includes) human factors discussion.

This textbook fills the gap; it not only provides information about human factors but also includes chapters on the ADA, universal design, diversity, special populations, and environmental considerations, along with applications of human factors in residential and various commercial spaces. This textbook is also a design-centered resource with space-planning applications, because human factors and space planning are integral. In this way, this textbook can be essential for lecture courses as well as an important resource for studio courses.

An important unifying element of the textbook is the application of concepts—accomplished via case studies and exercises to engage students. The exercises at the end of each chapter help to make *Human Factors in the Built Environment* a design-centered textbook. This unifying element provides a unique, real-world resource for students and a quick and easy reference for interior designers.

DESCRIPTION OF THE TEXTBOOK

This textbook consists of three parts: Part One, "What Is Human Factors?," Part Two, "Human Factors and Varied Abilities," and Part Three, "Human Factors Applied: Case Studies."

Part One (Chapters 1 through 3) begins with a brief overview of human factors and focuses on the basic concepts. Chapter 1 discusses various aspects of proxemics, such as Hall's concept of proxemics; DeLong's concept of the ovoid shape and individual needs for privacy and territoriality; and problems caused by crowding and by dominance, control, and avoidance issues. Humans also differ in other ways, and thus, this chapter discusses basic needs of self-actualization, genders, generations, cultures, and personality types.

Chapter 2 defines anthropometrics and discusses its variability as well as its use within the built environment. Anthropometrics also considers the person with dwarfism, with limited mobility, or in a wheelchair. Therefore, while collecting data for a project,

the designer must consider all users of a space in order to accommodate those who have special reach heights or depths and to ensure the appropriate design of products and equipment used within the space.

Ergonomics is the focus of Chapter 3, and it shares information about some careers related to ergonomics, and the relationship between anthropometrics and ergonomics. Whether the environment is an office or a factory, the adaptation of products must consider the physiological and psychological capabilities and limitations of each individual. If items are not adapted, physical problems may occur such as fatigue, accidents, and injuries; psychological problems may also occur due to stress or discomfort related to an injury.

Part Two (Chapters 4 through 8) provides an overview of special concerns related to human factors. The chapters address special needs and include human diversity, the elderly, children, and environmental considerations.

Chapter 4 begins with information about the Americans with Disabilities Act Accessible Guidelines (ADAAG), followed by information on universal design. Emphasis is placed on designs that go beyond the ADA and strive to create an inclusive environment that does not draw attention to any one disability. To be inclusive, spaces are designed to include individuals with dwarfism, those who are obese, and those who use wheelchairs, while providing an environment that is inviting to everyone.

Since no two people are alike, human diversity must be taken into consideration in the study of human factors. Chapter 5 addresses differences related to gender, growth and development, and ethnicity, design considerations in a global market, and the spiritual dimension. Understanding differences between people is important to facilitate working together effectively and comfortably in the global community.

Chapter 6 focuses on the elderly. Because of the aging of the baby boomer generation and the increasing number of older adults, designing for the elderly is gaining importance. This will include attention to various living arrangements—aging in place, condominiums, apartments, assisted living, long-term care facilities, and so on. These facilities must be designed for the physical and psychological changes that occur with age as well as for the diversity of a population who may be living side by side for the first time.

Chapter 7 highlights the fact that the range of anthropometric data is greatest among children. This chapter also emphasizes special concerns related to physical disabilities (asthma, muscular dystrophy) and neurological disorders (Asperger's syndrome, autism). These concerns affect the design of both homes and schools.

Chapter 8 focuses on environmental considerations related to humans and the built environment. Some considerations are physical (e.g., noise, motion or vibration, climate, hazards, indoor air quality, color, and illumination), and some are psychological (how an environment can cause stress or provide relaxation, be positive or negative, or affect performance and productivity).

Part Three (Chapters 9 through 15) focuses on applications and case studies of human factors within residential and commercial environments. These types of stories can also be obtained via trade magazines, from interviews and observations, through postoccupancy evaluations, and so on.

Chapter 9 addresses the topic of barrier-free design for single- and multi-level housing. In particular, it considers designing for a lifetime—children to elderly—and for individuals of varied abilities. The chapter includes examples of interiors that meet the needs of all occupants.

Chapter 10 provides an overview of human factors for commercial spaces and looks at ways of evaluating products and interiors with the human factors interaction model, using anthropometric data and ergonomics, examining diversity in the workplace, and more.

Chapter 11 is important because many people spend more time working than in their homes. Therefore, human factors theory plays a crucial role in the design of the working environment by considering proxemics (personal space), ergonomics (musculoskeletal health), and accessibility and inclusive environments. Also, within today's workplace, diversity is common and includes gender, generational, spiritual,

and cultural differences. Applying all aspects of human factors into the design will create a better working environment.

Chapter 12 examines facilities that provide rest, relaxation, entertainment, and food and drink for guests. Human factors are important in considering personal space (crowding, isolation, and security); anthropometrics and ergonomics (variable sizes from children to the elderly); accessible and inclusive spaces; diversity among guests; and environmental considerations (e.g., noise levels, visual and tactile surfaces).

Chapter 13 focuses on various aspects of human factors as they relate to health care (e.g., medical offices, patient rooms, assisted living environments, etc.). To apply human factors fully, the design must be patient-centered, which reflects the principles that align patients with a healing environment by providing privacy, facilitating communication, accommodating families, and empowering patients—all of which support the healing process as well as staff goals.

Chapter 14 examines learning styles and teaching methods as they relate to creating appropriate learning environments. These environments must also consider acoustics (noise level), eliminate distractions, provide healthy indoor air quality, incorporate appropriate colors for learning, use appropriate technologies, and provide a safe and secure space. But they also must support the education of children with physical or mental limitations.

Chapter 15 focuses on spaces where people shop. Proxemics—personal space and crowding—is an important human element in this setting. Other factors such as diverse ages, sizes, cultures, and preferences are also important in the design of retail spaces.

With all design typologies, the designer must conduct research early in the design process to learn about users and pertinent aspects of human factors. Application of human factors then continues throughout the process and culminates in the evaluation of the design through a postoccupancy evaluation, which will improve future designs.

PEDAGOGICAL FEATURES

This textbook can be used to introduce students to human factors in an introductory design course or a course in interior design foundations or environmental psychology. Once human factors are introduced, the textbook can continue as a supplement throughout the curriculum, particularly in studios. When the subject of human factors is presented for the first time, students generally have already obtained knowledge of design and color theory as well as spatial relationships and organization. Introducing human factors at this stage will help students make a strong connection between human factors and the spaces they design.

The following pedagogical features in this textbook make this a more effective teaching tool and will facilitate learning:

- Learning objectives at the beginning of each chapter.
- Key terms following the learning objectives.
- Inclusion of both the U.S. imperial system and the metric system.
- Appropriate tables and figures to provide data and visuals at a glance. These will be important references that students can apply to projects.
- Applications and/or case studies from practitioners, observations, analysis, or postoccupancy evaluations (found in Chapters 9 through 15). These may originate from various trade publications, interviews, personal observations, and so on.
- A few exercises at the end of each chapter to engage students in investigations, research, observations, evaluations, and analysis, as well as to personalize the material. Additional exercises are found in the Instructor's Guide.

Exercises are designed to move students through a learning experience. Personal experience exercises

engage the student and integrate the experience with personal meaning. Here, students experience something new as they draw from past experiences. Next, instructors provide informational/different perspective through presentations, videos, or other methods of material presentation; class discussion is encouraged to aid a greater understanding of the topic. Practice and personalization exercises allow learners to use ideas or concepts from their reflections to draw their own conclusions (e.g., develop theories or generalizations). Lastly, with self-discovery exercises, learners apply theories or generalizations to real-life situations or to practical problems.

Instructor and Student Resources

Human Factors in the Built Environment STUDIO™

New for this edition is an online multimedia resource—*Human Factors in the Built Environment STUDIO*. The online *STUDIO* is specially developed to complement this book with rich media ancillaries that students can adapt to their visual learning styles to better master concepts and improve grades. Within the *STUDIO*, students will be able to:

- Study smarter with self-quizzes featuring scored results and personalized study tips
- Review concepts with flashcards of essential vocabulary

STUDIO access cards are offered free with new book purchases and also sold separately through Bloomsbury Fashion Central (*www.BloomsburyFashionCentral.com*).

Instructor Resources

- Instructor's Guide provides suggestions for planning the course and using the text in the classroom, supplemental assignments, and lecture notes
- Test Bank includes sample test questions for each chapter
- PowerPoint® presentations include images from the book and provide a framework for lecture and discussion

Instructor Resources may be accessed through Bloomsbury Fashion Central (*www.BloomsburyFashionCentral.com*).

SUMMARY

Because understanding and applying human factors in the built environment is required by CIDA, all interior design programs expect students to understand and apply human factors (including ADA and universal design) to projects throughout the curriculum. This textbook is designed to serve those in interior design programs in higher education and to provide an update for working professionals in the field. Most importantly, this textbook provides a deeper understanding of and additional concepts related to human factors. It combines information on human dimensions, concepts of proxemics, and up-to-date information on topics such as the ADA and universal design, as well as considering differences between generations, sizes, cultures, spiritual dimension, and more. This textbook, thus, should expand the reader's perception of human factors and, ultimately, design for all users.

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As with every project I've undertaken, my husband Jerry is always there to encourage, critique, and support me every step of the way. So, once again—thank you, Jerry! Your support is what makes this project worthwhile!

PART ONE

WHAT IS HUMAN FACTORS?

Human factors is the study of the way humans relate to the world around them and is concerned with improving performance and safety. Specifically, the study of human factors focuses on human beings and how people interact with products, workspaces, and environments in the home and workplace.

On a daily basis, people encounter products, equipment, and environments that may be stressful because human factors have not been taken into account during the design process. Thus, understanding our capacity as humans to function within a space is an integral part of interior design, and interior designers study how people interact with each other and their environment, including physical objects such as equipment and other products. From this study, interior designers work to improve humans' ability to function in a productive, safe manner.

Topics most associated with human factors are proxemics, anthropometrics, and ergonomics (which correspond to Chapters 1–3 in this text). These three topics are important, but an interior designer must consider many other aspects of human factors. This includes the application of human factors data to a variety of spaces as well as considering issues such as dominance, territoriality, personal space, crowding, privacy, diversity, social dimensions, and age groups.

Examining human factors must be part of the programming process and will continue through the design and drafting of detail drawings; hence, it must be part of the training and education of the interior design student. Therefore, exercises are included at the end of each chapter to help students develop hands-on experience with the concepts of this design-centered textbook.

1

PROXEMICS

"It seems to be that southern Europeans are just more intimate socially, whereas I like a lot of personal space—like, a mile from the nearest person is fine for me."

—PETER STEELE, LEAD SINGER, BASSIST, AND COMPOSER

OBJECTIVES

- Define and understand the terms "human factors" and "proxemics."
- Know the importance of understanding and applying proxemics.
- Explain the various spatial types: fixed, semifixed, and nonfixed features.
- Demonstrate the ability to apply sociofugal and sociopetal awareness to situations.
- Describe the difference between Hall's and DeLong's proxemics theories.
- Explain types of privacy.
- Explain issues related to crowding and territoriality.
- Explain issues related to dominance, control, avoidance, retreat, and offensive display.
- Demonstrate the ability to apply the social distances to various situations.
- Explain proxemics as it relates to Maslow's Hierarchy of Needs.
- Explain the differences in proxemics related to gender, age, ethnicity, and personality types.

KEY TERMS

crowding
distance zones
dominance
extraverted
feeling
fixed-feature space
human factors
informal (nonfixed) space
intimate zone
introverted
intuition
isolation
judging
Maslow's Hierarchy of Needs
Myers-Briggs Type Indicator® (MBTI®)
offensive display
ovoid-shaped zones
perceiving
personal zone
personality types
privacy
proxemics
public zone
retreat (passive display)
self-actualization
semifixed-feature space
sensing
social zone
sociofugal
sociopetal
territoriality
thinking

The way humans relate to the world around them is the focus of the study of **human factors**. Studying human factors helps interior designers understand how people function and interact within a space. Proxemics examines how people interact with each other. Edward T. Hall, an American anthropologist and cross-cultural researcher (1990), coined the term "proxemics," which relates to the social, physical, and psychological aspects of space as well as ways interior designers plan spaces. This chapter addresses proxemics as well as social distances, crowding, territoriality, dominance and control, and privacy and isolation. These terms, along with the concepts of sociofugal and sociopetal, are introduced and defined. In addition, this chapter discusses Maslow's Hierarchy of Needs in relation to proxemics.

In the programming phase of the design process, the interior designer collects evidence by interviewing the client, observing behaviors, and learning about individual needs as well as the culture. All of these elements, which relate to proxemics, will aid the designer in planning the space. In the schematic development phase, conceptual space planning applies proxemics theory to the sketches and preliminary floor plans. Exercises at the end of this chapter address this process.

PROXEMICS DEFINED

Proxemics is the study of the relationship between humans in a particular culture and their use and perceptions of space (Hall, 1990). Interior designers examine the way people interact in order to better understand the social, physical, and psychological aspects of space. Then, based on this knowledge, they design spaces for occupants to move comfortably in both a physical and a psychological sense.

Interior designers examine distances that individuals maintain between each other in social interaction, as well as the significance of that distance. Particularly, they examine spatial needs of humans in regard to personal and cultural aspects. Hall (1990) determined that humans perceive the world around them based on their different languages and through different senses. In other words, a comfortable personal distance between two people varies with familiarity, cultural background, and sensory differences. Creating a furniture arrangement within public spaces is therefore based on personal distances for psychological comfort.

SPACES

Proxemics is used to define relationships between humans within a space; hence, interior designers encourage or even discourage human interaction by the way they organize space. There are three ways to organize activities: through **fixed-feature space**, **semifixed-feature space**, or **informal** (**nonfixed**) **space** (Hall, 1990). Each affects activities and human interaction.

Fixed-Feature Space

Fixed-feature spaces are fixed (immovable) material elements, such as the building, permanent walls of the building, and fixed furnishings or equipment. The fixed-feature space provides the basis for organizing activities and allows people to engage in groups or to be isolated. Elements may be static, immovable, and permanent. For example, homes in the American culture have either a visible boundary such as a fence or an invisible boundary that separates one property from another; these are fixed-feature spaces. Another example is a kitchen, which is designed for food preparation and cleanup, and has fixed features (sink, stove, refrigerator) that organize food-related activities (Hall, 1990).

In many Western homes, fixed-feature spaces are designed for specific functions such as food

preparation, socializing, eating, sleeping, and personal hygiene. Therefore, if an activity or object normally associated with one space is moved to a different space, the room may be considered "a mess" because the activities or objects are incompatible with the function of the space. If office work took place in a dining room, for example, the activity would be considered inappropriate and render the space messy (Hall, 1990).

The fixed-feature space also relates to culture or to personality. Therefore, one culture, individual, and/or family may choose to use a space differently than another. Although people in Western society currently use spaces for specific purposes, in the future, spaces may change because activities change due to changes in human behavior. For example, in many American homes, food preparation areas open to the social and eating areas. This allows everyone (family and guests) to be involved in the food preparation. Figures 1.1a–b provide an example of a food preparation area that is open to the social and eating areas of a home.

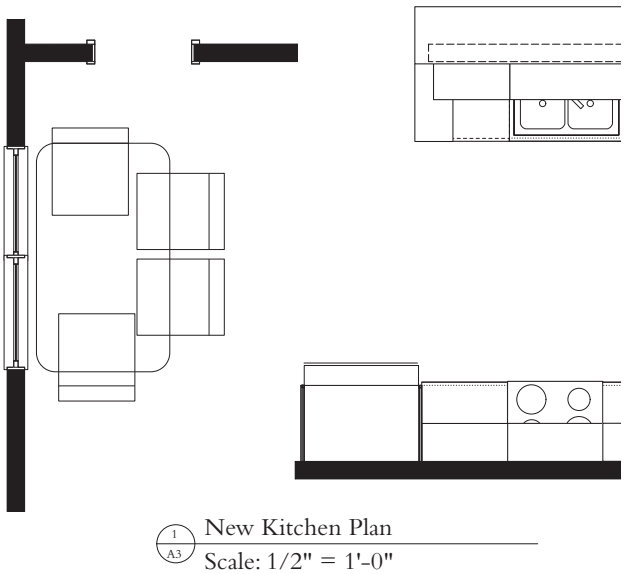
Semifixed-Feature Space

Semifixed-feature space pertains to movable furniture or objects, furniture arrangement, and the ability to move furniture or objects from place to place. The way furniture is arranged affects the interactions of humans. Figures 1.2a–g display various furniture arrangements; note that some keep people apart (such as straight-line or solo seating), while others encourage interaction (such as the L-shaped, U-shaped, box-shaped, and circular seating). Parallel seating may provide interaction but in a more formal manner.

To keep people separated, furniture is arranged in rows or far apart—this is called **sociofugal** space. On the other hand, to bring people together, pieces of furniture are arranged perpendicular to each other, which encourages interaction—this is called a **sociopetal** space (Hall, 1990).

Sociofugal and Sociopetal

Sociofugal spaces are found in lecture halls or medical waiting rooms, where interaction is discouraged. In these situations, chairs are lined up in rows and



(a)

(b)

Figure 1.1 Kitchen Layout (a) The food preparation is open to the social/eating area in the room. To the left is the casual eating area where interaction between family and guests can occur; all can be involved in the food preparation process. **(b)** This photo shows the food preparation area that is centered around the sink area of the kitchen.

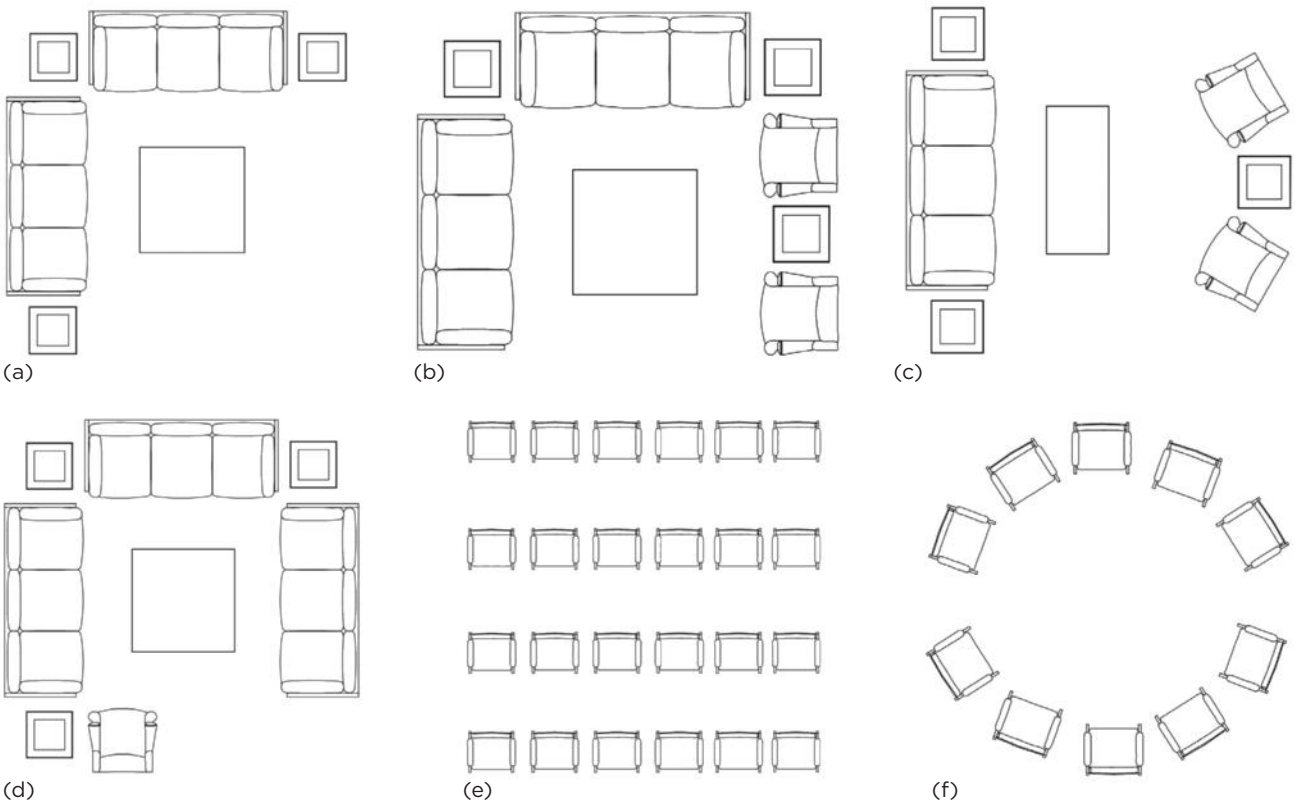


Figure 1.2 Furniture Arrangement (a) L-shaped The L-shaped seating area provides the opportunity to visit at 90-degree angles. **(b) U-shaped** The U-shaped seating area provides the opportunity to visit at 90-degree angles as well as across (180 degrees) from one another. **(c) Parallel** Conversations are at 180 degrees or across from each other. This is a more formal setting. **(d) Box** Similar to the U-shaped seating arrangement, a box provides the opportunity to visit at 90-degree angles as well as across (180 degrees) from one an other. **(e) Straight line** Conversation is limited in straight lines. This is a lecture hall type of seating where the focus is on the speaker or instructor in the front. **(f) Circular** Conversations in a circular seating arrangement give everyone equal opportunity to visit with everyone else. **(g) Solo seating** Solo seating areas provide opportunities for separation from the group to relax, read, meditate, and more.

frequently face one direction. In some waiting rooms, chairs line the perimeter of the room, with back-to-back rows in the center that face the chairs along the wall. In these situations, although patients face other patients, little or no interaction takes place. Figure 1.3 illustrates a sociofugal space in a waiting room that discourages interaction through the use of straight-line seating.

Sociopetal spaces are found in living rooms, dining rooms, hotel lobbies, conference rooms, and other spaces where interaction is encouraged. A common method to encourage conversation or interaction is to arrange furniture at right angles. However, cultural differences can affect whether a space becomes sociofugal or sociopetal. Additionally, sociofugal spaces are not always bad arrangements and sociopetal space is not always a good arrangement. For example, in a medical waiting room, the best arrangement may be sociofugal to limit the transfer of germs. However, it is usually most desirable to create spaces with "flexibility and congruence between design and function so that there is a variety of spaces, and people can be involved or not, as the occasion and mood demand" (Hall, 1990, p. 110).

Thus, the way an interior is created affects interaction between humans in the space and is important. Figure 1.4 illustrates a sociopetal space in a waiting room that uses U-shaped seating to encourage interaction.

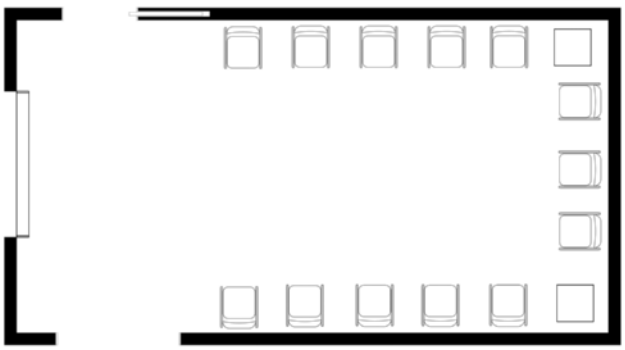


Figure 1.3 Sociofugal Space This waiting room illustrates sociofugal space, with straight-line seating that discourages interaction.

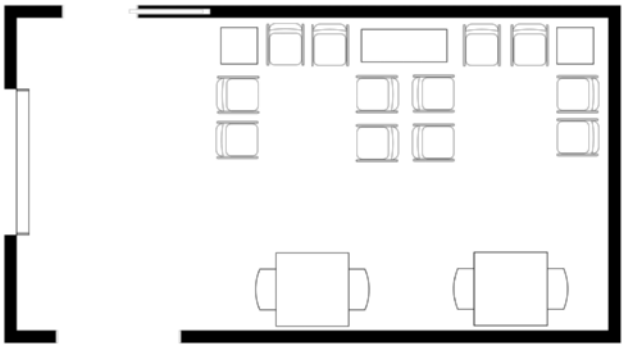


Figure 1.4 Sociopetal Space This waiting room illustrates sociopetal space, with U-shaped seating arrangements that encourage interaction.

Informal, or Nonfixed Space

While semifixed spaces that contain furniture or objects affect human interaction, informal or nonfixed spaces relate people to people—that is, interaction between individuals within the spatial experience occurs with or without the aid of fixed or semifixed features. Most importantly, informal or nonfixed spaces relate to distance zones—the distance between two people. Comfortable and proper distances between people may vary for standing, walking, and sitting. These distances ultimately affect placement of furniture.

Distance Zones

The four spatial or social **distance zones** are **intimate**, **personal**, **social**, and **public**. Each zone considers the distance between two people, and designers must understand these zones when designing spaces (Hall, 1990). Figure 1.5 shows proxemics and the distance zones.

The intimate zone (or bubble) begins from the point of contact to 18 inches (457 mm) out and is reserved for those with whom a person feels close. This zone relates to comfort, affection, and protection—as well as aggressive behavior. A stranger entering an individual's intimate space may cause both to feel uncomfortable and uneasy. Voice levels range from a whisper to very low volume (Hall, 1990), depending on the situation (e.g., hugging or in a private conversation). For these reasons, designers must avoid creating environments that penetrate the intimate space. For example, cocktail tables in bars placed too close together interrupt private, intimate conversations; therefore, placement of tables must allow for private conversations between two people.

The personal zone (or bubble) spans between 18 inches (457 mm) and 4 feet (1219 mm) from the individual. Friends are permitted within the personal zone at arm's length, but they do not enter the intimate zone, with a few exceptions such as a handshake or possibly a pat on the back. The personal bubble is

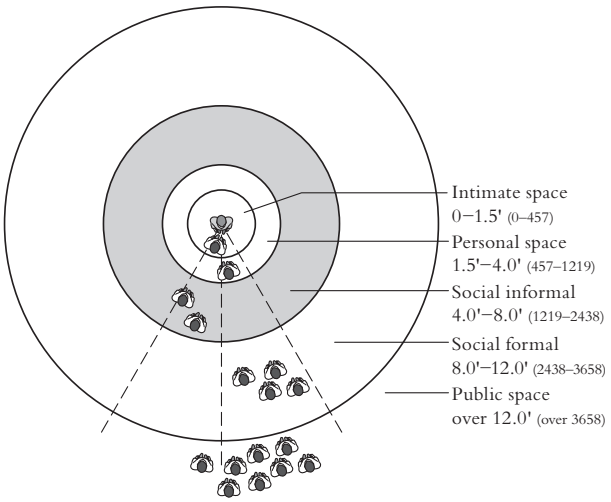


Figure 1.5 Proxemics The four distance zones of proxemics are concerned with the distances between people.

smaller for people from other cultures than it is for Americans. For example, people from South America, the Middle East, and southern Europe may feel at ease embracing or touching in an appropriate manner. Voice levels in the personal zone are at a modified range with casual conversation (Hall, 1990).

Because of these considerations, interior designers must understand who will use the space and how it will be used, as this affects furniture arrangement. For example, since placing furniture pieces at right angles to one another allows penetration into the personal space, interior designers must understand the relationships between occupants when designing that space (Kilmer and Kilmer, 1992; Nielsen and Taylor, 2007).

Often people must share spaces that penetrate their personal space. For example, children often share a bedroom; however, each child will create a private space within the room. The need for a private area for one's own belongings carries over into adult life in the workplace as well as within the home. Interior designers must be sensitive to the needs for privacy (Jones and Allen, 2009). Privacy is discussed further later in this chapter.

The social zone spans from 4 to 12 feet (1219–3658 mm). It can be either informal or formal and can be in a social or a business situation. Beginning at 8 feet (2438 mm) or closer, a person's features are clearly recognized, and conversation can take place with voice levels at a normal range (Hall, 1990). As people move closer and interaction increases, the situation becomes less formal. Furniture placed so that two people sit opposite each other is an arrangement that illustrates the social zone—informal or formal (Kilmer and Kilmer, 1992; Nielsen and Taylor, 2007).

The public zone spreads from 12 feet (3658 mm) and beyond, and there is little or no interaction here. A common example is the distance (and relationship) between a speaker and the audience, where voice levels are loud or at full volume—the public-speaking voice (Hall, 1990). Because waiting rooms and reception areas are considered public zones, chairs rather than sofas are most often used as the primary seating furniture so that personal space is not penetrated (Kilmer and Kilmer, 1992; Nielsen and Taylor, 2007).

Figures 1.6–1.10 illustrate various social zones: intimate, personal, social (informal and formal), and public.

Figure 1.6 Intimate Zone These individuals represent interaction within the intimate zone of social distance.

Figure 1.7 Personal Zone These individuals represent interaction within the personal zone of social distance.

Figure 1.8 Social Zone: Informal These individuals represent interaction within the informal social zone of social distance.

Figure 1.9 Social Zone: Formal These individuals represent interaction within the formal social zone of social distance.

Figure 1.10 Public Zone These individuals represent interaction within the public zone of social distance.

PERSONAL SPACE

Hall's proxemics is based on communication and a relationship between individuals. Alton DeLong, retired professor of interior design (1991), redefined Hall's zones to consider "people seated in furniture arrangements that provide body orientation . . . [P]roxemic zones vary depending upon the axial orientation of participants, rendering the functional zones more ovoid in shape and sharply truncated to the rear" (p. 19). Thus, a person's orientation or position (sitting or standing) affects whether or not the zone is circular or ovoid (an egg shape).

With the individual seated at the center, DeLong's distance zones are redefined into (1) Intimate/Personal-Close, (2) Personal-Far, (3) Social-Close, (4) Social-Far, (5) Public-Close, (6) Separation, (7) Privacy, and (8) Public-Far. (See Figure 1.11a.) Notice that DeLong's first zone does not separate the intimate and personal (Intimate/Personal-Close), because with furniture it is not physically possible to be closer together unless seated on the same piece of furniture. The second is similar to Hall's personal zone. Hall's social and public zones and DeLong's Social-Close, Social-Far, and Public-Close are within a similar range within the 45-degree angle. The greatest difference is found in DeLong's addition of the sixth and seventh zones: Separation and Privacy. In Figure 1.11b, Hall's circular zones are superimposed on DeLong's **ovoid-shaped zones** to illustrate the differences. Figures 1.11c–j illustrate the various zones by DeLong. DeLong's theory benefits interior designers as they determine placement of furniture, fixtures, and equipment in interior spaces.

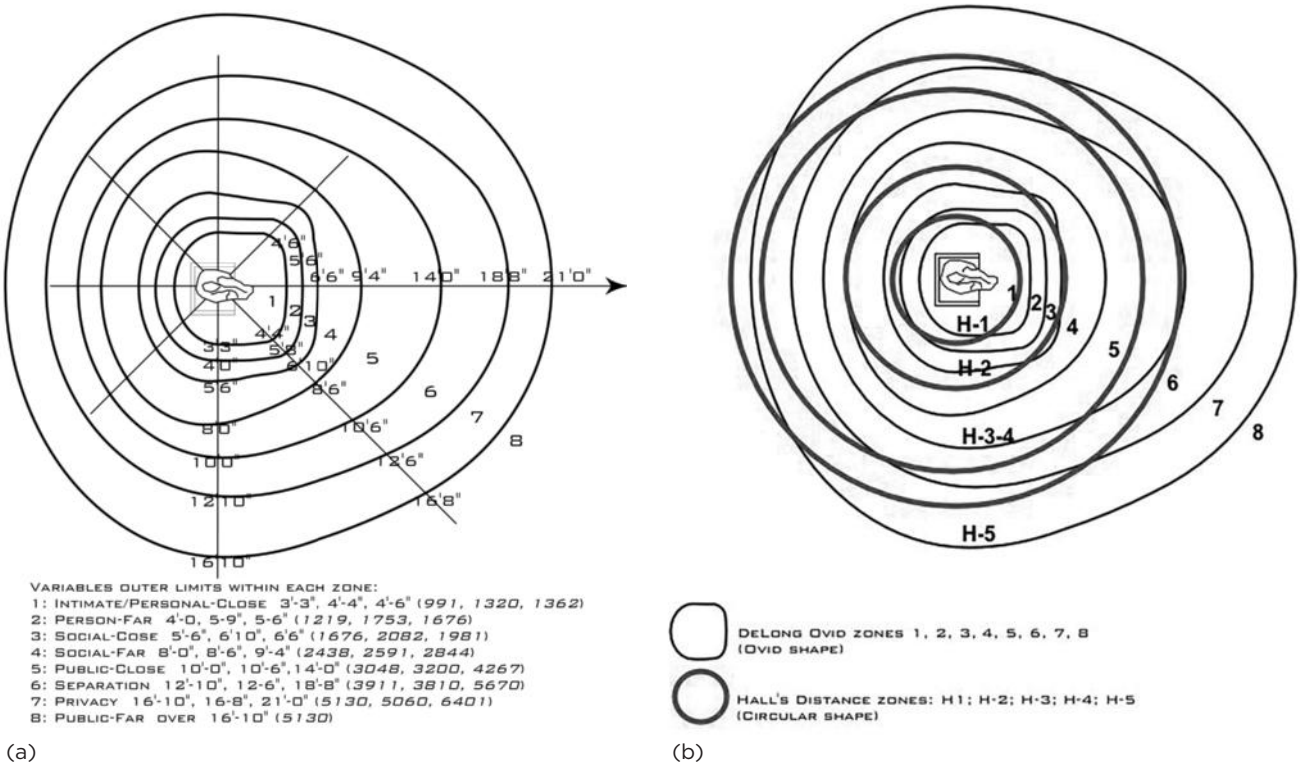
Privacy

Privacy relates to all personal spaces—intimate to public. It can refer to the means of controlling access to oneself or a group (Stewart-Pollack and Menconi, 2005) or to the right to privacy—being protected from unauthorized intrusion (Merriam-Webster, 2011). Privacy can be divided into two areas, each

with its own descriptors: (1) separation from others—solitude, anonymity, reserve, and **isolation**; and (2) being alone with selected individuals—intimacy with family, friends, or others of one's choosing. Stewart-Pollack and Menconi (2005, pp. 19–20) define these descriptors:

- **Solitude.** The need to be alone and free from observation by others; a place where others cannot hear or see what someone is doing—*retreating to our bedrooms or offices and closing the door.* See Figure 1.12.
- **Anonymity.** The freedom to be in public while at the same time free from identification or surveillance by others; being lost in the crowd—*surrounded by strangers and therefore not expecting to be recognized, such as when we go to a movie, sporting event, or concert alone.*
- **Reserve**. The need to limit communication about ourselves, which is protected by the cooperation of others; verbally controlling information about ourselves such as *withholding our feelings, opinions, and ideas rather than expressing them to others*.
- **Isolation**. The separation of ourselves physically from others by means of physical distance—*going for a long drive alone, hiking deep into the wilderness, or walking along a deserted beach*.
- **Intimacy.** The need to be alone with others such as friends, lovers, or family without interference from unwanted intrusions. Examples may include the following:
  - Intimacy with family: Being alone with family and excluding others—going to a family getaway location such as a beach house or mountain cabin.
  - Intimacy with friends: Being alone with friends to the exclusion of others.

Everyone needs privacy at times and in each of these ways described. Whether it is in the home, office, or a



(a) (b)

Figure 1.11 (a) DeLong's Distance Zones The ovoid shape of DeLong's distance zones demonstrates the use of furniture for distance zones. With the individual seated at the center, DeLong's distance zones include Intimate/Personal-Close (1), Personal-Far (2), Social-Close (3), Social-Far (4), Public-Close (5), Separation (6), Privacy (7), and Public-Far (8). **(b) Hall's Distance Zones** Hall's circular distance zones are superimposed on DeLong's ovoid-shaped zones. DeLong's first zone does not separate the intimate and personal zones. However, the second is similar to Hall's personal zone.

(c)

(d)

(e)

(f)

(g)

Figure 1.11 (*continued*) **(c) Intimate/Personal-Close** Intimate/Personal-Close is represented with two people sitting side by side. **(d) Personal-Far** Personal-Far is represented with two people sitting in chairs next to each other or perpendicular to each other. **(e) Social-Close** Social-Close: sitting in chairs next to each but with an object located in between, such as a desk or lamp table. **(f) Social-Far** This illustrates three different examples: the Personal-Far, Social-Close, and Social-Far (Social-Far is represented by the women in relation to the men with a large coffee table between them). **(g) Public-Close** There is little or no conversation going on in Public-Close. Generally, there would be more space between them, but these two individuals were desperate for a place to sit and wait.

(h)

(i)

(j)

Figure 1.11 (*continued*) **(h) Separation** Partitions create a separation from others and allow for some privacy. **(i) Privacy** To complete a task, full privacy is needed, as in this example. **(j) Public-Far** Separation from others so that no conversation can take place may involve full removal from others or finding seating that is separate.

public space, it is both important and possible to provide areas for privacy. However, how do we know when someone needs a specific level of privacy? How do we let others know when we need privacy? What behaviors do we use to achieve our desired level of privacy? How does the physical environment help us achieve privacy (Stewart-Pollack and Menconi, 2005, p. 21)?

The four privacy mechanisms (verbal behavior, nonverbal behavior, use of culturally accepted behavior, and use of the physical environment—personal space and territoriality) will help answer these questions.

Verbal behavior or the spoken word is the basic modern method of communication. One can say, "Leave me alone," or "Don't bother me now," and it is clear that privacy is desired. Nonverbal behavior or body language is a method of communicating without words and is the oldest form of communication. Nonverbal communication occurs through facial expressions, head movements, posture, gestures and other physical actions, and arm and leg positions. For example, if a woman stands in a doorway, she is signaling to another person not to enter; if, instead, the woman stands to the side of the doorway and angles her body, she signals to the person to enter (Stewart-Pollack and Menconi, 2005).

Communicating the need for privacy differs between cultures. Thus, it is important to use the culture's accepted behavior. One can be rewarded for correct behavior but punished for violating a culture's norms (Stewart-Pollack and Menconi, 2005).

The physical environment is frequently used to communicate a need for privacy. This may occur by the way a person positions him- or herself in relation to others and by the way a person manipulates physical

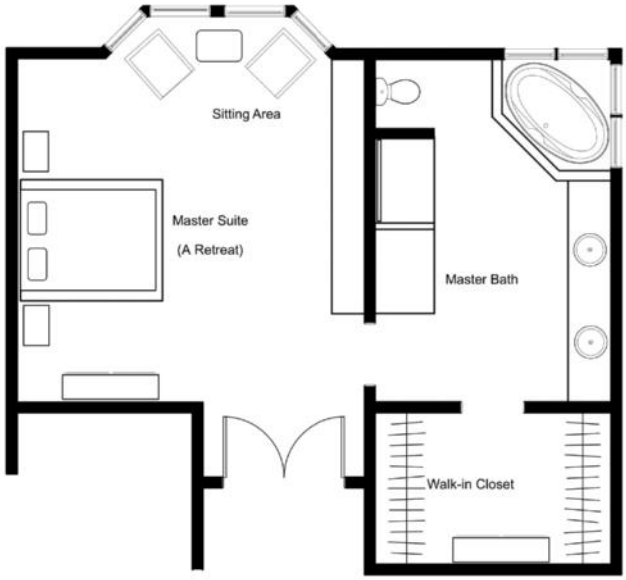


Figure 1.12 Solitude: This master suite plan illustrates a place of solitude as well as an area to read and relax.

elements within a space to control interaction. These behaviors communicate elements of proxemics—personal space and territoriality (Stewart-Pollack and Menconi, 2005).

Territoriality

Territoriality is a type of privacy used to communicate one person's control over an area (Hall, 1990). These territories are created through either visible or invisible boundaries. Visible boundaries or markers leave no question regarding territoriality, whereas the use of invisible boundaries or the removal of markers makes territory more difficult to discern.

Sommer (2007) categorized territories into four types: public, home, interactional, and body. Public territories are areas such as parks, shopping malls, and atrium spaces. These boundaries are often unmarked, and individuals may mark out their territory by arranging personal items, such as packages in a mall, or by sprawling across a park bench.

Home territories are those in which groups take over a space (e.g., a clubhouse created by children or a restaurant or bar that caters to "regulars") (Sommer, 2007). Groups may be related by ethnicity, lifestyle, spiritual beliefs, and so on. When designers create built environments for these groups, special needs of the groups must be considered. For example, a group of Korean students may meet together for lunch at the same time and place in an area of a cafeteria, coffee shop, or restaurant, and by doing so, the group has created a home territory within the space.

Interactional territories are where social gatherings take place involving a group that has specific boundaries and rules (Sommer, 2007). Examples may be a coffee group, a study group, or other types of social groups. These groups may not meet in the same location, but territoriality can be created within a space for the group's time together. This may be accomplished by the rearrangement of furniture to accommodate the group's needs.

Body territories relate to one's personal space with its invisible boundaries. Encroachment into this territory by another may be considered an invasion, violation, or contamination (Sommer, 2007) and relates to aspects of proxemics. For example, sitting in the only chair left in a crowded waiting room may feel similar to invading invisible boundaries between strangers.

An individual may identify and create his or her own territory within a space. This can be achieved with personal items, colors, and other physical manifestations of the personal self. For example, many individuals have their own seat in a classroom, sit in the same pew each week in church, or occupy a favorite chair in the family room. If a person's seat is taken, he or she may feel annoyed and even displaced (Nielson and Taylor, 2007). Territoriality is a basic need to have a space; therefore, if spaces are shared, areas must be provided for individuality and privacy (Nussbaumer, 2009).

Creating territoriality can occur in several ways. Personal photos, a special painting, and other personal memorabilia create territory for an office worker. Plants, photos, and even the way each individual uses space create territoriality in an open office. Some prefer clean desks while others prefer stacks. These preferences, along with dividers, indicate different territories within an office space. Within a classroom, students often create areas with personal items and make spaces their own territories.

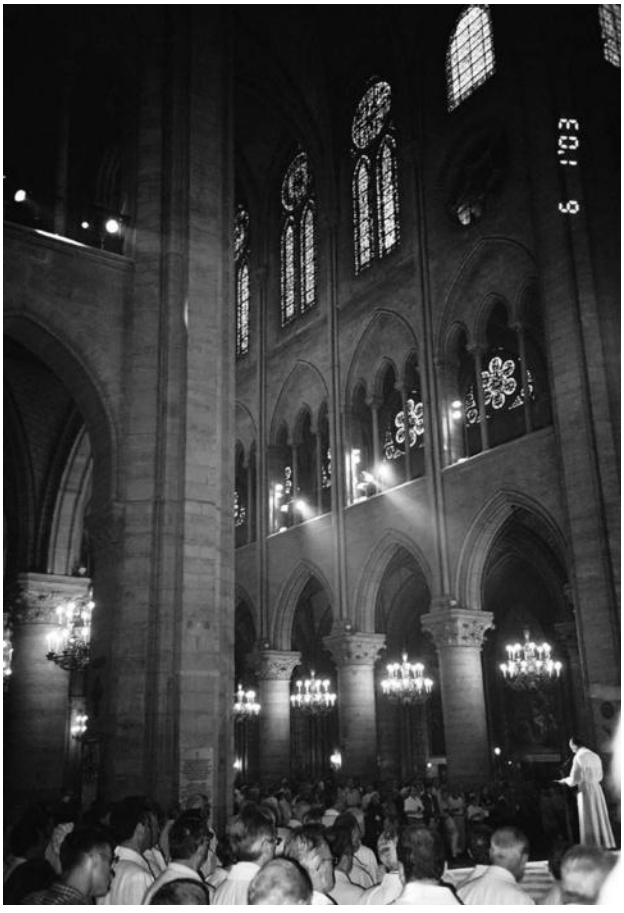
Crowding

Crowding is a throng or a large number of people gathered together. It can generate psychological feelings of insecurity and confinement; it can also provide a sense of security and stability. When animals are crowded into small spaces, they exhibit stress, abnormal behavior, illness, and sometimes even death. However, in dimensionally crowded situations, humans generally do not exhibit such behaviors. Rather, crowding for humans generally is individually based on numerous elements, including an individual's culture and personality, as well as the desire for involvement with other people. Some people enjoy interaction and involvement with others in crowded situations. Others feel overstimulated from crowding and need areas of solitude, or areas of retreat from others (Nussbaumer, 2009).

Interiors can be designed to accommodate preferences. For example, some individuals like to be surrounded by objects, furniture, and so on, while others prefer open spaces—visual or actual (Nielson and Taylor, 2007). Thus, during the data collection process, it is important to learn the preferences of clients and users of the space. However, crowding issues may also relate to different design typologies, such as casino or residential design (Nussbaumer, 2009). Figures 1.13a and b show crowded situations among strangers in Notre Dame cathedral in Paris and a Las Vegas casino hallway.

Control and Dominance

Exerting power or control over another is **dominance**. Dominance may be exhibited through body language such as body position and eye contact. For example, in the social space circle, those who maintain dominance in a meeting may sit straight and alert, while subordinates look down and avoid eye contact. People who lean back with their arms crossed or their hands behind their heads communicate dominance. A person standing demonstrates dominance over a seated person. Staring is negative eye contact that may also communicate dominance or a sense of superiority as well as a sign of disrespect or even an insult (Goman,



(a)

(b)

Figure 1.13 Crowding (a) Crowds throng to be in Notre Dame during mass; some will be uncomfortable while others will be more concerned about the experience and accept the closeness of people. **(b)** Crowds of people can be found in casinos throughout the country. In this case, the casino is located in Las Vegas, NV. Here, too, closeness may be comfortable for some and uncomfortable for others.

2008). These nonverbal cues by the dominant person may indicate that his or her personal space has been invaded and that he or she is trying to increase the personal or social circle through body movement. Nonverbal cues may be culture-dependent as well.

Other types of body language that may indicate dominance are finger pointing and touch. Finger pointing sends a signal of dominance by one party and possibly a need for retreat by the other. Touch can be interpreted as a means of control, intimidation, or even intimacy. For example, someone touching or leaning against an object (e.g., desk or file cabinet) in another person's office can indicate control and even attempted intimidation. Someone sitting on another's desk can signal intimacy or intimidation (Goman, 2008). In these cases, the personal space may be invaded.

Avoidance

To avoid or not go near something or someone often reduces tension (Sommer, 2007); however, it is "a negative response to an environment that we perceive as unsupportive of our needs and performance of activities" (Stewart-Pollack and Menconi, 2005, p. 40). When people avoid areas or environments, they attempt to physically withdraw from others and thus increase the distance of their personal space. On the other hand, it is not always possible to physically withdraw. In those cases, other means are used, such as psychologically turning inward; ignoring the person or persons; retreating into reading material, cell phone, or headphones; or closing the eyes to avoid interaction with others, work, or an activity. These behaviors extend the personal space or bubble.

Sommer (2007) conducted several studies to understand avoidance, in particular, the use of **retreat (passive display)** and **offensive display**. Students were asked the following questions regarding rectangular tables:

1. If you wanted to be as far as possible from the distraction of others, where would you sit? (Relates to avoidance)
2. If you wanted to have the table to yourself, where would you sit to discourage anyone else from occupying it? (Relates to offensive display)

In the first situation, a large majority chose an end chair to indicate the need to retreat. In the second situation, all students chose a middle chair to indicate the need to keep others away. Another aspect of this research relates to the location of the door. Findings revealed that the person who retreats through avoidance faces away from the door, whereas the person using offensive display will face toward the door (Sommer, 2007).

The ability to retreat in large sociopetal spaces may be difficult if, for example, furniture is arranged with one center of focus (e.g., circular or box seating), as shown in Figure 1.14. Sommer (2007) found the avoidance tactic of retreat was used more often than offensive display. For example, in spaces with rectangular tables such as libraries, the first occupant can easily retreat to the end chairs, but later arrivals may find it difficult to retreat. However, if the space was more frequently less dense with one person per table, an individual would occupy the center chair, which allows the person to spread out his or her work, read, and write.

It is important for designers to realize that some people may need a place to retreat or to keep others away, and these places must be approachable to those who need privacy. Thus, providing retreats and ample seating will be important and can be determined through observations, surveys, and interviews (Stewart-Pollack and Menconi, 2005).

Figure 1.14 Avoidance It is impossible to retreat from others within a circle.

DIFFERENCES

Differences between individuals often begin with their fulfilled and unfulfilled needs; the model of Maslow's Hierarchy of Needs can reveal patterns in proxemics differences. Differences are also found among genders, age groups, various ethnic groups, and personality types. The following are examples of these differences.

Maslow's Hierarchy of Needs

Maslow's Hierarchy of Needs describes stages of needs from the basic needs of survival to **self-actualization** (Maslow, 1943). Once the basic physiological and safety needs of water, food, shelter, clothing, and safety are satisfied, the social needs—a sense of belonging and the ability to show love and affection—will emerge. With these needs covered, an individual's self-esteem grows and the ability to achieve and gain respect from others occurs. Ultimately, this makes way for self-actualization: a desire for self-fulfillment (see Figure 1.15).

With respect to proxemics, as an individual moves up this pyramid, the comfort level with his or her personal space may change. People whose basic needs have not been fulfilled may have a wider circle for their intimate and personal spaces. For example, an adult with limited income may feel uncomfortable near others and may choose to avoid closeness of those outside his or her family unit. Additionally, living in cramped conditions such as high-density housing may limit opportunities for privacy.

With basic needs covered and with a developed sense of belonging with a safe community and separate dwellings, individuals may close their intimate and personal circle spaces (Maslow, 1943; Poston, 2009; Stewart-Pollack and Menconi, 2005). It is clear that "each of Maslow's needs is in some way environmentally dependent" (Stewart-Pollack and Menconi, 2005, p. 4). Differences may also vary with gender, age, culture, and even personality, as well as an individual's comfort level with another's invasion into his or her personal space.

Gender

Gender differences relate to various human factors of social distance and anthropometrics—the measurement of the human body. American men often prefer

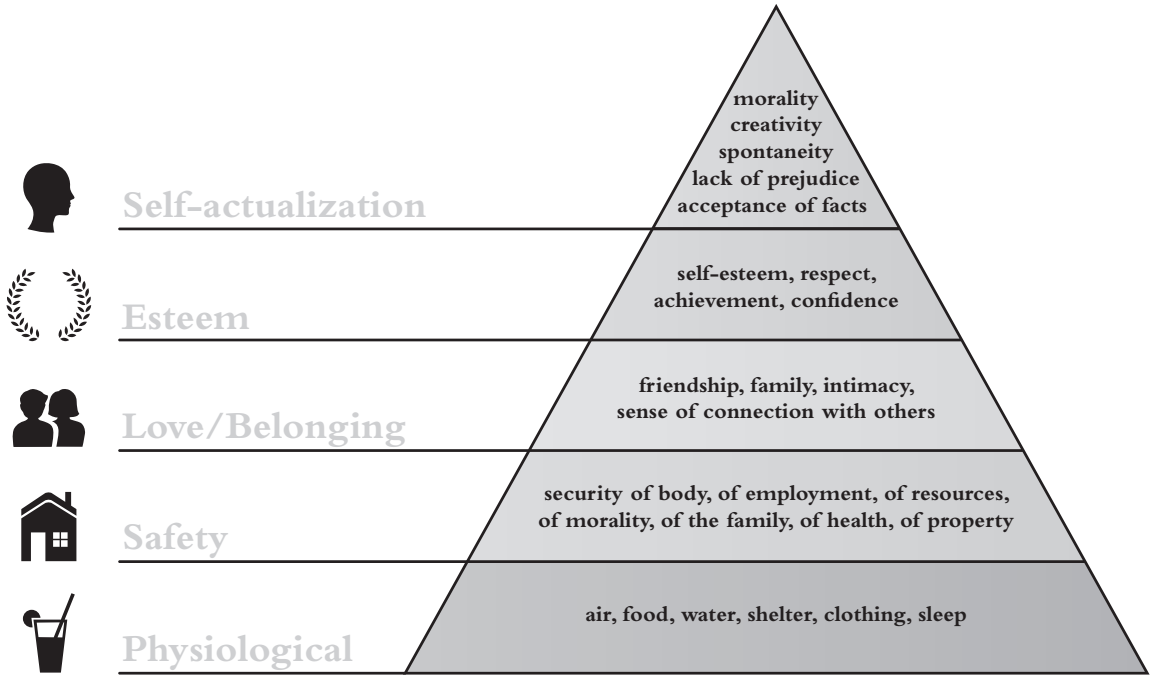


Figure 1.15 Maslow's Hierarchy of Needs As a person's physiological needs are taken care of, then safety needs, love and belonging, and esteem needs follow. Once all four are covered, a person is able to provide care for others beyond themselves and family—a time to give back to others.

greater distances between themselves and others, whereas women often prefer closer distances. As Audrey Nelson, PhD, a communications consultant, states, two male friends generally sit "a seat apart," and if one or both are large, a seat separation allows more space between. Often the distance between two men is 4 to 5 feet (1219–1524 mm). Conversely, two females almost never sit a seat apart. In fact, if a woman's female friend does not sit next to her, she may think the friend is angry with her (2004, p. 161). Many times, two female friends are close enough to embrace. When the opposite genders (a man and a woman) meet and visit, the personal distance is somewhere between 18 inches (457 mm) and 5 feet (1524 mm).

Therefore, the personal distance zone may be closer for many women and farther for many men. In creating spaces, interior designers must understand and know their client and whether the space will be occupied by men, by women, or by both. During the programming phase, prepare interview questions or make careful observations of the client concerning how that person regards personal space. Figures 1.16a–d represent the difference between personal space for two men versus two women.

Age

Children are less affected when adults or other children penetrate their intimate and personal space. For example, babies have a close, intimate relationship

(a)

(b)

(c)

(d)

Figure 1.16 Interaction (a) Having a meal together and sitting at a social distance demonstrates a formal discussion between these two men. **(b)** Here two men are discussing a business venture; one is more open to the information than the other (note the crossed arms on the person at the left). **(c)** Women tend to be more animated in their discussions. **(d)** As co-workers, women are more comfortable sitting closer to one another.

with the caregiver. Family or friends of the family may also provide assistance, and babies allow them into their intimate space. Of course, babies are dependent and therefore need assistance from those available. As children grow older, they gradually disconnect and allow only those with whom they are most comfortable into their intimate or even personal spaces. In other words, they emulate the distance zones of their parents—often related to their culture. Figures 1.17a–h represent the interaction between children, children and adults, teenagers and an adult, and between teenagers.

Cultural and/or International

Even without realizing it, people learn perceptions of space and social distances as children. Related to the perception of space, what is a fixed-feature space to one culture may be a semifixed-feature space to another (or vice versa). For example, Americans consider walls as fixed-feature spaces. They use different rooms (fixed-feature spaces) for different activities—eating, sleeping, working, and socializing (semifixed-feature spaces). However, in a Japanese home, walls are movable (semifixed-feature spaces), and activities are fixed and occur in one place (fixed-feature spaces). As activities change, walls open and close. On the other hand, the Chinese assign fixed-feature spaces to what Americans consider semifixed-feature spaces. For example, guests are not allowed to move a chair in the home without permission of the host. These chairs are fixed features. In an American home, the semifixed

(a)

(b)

(c)

(d)

Figure 1.17 Interaction among Generations (a) In the home environment, women often spend more time reading and working with children. **(b)** Children of all ages can be found playing together. **(c)** Families spend quality time interacting with one another. **(d)** People learn how to interact with others as children.

(e)

(g)

(f)

(h)

Figure 1.17 (*continued*) **(e)** Families—grandparents, children, and grandchildren—each working as they are able. **(f)** Teenagers begin developing a special bond with one another. In these cases, they share a closer, more intimate and personal relationship. **(g)** Teenagers sometimes prefer to separate themselves from others as well. **(h)** Teenagers often feel more comfortable with those of their own age.

nature of furniture is a matter of degree and situation. Some items such as a light chair are easier to move; the sofa or heavy tables are not.

As noted earlier, the personal bubble is generally smaller for people in other cultures than for Americans. For example, American businesspeople shake hands when they meet, whereas businesspeople from Asia bow to one another (see Figures 1.18a–b). In some Middle Eastern cultures (e.g., Israel and Egypt), people greet each other with a kiss to the check and will also hold hands. Figures 1.18c–d represent differences in personal zone

(a)

(c)

(b)

(d)

Figure 1.18 Greetings Related to Culture **(a)** Two men greeting in a Western culture is generally with a handshake. **(b)** Man and woman greeting in an Eastern culture (Asian) with a bow. **(c)** President Bush and King Abdullah Al-Saud of Saudi Arabia holding hands (not uncommon in Arab countries). **(d)** President Bush and King Abdullah Al-Saud of Saudi Arabia greeting with a kiss on the cheek.

distance between an Eastern culture and the Western culture.

The population of the United States has become much more diverse with many varied cultures, and people of these varied cultures are now working in offices and moving into various types of dwellings. Therefore, the ability to understand the various distance zones related to cultures, activities, relationships, and emotions is extremely important (Hall, 1990). Keep in mind that distances are approximate; again, use of space and preferences vary from culture to culture and person to person. Thus, since personal space requirements will vary, the data and research on a specific client's preferences along with approximate zonal distance will aid in planning interior spaces (Nussbaumer, 2009).

Personality Influence (MBTI®)

Knowing and understanding **personality types** can also help the interior designer in many ways. This, for example, aids in recognizing the different ways people are energized, gather information, make decisions, and work (Myers and Briggs, n.d.). For interior designers, it assists in understanding the ways people can function and interact more positively with others within the work environment. To gain this understanding, learning about the characteristics of personality type is important. The **Myers-Briggs Type Indicator®** (MBTI®) is a highly trusted and widely used personality test (Personality-Power-for-Everyday-Living, 2009). The theory behind MBTI® is that people vary in their behavior because of the different ways each individual perceives and makes judgments. Perception involves the different ways people become aware of things, people, happenings, or ideas. Judgment involves the different ways people make decisions regarding what they perceive. This means that people also differ in their interests, reactions, values, motivations, and skills. The knowledge gained from the MBTI® inventory can be applied to a variety of design situations—for example, whether individuals will be energized by working with others or by working in solitude.

Identification of Personality Types

The MBTI® uses four categories: energy, information gathering, decision making, and lifestyle (Myers and Briggs, n.d.). These four categories are then divided into two areas: (1) mental processes of gathering information and making decisions and (2) mental orientations of energy and lifestyle. From this, a personality type is defined into preferences by how a person is energized (**Extraverted** or **Introverted**), how information is gathered (**Sensing** or **Intuition**), how decisions are made (**Thinking** or **Feeling**), and lifestyle (**Judging** or **Perceiving**) (Myers and Briggs, n.d.). The interaction of preferences results in sixteen different personality types, as shown in Table 1.1 (Myers and Briggs, n.d.; Reinhold, 2006).

All personality types are used at different times; however, within each of the four categories, each individual will feel more comfortable and natural functioning with one preference than another. This results in a personality type (The Myers & Briggs Foundation, 2017; Nussbaumer, 2011). The following are descriptions of these areas.

- Energy (**E**xtraversion or **I**ntroversion): The energy orientation takes two forms—outward or inward. Extraverts are drawn to the outside world as a source of energy (e.g., people, places, things, activities). Introverts draw energy from internal sources of information (e.g., ideas, thoughts, or other reflections) (Nussbaumer, 2011; Reinhold, 2006). Designers, therefore, must be aware that within spaces, extraverts will need areas for interaction, while introverts will need areas for solitude to create and develop ideas as well as places for reflection. Related to proxemics, extraverts may be more comfortable in tight spaces and easily begin a conversation with strangers, whereas the introvert may wish to retreat.
- Gathering information (**S**ensing or **I**ntuition): As part of the mental processes, these preferences consider that how people gather or take in information (perceive) may be through sensing or intuition. People who prefer sensing perception prefer clear, tangible information that relates to the here and now. People who prefer intuition perception like to gather information from more abstract and conceptual ideas or possibilities for the future (Nussbaumer, 2011; Reinhold, 2006). Designers

will need to provide space for both sensing and intuition. For example, people who prefer sensing perception develop and display lists; they will need space to work on lists of various types. People who prefer intuition perception need space to create ideas; such space may be pin-up space that can allow ideas to flow and be manipulated.

- Make decisions (**T**hinking or **F**eeling): As part of the mental processes, these preferences identify how people make judgments or decisions. People who prefer *thinking* judgment make decisions through logical, analytical, and objective means. They place emphasis on the task and the results. People who use *feeling* judgment make decisions in a global manner and are concerned about a decision's impact on others (Nussbaumer, 2011; Reinhold, 2006). Designers will need to provide space for both thinking and feeling. For example, people who prefer *thinking* judgment need space to think, but whether it is through interaction (team area) or solitude (in a quiet retreat) depends upon the source for energy—extraversion or introversion. People who use *feeling* judgment need a place to visit with others at a conference table or in a team space, or they may need a place to contemplate alone before bringing their ideas to the group. Whether decisions are made through interaction or solitude depends once again upon the draw for energy—extraversion or introversion.
- Lifestyle (**J**udging or **P**erceiving): The lifestyle refers to the outer world orientation. People who prefer *judging* will rely on their preference for making decisions (thinking or feeling) to manage their outer world or lifestyle. These people prefer closure, are organized and scheduled, and make lists. People who prefer *perceiving* rely on their preference for gathering information (sensing or intuition) to manage their outer world or lifestyle. This often results in a more flexible, open, adaptable style in which a lack of closure is tolerated (The Myers & Briggs Foundation, 2017; Nussbaumer, 2011; Reinhold, 2006). People who prefer *judging* need space to work on a designated task. People who prefer *perceiving* like spaces that are flexible so that various tasks can be performed within a space.

TABLE 1.1 Myers-Briggs Type Indicator®

Energy	***E-Extraversion*** • Prefers to talk things out • Sociable and expressive • Communicates by talking • Speaks first, then reflects	***I-Introversion*** • Prefers to think things through • More private and contained • Communicates by writing • Reflects first, then speaks
Gather Information	***S-Sensing*** • Prefers specific facts, details • Practical application • Trusts experience • Present-oriented	***N-Intuition*** • Prefers the big picture • Options, possibilities, ideas • Trusts inspiration, hunches • Future-oriented
Make Decisions	***T-Thinking*** • Prefers logical implications • Analytical, objective, fair • Tough-minded, reasonable • Objective truth	***F-Feeling*** • Prefers impact on others • Sympathetic, relationship driven • Tender-hearted, accepting • Personal values, harmony
Lifestyle	***J-Judging*** • Prefers joy of closure • Scheduled, organized, plans • Systematic, makes lists • Avoids last-minute pressures	***P-Perceiving*** • Prefers joy of processing • Spontaneous, flexible, casual • Adaptable, open to changes • Energized by last-minute pressures

Source: Innovative Training Concepts. (2003–4). *The Power™ of Type: About the Myers-Briggs Type Indicator®*. (CD)

Table 1.1 outlines these descriptors as well as others. Table 1.2 combines the paired categories into abbreviations (first letter of each pair) that signify the sixteen different personality types. Table 1.3 provides tips for communicating with people strong in each category of the MBTI. Table 1.4 provides tips to remember when working with people whose strength is in a particular category. Table 1.5 provides space suggestions for each category.

Taking the MBTI® personality assessment will provide interior designers with a greater understanding of their own personality types as well as those of their clients. It can be taken for a fee and can be accessed through http://www.myersbriggs.org/my-mbti-personality-type/take-the-mbti-instrument. Without taking the assessment, determining the exact personality type will be difficult; however, the descriptors from Table 1.1 should provide at least a sense of characteristics of types. Also, a handout that provides further understanding of preferences can be downloaded from http://www.capt.org/catalog/MBTI-Book-20026.htm.

TABLE 1.2 MBTI® Type Table: Sixteen Different Personality Types

Combination of all four categories into sixteen different personality types

ISTJ	ISFJ	INFJ	INTJ
ISTP	ISFP	INFP	INTP
ESTP	ESFP	ENFP	ENTP
ESTJ	ESFJ	ENFJ	ENTJ

TABLE 1.3 Communication Tips for Working with Each MBTI® Category

"E" Tips • Keep your energy up • Allow them time to talk • Say "tell me more" • Use open-ended questions • Maintain good eye contact	***"I" Tips*** • Calm your energy • Allow them time to pause and think • Don't interrupt • Use close-ended questions • Send out an agenda prior to a meeting to allow them time to think things through
"S" Tips • Give enough details and facts • Talk in terms of present moment • Be realistic and practical • Be specific • Give information sequentially and in order of priority • Use concrete examples and facts	***"N" Tips*** • Talk in generalities, not too many details • Discuss future possibilities • Provide innovative options and ideas • Be prepared for creative bursts of ideas and concepts • Engage their imaginations and creativity
"T" Tips • Talk business first • Be logical, rational, analytical • Present an objective, impersonal argument • Be prepared to be challenged • Don't take skepticism or criticism personally	***"F" Tips*** • Talk in terms of personal values • Use personal pronouns such as *we, us*, and *our* • Create an atmosphere of harmony, appreciation • Draw conclusions about what is good and positive
"J" Tips • Expect pushing for completion • Be time conscious • Be punctual for meetings, appointments, or returning phone calls or emails • Be scheduled, organized • Remember they consider planning vital	***"P" Tips*** • Allow time for processing • Be spontaneous and flexible • Be adaptable, open to change • Loosen time constraints or plan extra time • Remember they consider rules and controls limiting and suppressing

TABLE 1.4 Z-Model and MBTI® Tips to Remember

Energy	***E-Extraversion*** • Provide adequate time for discussion and questions • When working with an **E**, remember: *Energy Up*	***I-Introversion*** • Written information ahead of time to think things through • When working with an **I**, remember: *Calm*
Gather Information	***S-Sensing*** • What currently exists? • Specifics around who, what, when, where, how? • When working with an **S**, remember: *Details*	***N-Intuition*** • What are the alternatives, options, and possibilities? • Long-term implications • When working with an **N**, remember: *Generalities*
Make Decisions	***T-Thinking*** • What are the pros and cons, and objective rationale of options? • Cost-benefit analysis? • Logical consequences? • When working with a **T**, remember: *Logical implications*	***F-Feeling*** • Connect logical options to people and values • How will it impact people? • Invite others to be involved • When working with an **F**, remember: *Impact on others*
Lifestyle	***J-Judging*** • Move to closure, time-frames • Clear, concise plan structure • No surprises • When working with a **J**, remember: *Goal-oriented*	***P-Perceiving*** • Open to new information • Flexible to changes • Builds flexibility into plans • When working with a **P**, remember: *Process-oriented*

Source: Innovative Training Concepts. (2003–4). *The Power™ of Type: About the Myers-Briggs Type Indicator®*. (CD)

TABLE 1.5 Z-Model and MBTI® and Need for Space Suggestions

Energy	***E-Extraversion*** • Areas for interaction with others • Area to work through ideas generated during group interaction	***I-Introversion*** • Areas for solitude • Areas for reflection • Area to observe but not interact with others
Gather Information	***S-Sensing*** • Space to develop list • Space to display list of information or tasks	***N-Intuition*** • Space to create ideas • A pin-up space for ideas
Make Decisions	***T-Thinking*** • Space to think alone	***F-Feeling*** • Place to visit and interview others • Areas for contemplation
Lifestyle	***J-Judging*** • Each space must have a designated task	***P-Perceiving*** • Allow space to be flexible so that various tasks can be conducted within a space

Summary

What constitutes the invasion of one's personal space differs from one person to another; this is defined by many factors, including culture and personality. Awareness of this will be important to consider in all designs. Observations often provide the best information about personal space. Begin observing proxemics in public spaces—lobbies, malls, airports, waiting rooms, and so on. Depending on the type of project, observation of these spaces can provide important data regarding proxemics.

Proxemics can be considered with the subject standing, moving, or sitting. Hall's concept relates to standing, walking, or sitting, whereas DeLong's considers the proxemics of the seated person. For more in-depth insight into DeLong's theory, read "Rethinking Proxemic Zones for Microspatial Analysis." Both Hall's and DeLong's concepts are important, and both should be considered in the design of interior spaces.

During the programming phase of the design process, interior designers collect evidence by interviewing the client, observing behaviors, and learning about individual needs as well as the culture. These elements will aid the designer in planning the space that relates to proxemics—spaces, distance zones, crowding territoriality, and personality types. Research into the needs of individuals is crucial and should include all individuals using the space and consideration of their need for privacy or interaction. In the schematic development phase, conceptual space planning applies proxemics theory to the sketches and preliminary floor plans.

Review Questions

3. How do fixed-feature spaces differ from one culture to another?
4. What is the difference between sociofugal and sociopetal?
5. How do you apply the various social distance zones to a design project?
6. What gender preferences can affect the design of a space?
7. What differences can be found among various age groups in regard to social distances?
8. Discuss the application of various proxemics issues related to residential and commercial spaces.

Exercises

PERSONAL EXPERIENCE EXERCISES

Designs Causing Discomfort

This chapter discusses a variety of proxemics topics. The essence of proxemics relates to an individual's comfort with others. Think about situations where you have been uncomfortable around others. Did the design of the space affect your feelings? If so, how could changing the design make the situation better for you? Write a paragraph about the experience and how the design could make this experience better. Then conduct a class discussion about these types of situations and the design faux pas.

Personality

Complete an MBTI® personality assessment to determine your personality type. Discuss the difference between the types and how types can work together.

PRACTICE AND PERSONALIZATION EXERCISE

Apply the Sociofugal and Sociopetal Concepts to Situations

In medical waiting rooms or other large waiting areas, the room is often filled with strangers. When you select a place to sit, where do you sit? Do you sit next to someone you do not know or go as far away from others as possible? For this exercise, students will

role-play in sociofugal (medical waiting room) and sociopetal (hotel lobby) situations.

1. In an empty room, align chairs against the wall. Then, one at a time, students should come into room and choose a place to sit. (When it is your turn, pretend you know none of the others seated.) After this exercise, discuss the process by which seats were chosen and the reasons for each choice.
2. Next, arrange the chairs into groups of four to make small conversation areas. Then students should proceed as with the first part of the exercise. After this exercise, discuss the process by which seats were chosen and the reason this occurred.
3. Now compare the two situations and ask this question: Would you be more apt to strike up a conversation with anyone in either situation? Would you feel that your personal space was violated in either case? How will this help you design for a medical waiting room versus a hotel lobby, and why?

SELF-DISCOVERY EXERCISES

Need for Privacy

Everyone needs privacy—whether at home, work, or school. College students can sometimes find it difficult to find places or times for private moments. Thus, the following will help you better understand each term presented in this section of the chapter.

- Solitude: How are you able to find moments of solitude within the studio setting?
- Anonymity: How can you maintain anonymity on campus, within the studio, or in a classroom setting?
- Reserve: How do you limit your communication about yourself with others on campus, on social media, or, particularly, within the studio or classroom setting?
- Isolation: How, when, and why do you isolate yourself from others?
- Intimacy: Within your university setting, how can you maintain intimacy with friends only (or with family when they come to visit)?

After answering these questions: (1) imagine yourself working in a large office, (2) answer each question again but within the context of a large office, and (3) describe how this information and insight will affect your design projects.

Territoriality

People carve out territory everywhere: in libraries, cafeterias, churches, and classrooms, among other places. Observe and record how people mark their territory in a public space, and then observe how an individual with a private office personalizes and creates his or her own territory.

1. Observe people in the school cafeteria, library, or other public space and record ways in which individuals personalize spaces while working in public situations.
2. Find an instructor who has a private office and do the following:

    a. Observe how that person has personalized his or her office.
    b. Ask the following questions:
        i. What was the office like before you moved in?
        ii. How did you personalize the office?
        iii. Why was it important to personalize the office?
    c. Describe what you learned from this exercise and how it will affect your designs.

2 ANTHROPOMETRICS

". . . the average height of human beings in most parts of the world is significantly greater than that of their forebears 100–200 years ago."

—BERNARD HARRIS

OBJECTIVES

- Define and understand the term "anthropometrics" within the study of human factors.
- Know the importance of understanding and applying anthropometrics within human factors.
- Describe the application of anthropometrics related to various age groups and cultural differences.

KEY TERMS

anthropometrics
constraint
criterion
dynamic dimensions
functional dimensions
static dimensions
structural dimensions

Anthropometrics is a science that is concerned with measurements of the human body; more specifically, it is the science of body measurements and proportions of the human body in various activities (Panero and Zelnik, 1979; Jones and Allen, 2009). "Anthropometrics" means man ("anthro") measurements ("metric"). Anthropometrics plays an important role in the design of products, clothing, and environments, as well as in ergonomics. Human dimension standards have been developed for the average child at each age and the average adult in three percentiles (5, 50, and 95). With this information, standards have been developed for many products (clothing, doors, furniture, appliances, and so on) as well as for our built environment.

The challenge with anthropometric data is limiting the design of products and spaces to the average person. For example, top shelf placement in retail stores or kitchen cabinetry and placement of door handles coincide with the average reach (72 inches [1829 mm] above the finished floor and 36 inches [914 mm] high, respectively). However, those placements do not allow access to everyone, especially someone with short stature, with limited mobility, or in a wheelchair. Thus, it is important for interior designers to consider a variety of sizes (height, weight, strength, etc.) as well as variation due to age, ability, and ethnicity. This chapter discusses the variability related to anthropometric data and ways to use data collected.

ANTHROPOMETRIC DATA

Interior designers apply anthropometric data to design by considering heights, widths, reaches, and other extensions related to body dimensions. For example, anthropomorphic data are used to determine appropriate seat and arm height for the average adult or for children at various age levels. It is also used for ergonomic furniture design and to compare various populations with regard to age and gender. Additionally, anthropometric data are considered when arranging furniture to allow people to move comfortably through the space. Therefore, data are used to aid in the effective, efficient functioning of people within a space.

In the programming phase of the design process, the interior designer considers the body sizes of those using the space, and, initially, the average size is a starting point. However, during the data collection process, individuals have the opportunity to express their specific needs; in addition, the interior designer also observes users of the space. In the contract document phase, detail drawings are dimensioned and demonstrate the application of anthropometric data.

Anthropometric data are divided into structural or functional dimensions. **Structural dimensions** or **static dimensions** are taken with a human form standing erect (but not rigid), weight equally distributed, and fingers straight. **Functional dimensions** or **dynamic dimensions** are taken with the body in a working or moving position while working on a specific task (Panero and Zelnik, 1979). This chapter focuses more on structural dimensions, while others explore both structural and functional dimensions.

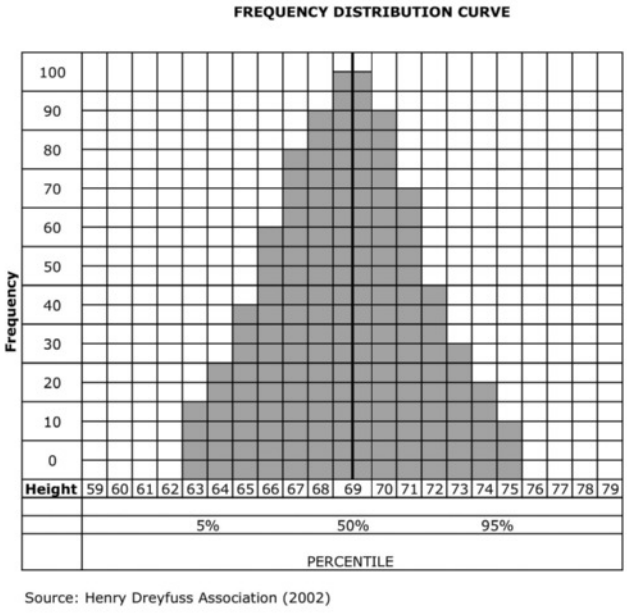
Anthropometric data are important because this information determines the amount of space needed for circulating through an area and for using products or equipment. A variety of factors affect anthropometric measurements, including height, age, sex, ethnic groups, and even socioeconomic conditions (Panero and Zelnik, 1979); these factors are discussed later in this chapter and in subsequent chapters.

Classifications

For adults who have achieved their full height, measurements for anthropometric data are often divided into three percentiles: 5, 50, and 95. The 50th percentile makes up 95 percent of the U.S. population between the 5th and 95th percentile (see Figure 2.1). Those above the 95th percentile are taller, and those below 5th percent are shorter; both consist of fewer individuals within the population.

Anthropometric data are also segmented by age group, from birth through adult. The divisions are greater during the first two years of life, with yearly changes noted until the age of 18.5. However, from the ages of 20 through 65, anthropometric data for adults are limited to the three percentiles for men and women.

In considering this data, we must take into account the data's source. Data are most frequently found within the military populations rather than the civilian. Military data are easy to obtain and important in the design of appropriate clothing and equipment for personnel in the armed forces. Military data have also served as a benchmark for the general population.



Source: Henry Dreyfuss Association (2002)

Figure 2.1 People within each percentile: The majority are in the 50th percentile with a smaller number in the 5th percentile (shortest) and 95th percentile (tallest).

However, this data only reflect a specific population that is young and physically fit. Therefore, it is the designer's responsibility to obtain measurements needed for a specific project in order to best serve the client.

Obviously, the possible number of body dimensions is infinite (see the discussion on variability in the next section). However, for the interior designer, the following twelve measurements are most frequently needed:

- Standing height
- Sitting height (erect)
- Sitting height (normal)
- Knee height
- Popliteal
- Elbow-rest height
- Thigh thickness
- Buttock-knee length
- Buttock-popliteal height
- Elbow-to-elbow breadth
- Seat depth
- Weight

These twelve standard body measurements are defined in Table 2.1, and Table 2.2 explains some ways in which these measurements are used for a design purpose. Next, using the percentiles from Figure 2.1 and these twelve measurements, dimensions for men and women are shown in the anthropometric chart in Table 2.3.

Though select measurements are used here, Figures 2.2–2.3 show the additional measurements that are also needed by a designer. These measurements relate to structural dimensions with the person standing or sitting in a set position. Table 2.4 shows additional structural body measurements for male and female at 5 percent and 95 percent.

TABLE 2.1 Annotated List of Body Measurements and Their Definitions

Body Dimension	***Definition***
Stature (standing height)	Vertical distance from the floor to the vertex (i.e., crown of the head)
Sitting height	Vertical distance from the sitting surface to the vertex (i.e., crown of the head)
Knee height	Vertical distance from the floor to the upper surface of the knee (usually measured to the quadriceps muscle rather than the knee cap)
Popliteal height	Vertical distance from the floor to the popliteal angle at the underside of the knee where the tendon of the biceps femoris muscle inserts into the lower leg
Elbow-rest height	Vertical distance from the floor to the radiale (the bony landmark formed by the upper end of the radius bone, which is palpable on the outer surface of the elbow)
Thigh thickness (or thigh clearance)	Vertical distance from the seat surface to the top of the uncompressed soft tissue of the thigh at its thickest point, generally where it meets the abdomen
Buttock-knee length	Horizontal distance from the back of the uncompressed buttock to the front of the knee cap
Buttock-popliteal height	Horizontal distance from the back of the uncompressed buttock to the popliteal angle, at the back of the knee where the back of the lower leg meets the underside of the thigh
Elbow-to-elbow breadth	Distance between the tips of the elbows when both upper limbs are at the side
Seat breadth (or hip breadth)	Maximum horizontal distance across hips in the sitting position
Weight	Pounds or Kilograms

Source: Pheasant, S., and Haslegrave, C. M. 2003. *Bodyspace: Anthropometry, Ergonomics and the Design of the Work.* 2nd ed. Philadelphia: Taylor & Francis.

TABLE 2.2 Twelve Body Measurements and Their Uses in Design

Measurements	***Design Purposes***
Standing height	Height needed for openings and doors
Sitting height (erect)	Allowable height of obstructions above floor (ex: bunk beds, loft beds, both partitions in eating establishments, or other space-saving designs)
Sitting height (normal)	Minimum height of obstructions above floor (ex: bunk beds, loft beds, both partitions in eating establishments, or other space-saving designs)
Knee height	Distance between floor to underside of a desk, table, or counter
Popliteal (behind the knee height)	Height of seating surfaces above floor (the highest point on the front of the seat)
Elbow-rest height	Height of arm rest, work counters, desks, tables, and special equipment
Thigh thickness	Space needed beyond seat depth for comfort when positioning legs under a work surface
Buttock-knee length	Location of leg to determine seat depth
Buttock-popliteal height	Seat height above floor
Elbow-to-elbow breadth	Allowance for seating around tables and counters
Seat breadth	Allowance for inside chair width at bars, counters, offices, and homes
Weight	Tolerance for strength and performance of seating

Source: Panero, J., and Zelnik, M. 1979. *Human Dimension and Interior Space*. New York: Whitney.

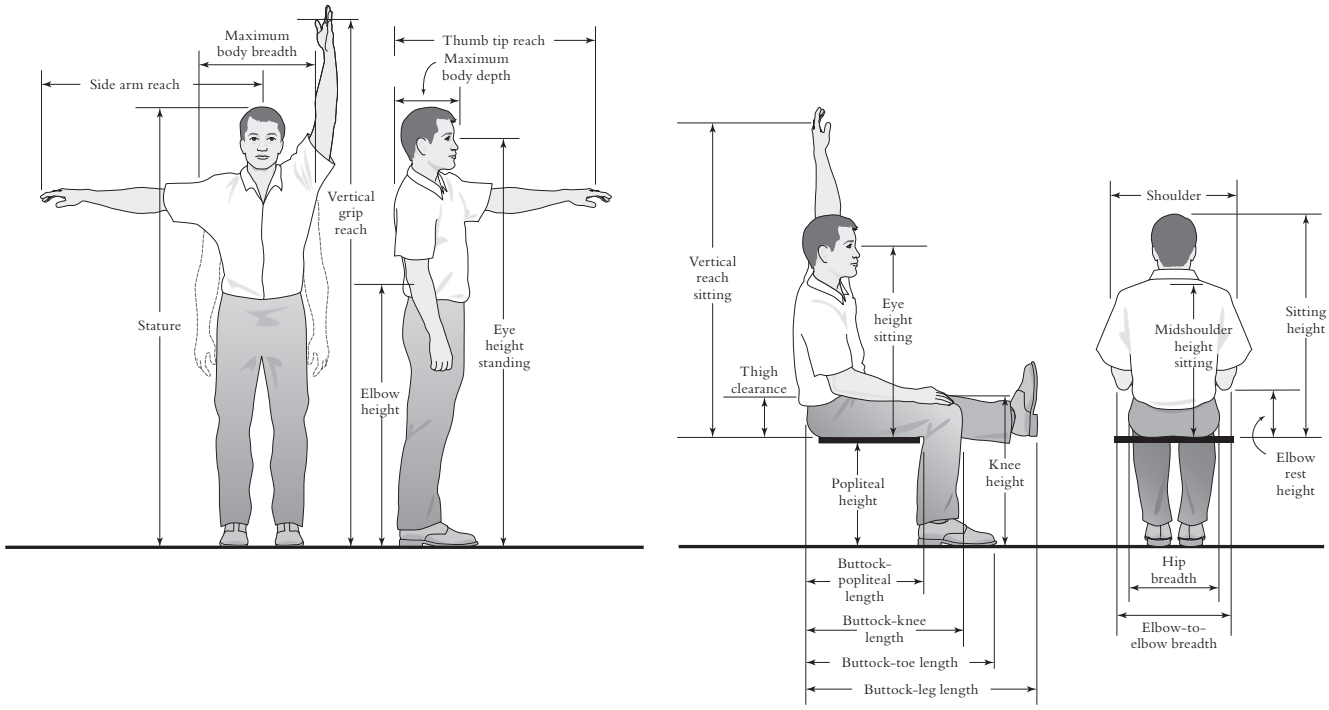


Figure 2.2 Average size (50 percent) with various movement and measurements indicated.

TABLE 2.3 Anthropometric Chart with Select Anthropometric Features for Average Adults

(relates to Figures 2.3a–g)

Measurements in inches (millimeters)	***Male***			***Female***		
Body features	5%	50%	95%	5%	50%	95%
Standing height	63.6 (1615)	68.3 (1735)	72.3 (1836)	59.0 (1499)	62.9 (1598)	67.1 (1704)
Sitting height: erect	33.2 (843)	35.7 (907)	38.0 (965)	30.9 (785)	33.4 (848)	35.7 (907)
Sitting height: normal	31.6 (803)	34.1 (866)	36.6 (930)	29.6 (752)	32.3 (820)	34.7 (881)
Knee height	19.3 (490)	21.4 (544)	23.4 (594)	17.9 (455)	19.6 (498)	21.5 (546)
Popliteal height	15.5 (394)	17.3 (439)	19.3 (490)	14.0 (356)	15.7 (399)	17.7 (450)
Elbow-rest height	7.4 (188)	9.5 (241)	11.6 (292)	7.1 (180)	9.2 (234)	11.0 (279)
Thigh thickness	4.0 (102)	5.7 (145)	6.9 (175)	4.1 (104)	5.4 (137)	6.9 (175)
Buttock-knee length	21.3 (541)	23.3 (492)	25.2 (640)	20.4 (418)	22.4 (569)	24.6 (624)
Buttock-popliteal height	17.3 (439)	19.5 (495)	21.6 (546)	17.0 (432)	18.9 (480)	21.0 (533)
Elbow-to-elbow breadth	13.7 (348)	16.5 (419)	19.9 (505)	12.3 (312)	15.1 (384)	19.3 (490)
Seat breadth	12.2 (310)	14.0 (356)	15.9 (404)	12.3 (312)	14.3 (363)	17.1 (434)
Weight pounds (kilograms)	126 (57.2)	166 (75.3)	217 (98.4)	104 (47.2)	137 (62.1)	199 (90.3)

Sources: Slotkis, S. 2006. *Foundations of Interior Design*. New York: Fairchild Books.

Nussbaumer, L. L. 2009. *Evidence-Based Design for Interior Designers*. New York: Fairchild Books.

In Figures 2.3a–g, structural measurements of the human form are shown in various stages of life—from birth to adult in both frontal and side profiles. Body measurements change the most from birth to 23 months with varied spurts of growth to adult height. Chapter 6 provides greater detail regarding measurements for children. Coordinating with Tables 2.3, adult figures (Figures 2.3a–g) are divided into men and women with the three percentiles (5, 50, and 95). These average measurements provide designers with the standard measurements for age, weight, and height as well as extensions of the leg and arm. However, because the body is more often in motion by reaching, stretching, or carrying out some type of activity, Table 2.5 shows select functional body measurements for males and females, at 5 percent and 95 percent, that relate to such movements.

Variable Measure

The challenge found in the distribution curve, anthropometric chart, and average dimensions shown in drawings is that the variation within each percentile is great. For example, two people in the same percentile and with the same height "may or may not be the same percentile shoulder breadth or waist circumference, since people differ in shape and proportion" (Pheasant and Haslegrave, 2003, p. 15). Even identical twins are not exactly the same (Henry Dreyfuss Associates, 2002). Thus, since people vary in shape and proportion, designers are challenged to design products and spaces that accommodate the needs of the greatest number of people. Henry Dreyfuss Associates (2002) points out the variability of measurements, which can be segmented into three categories: intra-individual, inter-individual, and secular variability.

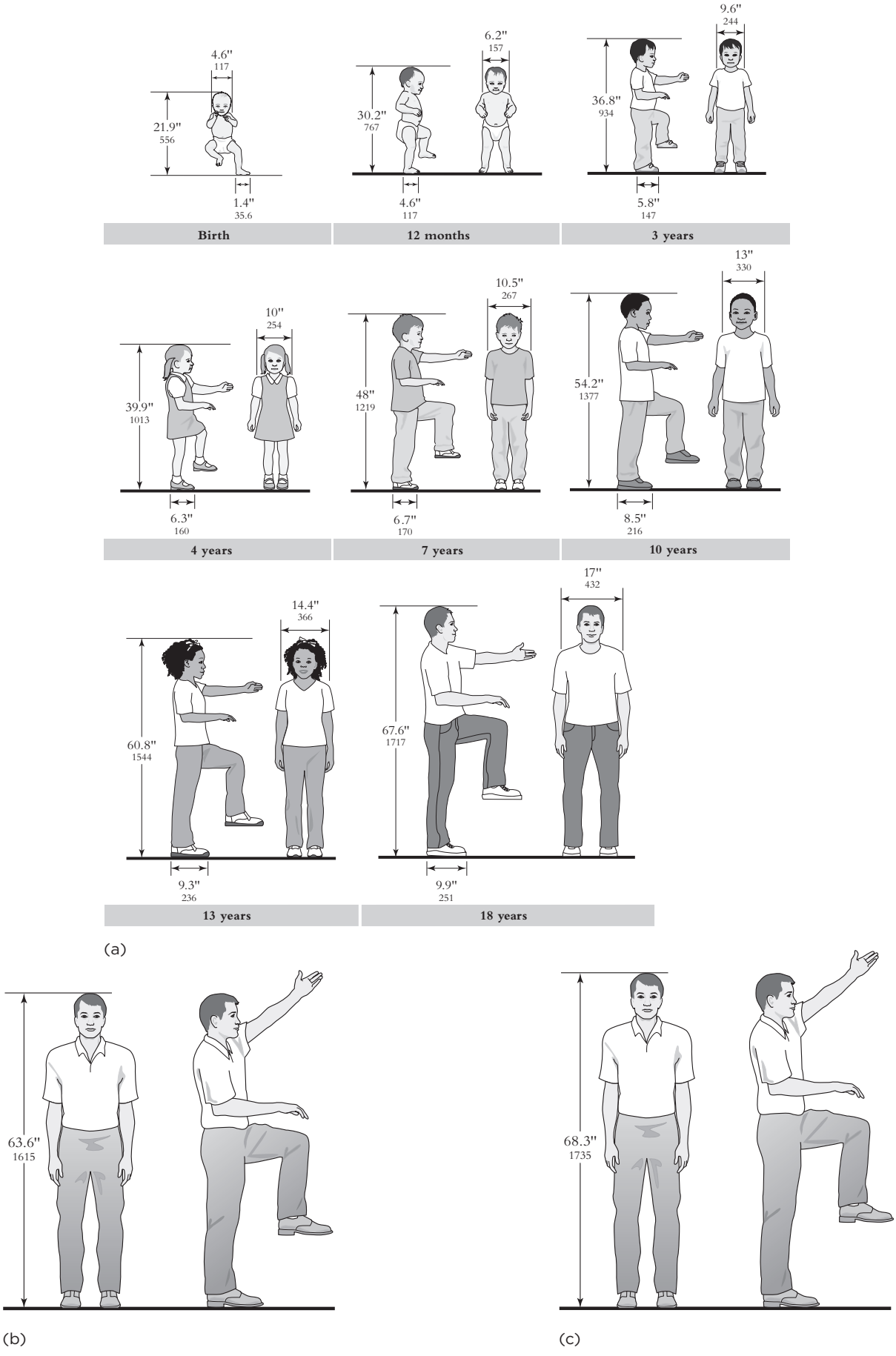


Figure 2.3 Average Measurements **(a)** Children: infant through 18 years of age. **(b)** 5th percentile man. **(c)** 50th percentile man.

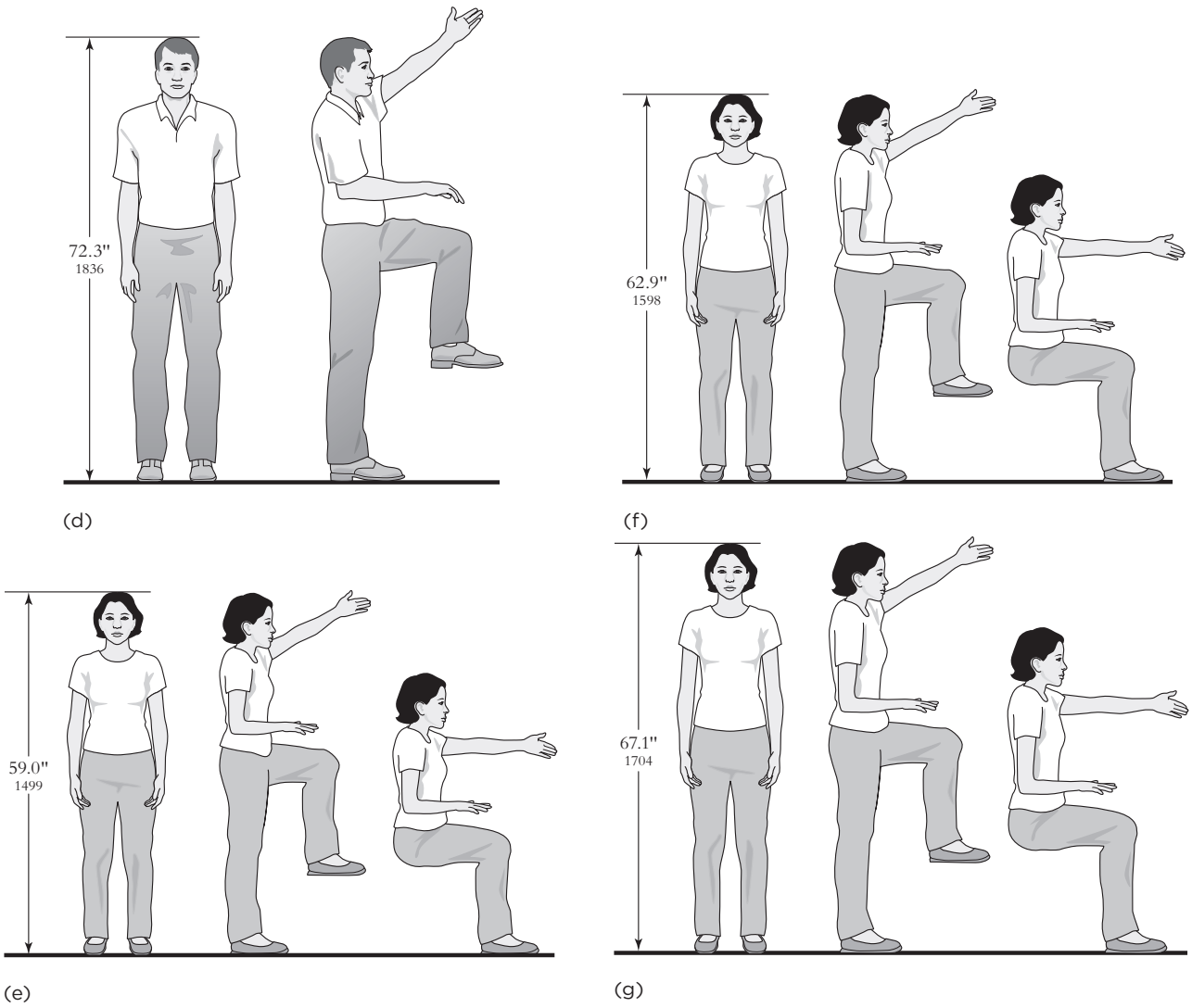


Figure 2.3 *(continued)* **(d)** 95th percentile man. **(e)** 5th percentile woman. **(f)** 50th percentile woman. **(g)** 95th percentile woman.

TABLE 2.4 Miscellaneous Structural Body Measurements for Male and Female at 5% and 95%

Measurements in inches (millimeters)	***Male***		***Female***	
Body Features	5%	95%	5%	95%
Crotch Height	30.8 (782)	36.2 (919)	26.8 (681)	32.0 (813)
Elbow Height	41.3 (1049)	47.3 (1201)	38.6 (980)	43.6 (1107)
Eye Height	60.8 (1544)	68.6 (1742)	56.3 (1430)	64.1 (1628)
Shoulder Height	17.4 (442)	20.7 (526)	14.9 (378)	17.0 (432)
Mid-Shoulder Height Sitting	23.7 (602)	27.3 (693)	21.2 (538)	24.6 (625)
Buttock-Toe Length	32.0 (813)	37.0 (940)	27.0 (686)	37.0 (940)
Eye Height Sitting	30.0 (762)	33.9 (861)	28.1 (714)	31.7 (805)

Source: Panero, J., and Zelnik, M. 1979. *Human Dimension and Interior Space.* New York: Whitney.

TABLE 2.5 Select Functional Body Dimensions for for Male and Female at 5% and 95%

Measurements in inches (millimeters)	***Male***		***Female***	
Body features	5%	95%	5%	95%
Thumb Tip Reach Extended	32.4 (823)	38.3 (973)	29.9 (759)	36.3 (922)
Buttock-Heel Length	39.4 (1001)	46.1 (1171)	34.0 (864)	49.0 (1245)
Vertical Reach Height Sitting	59.0 (1499)	51.6 (1311)	55.2 (1402)	49.1 (1247)
Thumb Tip Reach (horizontal reach)	29.7 (754)	35.0 (889)	26.6 (676)	31.7 (805)
Side Arm Reach	29.0 (737)	39.0 (864)	27.0 (68.6)	38.0 (965)
Vertical Grip Reach	76.8 (1951)	88.5 (2248)	72.9 (1852)	84.0 (2134)

Source: Panero, J., and Zelnik, M. 1979. *Human Dimension and Interior Space.* New York: Whitney.

Intra-Individual

Intra-individual relates to the individual or a person's body measurements that may change over time. During the adult years, people may also change in size. Changes may be due to health conditions, medical problems, aging, nutrition, range of motion, ability to move, or the environment itself. For example, as adults age (into their 70s, 80s, and 90s), bone density changes, and older adults often shrink in size or experience changes in posture. Nutritional or hereditary factors can also affect bone density and thus result in osteoporosis—loss of bone density that can cause fragile bones that break easily. However, with good nutrition, exercise, or medication, individuals may not be affected by or may decrease their chance of bone density loss. Lack of movement may also tighten muscles and cause a decrease in size but an increase in the width of various parts of the body. Moving the body tends to improve flexibility and can decrease body width as well as develop stronger muscles. Of course, the environment in which an individual lives and his or her socioeconomic status may affect the opportunity to exercise and obtain healthy foods.

Intra-individual factors consider not only how humans grow and change through their lifetime but also the differences among children at various stages of life. Thus, though children are placed in various categories within the anthropometric chart, they do not grow at the same rates. Nutrition, movement, and the environment also may affect physical variability among children in each stage of growth (Henry Dreyfuss Associates, 2002).

Inter-Individual

Inter-individual factors relate to differences between individuals, and these differences are based on size, gender, and culture. Those differences include body proportions. Figure 2.4 compares people of the same height but with varied measurements. In viewing the table and drawings for men and women, it is clear that men are generally taller with different body proportions than women (see Table 2.3 and Figure 2.2). However, there is greater variability within each than is illustrated in these drawings. Also, since 1920, Americans (and Europeans) have grown taller by approximately .04 inches (1 cm) per decade, and in America, obesity rates have climbed from 13 percent in 1962 to over 30 percent in 2012 (Johns Hopkins University, 2007; Trust of American Health, 2012). And yet, with the immigration of groups who tend to be shorter (Asian, in particular), anthropometric data may need to be reexamined. Tables 2.6 through 2.8 and Figure 2.5 compare differences among groups. Table 2.6 shows the mean difference between white, black, and Japanese people whereas Table 2.7 shows actual measurements in inches and millimeters for males and females for different ethnic groups.

Figure 2.4 Intra-individual: People of the similar height (or same percentile) vary in proportionate arm length, shoulder width, and more.

Figure 2.5 Inter-individual: Sizes (height, proportion, and more) vary among cultures and genders.

This comparison illustrates that the average Mexican American person is shorter than the average white or black person. As another comparison, Table 2.8 lists measurements for various populations throughout the world. From this list, it is clear that even within one geographic region, such as Europe, the average adult varies in height.

There are two important points to remember with this data: 1) variability exists within and between populations, and 2) according to Henry Dreyfuss Associates (2002), anthropometric data are not representative of the world population. In fact, although some countries (e.g., France, England, China, and Korea) collect anthropometric data, few consistently update their data. Regardless of this variability, interior designers must begin with the representative value and then determine the differences for a specific client.

TABLE 2.6 Differences: White, Black, and Japanese

Total Leg Length	
White	Mean
Black	Mean +1.5″ (38 mm)
Japanese	Mean –3.6″ (91 mm)
Total Leg Length	
White	Mean
Black	Mean +0.6″ (15 mm)
Japanese	Mean –2″ (51 mm)
Total Leg Length	
White	Mean
Black	Mean –1.5″ (38 mm)
Japanese	Mean (almost as high)
Total Leg Length	
White	17.5″ (444 mm)
Black	18″ (457 mm)
Japanese	15.8″ (400 mm)

Source: Henry Dreyfuss Associates. *The Measure of Man & Woman* Rev. ed. New York: Wiley, 2002.

Secular (Generational) Variability

Much of anthropometric data were collected over the last two centuries (Harris, 1994), but data are infrequently updated because surveys are too expensive and time-consuming (Henry Dreyfuss Associates, 2002; Pheasant and Haslegrave, 2003). And, as previously mentioned, anthropometric data are based on members of the military—a young, fit, and selective group. Little data exists for the civilian population because outside the military, it would take extensive resources to conduct a full-scale anthropometric survey (Pheasant and Haslegrave, 2003). But, in general, it is safe to say that the average height of humans today in most of the world is significantly greater than that of their ancestors (Harris, 1994). Changes in anthropometric measurements occur from one generation to the next and indicate that social and economic factors affect average height (Harris, 1994; Henry Dreyfuss Associates, 2002). For example, children who are undernourished because of impoverished conditions in their countries tend to be smaller than children who are well nourished. Though greater research is needed, measurements may be due to dietary changes as well as improved sanitation conditions that give all children the opportunity to achieve their full growth potential (Harris, 1994).

To emphasize this issue where the population is well nourished, in the last several decades, the younger generation has grown taller, which affects other body measurements. This can be seen in Figure 2.6, in which the son is taller than his father (and other body proportions vary as well). If this trend continues, the grandson will probably be taller than both his father and grandfather. Clearly, with these differing

TABLE 2.7 Average Anthropometric Data for Various Ethnicities Based on 2003–2006 Research

Height measurements in inches (millimeters)	***Male***			***Female***		
Adult 20 years and over	5%	50%	95%	5%	50%	95%
All Ethnic Groups	64.4 (1636)	69.4 (1763)	74.3 (1887)	59.3 (1507)	63.8 (1622)	68.2 (1731)
Non-Hispanic White	65.4 (1660)	69.8 (1774)	74.5 (1891)	59.9 (1521)	64.2 (1630)	68.4 (1736)
Non-Hispanic Black	65.1 (1654)	69.7 (1770)	74.6 (1896)	59.7 (1515)	64.0 (1627)	68.4 (1738)
Mexican American	62.5 (1587)	67.1 (1704)	71.6 (1820)	58.0 (1473)	62.1 (1578)	66.2 (1681)

Source: McDowell, M., Frayer, C. D., Ogden, C. L. 2008, October 22. "Anthropometric Reference Data for Child and Adults: United States, 2003–2006." *National Health Statistics Report*, 10.

TABLE 2.8 Average Anthropometric Data for Various Cultures Based on 1990 Research

Height measurements in inches (millimeters)	***Male***			***Female***		
Country: Average Adult Ages 19–65	5%	50%	95%	5%	50%	95%
Dutch	66.5 (1690)	70.7 (1795)	74.8 (1900)	60.8 (1545)	65.0 (1650)	68.3 (1755)
Swedish	64.2 (1630)	68.5 (1740)	72.8 (1850)	60.6 (1540)	64.6 (1640)	68.5 (1740)
British	64.0 (1625)	68.5 (1740)	73.0 (1855)	59.3 (1505)	63.4 (1610)	67.3 (1710
French	63.0 (1600)	67.4 (1715)	72.0 (1830)	59.1 (1500)	63.0 (1600)	66.9 (1700)
Polish	62.8 (1595)	66.7 (1695)	70.7 (1796)	58.3 (1480)	62.0 (1575)	65.7 (1670)
Brazilian	62.8 (1595)	66.9 (1700)	71.3 (1810)			
Hong Kong Chinese	62.4 (1585)	66.1 (1680)	69.9 (1775)	57.3 (1455)	61.2 (1555)	64.4 (1635)
Japanese	61.4 (1560)	65.2 (1655)	68.9 (1750)	57.1 (1450)	60.2 (1530)	63.4 (1610)
Sri Lankan	60.4 (1535)	64.6 (1640)	68.7 (1745)	56.1 (1425)	60.0 (1525)	63.8 (1620)

Source: Pheasant, S. and Haslegrave, C. M. 2003. *Bodyspace: Anthropometry, Ergonomics, and the Design of the Work.* 2nd ed. Philadelphia: Taylor & Francis.

Figure 2.6 Secular (generational) variability: Measurements of two generations (same gender) vary. Often the younger generation is taller than its forefathers; people also lose height as they age. In this photo, the father is shorter than the son.