SECTION 1

DESIGN PRINCIPLES AND PROCESS

ENVIRONMENTAL AND BEHAVIORAL ISSUES

1

HUMAN FACTORS

Human factors information refers to the variables that affect human performance in the built environment, such as human physiology and human psychology. Data accumulated from the fields of engineering, biology, psychology, and anthropology are integrated in this multidisciplinary field.

Fit describes a design that uses human factors information to create a stimulating but nonstressful environment for human use. Some areas of fit are physiological, psychological, sensual, and cultural.

ANTHROPOMETRICS AND ERGONOMICS

The field of anthropometrics provides information about the dimensions and functional capacity of the human body. *Static anthropometrics* measures the body at rest; *dynamic anthropometrics* measures the body while it is performing activities defined as "work." Dimensional variation occurs in anthropometric data because of the large range of diversity in the human population. To utilize anthropometric charts effectively, a designer must identify where a subject user group falls in relationship to these variables. The factors that cause human variations are gender, age, ethnicity, and race. Patterns of growth affected by human culture cause variation in human measure as well. Percentiles that refer to the frequency of occurrence describe dimensional variations on anthropometric charts: that is, the mean percentile (50%), the small extreme percentile (2.5%), and the large extreme percentile (97.5%).

MEASURE AND DEVELOPMENT OF TODDLERS—2.5 TO 4 YEARS
1.1

MOTOR DEVELOPMENT **SOCIAL DEVELOPMENT** **LANGUAGE MILESTONES** **COGNITIVE DEVELOPMENT**

2.5 TO 3 YEARS

- CANNOT TURN OR STOP SUDDENLY OR QUICKLY
- CAN JUMP A DISTANCE OF 15 TO 24 IN. (381 TO 610)
- CAN ASCEND STAIRWAY UNAIDED, ALTERNATING THE FEET

BEGINNINGS OF CONVERSATION; BREAKTHROUGH IN ATTENTION TO COMMUNICATION

- NEW WORDS ARE LEARNED ALMOST EVERY DAY; COMPREHENSION IS EXCELLENT, ALTHOUGH CHILD STILL MAKES MANY MISTAKES IN GRAMMAR
- VOCABULARY REACHES 1,000 WORDS, ABOUT 80% ARE INTELLIGIBLE; GRAMMAR IS CLOSE TO ADULT SPEECH, AND SYNTACTIC MISTAKES ARE FEWER

GROUNDWORK FOR LOGICAL THINKING: CHILDREN CAN THINK ABOUT OBJECTS, PEOPLE, OR EVENTS IN THEIR ABSENCE BY USING MENTAL REPRESENTATIONS OF THEM, BUT THEY CANNOT YET MANIPULATE THESE REPRESENTATIONS

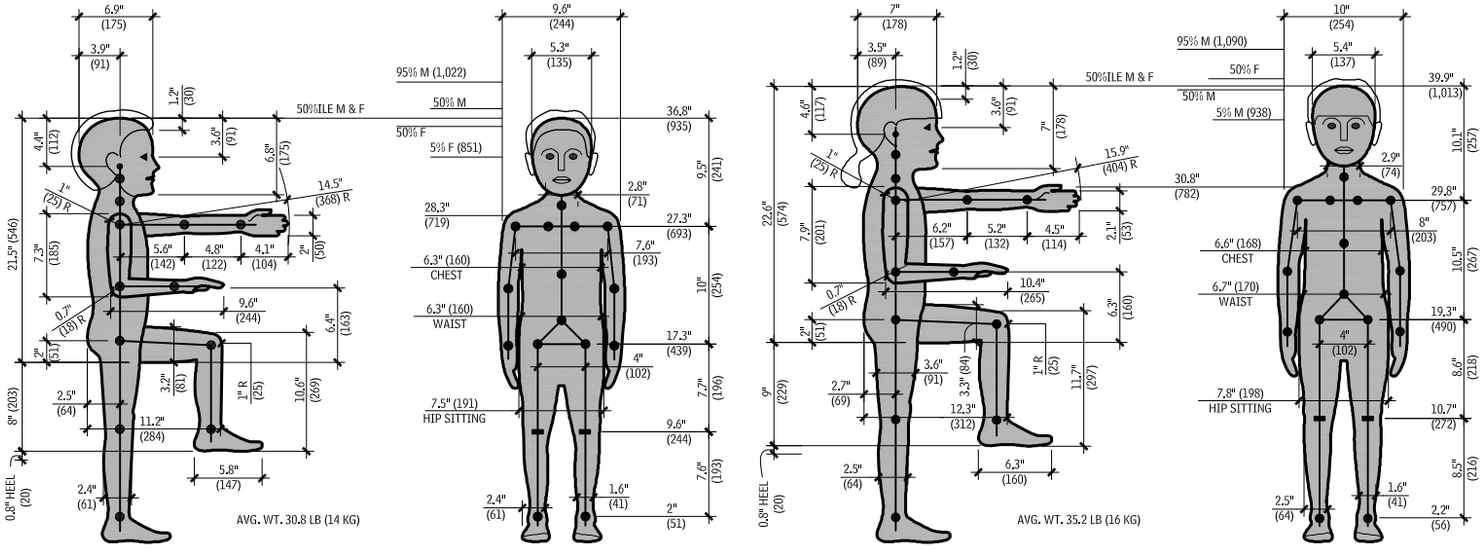
4 YEARS
GIRLS TALLER THAN BOYS

- MORE EFFECTIVE CONTROL OF STOPPING, STARTING, AND TURNING
- CAN JUMP A DISTANCE OF 24 TO 33 IN. (610 TO 838)
- CAN DESCEND LONG STAIRWAY ALTERNATING THE FEET, IF SUPPORTED

CHILD THINKS THAT HIS OR HER POINT OF VIEW IS THE ONLY ONE POSSIBLE

6 YR

6 YR



MEASURE AND DEVELOPMENT OF YOUTHS—7 TO 8 YEARS
1.2

MOTOR DEVELOPMENT **SOCIAL DEVELOPMENT** **COGNITIVE DEVELOPMENT**

7 YEARS

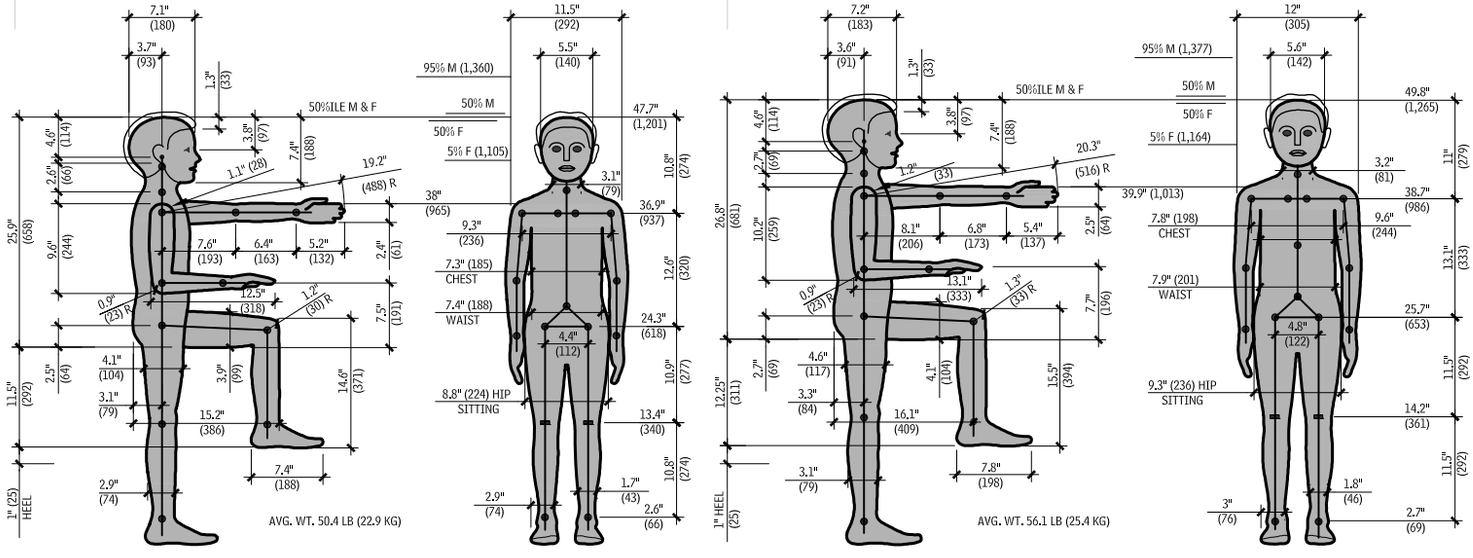
- BALANCING ON ONE FOOT WITHOUT LOOKING BECOMES POSSIBLE
- CAN HOP AND JUMP ACCURATELY INTO SMALL SQUARES
- CAN ACCURATELY PERFORM JUMPING JACK EXERCISES

8 YEARS

- GRIP STRENGTH PERMITS STEADY 12-LB PRESSURE (5.4 KG)
- GIRLS CAN THROW A SMALL BALL 40 FT (12.2M)

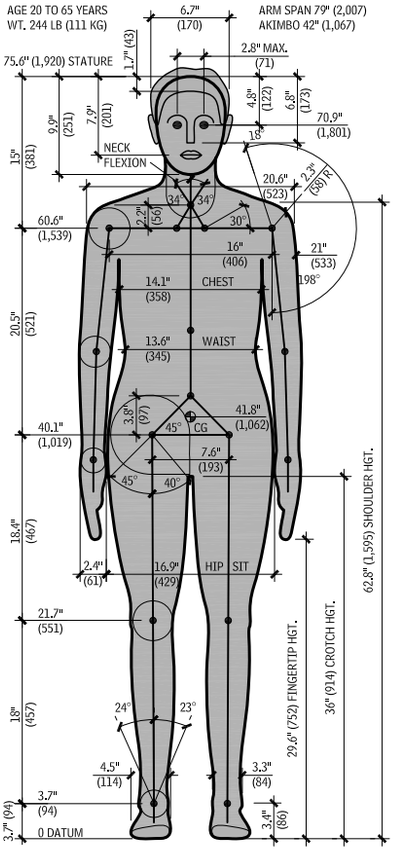
6 YR CHILD REALIZES THAT OTHERS MAY INTERPRET A SITUATION IN A WAY DIFFERENT FROM HIS OR HER OWN

CHILDREN CAN THINK LOGICALLY ABOUT "HERE AND NOW," BUT NOT YET ABOUT ABSTRACTIONS **10 YR**

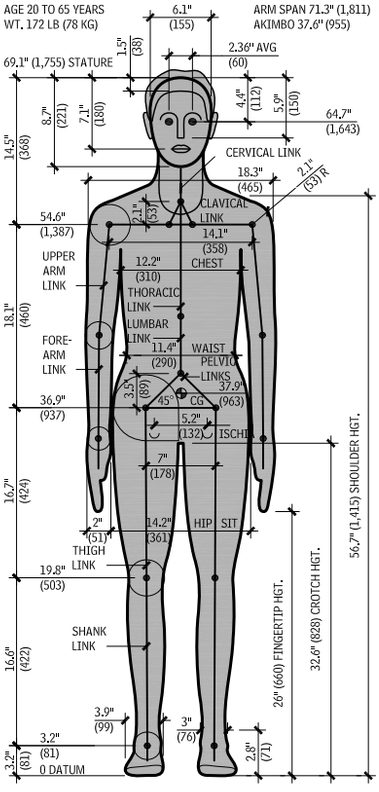


MEASURE OF MAN—FRONT VIEW
1.3

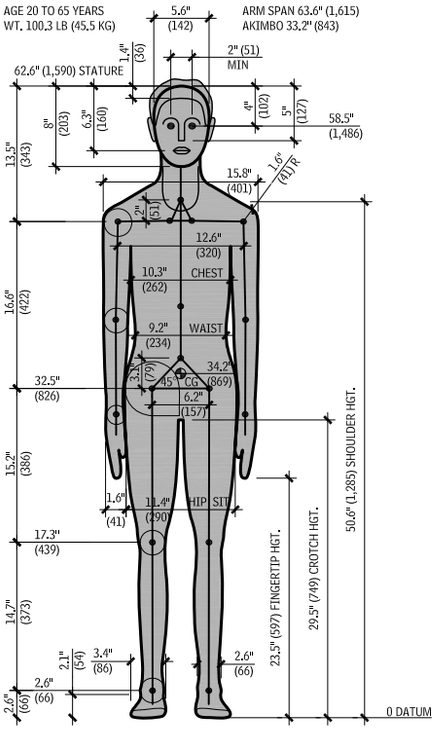
99 PERCENTILE MAN



50 PERCENTILE MAN

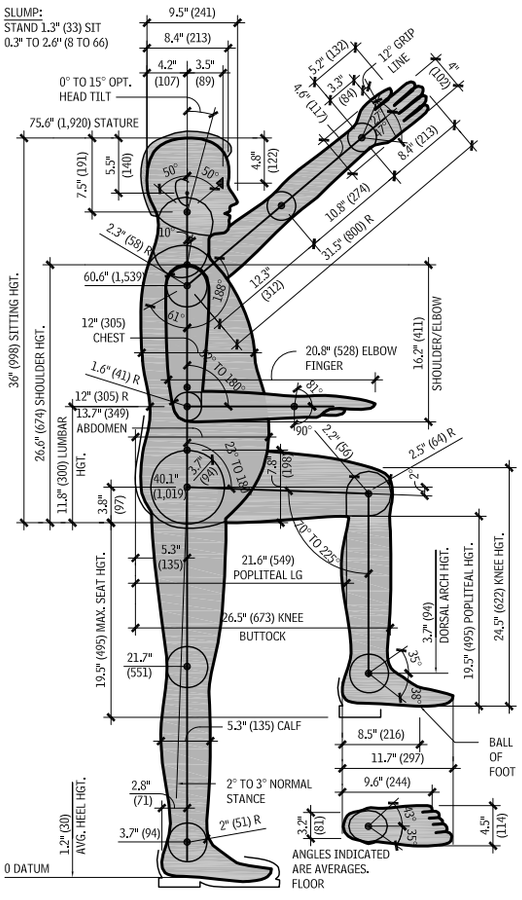


1 PERCENTILE MAN

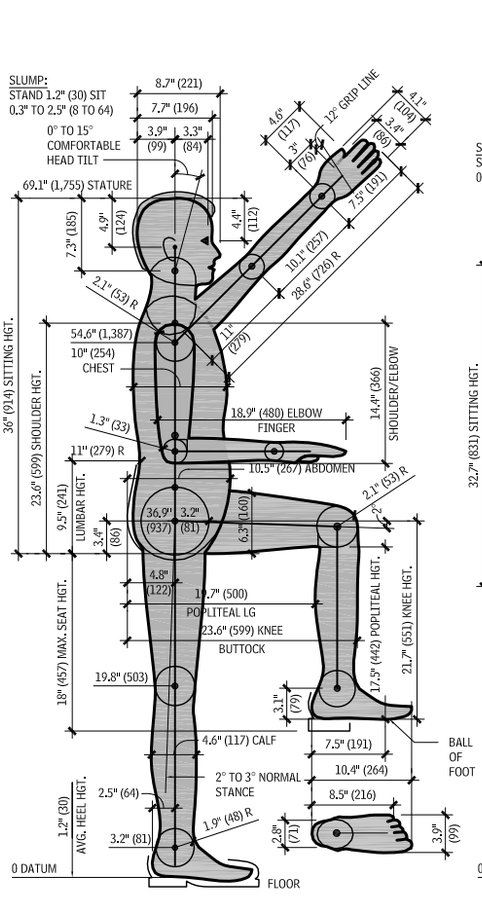


MEASURE OF MAN—SIDE VIEW
1.4

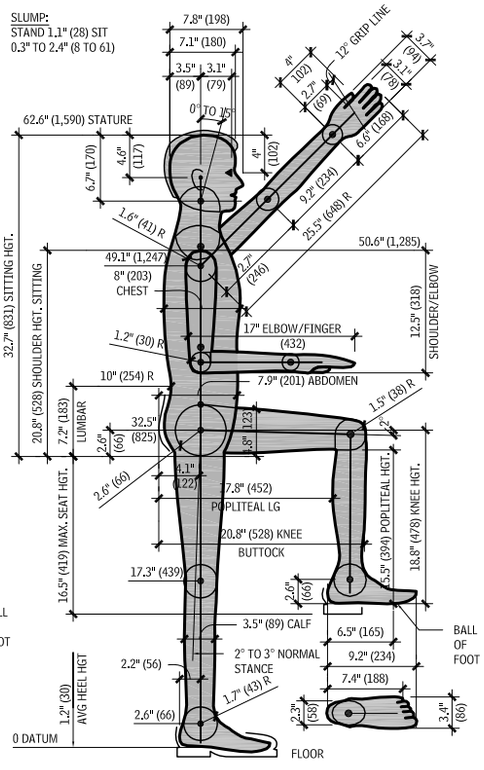
99 PERCENTILE MAN



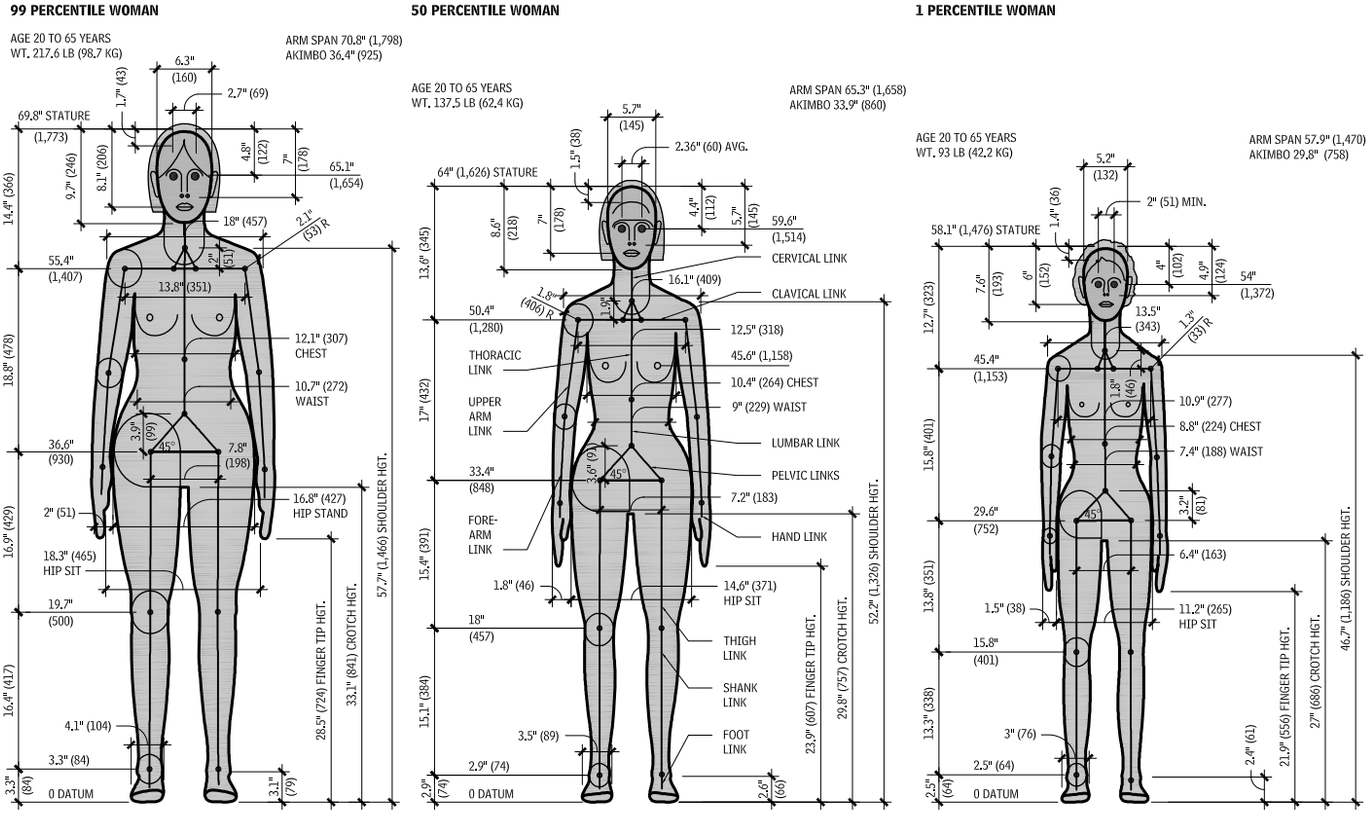
50 PERCENTILE MAN



1 PERCENTILE MAN

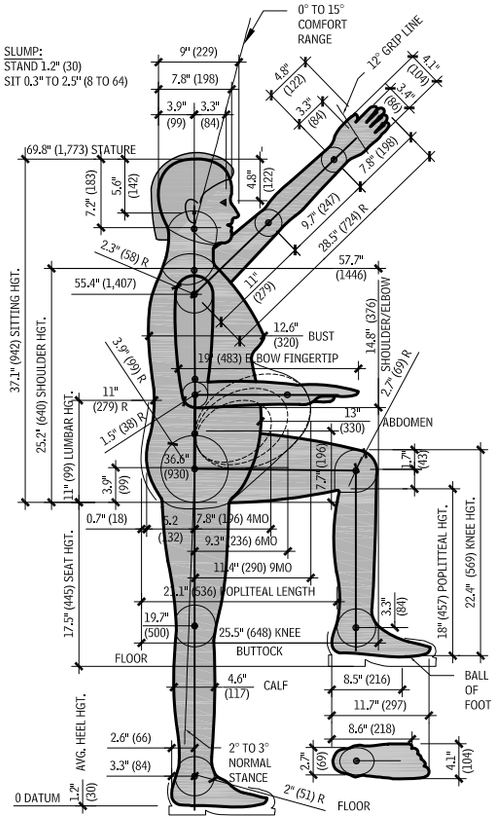


MEASURE OF WOMAN—FRONT VIEW
1.5

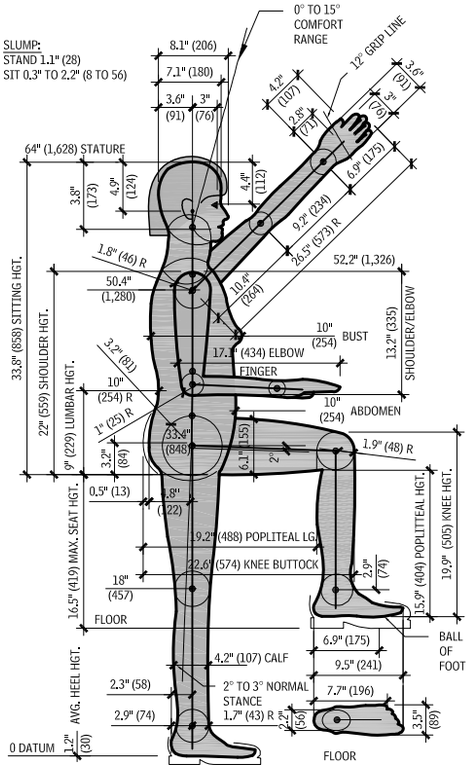


MEASURE OF WOMAN—SIDE VIEW
1.6

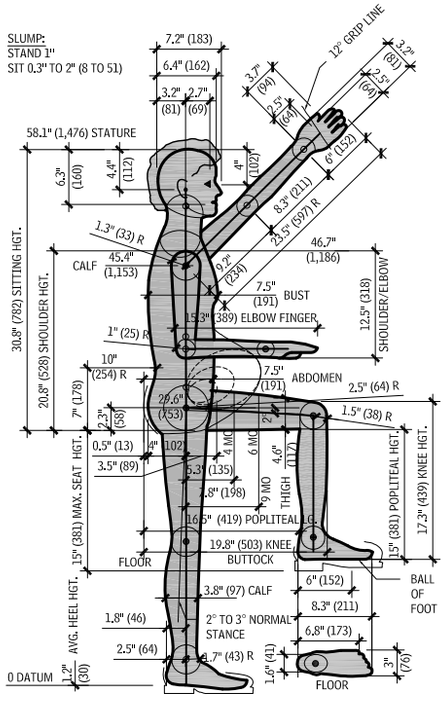
99 PERCENTILE WOMAN



50 PERCENTILE WOMAN



1 PERCENTILE WOMAN



Contributor:
Alvin R. Tilley, Henry Dreyfus Associates, *The Measure of Man & Woman: Human Factors in Design,* John Wiley & Sons, New York, 2001.

Ergonomics is the application of human factors data to design. This term was coined by the U.S. Army when it began to design machines to fit humans, rather than trying to find humans to fit machines.

HUMAN BEHAVIOR

Human behavior is motivated by innate attributes such as the five senses and by learned cultural attributes. Each human has a unique innate capacity to gather sensual information. How that information is understood is determined by personal and cultural experience.

Proxemics is the study of human behavior as it relates to learned cultural behavior. Human behavior originates in the expression of a person's genetic code, modified by his or her experience.

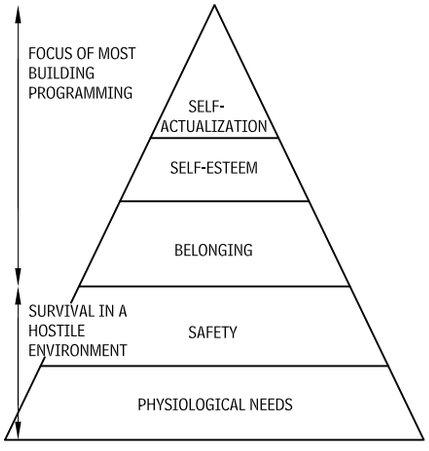
HIERARCHY OF NEEDS

Psychologist Abraham Maslow created a theoretical model that describes human needs and motivations. His hierarchy of needs is presented as a constantly evolving process, such that when a person satisfies one need, another presents itself, and the individual will be driven to satisfy that set of needs.

Maslow's hierarchy of needs is presented as a pyramid depicting the levels of psychological and physical human needs. The two levels at the pyramid's base—physiological and safety—are required for survival in a hostile environment. Physiological needs include air, food, water, sex, sleep, and other drives that sustain life and health. Safety includes security, order, and stability necessary to protect an individual's body, family, and property.

The three levels at the top of the pyramid—belonging, self-esteem, and self-actualization—are the focus of programming for most interior spaces. Belonging is associated with love and with membership in friendships, family life, and sexual relationships. Self-esteem relates to confidence, achievement, and mutual respect. The final level at the top of the pyramid is self-actualization, which involves fulfilling one's own highest needs and striving for one's fullest potential as a human being; it is associated with morality, creativity, problem solving, and other open-minded behaviors.

HIERARCHY OF NEEDS
1.7

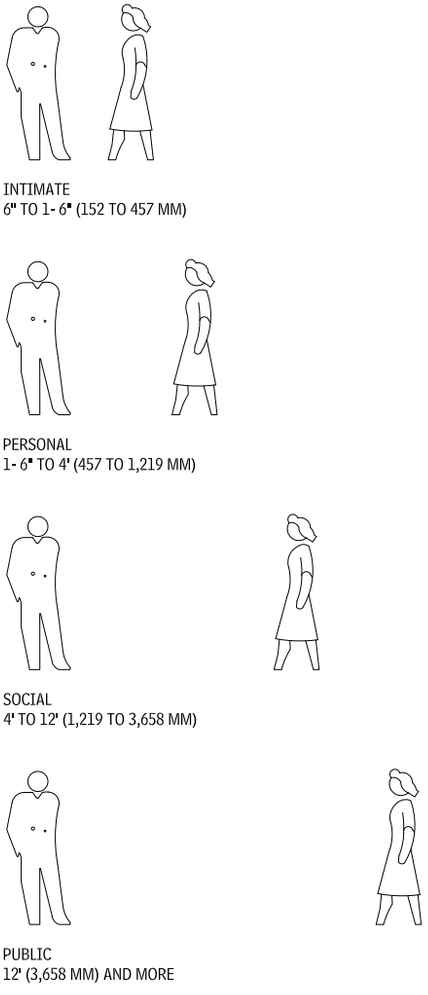


DISTANCE RELATIONSHIPS

Some aspects of human behavior related to territoriality are cultural. The space between objects has form, but the space between people is kinetic. The dimension of human territoriality varies in dimension because of cultural forces.

- *Defensible space* occurs when designed form reinforces meaning for the user and where boundary and ownership are visible in public space
- *Intimate space* is where lovers, family, small children, and close friends are allowed to enter
- *Personal space* is a protected area, where strangers are not welcome.
- *Social space* is the range of space in which most public interactions occur. Speech and expression are clear and communications are efficient and accurate.
- *Public distance* is the range of space where it is not considered rude to ignore someone, and interaction is not allowed.

DISTANCE RELATIONSHIPS AMONG PEOPLE
1.8



WAYFINDING

Wayfinding refers to the way people orient themselves in a given environment and find their destination. The ability to orient oneself is based on many pieces of information, including visual clues, memories, and knowledge of a place, along with the ability to reason. Environmental psychology terms the ability to acquire, code, store, recall, and decode information about the physical environment *cognitive mapping*. Successful wayfinding is the ability to naturally orient oneself in the environment and to easily locate a destination without experiencing stress.

MAPPING

Three components for the analysis of environmental imaging include:

- *Identity*, or objects in background
- *Structure*, or objects in relationship to each other
- *Meaning*, or personal, societal, or figurative belief

A highly imageable space has components that relate in a well-structured manner. The way a space is mapped for an individual varies, depending on the person. Certain images and visual clues are perceived similarly by groups of people who share similar backgrounds, activities, or routines, and recurrent features in their environment. For example, a group of schoolchildren may be of a similar age, share the learning and play activities of a school, and be aware of the physical features of the school building.

MAPPING ELEMENTS

Lynch's research resulted in the identification of five categories of elements that people use to map an environment:

- *Paths:* Channels of movement
- *Edges:* Boundaries that break, contain, or run parallel to forms
- *Districts:* Areas of recognizable identity
- *Nodes:* Places of intense activity
- *Landmarks:* Points of reference that are visually distinguishable

COGNITIVE MAPS

Cognitive maps are psychological impressions or representations of an individual's ability to understand space and the organizing elements by which they orient themselves. Cognitive maps usually combine several of the mapping elements. Three-dimensional characteristics of a space, material choices, colors, and lighting can all impact the formation of edges, districts, or nodes.

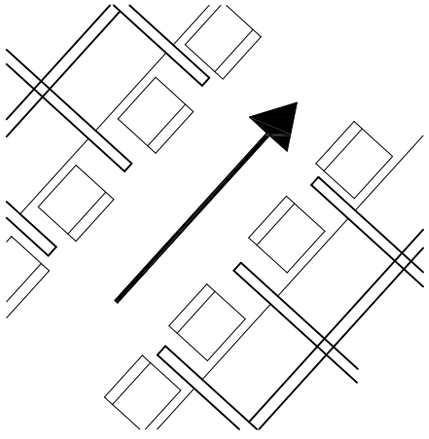
Where the boundaries of the districts meet, an edge may be formed, providing a sense of having exited one area and entered another. A node may occur at an intersection of activities or along paths where activity is concentrated. Landmarks may be used by the designer to mark entrances or points of interest.

WAYFINDING AND AGE

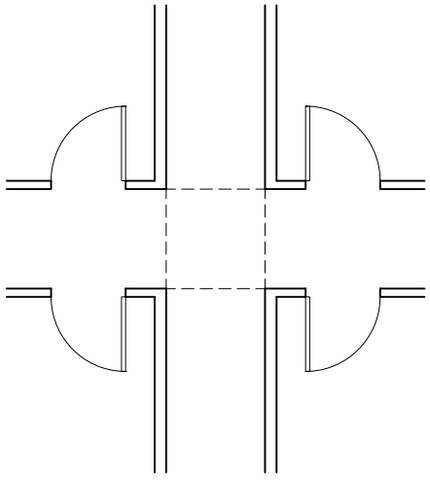
The process of learning involves an increase in perception of detail as a person develops. Adults navigate wide-reaching, complex environments on a daily basis, whereas children's environments are more limited in range and tend to be perceived on the basis of reference points.

The designer of environments for small children should be aware that children are naturally oriented in relation to their own positions. Children see the world always in relation to themselves. For example, an especially enjoyable piece of equipment at the playground and its relationship to the toilet facility a child uses while at the playground may be the elements by which he or she organizes and understands that environment. A child's cognitive map will likely include detailed aspects of a space with which he or she is directly involved.

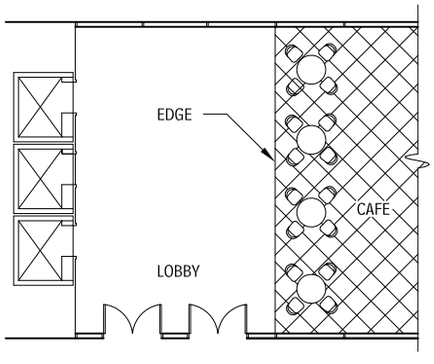
MAPPING ELEMENTS
1.9



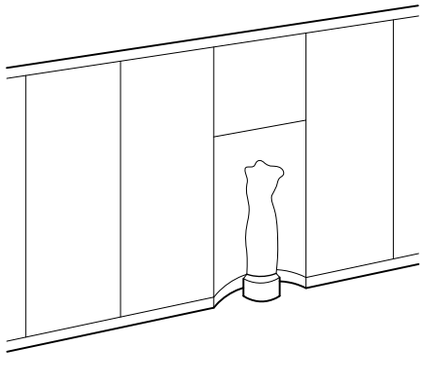
PATH



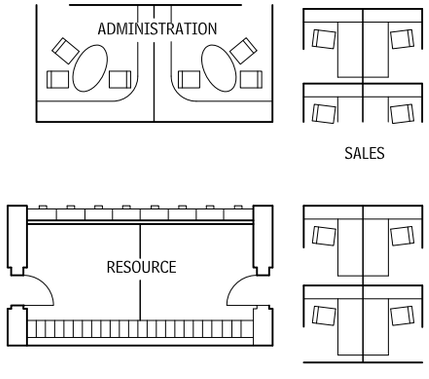
NODE



EDGE



LANDMARK



DISTRICTS

The adolescent child's orientation system may be based on a local hangout, the path of travel between home and school, local landmarks within the community, and similar points of reference.

As adults, people tend to rely on maps, diagrams, and more highly abstract information for orientation and finding their way within a new area. An adult who is visiting an unfamiliar city may use a city map to reach a destination.

SIGNAGE AND WAYFINDING CLUES

Signage is an important part of directing people through a space. Building signage can include building identification, building layout illustration, directional signs, and place signs.

Signs should be designed and placed consistently throughout the facility. The overuse of signage and cluttered signage becomes ineffective, and should be avoided. Signs should be placed strategically at decision-making areas.

WAYFINDING CLUES

In addition to signage, visual clues can be utilized to help orient the user. Architectural elements like lobbies, stairs, elevators, and areas of special use can create a framework into which users can place themselves. The following interior treatments typically used for aesthetic effect can also assist the designer in creating a highly understandable environment:

- Change of wall color, type, or texture
- Change in flooring
- Use of lighting to highlight or minimize areas
- Change of ceiling treatments
- Furniture arrangement or type.

The extent of wayfinding clues incorporated in the environment should vary from public to private spaces. Public areas require more information to be presented to aid visitors in locating their destinations. As the spaces become more private, fewer clues will be needed because of the occupant's knowledge of the environment.

Contributors:
Bradford Perkins (Stephen Kliment, Ed.), *Building Type Basics for Elementary and Secondary Schools*, John Wiley & Sons, Inc., New York, 2001, pp. 193–200
Kevin Lynch, *The Image of the City*, MIT Press, Cambridge, 1960
Gary T. Moore, "The Development of Environmental Knowing: An Overview of an Interactional-Constructivist Theory and Some Data on Within-Individual Development Variations" in *Psychology and the Built Environment,* David Carter and Terrence Lee, Eds. Architectural Press, London, 1976