2nd Edition

History of
INTERIOR
DESIGN

JEANNIE IRELAND

History *of* In

terior Design

2nd Edition

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To Tom, who keeps his armor polished.

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Preface

Having taught history of design for more than thirty years, I've been disappointed in the texts on the market. Many cover history of architecture very well, although they typically concentrate on specific structures rather than general characteristics. Others cover interiors and furniture but typically concentrate on Renaissance design. There are few texts that combine architecture, interiors, and furniture over a broad spectrum of time, and those that do are rarely comprehensive. Because architecture is the basis for interior design, as well as for furniture in most artistic periods, it is essential that students have a broad-based knowledge and be able to see the similarities among the three entities. While many texts cover ancient design in a few pages, classical forms have been revived throughout the subsequent ages and have affected design throughout history. Classical design forms the basis of much design and must therefore be thoroughly understood.

Those of us in modern society often tend to believe that the technological developments that shape our world are recent innovations. It is, however, the ancient cultures that were called on to develop, over a period of hundreds of years, the basic forms for construction, space planning, the forms and design of ornament and interiors, and even functional furnishings. The post and lintel, arch, truss, and cantilever were developed very early, as were methods of turning corners, forming walls, and spanning space. The same techniques developed by early cultures are used today. This edition follows technological innovations in materials, processes, and structural design that have made it possible to construct buildings and even furnishings that would not have been feasible even a few decades ago. Stronger, lighter-weight materials coupled with structural developments and creative genius have resulted in designs that stretch the imagination. Buildings reach ever higher into the sky as a result of advances in structural engineering; they soar outward, seemingly without support to unprecedented lengths, and after thousands of years of angled corners and straight walls, structural components are configured in ingenious arrangements. Some of these changes are the result of developments in age-old techniques. Others exploit the characteristics of new materials or changing manufacturing techniques of more traditional ones.

Differences in buildings constructed for the rich, the middle class, and the poor are usually related to size and opulence rather than structural form. The house has changed less over time than have public and religious structures. Cultural and religious developments dictated change, while the basic family unit and its needs remained relatively static. Fashions in architecture, interiors, and furnishings have changed over time, but most changes have been a result of increasing knowledge of the world, differences among groups of people, and availability of materials. Early buildings most often made use of local materials, although some important structures, such as Stonehenge, were constructed of materials brought long distances.

While the most obvious changes have been in structures, furniture, too, has changed with the times. New pieces necessitated by affluence and changes in lifestyles, increasing concern with ergonomics in response to demand for comfort and utility, and the desire for something innovative have resulted in more choices than ever before. Changes in technologies and materials have resulted in furniture that is affordable yet pleasing to the eye.

Energy efficiency and environmental conservation are not new ideas. From prehistoric times, people have, of necessity, been concerned with these ideas. It has only been in the last few centuries that technological innovations have made it possible to ignore these concerns. Since the 1970s, increasing energy prices and the recognition that some energy sources are finite have again resulted in an increased emphasis on energy efficiency and environmental conservation. These concerns have resulted in new materials and techniques that have successfully changed not only monumental, but more insignificant, structures. Demand for some of these innovations has been the result of increasing costs to consumers, some due to more altruistic reasons. In this edition, these trends have been more closely followed throughout history.

Fashions change but are associated with culture, social mores, and economic conditions that have varied over time and among groups. The folk paintings on building exteriors in cultural pockets in Eastern Europe, onion domes covered with multicolored tiles in Russia, and movable rice paper walls in Asian structures are differences that may not be understood by individuals in other cultures. Each, however, has been developed over a long period of time and reflects the habits and values of the people who built them. Technological innovations in travel and communication have resulted in a greater mixture of cultures and a desire for individuals in remote locations to emulate avant-garde designs. With few exceptions, no longer are cultures isolated. Today, skyscrapers in Hong Kong, New York, Berlin, or Bangkok are so similar that it would be difficult to determine from a photograph their locations. The world has become a global community and though much is the same, much is different. It is essential that designers understand differences across history and across the contemporary world. Only then can buildings suit the needs of their occupants. This text compares historic and contemporary buildings, interiors, and furnishings to better enable designers to complete their tasks successfully.

Coverage and Organization

History of Interior Design is organized chronologically and arranged in five parts plus an introductory chapter. Typical chapter organization begins with an overview of historical political, social, religious, and technological backgrounds to enable readers to better comprehend design motivations. Each then continues with a general discussion of arts and design, followed by a more detailed discussion of architecture (including city planning, monumental, and domestic structures), interiors, and furnishings.

Chapter 1 is an introduction to design and considers the varying design processes with which interior designers should be familiar. The chapter includes a discussion of the technologies associated with buildings including food-getting methods and building techniques and materials. There is further review of architecture itself, consisting of the conditions of architecture, its significance, and the influences on building design. This chapter continues by defining interior design and discussing its historic impacts. The development and use of furniture are then addressed. Finally, types of ornament are examined with methods and forms of ornament defined.

Part 1 includes chapters on ancient cultures beginning with Mesopotamia and Egypt and extending through the fall of Rome in AD 476.

> **Chapter 2** covers ancient civilizations in the Middle East, including Sumeria, Babylon, Assyria, and Egypt.
>
> **Chapter 3** examines design in the Minoan, Mycenaean, and Greek civilizations in and around the Mediterranean Sea.
>
> **Chapter 4** reviews the impact of the Etruscan and Roman civilizations on design.
>
> **Chapter 5** includes a survey of ancient design in Africa, Persia, India, China, Japan, and the Americas.

Part 2 considers the designs associated with the medieval periods.

> **Chapter 6** looks at Early Christian design in the Mediterranean area and Byzantine design not only in ancient Byzantium but also in the areas to which this design spread, including Russia.

Chapter 7 is a new chapter that focuses on Islamic design in the Middle East, India, Africa, China, and into the Iberian Peninsula.

Chapter 8 includes a discussion of styles in Western Europe during the Dark Ages including Romanesque, Anglo-Saxon, Asturian, and Carolingian design.

Chapter 9 deals with the variations of Gothic design in Europe as advancements in technology improved living conditions and changed the landscape.

Chapter 10 follows design in Africa, Asia, and the Americas and discusses the impact of Eastern technologies imported to the West.

Part 3 deals with the enlightenment of the Renaissance in the West, the expansion of trade, and the discovery of previously unknown worlds.

Chapter 11 examines the beginnings of the Renaissance and its manifestations in Italy.

Chapter 12 reviews the spread of the Renaissance throughout France, the Iberian Peninsula, and central Europe as that continent emerged from harsh medieval conditions.

Chapter 13 focuses on the Renaissance in the Low Countries and England as trade became more important.

Chapter 14 examines design in Africa, Asia, and the Americas from the Renaissance into the modern period and traces some of the important influences of design from those areas into the West.

Part 4 surveys the changes in the political landscape, technology, and culture in Europe and discusses the importance of the explorations and discoveries of the Americas.

Chapter 15 traces baroque and rococo design in various areas of Europe and Latin America as governments became stronger and demand for goods and services increased.

Chapter 16 tracks the influence of Spain, France, the Netherlands, Sweden, and Germany into the Americas as colonization began.

Chapter 17 reviews the developments associated with the colonization of the Americas by the English and examines the design modifications resulting from the disparities of both social and natural environments.

Chapter 18 covers design in Europe and America during the neoclassical period as discoveries of ancient cities resulted in a resurgence of popularity of classicism not only in design but in the development of nations.

Part 5 traces the changes resulting from technological innovations as the world moved into the modern era.

Chapter 19 focuses on the Industrial Revolution and the numerous styles that evolved during the course of the nineteenth century.

Chapter 20 looks at late nineteenth- and early twentieth-century technological developments and their effects on design, further revivals of past designs, and the introduction of the Arts and Crafts and Art Nouveau styles.

Chapter 21 examines the progress of modern design in light of fast-paced changes in technology, especially in building materials and construction. Twentieth-century design movements are traced beginning with the Bauhaus and going through the International Style. Interior design as a profession is introduced.

Chapter 22 describes the challenges facing the postmodern world and current solutions to those issues. The varying forms of postmodern design are surveyed, as are the reactions to that style.

Features

To support and further describe the concepts in each chapter, the following features appear throughout the book:

- *Influences* of the civilization being discussed on future design in other civilizations are set apart for easy identification. This feature helps readers to better comprehend the impact even remote ideas can have on other cultures and in other times.

- A summary of characteristics of each architectural design style is included within the chapters following a discussion of the style. This *Architecture* feature provides a synopsis that can be used for review.
- Visual examples of the various *Motifs* used by each culture are included in a separate box within chapters to facilitate recognition of the designs, many of which are unfamiliar to modern designers.
- Other descriptive or visual boxes set out within the chapters identify specific *Details*, such as column types, floor plan arrangements, or molding types that may be unfamiliar to readers.

New to This Edition:

For this second edition, changes have been made that reflect ongoing technological developments, the increasing emphasis on green design, and fluctuations in cultural values. These include:

- Reorganization of design details of Latin American, African, and Asian cultures. In the previous edition, these were organized geographically; in this edition, they are arranged chronologically so that they better fit into the historic sequence. In addition, coverage of these areas has been expanded so that it is easier to see the influences they have had on mainstream design over the centuries.
- As the world increasingly develops into a global community, some cultural designs have become more prevalent. To that end, a chapter on Islamic design has been added for this edition.
- Additional information concerning technological developments in materials, processes, and structural design has been included throughout.
- More emphasis on green design and its historic development has been integrated into each chapter.
- Increased emphasis on modern design has been added to bring the text up-to-date.

Instructor and Student Resources
History of Interior Design STUDIO™

New for this edition is an online multimedia resource—*History of Interior Design 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.Bloomsbury FashionCentral.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's Resources may be accessed through Bloomsbury Fashion Central (*www.Bloomsbury FashionCentral.com*).

Acknowledgments

The unsung heroes of ancient cultures deserve much credit. Their patient development of the basic building blocks of architecture, interiors, and furniture ultimately led to this text. Who were these people? Some will never be known, but they were true heroes of their time. They experimented with materials and forms, sometimes giving their lives in the advancement of knowledge, which led to subsequent and more successful trials.

There are many, though, who are known and can be acknowledged as part of the creative process that led to this tome. First, and foremost, are the students who asked questions, stimulated thought, and motivated me to better understand the history of design. It is my hope that through the laughter, toil, and seeking of solutions, they have gained an appreciation of what the world of design had to do to become what it is today.

FIGURE 1.0 Here at the Vatican Museum in Rome, the staircase spirals inward toward the bottom.

1

Introduction to Design History

Technology and availability of materials play important roles in design, but choices are shaped more by cultural needs. Even primitive structures usually go beyond filling basic needs: they are affected by users' desires to enhance them aesthetically. Simple mud buildings, for example, may have painted or incised designs on surfaces.

The first and still most important function of a building is to provide shelter from the elements—whether it is for a statue of a god or a family. Climate and location play a decisive role in determining how that shelter is designed, as well as affecting the materials that are available for structures, interiors, and furnishings.

Culture, including religion, often dictates the size of the structure, reserving the largest for the gods or individuals with higher status; the location of the structure in relation to topography, the sun, or the cardinal points; and the amount and type of decoration used. Furnishings provide comfort, serve utilitarian purposes, and often indicate status through height, ornamentation, or even use. Throughout history, the designs of structures, interiors, and furniture have changed, usually slowly, reflecting the society in which they were used. In order to understand these changes, it is necessary to put them into social and historic context.

Technologies Associated with Buildings

Technology, or the application of knowledge for a practical purpose, influences the building arts in very basic ways. Building does not always mean enclosing space, but it does mean defining space. Structures such as those at Stonehenge in England or the alignments at Carnac in Brittany remain enigmas with their true functions unknown. It is evident, however, that technologies for moving and erecting great stones were used in their construction.

Building technology has developed over many centuries, albeit more slowly than other technologies, such as warfare or agriculture. Early building technologies used simple construction techniques for shelter, many of which are still used by primitive and nomadic cultures. Innovations in building technology are predominantly reflected in monumental structures rather than in homes, in part because a suitable form of shelter was developed very early and significant change was unnecessary. Other technologies, even those as basic as food getting, that are indirectly related to building have an impact on structural design as well.

Food-Getting Technology

Because satisfaction of the basic physiological need for food takes precedence over other needs, the methods by which people obtain food affect building arts. Anthropologists generally separate food-getting technologies into two major categories: hunting-gathering and agriculture. Herding falls between the two types but is not necessarily a transitional form. Hunter-gatherers and herders establish nomadic cultures, while agriculturalists establish more settled ones.

Hunter-gatherer societies subsist especially where herding or agriculture are not viable alternatives, as in some arctic, arid, and tropic areas. In hunting-gathering technologies, only

naturally occurring wild plants are gathered and wild animals are hunted. As the food supply is exhausted or as animals reposition, the people must move.

Hunting-gathering requires more land to support each individual than do herding or agriculture; consequently areas inhabited by these groups are sparsely populated. Groups foraging for food follow culturally established norms. Nomadic Australian Aborigines camp several hundred feet away from the scarce water holes for two reasons: They do not want to frighten away game, and they do not want to cause strife with other bands waiting for game at the same water hole.

Nomadic herders and pastoralists who maintain large herds of animals must also follow a food supply. In this instance, the food supply is for the animals. The human food supply is relatively constant, shelters are often made of animal hides or fibers and may be framed with their bones, and clothing is made with yarns woven from the fibers produced by animals or from their skins.

Nomadic herders follow wild animal herds, with only a few individuals actually staying with the animals as they migrate. When the animals have reached their seasonal feeding grounds, the remainder of the people follows and sets up camps. Lapps of northern Europe still follow herds of reindeer, satisfied with an age-old quality of life.

Nomadic people either carry their belongings with them or leave them behind. Shelters designed to be abandoned are quickly constructed of readily available materials in a new location. African Pygmies, who live in dense forests, erect hemispherical huts of flexible poles that are then covered with leaves. The huts can be quickly constructed, used for one or two nights, and abandoned without concern. Some nomads build transportable shelters, carrying them along as they travel. Such structures must be easily dismantled and erected and be light in weight for portability. The cone-shaped tent structure, or **tipi**, of the North American Plains Indians is an example. Because the Amerindians had to travel long distances to cut poles for their tipis, the poles had to be transported when moving to another site. Amerindians lashed them together to form a **travois**, which could carry other belongings. Originally, dogs pulled the travois. Tipi size increased when Amerindians were able to obtain horses, an animal not indigenous to the Americas, because horses could pull longer poles.

Pastoralists herd domesticated animals and are more vigilant toward their animals than are nomadic herders. Rather than following herds to food supplies, pastoralists accept greater responsibility and locate food and provide protection for their herds.

The Navaho Indians became pastoralists after the Civil War, which obliged them to move seasonally to provide pasture for their animals. Two types of dwellings evolved: the **hogan** was a mud and log structure used during cold weather and the **ramada**, a roof of branches supported by posts, was the summer shelter.

Even nomadic peoples are concerned with aesthetics and may ornament their structures, especially when the shelter will be moved with them. The circular Mongol tent called a (**ger** or **yurt**), for example, is often decorated with traditional designs. (See Figure 1.1.)

The development of agriculture about 10,000 years ago made it possible for people to stop wandering in search of food and settle in one place. Successful agriculture requires that people remain in one place through a growing season or, in the case of orchards and vineyards, for years. The food supply is relatively reliable, and people are released to expend their energies in other pursuits.

Agriculture made living in larger groups possible, which improved security for the group and its food supplies. In fact, urban development depends on agricultural surplus. People first settled where wild grains were indigenous. Civilizations depend on water supplies, and settlements in river valleys ensured constant supplies. Four river valleys are known to have supported major ancient civilizations: the Tigris-Euphrates of Mesopotamia, the Nile River in Egypt, the Yellow River in China, and the Indus River in India. In an agricultural society, residences are more permanent, and people have more leisure time to develop an aesthetically pleasing environment. Eventually, this leads to the development of arts and crafts and division of labor based on skill. As agriculturists banded together and settled down in one place, building arts became more important. Not only could settled people build permanent homes for themselves but for their gods.

FIGURE 1.1 Modern gers make use of lumber, but traditional examples used bent poles to form the framework that supports the felt covering. Until modern times, yaks, camels, and oxen transported gers when people moved.

Building Techniques

Turning corners and spanning space were early technological problems that had to be solved before freestanding structures could be erected.

Turning Corners

Enclosing space required the development of methods of turning corners. In substantial buildings, the rounded form is very stable, and during the medieval period, round towers were constructed because they were difficult to collapse by tunneling under them (a contemporary warfare technique). The techniques for constructing corners, however, were developed early by Mesopotamian builders who discovered that adobe bricks could be overlapped to create square corners. **Adobe** is mud mixed with a binder, such as straw or animal hair.

Spanning Space

In order to cover an open space, the weight of the roof must be supported. How that is accomplished is a function of the materials used, as well as the structure of the roof itself.

Four methods are used for spanning space, all of which were developed early and which have

since been used continuously: the post and lintel, the arch, the truss, and the cantilever (or corbel).

The **post and lintel**, or wall and lintel, was the earliest device employed to span space. In this technology, two or more vertical supports, either posts or walls, are bridged by horizontal **lintels**. When isolated freestanding posts are used for support, vertical members may be called posts or columns. Today, post-and-lintel construction is used for openings and as a basic support system for carrying the roof load.

The **arch** was developed where large stones and heavy timbers were unavailable, thus making the simpler post-and-lintel device impractical. The earliest arches were **corbelled arches** and employed the **cantilever** or **corbel**—a horizontal projection that extends beyond the support beneath it. (See Figure 1.2.) Materials were laid in horizontal rows, or **courses**, with each successive course projecting slightly beyond the one below until they came together at the top. The corbelled arch was used in ancient India, Scotland, Ireland, Central America, and third-century AD Chinese tombs.

The true arch employs a series of small blocks, called **voussoirs**, to span space. A voussoir is a truncated wedge-shaped unit designed to

FIGURE 1.2
The earliest cantilevers were used to roof buildings, with each successive horizontal layer projecting slightly beyond the one beneath it until the two sides met at the top.

retain its position while resisting thrusts against it. Each voussoir pushes diagonally against the block below it to finally transfer the weight to the ground. The sideways pressure of one part of the arch against another is called **thrust**. As weight is added, the arch becomes stronger as long as there is sufficient mass or another device, such as an adjacent arch or **buttress,** or a heavy projecting structural component, to provide counterthrust. (See Details 1.1.)

The ancient Mesopotamians used arches for drains, tombs, and gates, but the Romans used them extensively above ground and carried them throughout their empire. Arch design is often associated with a specific historic period or cultural group. Pointed arches, for example, are characteristic of the Gothic period.

The **truss** is a triangular form that relies on the geometric principle that the length of any side cannot change without changing the angles at the corners. If one angle is stable, the truss itself is stable. The truss can span very long distances, freeing up large interior spaces. The truss form was first extensively used in ancient Greece. As a result, in contrast to Egyptian post-and-lintel construction, Greek structures were more open and less massive in appearance.

Columns
The column is a type of decorative post and has been used in every historic architectural period. Columns consist of three parts: **base, shaft**, and **capital**. (See Figure 1.3.) The base is larger than the shaft and serves to spread the weight transmitted through the column over a larger area. Capitals may be purely decorative, educational, or symbolic. The lacy capitals of the Byzantine era served a decorative function only, but during

DETAILS 1.1 ARCH TERMINOLOGY

- The keystone is the center voussoir at the top of the arch. The arch must be supported until the keystone is installed. Once the keystone is inserted, the arch is self-supporting.
- The soffit, or interior curve, beneath the arch is the intrados.
- The exterior curve of the arch is the extrados.
- The point at which the curve of the arch begins is the springpoint.
- The springline is an imaginary line drawn between the two springpoints of the arch.

When voussoirs are used without forming a curve, the arch is termed a flat arch.

the medieval period when most individuals were illiterate, capitals were used to tell a story or make a point. The corn capitals in the US Capitol building (1809) in Washington, DC, were a way the architect Latrobe[1] chose to "Americanize" the columns.

Columns can provide structural support or be decorative. A partial round column attached to a wall is an **engaged column**. (See Figure 1.4.) When an applied column is squared off, it is known as a **pilaster**. (See Figure 1.5.) Decorative columns may be used as bases for statues: Trajan's Column in Rome (113 AD), the Nelson Column in London's Trafalgar Square (1840–1843), and the Ashoka column[2] in India (c. 279–232 BC) are examples.

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1 Benjamin Henry Latrobe (1764–1820)

2 The capital with four outward-facing lions supported by the original Ashoka column was adopted in 1950 as the emblem of India.

FIGURE 1.3 Column bases do not need to have the same footprint as the column shaft and are usually square or circular. The vertical shaft is cylindrical and may be plain or decorated. The decorative capital at the top is larger than the shaft, and it is to the capital that the weight above is transmitted.

FIGURE 1.4 Engaged columns may be a part of the wall structure of a building, projecting outward from a few inches to almost their entire diameters.

Architecture

Modern definitions of **architecture** vary, but most agree that architecture

- refers to contrived environments suitable for their functions
- involves preplanning
- has inherent structural stability
- deliberately attempts to create pleasing aesthetic effects

While structures often enclose space, this is not a restricting characteristic. Architecture defines boundaries—not necessarily walls—that separate arranged spaces from their natural surroundings. Outdoor spaces have been an important part of architecture since ancient times, when they frequently included processional pathways and courtyards. The fora of Rome, the cloisters of medieval Europe, and the open spaces between structures in Beijing's Imperial City are all part of space planning. Modern variations of architectural outdoor spaces include parks, golf courses, and fairgrounds.

The fact that architectural forms are expressive of the contemporary political, social, economic, scientific, technological, and intellectual climate of the times in which they were built

makes them historically significant. This is only true, however, if all types of structures are considered. Deriving an impression of a civilization by reading its monumental structures results in a one-sided view. For these reasons, this text embraces a broad definition of architecture and includes, where possible, information about indigenous housing.

Conditions of Architecture

Marcus Vitruvius Pollio, a first-century BC Roman engineer, established a number of criteria that were necessary for what he termed "well building." Sir Henry Wotton (1568–1639) later selected what he designated firmness (durability), commodity (function), and delight (aesthetics) from the writings of Vitruvius as requirements for architecture. Contemporary architecture must meet these criteria. While the underlying principles of construction must be understood and properly used, architecture is more than mere building technology.

Without the element of aesthetic concern, any structural form that is planned in advance and durable could be considered architecture. History of architecture often excludes humble structures, including homes, partly because many of them have disappeared over time, but also because professionals often do not consider relatively simple structures architecture. The exclusion of humble structures as architecture assumes that they are untouched by aesthetic concerns, yet even primitive people incorporate decorative devices purely for aesthetic purposes in their structures. A highly decorated central pole may be imbued with significance or designs may be molded into, scratched, or painted on surfaces, including mud walls. Excluding such structures as architecture implies that only the wealthy, who can afford more lavish manifestations of beauty, have an aesthetic sense.

Durability

Durability implies strength and safety. Appropriate wall construction and space spanning techniques must be incorporated to ensure that loads are safely transmitted to the ground. This requires the knowledge and use of certain engineering principles, including those of ensuring that underlying soil is capable of support and that foundations are suitable. (See Figure 1.6.)

It has only been since the nineteenth century that accurate load calculations could be made with the subsequent specification of appropriate materials or building forms. In medieval Europe, people of one city were often obsessed with building cathedrals with heights or spans that exceeded those in rival cities. For lack of adequate knowledge of engineering principles, innovations in building design were tested by trial and error. As a result, many roofs and towers collapsed, causing injury and death, as well as construction delays and increased costs. Modern building codes dictate standards to ensure that buildings are durable, safe, and structurally sound, although even then, structural soundness may be tested by unforeseen events. In 1981, when strict building codes were in place and the science of structural engineering was well advanced, part of the Hyatt Regency in Kansas City, Missouri, collapsed due to a design flaw.

How long a physical structure should last depends on social expectations. The nomadic hunter who constructs a branch and leaf hut expects it to last the few days it will be used, but there are numerous ancient structures that retain their structural integrity after thousands of years.

Function
The maxim "form follows function" is not new, although forms of interaction differ according to time and culture and affect the size and shape of required spaces. The activities carried out in ancient Roman circuses and modern stadiums are similar, as are the structures provided for them even though 2,000 years separate them. While the basic function of religious edifices has remained constant—worship of gods— significant differences in rituals and ceremonies affect building form. Ancient Greek temples were designed to house a cult statue and were not entered by anyone other than those serving as priests. Christian worshippers gather in large groups, requiring religious edifices that have appropriate spaces for mass participation in rituals and ceremonies. Buddhist temples provide numerous icons for worship and allow participants to circulate, contemplate, and worship individually rather than as a group.

A functional building is also efficient. In homes, this means well-designed kitchens, workshops, and laundry areas—the places where most tasks are performed. Work efficiency becomes even more critical in the evaluation of businesses and manufacturing environments. Efficient means of entry and egress and crowd movement are especially important in public structures.

Aesthetics
What is pleasing to the eye depends on culture, historic period, and individual taste. The ancient Greeks considered the human body the ideal form and based their proportions on it. The Egyptian seqt, the Golden Mean, and the Golden Rectangle were also based on the human form. The proportions of the ideal human body when divided horizontally at the navel are 1:1.618, with the torso used as the basis of measurement. Thus, ideally, the lower part of the body should be 1.618 times the height of the torso. These ratios have been transferred to buildings and furnishings for centuries.

The desirable overall shape and form of a structure may depend on other aesthetic features. Modern skyscrapers reach for the sky and draw the eye upward. In some ways, these vertical lines manifest the ascent of humans up the ladder of corporate success. The verticality of Gothic cathedrals was a visual expression of the desire to reach a heavenly realm. A more horizontal orientation, such as that of the twentieth-century Prairie House and ancient city walls, implies security or contentment. The appearance of a structure, however, is not only affected by technology but also by social factors.

FIGURE 1.6
The Leaning Tower of Pisa, started in the eleventh century, began to lean during construction. Rather than abandon it, architects tried to compensate for the lean by raising the height of one side of successive layers.

Significance of Architecture

Architecture defines the source of power in a society. Government buildings are frequently built to impress or control populations—a factor often accomplished by the scale of buildings. Increasing the scale of a structure relative to the human body makes the building seem daunting and results in a psychological feeling of humility. Roman triumphal arches; the government buildings in Washington, DC; and Beijing's Forbidden City were all designed specifically for that purpose.

Architecture may also be conceived to inspire a sense of awe. This is most frequently accomplished by impressive size or extravagance of decoration. Places of worship often use this technique to corroborate the power of the gods. The soaring space and expanses of stained glass in Gothic cathedrals, gold leaf mosaics of Byzantine churches, and Mayan stepped pyramids helped to establish that sense of awe and wonder. Some architectural examples become national icons and serve the same purpose: India's Taj Mahal (1631–1648), Rome's Colosseum, and the Great Pyramid of Egypt (2589–2566 BC) are recognizable buildings that bring to mind the locations in which they are sited.

External Influences on Architectural Design

In addition to designing according to the basic tenets of architecture, there are external influences that must be considered. Until the advent of modern transportation methods, materials were usually obtained from sources near the building site. There are examples, however, where materials were carried long distances, increasing costs, time, and effort significantly. In almost every case, however, the structures in which the materials were to be used were significant, which allowed builders to override the importance of economy. The builders of Stonehenge brought bluestones from the Preseli Hills in Wales, about 240 miles away, and Egyptian temples and pyramids were constructed of stones ferried down the Nile.

The choice of building materials depends not only on availability but also on sociocultural values and economic conditions. In ancient Egypt, various types of stone were readily accessible and were used to build temples, palaces, and tombs. However, houses, even those for people of noble rank, were constructed of mud rather than stone. The Egyptians, assuming that the soul lived on after death, believed that permanent structures were more appropriate for sheltering the soul than the living body. The Greeks had to adapt their architecture because the forested hillsides from which they obtained large trees for early structures were denuded. They chose, instead, the rich stores of marble available on the Aegean islands.

Climate

Sustainable design, also known as **green design**, is a design strategy that promotes ecological sustainability. During the past century, climate control systems and advances that required increased use of electricity have improved comfort in the built environment. In the past few decades, individuals and societies have begun to realize that resources are finite and that environment consciousness is imperative. Although some changes have been made in the modern built environment, an examination of the building practices of less industrialized societies who have fewer choices would be beneficial

It was essential that early civilizations worked with, not against, nature when designing and building structures. For most of history, people cooperated with climatic conditions, using available materials and designing buildings so interior environments could be modified without mechanical means. Climate affects the availability of some materials, although throughout history, people have found innovative ways to use what is at hand. Clay, stone, and timber are the materials of choice where they are available, but less obvious materials, such as animal skins and bones, volcanic ash, reeds, dung, branches, and leaves, have also seen use as structural materials. Large animal bones, such as those of mammoths and whales, were used to form frameworks, especially over pit houses. The frame was then covered with layers of animal skin. Volcanic ash, known as **pozzolana**, was the ingredient that made Roman hydraulic cement possible. Adobe mixed with cow dung and other materials is still used in rural areas in Africa and India.

Three types of climates occur: hot and dry, hot and humid, and cold. Conditions that affect climate include topography, location, air movement, and temperature.

Topography

Mountain ranges, deserts, and large bodies of water cover much of the earth's surface and create natural boundaries that, until recently, resulted in isolated cultures with limited outside communication. Building forms and decorative ideas in isolated areas often differed from those in similar cultures or areas. As a result of a successful military campaign in Egypt, Napoleon's army took Egyptian design ideas back to Europe. The resulting French Empire style was promulgated by the emperor and spread through much of Europe.

Natural boundaries and long distances allowed China to remain isolated for centuries, with ensuing traditional building, interior, and furnishing styles that changed little. Most cultures, however, were not so isolated from one another and contact through trade and warfare led to the communication of ideas. (See Figure 1.7.)

Mountain ranges, deserts, and other topographical features affect the supply of **arable** land, or that which is suitable for producing crops. Throughout history, cultures have devised ways of preserving land for agriculture by locating structures in or on nearby cliffs or beneath the earth. In the loess belt of China, for example, deep pits form communal courtyards for the multiple layers of residences gouged out of the pit walls.

Mountain ranges affect both air flow and moisture distribution. On the windward side, moisture carried by flowing air usually falls before reaching the top, making conditions wet on the windward side and dry on the leeward side. Temperatures decrease as elevation increases so that air flowing down the mountains carries cooler temperatures.

Where winds are strong or constant, builders may reduce building profiles or streamline the structures. In many island villages in the Pacific, buildings have a low profile in response to constant winds. In Normandy, streamlined structural elements are more common. Because slanted and rounded surfaces allow air to flow around or over with minimal turbulence, many traditional houses have rounded roof ends on the windward side, while on the leeward side, gables may be used.

Large bodies of water moderate temperatures because water serves as a **heat sink**. Warm air flows toward the water during the day and from the water at night, creating almost constant breezes. While this leads to less temperature fluctuation near coastlines, the water itself necessitates modifications in structures. Lower stories may be constructed of masonry or buildings may be raised on stilts or piers to minimize damage due to high tides and storm surges. In coastal areas where fishing is common, stilted houses are located in the water.

Hot, Dry Climates

In hot, dry climates, temperatures soar during the day and plummet rapidly at night. Shelters that respond appropriately to these conditions maintain cooler temperatures inside during the day but provide warmth at night. Stone and adobe form heat sinks that absorb and store heat during the daytime. By nightfall, heat has permeated wall materials, and the stored heat is radiated to the interior. These materials have been common in the arid climates of the American Southwest and areas of India and Pakistan.

To prevent excessive heat from collecting, a compact shape may be employed to minimize the wall surface exposed. Vegetation is generally missing in these areas, so shading is accomplished by crowding structures together—sometimes even sharing walls. Often, these buildings have flat roofs that are used for sleeping. In other areas, such as Tunisia, traditional cultures have built their structures beneath the surface where air temperatures fluctuate less.

FIGURE 1.7 Today, modern communication methods have resulted in cities all over the world having a similar appearance. This city could be anywhere—China, New York, South Africa—but it is Kuala Lumpur, Malaysia.

Hot, Humid Climates

In hot, humid climates, structures are often elevated, allowing breezes to carry away radiated heat from beneath the building and raise living areas above low-growing vegetation. Materials such as bamboo, leaves, and thatch that do not retain heat are prevalent for walls and roofs. (See Figure 1.8.) Steeply pitched roofs with large overhangs shade the interior, provide protection from rain, and allow breezes to carry away heat rapidly. Choco houses in Panama consist only of a raised roofed platform; walls are absent, allowing air to circulate freely. French colonial buildings in the American South were two stories with family living areas on the cooler second story and servant quarters beneath. Most of the wall surface was enclosed with shuttered openings in these single-room-wide structures. The overhanging roof covered a surrounding open gallery.

In hot areas, structures are generally spread out. Large open areas in walls may lead to exterior living areas, including courtyards, and much day-to-day living and cooking are accomplished outdoors.

Cold Climates

In cold climates, the goal is to retain as much heat as possible. Buildings are small and compact to minimize the surface area through which heat can be lost. Usually there is a central heat

FIGURE 1.8 In tropical areas, buildings often employ walls or roofs made of vegetative materials that breathe.

source—until the invention of the chimney, a hearth—but later, a fireplace or stove. In rural areas, animals may be kept inside the home to take advantage of their body heat. In Europe, animals may be housed beneath the living area; in Ireland, a single-storied building was used to house both people and animals with only a short partition between them; and in Africa, goats are housed in a room at night, not only providing heat but also serving to protect the animals from harm.

People in cold climates select materials for their insulative qualities. Heat sink materials, such as adobe and stone, are common for the same reason they are used in hot, dry climates—they absorb heat during the day and release it to the interior at night. In arctic areas of North America, natives traditionally used a double layer of sealskin with a layer of moss sandwiched between them to provide insulation. Subterranean structures are also used in cold climates because earth sheltering moderates surrounding temperatures. In the latter part of the twentieth century, earth contact homes were popular in America because they saved energy. (See Figure 1.9.)

Today, large buildings particularly rely on mechanical systems to heat and cool interiors. Large expanses of glass allow heat flow with little impediment. Heat flows in when exterior air temperatures are high and out when exterior temperatures are low. In urban landscapes, buildings are closely packed with only narrow canyons between them. The resulting increase in the speed of air flow carries heat away rapidly. Pavements serve as heat sinks absorbing heat and radiating it when temperatures drop. The overall result is consistently higher temperatures in urban areas than in rural ones. Evidence of this becomes apparent as the weather begins to warm in the spring. Vegetation in urban parks and along highway pavements begins to flourish in these warmer areas before those in the countryside do.

Other Influencing Factors

Unrelated technological developments can have a significant impact on buildings. When gunpowder made cannons possible, fortified walls could no longer provide protection, and castles became obsolete. The development of the jigsaw made it possible for Victorian buildings to incorporate

a significant amount of decorative wood trim, which affected design.

Social concerns and mores are often expressed in architecture. In Muslim areas, **jali**, or pierced screens, and the location of doors on opposite sides of the street in alternating positions protect women from prying eyes. Medieval churches had special places for nonbelievers, who were not allowed into the main worship area.

Religious beliefs may play a key role in the design of a structure. In Japanese homes, small rooms reserved for worship require space in the floor plan. In Asia, roofs that curved upward were originally designed so that the spirits who were believed to live in the surrounding area could slide down the roof and head back up instead of landing beside the building.

Tombs also serve a religious function. Belief in an afterlife has led people to provide worldly goods and comforts to carry over into the next life. Ancient Egyptian pyramids served the same function as tombs in Manila's Chinese cemetery. There, the cemetery has the appearance of a small town with lighted streets and regular spacing of buildings that have the appearance of homes.

Exposure to other cultures affects architecture and design. It is difficult to determine, for example, which of the ancient civilizations developed the column first, but all used it. Its widespread use was most likely a result of cultural exchange. The establishment of the Portuguese colony at Macao (1557) opened up trade with China, and Chinese porcelain and other goods became popular in Europe. The Portuguese colony at Goa (1510) in India led to the extensive use of ivory in furniture. The importation of mahogany from the West Indies after their discovery changed furniture construction because large planks became available for use.

Architectural Style

Architectural styles are affected by changes over a period of time and evolve gradually, unless there is a significant technological development. In 1853, Elijah Otis developed the elevator braking system still used today. The Bessemer process was introduced for the manufacture of steel in 1855 reducing production time and costs, making it affordable for building. These two innovations were quickly embraced and changed the face of urban landscapes as skyscrapers became more feasible.

FIGURE 1.9 Snow is an excellent insulator, and Swiss roofs may have low fences or stones to retain snow on the roof for that purpose.

What are termed "historic" styles gradually evolved from their beginnings in ancient Mesopotamia and Egypt, influencing the subsequent styles of Greece and Rome, and continued to evolve as they were carried throughout Europe and eventually to the Americas. Some architectural styles have little effect on architecture in distant regions. Ancient American architecture of the Incas, Mayans, Aztecs, and the farmers of the Pueblo cultures; the architecture of India; and African sub-Saharan structures have all had only a small influence on architectural styles of other areas. Islamic and Oriental styles have had more influence on mainstream architectural styles, although Western architecture has had more influence on non-Western architecture in the last 100 years than vice versa.

The development of architectural styles usually follows a pattern. In the beginning stages, the style incorporates simple forms. Gradually, the design is improved to best fit required functions. Once the design of the structure has been perfected, there is a gradual addition of ornament to the structural form until ornament dominates. By this time, another style has probably begun to develop and its use overlaps that of the original style. Over time, structures may be adapted to meet new demands and the additions or changes to a structure may conceal its original design. Styles may be revived but almost always with adaptations for more modern techniques,

materials, and processes. Revivals are often far removed from their original locus of influence, and resulting structures have attributes that make them suitable for the places and times in which they occur.

Interior Design

The term **interior design** implies that some effort has been made to enhance the quality of interiors, to improve function of spaces, and to treat interior areas in an aesthetically pleasing manner. (See Figure 1.10.) Interiors have been thoughtfully contrived since drawings and paintings were done on the walls of caves. Like architecture, interiors are treated to make them more functional, as in the arrangement of furniture, and to make them beautiful. Surfaces are treated, furnishings and accessories included, and design motifs employed to ensure that the sum of the parts results in a pleasing whole. Interiors often incorporate architectural features, such as columns, pediments over doorways, and moldings, to delimit structural components.

Until the twentieth century, interiors were usually completed by building architects and, as such, complemented the structure. Indeed, since the structure serves as the background for the design of the interior, creating a pleasing interior is simplified when the structure itself is pleasing.

Historically, interiors have been designed to conform to social mores that affect other aspects of design. There is little ornamentation and furniture is simple in Quaker homes, keeping with the beliefs of their inhabitants. In Renaissance palaces of Europe, interiors were lavish, as were the lifestyles and the types of entertainment of the occupants.

Furniture

Furniture must function in one of two ways: It must support objects or store them. Accessories such as mirrors, lighting units, and works of art perform other functions and may be purely decorative.

Like architecture, furniture reveals habits and social mores of a civilization. In parts of the Orient, beds consist of mats that are rolled out when needed, allowing the space to be otherwise used during the day. By contrast, in Western cultures, the bed is often in a separate room occupying permanent space. The seat-back angle of chairs has changed over time. A 90-degree angle requires users to sit upright. For many centuries, it was a way to preserve an individual's dignity (and sometimes to avoid disturbing one's wig). Most modern chairs have a 105-degree seat-back angle, and some adjust beyond that. Individuals lean against the back of the chair in an informal manner reflective of modern society.

Social status can also be expressed through furniture. Throughout much of history, only the wealthy were privileged to sit on chairs, while peasants squatted or sat on stools. Chairs with arms were often reserved for the most important person, and many households did not even have one. Height of furniture has also been an indication of status, visually demonstrating elevated social position—the higher the furniture off the floor, the more important the person. Footstools or steps may have been necessary to mount the chair or bed of a particularly important individual. Raising the furniture on a dais serves the same purpose. Even today, the "head table" at a formal event is located on a dais where occupants are visible from every part of the room.

Ornament

Ornamentation is a decorative treatment that creates a contrast to the surface itself. Ornament is the element that has been most vilified

FIGURE 1.10 Interior design is related to culture, lifestyles, and economic conditions, as well as historic period.

or embraced. Greek architects insisted that anything that was not necessary for the structure itself detracted from it. Gothic builders added ornament to almost every surface. The ornament used for interiors and on furniture is often derived from that used on architecture, so an understanding of those forms is necessary. Ornamentation can be achieved by applying a color or pattern to a surface, changing surface depth, or piercing.

Application of Color or Pattern

Of the techniques used for ornamentation, the application of color is the most widespread. A single color may be applied to an entire surface, such as a wall, or multiple colors may be applied in a pattern. Paint may also be used to conceal what may be considered undesirable. The various Windsor chairs of the eighteenth century were often painted to hide the fact that a variety of woods were used for construction. This is not to say that the design inherent in wood has not been appreciated. The reddish-purple color of the Dalbergia tree, often called rosewood or kingwood,[3] has been highly valued since the mid-eighteenth century in Europe, where it was imported from South America and the West Indies. Ebony, citrus, and other woods have been prized during various historic periods and their natural coloring and grain enhanced by polishing or the application of uncolored finishes.

Whitewashing, or the use of a lime-based coloring medium, has been a common technique for coloring a surface. When open fires were common in homes, surfaces were whitewashed every spring to cover the accumulated soot. **Stain** changes the color of wood and, depending on opacity, allows the grain to show to varying degrees. Stains are often used on inexpensive woods to give them the same coloring as more expensive species, although the pattern of the grain is usually dissimilar.

Lacquering is a more complicated technique used to apply color. This technique was well-developed by the Chinese as early as the fourth century BC. Lacquer is made from the sap of a tree (*rhus vernicifera*) indigenous to China. When exposed to air, the molecular structure of the sap changes to form a plastic substance. The thick-

ened liquid may or may not be colored before application. Lacquer is waterproof and resistant to heat and the effects of acids and alkalis. It is applied in multiple coats, sometimes hundreds, and is so hard it can be carved. European artisans often imitated the carving of lacquer products by using a mixture of sawdust and gum arabic to create raised designs. The object was then coated and sometimes gilded with metal dust. Inlays of precious and semiprecious stones, precious metals, ivory, and mother-of-pearl were often added to further ornament these objects.

Japanning is an imitation of the lacquering technique used in Europe from the seventeenth through the nineteenth centuries. Japanning employs an alcohol-based **shellac**, usually with black or red coloring added.

Veneering employs thin sheets of rare or expensive materials laminated to a less expensive material. Often, exotic woods are used to cover more common woods, making efficient use of rarer materials. The veneer sheet can consist of a single material or of shaped pieces of a variety of materials fit together to form a design. In the latter case, the technique is known as **marquetry** or **intarsia**.[4] Ivory, mother-of-pearl, brass, and tortoiseshell have been used in this way.

When a space is gouged out of a material and another material is shaped to fit the space, the technique is known as **inlay**. (See Figure 1.11.) This technique has been used since ancient times to incorporate semiprecious stones and other materials, especially in furniture.

Gilding is the application of thin sheets of gold to a surface. Very thin sheets are known as gold leaf; slightly thicker sheets are called foil. Because of the malleability of gold, gilding can be made to conform to the intricacies of an object's surface, or the surface can be patterned by tooling the gold. Over time, the gold wears off.

Textiles, leather, and paper can be applied to provide colors or patterns on interior surfaces and furnishings. Tapestries and leather were hung on the stone walls of medieval and Renaissance castles and palaces, not only for decorative interest, but also to minimize cold drafts from the walls. Wallpaper as it is known today began to be

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3 Also known as palissandre.

4 In Renaissance Italy, the term *intarsia* was used, although usually to describe a picture done in this manner that was used as veneer.

FIGURE 1.12 Embroidery uses yarns of various colors to form a raised design on textile products. This technique has been used for upholstery materials, tapestries, rugs, and other decorative fabrics.

available in 1675, although the Chinese had glued rice paper on walls as early as 200 BC.

Changes in Surface Depth

Ornamentation can be achieved by the addition or subtraction of materials to alter the depth of the surface, resulting in a three-dimensional appearance. The addition of materials includes **embroidery** (creating a pattern with thread or yarn) and appliqué. Carving removes materials, leaving the design exposed. (See Figure 1.12.)

Adding Materials to a Surface

Appliqué may refer to a material of a different color or texture applied to a second product and may result in a three-dimensional effect. During the Georgian period (1720–1840), molded plaster designs were attached to ceilings, while modern artisans apply pressed or carved wood decoration to furniture, doors, panels, walls, and ceilings.

Subtracting Materials from a Surface

Carving removes material from a surface. Both incised and relief carvings have long been common. **Incised carving** is a pattern cut below the surface and includes scratch, chip, and gouge carving. **Scratch carving** consists of lines on the surface that form an outline. The surfaces between the lines remain flat and may or may not be filled with color. (See Figure 1.13.) Until the eighteenth century, scratch carving was commonly used on provincial furniture. In **chip carving**, small chips are removed from a surface, typically in geometric patterns. (See Figure 1.14.)

The tools used for **gouge carving** are shaped like a scoop and form shallow curved depressions. Gouge carving was used extensively in the sixteenth and seventeenth centuries.

In **relief carving**, the background surface is removed and the design projects above the finished surface. **Low-relief**, or **bas-relief**, carving differs from high-relief carving in that low relief is cut from the top only. (See Figure 1.15.) In **high-relief**, or **alto-relief**, carving, the design is undercut, forming a three-dimensional effect on the underside as well as the top of the design.

Molding is a type of relief carving. Sharp edges of furniture tops and chair seats or at the angles of case furniture may be modified along their length to soften their lines, to simulate wear, or for safety. The technique may also be used to modify the surface of long boards that will be used as crown, base, picture, and other moldings on walls and ceilings.

Molding, however, has another connotation that is unrelated to carving. Materials may be shaped in a mold during manufacture to have three-dimensional surfaces. Ancient Mesopotamians molded brick and tile to create surface

FIGURE 1.13 Scratch carving has been used since the earliest times. The lines identify features, much like in a coloring book.

FIGURE 1.14 Chip carving, popular on medieval chests, is common on Pennsylvania Dutch furniture and is still frequently used in traditional rural areas in Eastern Europe and in Asia.

FIGURE 1.15 Parts of this stone plaque in Beijing's Imperial City are carved in low relief. Heads and some other parts of the dragons are carved in high relief.

designs. The term **shaping** also relates to subtracting material from a surface. The outside edges of objects can be shaped to make them conform to specific designs. In the Mycenaean Treasury of Atreus (1250 BC), stone edges were shaped to form a circle. The vertical surfaces beneath table edges or beneath case furniture are often shaped with curves. (See Figure 1.16.)

Piercing is usually done in a pattern rather than randomly. It may be purely decorative or it may function as a way to provide ventilation.

Turning also subtracts material from a surface. Cutting of the design is accomplished while the material is rotating on a center axis. Material may be turned by hand, which results in some inconsistencies, or on a tool called a lathe that spins at a constant speed and results in shapes that are consistent. Early lathes were powered by humans; modern lathes are electric. **Balusters,** spindles, and furniture legs are often turned. Balusters are turned pieces that incorporate a vase-like shape. (See Figure 1.17.)

Ornamental Motifs

Regardless of the methods used, the design of the ornament itself is typical of an historic period or group of people. Motifs are usually based on geometric forms, free-form curves, natural objects, or miscellaneous forms. Motifs may be formed into a **pattern**, or orderly arrangement.

Geometric Forms

Geometric designs employ lines, angles, and curves. The **chevron** is a line motif that uses a single V-shape or a series of them and has often

FIGURE 1.16 Shaped pieces can have any silhouette and often incorporate curves.

FIGURE 1.17 To create a turning, such as these legs, a sharp tool is held against the rotating piece of material.

been used to signify water or lightning. Native Americans of the Southwest and the medieval Normans made extensive use of this device.

INFLUENCE 1.1

The chevron was often used on medieval shields and from there found its way into symbols of rank in the armed forces today.

The most commonly used geometric shapes are polygons.

The triangle played a major role in Greek architecture and subsequent buildings as the shape that predominated at the ends of roofs.

The square is frequently used for building footprints and appears in a number of recurring motifs. Square blocks were separated by spaces to form **dentil** molding in ancient Greece and Rome; medieval battlements employed square, rectangular, or trapezoidal forms for the protection of those fighting on the ramparts; and checkerboard patterns have been used since at least ancient Roman times.

The rectangle is the most frequently used form for building footprints and has been used during all historic periods.

When people believed the earth was flat, they also assumed it was square. From any point on the earth, however, the heavens appeared as a circular dome. An octagon results when the square and circle are combined and the curves changed to angles. The octagon has been especially imbued with symbolism for this reason. The form was used by Charlemagne (c. 742–814 AD) to indicate his status as a liaison between the heavens (God) and the earth (humankind). His ninth century chapel at Aachen, Germany, illustrates this symbolism. The hexagon was used for motifs but rarely for buildings.

Circles and Curves The curves used in ornamentation include mechanical, mathematical, and free form.

Mechanical curves are based on a circle, include any portions of circles, and are drawn with a compass. Circular designs include spheres, which were symbolic of the pearl of wisdom in Chinese motifs and as globes used during the Renaissance. Two-dimensional round forms have been used for footprints in buildings from prehistoric times to the present. The major use

of circles, however, is as design motifs, often representative of the sun, as in the Egyptian winged disk. Used since ancient times, circles with designs that radiate from the center are known as wheel or **rosette** forms and may have the appearance of stylized flowers.

The circle is the basis of both the arch shape and the individual curved foils in both medieval and Islamic designs. **Semicircular arches**—those that form half a circle—were common in ancient Rome and derivative periods and are still frequently incorporated in buildings. An arch formed by a portion of a circle greater than 180 degrees is a **horseshoe arch**, which is extensively used in India and in Muslim architecture. **Segmental curves**, in which the curve is less than 180 degrees, are less frequently used but were common in Regency and Baroque designs.

Mathematical curves are derived from conical sections, with the degree of curvature dependent on the length of the curve. Ellipses, spirals, and helixes are examples. The egg and dart of the ancient Greeks and Romans, room footprints and design motifs of the Rococo period, and semicircular windows of the Georgian period all incorporate ovals or ellipses.

Spirals begin with a rather sharp curve that lessens as it progresses. While they may eventually have little curvature, they do not become straight lines. Both the **helix** and spiral wind about a center: the helix remains the same distance from the center but the spiral increases its distance from the center, as it progresses. The helix is the basis of the thread of a screw. The Mayans used the spiral as a symbol for the wind, and the structure of the Guggenheim Museum in New York City (1959) employs this form. (See Figure 1.18.)

Free-form curves are drawn by hand and were especially popular during the Rococo period when asymmetrical scrolls and elongated S- and C-curves dominated.

Cross Forms   A variety of cross forms are used for the design of both building footprints and as decorative motifs. The **Latin cross**, which has four arms, three of which are equal in length and one that is extended, was used for floor plans, especially in medieval churches. The **Greek cross** consists of four arms of equal length, a footprint that adapts well to the form of worship in Greek and Russian Orthodox churches.

The **Maltese cross** has four arms radiating around a center point. Each arm is V-shaped, with the widest part on the outside edge. The width of each arm also has a wide V-shaped indentation. This cross form appears on the wall of the Krak de Chevaliers in Tartus, Syria, the castle of the Knights Hospitaliers (1144–1271). (See Figure 1.19.)

The **swastika** is an ancient decorative form found in prehistoric Asia, pre-Columbian South America, ancient Mediterranean countries, and parts of Western Europe. A cross form, it has four equal arms that intersect at right angles in the center. Each arm has an additional 90-degree angle halfway along its length. Both clockwise and counterclockwise swastikas have been used. (See Figure 1.20.)

FIGURE 1.20 The term *swastika* derives from the ancient Sanskrit *svasti*, meaning well-being. The swastika has been used as a symbol of prosperity and good luck, as symbolic of the sun, and in early Christianity, as a symbol of the resurrection. The use of the swastika by twentieth-century Nazis gave it a more negative connotation.

Other Geometric Motifs   Other geometric motifs include stars, lozenges, and lunettes. Star patterns may have any number of points. Ancient Egyptian ceilings and Gothic vaulting incorporated star motifs. The **lozenge**, or diamond-shaped pattern, has often been used as a background for other motifs, as well as in vaulting, heraldry, and strapwork. The **lunette**, which ranges from a very narrow crescent shape to a full half circle, is a familiar form in Islamic design and was common during the European Renaissance (1400–1643) and Baroque (1563–1760) periods.

Forms Derived from Nature

Forms derived from nature are inspired by natural forms, usually real or imaginary plants and animals and are either naturalistic or stylized. **Naturalistic** designs have an appearance that is as natural as possible within the limits of the material used. A natural-appearing flower printed on wallpaper, woven into a textile product, or carved in a material

FIGURE 1.21 Carved from wood, this rose is an example of a naturalistic motif. While the rose has the same form as a natural one, color, texture, and size differ.

that is obviously not its natural medium are examples. (See Figure 1.21.) A flower made of silk and other fibers may be so realistic that it is mistaken for the actual object. This type of form is an **imitation**. **Stylized** forms are inspired by natural ones but simplified to an extent that their origins may be difficult to determine. Paisley is a stylized plant form thought to have come variously from the pinecone or from the palm, almond, or cypress tree.

Animals and animal parts are also popular design inspiration. The eagle has recurred as a symbol of power: ancient Rome, the Hapsburg Empire, Poland, France under Napoleon, Nazi Germany, Russia, the Toltecs, and the United States have all used this form. The bull, lion, ram, jaguar, swan, and other animals have been fashionable in various regions and historic periods. Sometimes, animal parts, such as the head, legs, wings, skulls, scales, hooves, or claws, are used alone. A number of chair leg styles through history have incorporated stylized animal legs.

The entire human form is featured in the paintings and other decorative mediums of a number of cultures. The three-dimensional human forms used by Greeks and Romans as columns often supported a load, but most human forms are depicted in everyday activities that range from Egyptian figures enjoying the hunt to players in Mayan ball courts. As with animal forms, sometimes only a part of the human body is used for design. Torsos are frequent, as are heads, but other parts may be used as well. Even heart and kidney forms have recurred. Medieval gargoyles and grotesques often featured some obvious human characteristics.

Typically, imaginary animal forms are combinations of actual animals. The sphinx is a combination of a lion's or ram's body with a human head, and the mermaid merges a human torso with the body of a fish. Totally imaginary animal forms, such as the dragon, unicorn, and winged horses, were especially common during the Middle Ages and are still used in the Orient.

Miscellaneous Forms

Miscellaneous forms include those derived from something other than natural sources. Representations of man-made objects and abstract forms are examples. Shield forms, especially popular during the medieval period, probably stem from the use of the shield in battle and the subse-

quent personalization of shield emblems emblazoned with identifying crests. Shield-back chairs designed by George Hepplewhite (d. 1786) were popular during the neoclassic period. The cornucopia has been used since ancient times as a symbol of abundance; musical instruments, especially the lyre and the trumpet, appear with some regularity; and initials are frequently used, especially on dower chests.

Patterns

The basic pattern types include bands, diapers, and panels. **Band patterns** are linear, may go in any direction, and are unlimited in length although their width is static. The wave pattern is a typical band pattern symbolizing ocean waves. Band patterns have been used in all historic design periods and in almost all media. (See Figure 1.22.)

   Diaper[5] **patterns** employ motifs repeated in any direction to cover all or part of a surface. Wallpaper and textiles usually employ diaper patterns. **Counterchange patterns** are diaper patterns that incorporate two alternating colors or textures with the same shapes. The checkerboard is an example. A **gyronny** pattern is a type of counterchange that incorporates triangular shapes. (See Figure 1.23.)

   Panel patterns are nonrepeating discontinuous patterns that cover a fixed area and are therefore difficult to extend in either direction. Panel patterns include rinceaux, arabesques, and grotesques. A **rinceau** is a linear decoration that incorporates foliage in curving lines. Often, it is symmetrical from a center point. **Arabesques** may have originated in Saracenic decoration used in Venice mostly on metal objects. They make use of interlaced scrolling foliage often in **ogival**[6] patterns—S-shaped curves that meet to form pointed arches—at design element intersections. The arches are known as **ogee arches**. (See Figure 1.24.) **Grotesques** are similar to arabesques but add figures of birds, animals, and humans.

Drawing from the Past

Most of the technologies and design features used today were developed hundreds or even

thousands of years ago. Each culture or historic period, however, interprets design elements differently, and for this reason, design choices can reveal much about the people. Even the choices made by prehistoric and primitive peoples provide clues to their cultures. Interpreting those clues can lead to a better understanding of the past, furnish a greater appreciation for the present, and inform the very future of design.

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   5 The original *diaspros* (Greek) denoted a fabric with a pattern woven in monochrome showing two textures that reflected light differently.

   6 Ogival is an adjective describing ogee arches.

FIGURE 1.22 Band patterns use repeated single or multiple motifs and are found on moldings, frames, linear forms, and around columns.

FIGURE 1.23 The gyronny pattern has been used in mosaics, tiles, and heraldry and is still common today.

FIGURE 1.24 A number of geometric forms are employed on this entry, although the ogee arch formed by elongated S-curves dominates.

IN THE BEGINNING

Camulodunum
Londinium
Koln
Treverorum
Lutetia

Atlantic

Ocean

Appenine Mountains

•Nimes
Arelate
Masillia
Felathri   Arretium   Ankon
Elba   Clevsin   Curtun
Pupluna   Perusna   •Split
Vetulonia   Velzna
Corsica   Tarquinii   Veio
Caisra   Rome

Adriatic Sea

Iberian Peninsula
Balearic Islands

Neapolis   Kapue
Herculaneum   Pompeii   Taras
Paestum
Sardinia

MAGNA GRAECIA   Subaris
Kroton

PORTUGAL

Tyrrhenian Sea

SICILY

Akragas
Syracuse

Mediterranean Sea

TUNISIA

AFRICA

Hudson Bay

CANADA

Sahara Des

Newfoundland

Great
Lakes

St Lawrence River   Gulf of
St. Lawrence

Quebec
Montreal   Cape Breton Island
Wisconsin   NOVA SCOTIA

UNITED STATES

California

Anasazi culture   Ste. Genevieve, Missouri
AMERICAN
SOUTHWEST
San Xavier del Bac,   •Santa Fe
Tucson •   Texas

Mississippi River

New Orleans   •St. Augustine

Rio Grande River

Baja California

Florida

MEXICO
Teotihuacan
Tenochtitlan
Mexico City
Oaxaca Valley

Yucatan
Peninsula   Uxmal
Sayil   •Chichen Itza
Labna
•Palenque

*Caribbean
Sea*

GUATEMALA   HONDURAS
EL SALVADOR   NICARAGUA
COSTA RICA

Corfu

Aegean Sea

•Troy

•Pergamon

Delphi •

Mt. Pentelicus
Corinth • ▲ •Marathon
Mt. Olympus • • Athens
Argos • •Mycenae
• Tiryns
Sparta •

•Priene
•Miletus

Mt. Parpessa ▲

RHODES

Ionian Sea

Knossos•
CRETE •Mallia
Phaestus• •Zagros

Gobi Desert

Great Wall of China

MONGOLIA

•Xi'an

CHINA

Caspian Sea

Black Sea

Byzantium

Hattusas

Armenian Highlands

ANATOLIA

Çatal Hüyük

HITTITES

Nineveh•

Tigris River

Euphrates River

CYPRUS

Byblos

SYRIA

Jordan River
•Damascus
Jericho•
Dead Sea

ASSYRIA

PERSIA

CHALDEANS

SUMERIA
Babylon
•Nippur
•Persepolis

Gaza

Cyrene

Naucratis•

BABYLONIA
al 'Ubaid

Lagash
Ur•

Persian Gulf

Upper Egypt
Saqqara

Giza
Memphis

SINAI

Lower Egypt
Tell el-Amarna

Nile River

Red Sea

Luxor Karnak
Valley of the Kings

LOWER NUBIA

Abu Simbel

Second cataract

N

Third cataract

Fourth cataract

Fifth cataract

UPPER NUBIA

Kingdom of Meroe

Kingdom of Axum

0   500 Miles

0   500 Km

All dates in BC unless otherwise noted

c. 8000
Jericho inhabited

Egyptian calendar begins

Egyptian hieroglyphics

c. 4000
Irrigation practiced in Mesopotamia

3300–1700
Harappan civilization in Indus Valley

3200–3000
White Temple of Warka

Mesopotamian lyre with gold, lapis lazuli, and mother-of-pearl

c.3000
Jōmon culture in Japan

Jōmon earthenware figurine

3114
Mythical starting date of Mayan calendar

c. 2650
Step pyramid of Zoser

c. 2590
Bent pyramid
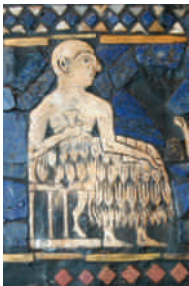
Detail from the Standard of Ur, showing king on throne

c. 2560
Great pyramid constructed

c. 2530
Great sphinx

2500 BC–AD 300
Pre-classic period in Mesoamerica

2375–1800
Middle Kingdom in Egypt

Egyptian Pharaoh

2334–2279
Sargon the Great, King of the Akkadians, founds the first great empire

2169–1926
First Babylonian empire

Babylonian female figurine

2123–2081
Hammurabi

Hammurabi, King of Babylon

c. 2100
Ziggurat at Ur

1900–1180
Hittites in Anatolia

1800–1600
Shepherd kings in Egypt (Hyksos)

Egyptian New Kingdom bowl

1716
Assyria dominant in Mesopotamia

1770–1670
Babylon the largest city in the world

c. 1500
Bronze Age in China

c. 1500–400
Olmecs dominate coastal regions of southern Mexico

Olmec heads had features associated with the jaguar mask

1600–1360
Egyptian domination of Syria and Palestine

c. 12th century–1027
Shang Dynasty in China

Shang Dynasty plaque with demonic mask

1360–1350
Tutankhamen Pharaoh of Egypt

c. 1260
Rock-cut temple of Ramesses II at Abu Simbel

1193–1183
Traditional date of Trojan War

Helmet of boar tusks, Sparta, Greece

1122–256
Chou Dynasty in China

c. 1050
Dorians invade Greece

Greek sculpture
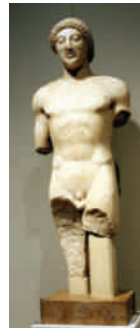
c. 1000 BC–AD 1100
Mayan civilization flourishes

814
Carthage founded by Phoenicians

Chinese bronze wine flask

8th century
Greek settlements in Magna Graecia

c. 751–666
Kushite rulers in Egypt

750 BC–AD 300
Kingdom of Meroë
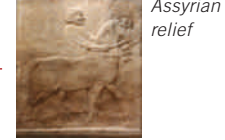
Assyrian relief

753
Traditional date of founding of Rome

776
Traditional date of first Olympic Games

Roman remains in Pompeii, with brick column

Late 8th–early 7th century
Homer's *Iliad* and *Odyssey*

7th–5th centuries
Jainism in India

660
Byzantium founded

612
Fall of Nineveh and the end of Assyria

612–539
Second Babylonian Empire

Qin Dynasty tiger made of gold

605–562
Nebuchadnezzar II, king in Babylon

c. 600
Lao-tzu

580
Construction of Hanging Gardens of Babylon

c. 563
Buddha

551–479
Confucius

Etruscan funerary tray for perfume and oil

539
Cyrus I conquers Babylon and establishes the Persian Empire

525
Persians conquer Egypt

509
Roman Republic

338
Philip II of Macedon
(382–336) invades Greece

*Gold gorgon
mask from
grave of
Philip II of
Macedon*

Roman sarcophagus

490
Battle of Marathon—Athenian
victory over Persians

332
Alexander the Great conquers
Egypt and establishes
Alexandria

470–399
Socrates

329
Alexander the Great
campaigns in India

460–445
First Peloponnesian War
between Athens and Sparta

c. 300 BC–AD 300
Yayoi period in Japan

Yayoi earthenware pot

c. 300 BC–AD 500
Teotihuacan civilization
dominates most of
Mesoamerica

283
Romans occupy most of
Magna Graecia

221–206
Ch'in Dynasty in China and
Great Wall constructed

Greek Hoplite warrior

450
Herodotus visits Egypt

447
Parthenon begun

*Han
Dynasty
winged
feline
from
spirit
road*

443–429
Golden Age of Greece under
Pericles (495–429)

431–404
Second Peloponnesian War

*Etruscan
bronze cista*

218
Hannibal crosses the Alps
and defeats Roman armies in
two battles

206–AD 9; 25–220
Han Dynasty in China

201
Spain becomes a Roman
province

c. 429–347
Plato

146
Rome destroys Carthage and
occupies Greece

Before 400
Shinto religion in Japan

c. 400 BC–AD 600
Zapotec culture in Oaxaca
Valley in Mexico

*Chinese
terra-cotta
warrior*

384–322
Aristotle

c. 100 BC–AD 750
City of Teotihuacan thrives in
Valley of Mexico

63 BC–AD 14
Roman Empire or Imperial
Period

*Urban street in Pompeii with
crossing blocks arranged so
carriages can get through*

58–50
Julius Caesar conquers Gaul

44
Julius Caesar assassinated

c. 1
Mayan city of Mirador,
Guatemala, at height

AD 30
Egypt added to Roman
Empire

c. 50
Nazca lines that can be
interpreted only from the air

*Relief with
Buddha
meditating,
Pakistan*

AD 64
Burning of Rome and first
persecution of Roman
Christians

AD 70
Colosseum begun

AD 77–84
Roman conquest of Britain

AD 79
Eruption of Vesuvius buries
Pompeii and Herculaneum

*Red sandstone
lion capital,
India*

c. 100
Pyramid of the Moon
constructed at Teotihuacan

AD 113
Column of Trajan constructed

AD 122
Construction of Hadrian's
Wall in England

*Tomb
model
of Han
Chinese
building*

AD 200–600
Kingdom of Axum

AD 285
Emperor Diocletian divides
Roman Empire

c. 300–900
Mayan classic period

*Temple
of the
Warriors,
Chichén
Itza,
Mexico*

AD 306–337
Constantine I, Roman
Emperor

AD 311
Christianity legalized

AD 312
Battle of Milvian Bridge

AD 313
Edict of Milan promotes
Christianity to official favor

AD 315
Arch of Constantine

*Roman mosaic framed with
guilloche*

AD 330
Constantine moves the
capitol of Roman Empire to
Byzantium

AD 370
Huns invade Europe

*Byzantine
mosaic*

AD 410
Goths sack Rome

AD 451–452
Attila invades Gaul and Italy

*Observation tower at
Palace in Palenque,
Mexico*

AD 476
Fall of Rome and Western
Roman Empire

FIGURE 2.0 The pyramids of Giza attest to the power of Egyptian Fourth Dynasty pharaohs and were designed to serve as their eternal homes.

2

Ancient Mesopotamian and Egyptian Design

The Mesopotamian and Egyptian civilizations were located in warm climates where the land was relatively flat. Rainfall was limited, but the rivers periodically flooded. Both civilizations built dikes to hold back floodwaters and developed irrigation systems as early as 4000 BC, allowing sufficient crops to be harvested to have surplus for trade.

Each year, priests determined which crops would be planted and how the crops would later be distributed—a complex system that required records. For this purpose, a system of pictographic writing was devised by 3600 BC, with stone used as a writing surface. By 3000 BC, the Sumerians wrote on wet clay tablets using a reed stylus, which left a wedge-shaped mark—called **cuneiform**, meaning wedge. By the Old Kingdom, Egyptian scribes wrote on papyrus made from layered strips of papyrus stalks rather than stone.

Mesopotamia (4500–539 BC)

It was in Mesopotamia that the earliest civilizations[1] developed. Situated at the head of the Persian Gulf, the region stretched at times north to the highlands of Armenia, east to the foothills of Persia, as far west as Syria, and south toward the Arabian Desert. Political domination was mostly of one or more cities with their surrounding territories, although over several millennia, some far-reaching empires were established. With few exceptions, the major cities were located in the

Tigris and Euphrates River valleys and along their tributaries. The lack of natural boundaries made Mesopotamian cities accessible for trade but also vulnerable to attack.

The agricultural villages of Sumeria (4500–2000 BC) occupied the southern area of Mesopotamia, and by 3500 BC they had become cities with a well-organized social and political structure. The Sumerian civilization was followed by the Akkadians, the Babylonians, the Assyrians, and the Chaldeans, each of which was influenced by Sumerian social structure, religion, and art.

The religions of Mesopotamia concentrated on life in the present. The afterlife was thought of as a dreary existence where only the gods would be happy. For this reason, there were only a few monumental tombs. Most people were either buried under the floors of their houses or cremated.

The gods were usually identified with natural phenomena, including heavenly bodies, storms, and lightning, and differed from humans only in that they were more powerful and immortal. Through sacrifices, magic, and prayer, the gods could be manipulated, although this required certain rituals and expert knowledge leading to a powerful priesthood. Each of the dozen city-states of Sumeria was led by a priest-king in whom both political and religious powers were concentrated.

The Babylonians (2169–1926 BC) were the best astronomers of their time, although astrology was more significant. The Babylonian king Hammurabi (reigned 2123–2081 BC) established a single code of laws that replaced those

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1 By definition, civilization requires that a culture have a system of writing.

of individual cities. These laws demanded exact retribution—an eye for an eye was literal.

— **INFLUENCE 2.1**

Greek city-states were similar to those of Babylonia, and their mathematics, medicine, and philosophy owed much to these antecedents.

The Assyrians (c. 1200–612 BC) established an empire that ruled an area from North Africa to parts of Persia. Technological advances included the spoked wheel, advanced plows, and glazed pottery. In addition, Nineveh, the Assyrian capital, had an **aqueduct**, a man-made channel that brought water from a distance.

Babylonia once again rose to power in 612 BC as the Chaldean Empire. It was this Babylonian Empire that first produced glazed brick and tile, marble streets wide enough for two chariots, and the Hanging Gardens—one of the Seven Wonders of the Ancient World.

Mesopotamian Arts and Design

Mesopotamian art forms were similar and showed gradual changes from simple stylized designs to more natural depictions. Early Mesopotamians carved low-relief figures in stone and in adobe brick prior to firing. (See Figure 2.1.) The chemicals used for glazing created different

FIGURE 2.1 A brick design might cover numerous bricks, so its final installation required careful planning. Such figures were used on Babylon's Ishtar Gate, where relief dragons, representing the god Marduk, and lions, representing the goddess Ishtar, invoked the power of the deities for the protection of the city.

colors and fused with the brick during the firing process, resulting in a durable, water-resistant product.

— **INFLUENCE 2.2**

Molding three-dimensional designs into brick has been revived and is used in high-end décor today.

In paintings, figures were represented on ground lines and depicted with their heads and legs in profile and with their shoulders and an eye shown frontally. Mesopotamian artists did not use perspective but overlapped figures to establish a sense of depth. Sculpture in the round exhibited rigid forms without any spaces between the limbs and the body. Arms were carved close to the body and elaborate beards and hair filled spaces around the neck. The eyes of Sumerian figures were emphasized by making them exceedingly large and inlaying them with shells.

Artisans were skilled at inlay work using shell, **lapis lazuli** (a semiprecious blue stone), limestone, and other materials. The Standard of Ur—a box probably intended to be mounted on a pole—illustrates third-millennium BC artistic forms. (See Figure 2.2.)

Among the animals found in the various decorative arts were the ibex, lion, bull, bear, deer, wolf, eagle, and horse, each associated with a deity. Animals were often featured standing on their hind legs and participating in human activities, such as carrying objects and serving food. **Griffins** (mythical creatures with a lion's body, an eagle's head and wings, and in some instances, the tail of a snake), winged lions and bulls, and winged human figures were all incorporated in designs. Motifs derived from nature; geometric forms, such as the zigzag and chevron, and counterchange and gyronny patterns were used. Plant forms included the lotus characterized by pointed petals, which was frequently alternated with the fir cone. (See Motifs 2.1.)

By 3000 BC, the Sumerians were creating cone mosaics by embedding thousands of thin, fired clay cones in adobe walls and columns, so only the circular bases of the cones were visible. The black, red, white, or tan enameled bases of fired clay cone-shapes were applied in patterns on a surface that was sometimes prepared by whitewashing. The fired cones were set closely

FIGURE 2.2 The activities depicted on the two sides of the Standard of Ur differ. On one side are scenes from war. In the peaceful scenes on this side, the king is larger than other figures, indicating his elevated status.

together and improved the durability of adobe structures.

Mesopotamian Architecture

Because the southern part of the region lacked good building stone, it was reserved for carved reliefs on the lower parts of palace walls, thresholds, foundations, and some pavements. Most buildings were constructed of adobe brick. The brick, like stone, was used in **load-bearing construction**, meaning that each part of the wall supported weight above it. This limited the size of openings and required that walls be thick. Alternating projections and recesses in the walls recalled early structures from the marshes. (See Figure 2.3.)

At al 'Ubaid (6000–4000 BC), a few fired bricks were found—a significant technological innovation. The lack of wood for fuel, however, made fired brick expensive, and it continued to be used sparingly throughout Mesopotamia. Because there was little timber or stone for roof construction, fired bricks were employed in vaults and arches and possibly domes. There are numerous representations of buildings with domical roofs, although the material used is not known. Clay was plastered on adobe surfaces to smooth them, and later, the Assyrians used stone slabs and Chaldeans used a layer of glazed brick for facing important buildings.

INFLUENCE 2.3

Fired brick has been consistently used since its early development.

In northern areas of Mesopotamia, where there was indigenous stone, the arch was first used. The royal tombs at Ur and the more than 5,000-year-old drains in Nippur are examples of these ancient arches and vaults. The Greek historian Herodotus (d. 425 BC) reported that the Hanging Gardens of Babylon were supported on an **arcade**, or a series of side-by-side arches. The Mesopotamian use of columns and engaged columns preceded their use in Egypt by 500 years.

INFLUENCE 2.4

The Mesopotamians developed the arch and vault, which have been used continuously throughout history.

MOTIFS 2.1 MESOPOTAMIAN MOTIFS

The palmette had radiating fronds, each of which might have a central stem and diagonal lines representing individual leaves. The palmette was sometimes used as a terminal device at the top of a stele or other trunk-like form.

The tree of life motif incorporated a number of palmettes connected by curving "ribbons" or bands.

The guilloche was formed by interlacing curved lines or bands. Most civilizations have used the guilloche, and its form varies considerably.

FIGURE 2.3 Modern houses in the marshes of Iraq are strikingly similar to the reed structures depicted in ancient drawings and reliefs. Bundles of reeds are tied together to form a framework. Reed mats or wattle and daub may fill the spaces between the bundles.

City Planning

Walls surrounded the cities, and access was through gates flanked by towers. Both walls and gates had **crenellated** battlements with stepped projections. A **battlement** included the walkway along the top of a wall with alternating vertical recesses (**crenels**) and projections (**merlons**) allowing soldiers to shoot arrows from the crenel and retreat behind the merlon for protection. Gateways and city walls not only served a protective function but were also intended to impress visitors and to demonstrate the prosperity of the city. (See Figure 2.4.)

The Babylon of Nebuchadnezzar (c. 605–562 BC) exhibited the first urban planning with a raised paved processional way, or **dromos** (*pl. dromoi*), that began at the Ishtar Gate and led to the palace and the temples. The gate featured a semicircular arch and the dromos was flanked by walls faced with fired brick featuring low-relief lions.

Monumental Architecture

The earliest type of public building was the temple—the focus not only of religion but of administration. Like humans, the gods required shelter and a constant supply of food, servants, concubines, and money.

Temple corners were oriented toward the cardinal points. Early temples were constructed on a solid **battered** (sloped) brick platform to raise the temple above the level of the houses of mortals. These adobe structures deteriorated and others were built on top of the remains, eventually resulting in the **ziggurat**, or stepped tower. Formal staircases led to the top of the ziggurat, where the temple was located. Stairways might be straight, multiple stairways might ascend to a gateway from which a single stairway proceeded, or the stairway might wind around the ziggurat. The White Temple of Warka (3200–3000 BC) was composed of successive platforms that were stepped back from those below, with each level painted a different color. Remains of one ziggurat show circular designs in its sides formed by the bottoms of pottery jars embedded in the walls, and others were decorated with cone mosaics.

INFLUENCE 2.5

Mesopotamian ziggurats were the precursors of church steeples and towers beginning in the Middle Ages. A number of twentieth-century buildings employed the ziggurat concept.

Two types of temples developed: the house of the god (usually located near the ziggurat) and the summit temple. The lower temple was similar to a dwelling and had a courtyard surrounded by a wall. It was in this courtyard that most of the religious ceremonies took place.

FIGURE 2.4 This reconstruction of Nimrud depicts the city walls, palaces, and ziggurat.

Doors were staggered so they were not in line with one another, avoiding a straight axis—a typical Mesopotamian feature. Summit temples were entered from the side rather than through the imposing gateways at the ends that were reserved for use by the gods.

The exteriors of temples were decorated with glazed brick or cone mosaics, and the decorations at the top of the temple and over doorways might be worked in copper or semiprecious stones. Walls of the central sanctuary rose above those of the side rooms, allowing openings to penetrate the higher wall.

Statuary representing animals, gods, and heroes were housed in temple rooms. **Anthropomorphic** forms were common and combined features of an animal with a human head or vice versa. (See Architecture 2.1 for a summary of Mesopotamian architectural characteristics.)

The Hittites (1900–1180 BC) were an Indo-European people who immigrated to Asia Minor and controlled the area of Anatolia. By the fourteenth century BC, the Hittites mined iron, which they may have been the first to process by smelting. They used the cuneiform script of the Babylonians and taught the Minoans on Crete to use clay tablets.

The Hittites' access to stone and timber resulted in differences in architectural style from the Tigris-Euphrates region. Rather than adobe brick buildings, those with timber frames and brick infill (**half-timbered**) were more common, and temples were constructed of stone. Arched gateways were guarded by monumental sculptured beasts, long before such sculptures were used in Mesopotamia. On the lower part of gateway walls, stone **friezes**, or horizontal bands of decoration, were filled with relief sculptures. **Colonnades**, or rows of columns, bordered courtyards. While columns were often of wood, they were set on bases of stone, some relatively simple and cushion shaped, others reclining beasts that supported columns on their backs.

INFLUENCE 2.6

In Western Europe, columns were sometimes placed on the backs of reclining beasts during the medieval and Renaissance periods.

Domestic Architecture

Homes in urban areas were built of adobe brick, with wood beam ceilings covered with mud that resulted in a flat roof. Doors were wooden and pivoted on pegs set into stone sockets. The Assyrians were the first to emphasize the palace, which was built by wealthy citizens as well as by members of royalty. Palaces, like temples, were built on artificial hills as high as 40 feet—a use of height as an indication of status. These walled complexes were entered through narrow gateways guarded by colossal figures. The eighth century BC palace of Khorsabad was entered through an arch that sprang from the backs of **Lamassu** (*sing. and pl.*), an anthropometric form with a human head, wings, and the body of a bull. (See Figure 2.5.) Basalt lions guarded the palace of Nebuchadnezzar in Babylon. Private apartments were guarded, and temples were constructed on palace grounds—sometimes on a small ziggurat—to decrease the necessity for kings and nobles to leave the security of their palaces.

The long rectangular throne room was accessed from a courtyard. Behind this was another courtyard around which palace rooms were arranged: a large reception room, a kitchen, bedrooms, and other necessary spaces. In multistoried structures, there was probably an exterior gallery that provided access to private upstairs family rooms and shaded the courtyard below. There was little overall planning, and individual buildings were located without regard for symmetry.

Mesopotamian Interiors

Mesopotamian floors were often simply compressed earth: stone flooring was typical of more

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ARCHITECTURE 2.1 SUMMARY OF MESOPOTAMIAN ARCHITECTURAL CHARACTERISTICS

- Adobe brick construction with some use of fired brick or stone
- Glazed brick and tiles for external facings
- Surfaces covered with relief sculpture
- Sculpted anthropomorphic figures used as guardians at gates
- Ziggurats
- Monumental stairways and gateways
- Walls surrounding cities, temples, and palaces
- Alternating projections and recesses along walls

opulent dwellings. Walls were plastered and divided horizontally into decorative bands. Stone slabs with relief carvings formed a **dado**, or lower part of an interior wall when finished differently from the remainder of the wall. Frescoes covered much of the wall surface. (See Figure 2.6.) Walls might be covered with cedar or cypress wood, alabaster or marble paneling, or inlays of agate, onyx, mother-of-pearl, or precious metals. The walls of the palace of Nebuchadnezzar in Babylon featured yellow brick and blue glazed tiles with reliefs. Palace ceilings were probably timber framed and mud covered or vaulted with fired brick.

Mesopotamian Furniture

Furnishings were raised above the floor on turned or carved supports. Chair seats were often high enough to require the use of a footstool—an indication of status. (See the seat of the king on the Standard of Ur in Figure 2.2 and Figure 2.7.) Some Assyrian furniture legs were evidently turned on a lathe, and when legs were carved, they often terminated in representations of animal feet. Records exist of furniture constructed of expensive woods and inlaid with precious metals and stones.

Furniture legs were connected with **stretchers** near the floor. Stretchers attached the legs to

FIGURE 2.5 Sculpted Lamassu had five legs and were designed to be seen from both the front and the side.
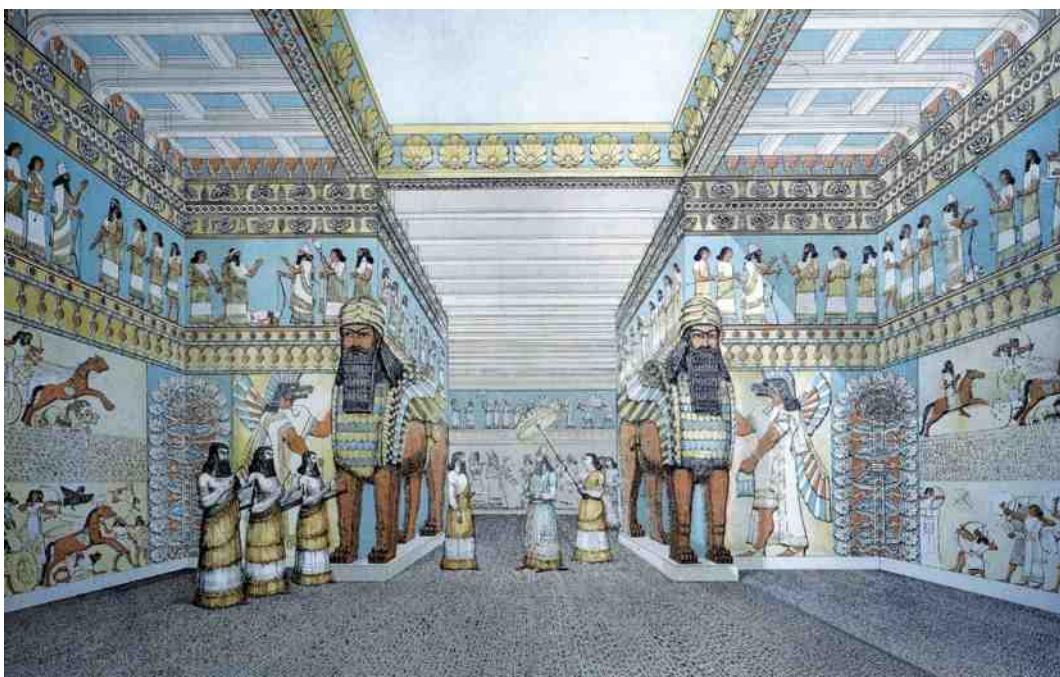

FIGURE 2.6
Mesopotamian walls were often divided into three sections. Scenes were painted above the stone lining on plastered walls. The frieze at the top often had another set of paintings—sometimes scenes from a religious ritual, sometimes band or diaper patterns.

FIGURE 2.7 Here the sun god is seated on a stool with a stretcher at floor level. His seat is shaded by an awning supported by columns. The table or altar on which an image of the sun is depicted has turned legs with a stretcher above the feet. The much smaller Babylonian king approaches the god from the left.

one another horizontally and prevented the legs from splaying outward. Some of the bands that appear in depictions of furniture appear to represent the method by which one piece was attached to another. Other bands appear to be decorative.

INFLUENCE 2.7

The popularity of animal feet as furniture supports continued throughout all of the ancient periods, and they were again used from the eighteenth century on.

The Mesopotamians used stools, chairs, footstools, chests, tables, and beds. Beds might be simple built-in platforms or more elaborate models used not only for sleeping but also for dining. Seating units such as stools and chairs were used by royalty or reserved for deities, with attendants standing.

INFLUENCE 2.8

One relief depicts the Babylonian king Ashurbanipal (reigned 668–627 BC) dining from a small table near his high bed or couch—a custom that was adopted by the Greeks, the Etruscans, and later the Romans.

Egypt (3500–1100 BC)

Ancient Egypt consisted only of the land along the Nile River and the area that it flooded. In fact, except for a little rain in the delta area, there is no rain in Egypt, and the civilization that developed along the banks of the Nile depended on its water for survival. The Nile flows through 500 miles of narrow cliff-lined valleys before it widens near Memphis, about 175 miles before reaching the Mediterranean, and spreads into a delta where the silt deposited by the river enriches the soil

Prehistoric Egypt was divided into two parts: Upper Egypt in the south and Lower Egypt in the north. It was possibly under the half-legendary Narmer (also known as Menes) that the two kingdoms were unified, after which artistic creations became more regular and structured, and the conventions that underlined Egyptian art for the next 3,000 years were established. Little art remains from the early period—only a few statuettes, engravings, and some **stelae** (*sing. stele*). Stelae are upright monuments with an inscription and/or decoration that memorialize an individual or an important event.

INFLUENCE 2.9

Stele have been used continuously to memorialize events and people. Historical markers beside American roads are stelae.

The Old Kingdom (c. 3500–2631 BC)[2] capital was at Memphis, a city located on the border between Upper and Lower Egypt near modern Cairo. The Old Kingdom broke down when centralized control was lost. During the succeeding First Intermediate Period, areas were controlled by local leaders. The Middle Kingdom (c. 2375–c. 1800 BC) began when an Eleventh Dynasty pharaoh was able to wrest control from the nobles. The capital of both the Middle and New Kingdoms was at Thebes, some distance south of Memphis. A Second Intermediate Period followed when Egypt was ruled by the

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2   All dates are approximate partially due to the lack of a definitive date for the beginning of the Egyptian calendar. When available, dates given by Durant have been used. See Durant, Will, *The Story of Civilization: Part 1: Our Oriental Heritage*, New York: Simon and Schuster, 1954.

Hyksos from Western Asia. The Hyksos invaded with horse-drawn chariots and compound bows for which the Egyptian army on foot and using the longbow was no match. The New Kingdom (c. 1580–1100 BC) encompassed the reigns of some of the most powerful pharaohs, including Rameses III, the last strong native ruler of Egypt. Subsequent to his reign, Egypt was conquered by foreign armies who succeeded one another until Egypt finally succumbed to Roman rule after the death of Cleopatra in 31 BC. After the rule of Rameses III, ancient Egyptian art and design became enmeshed with that of foreign powers.

Egypt was bordered by the Mediterranean Sea on the north and by large expanses of desert elsewhere, creating natural boundaries that provided some security and made it unnecessary for cities to have walls.

Egyptian kingship under the pharaohs was based on divine right. The future pharaoh was considered a child of the sun god Ra and, upon coronation, was deified as the god Horus. On his death, the pharaoh became the god Osiris, the god of the dead, who had it in his power to grant immortality to his subjects. As a god, the ruler had absolute power.

The pharaoh owned all of the land, although control was assigned to administrators, distributing wealth and ensuring the loyalty of powerful individuals. Peasants were attached to the land, and the majority of the harvest belonged to the pharaoh. During the flood stage of the Nile, when farming was not possible, most peasants were required to work for the pharaoh—essentially paying a tax. This large labor force enabled the Egyptians to undertake huge building and engineering projects. Peasants were not slaves, however, and evidence at one site indicates they lived relatively comfortably.

Egyptian Religion

Because Egypt depended on good harvests, there were gods associated with agriculture: Ra, the sun god; Osiris, the god of vegetation (and of death and resurrection); and Isis, the goddess who ensured fecundity. Animals were often deified, and their images were anthropomorphic. The falcon represented the god Horus, who was associated with the living pharaoh and was thus a symbol of royalty. None of the gods were considered so powerful that they could not

be controlled with the right words or offerings, ensuring a powerful priesthood.

Life was considered temporary and the afterlife eternal; hence, it was most important to prepare for the afterlife. The Egyptians believed that the individual had both a body and a spirit, or Ka. It was essential to preserve the body by mummification, although in order to ensure that the Ka could recognize the body in the event the mummy deteriorated beyond recognition, images in the form of drawings or sculpture were left in tombs and name signs, or **cartouches**, were located in numerous places. The oval shape of the cartouche probably represented the sun on the horizon. The Ka would live better if the body was provided with the accoutrements of life, and images or models sufficed. Housing both the body and the material possessions of the dead required tombs constructed of durable materials.

Egyptian Arts and Design

Because art served religion and most craft schools were attached to temples, deviation from standard forms was unlikely. While the art of most of ancient Egyptian history was formal, there was one short interlude when art became more informal and realistic. When Amenhotep, the son of a foreign queen and an Egyptian pharaoh, came to the throne, he tried to replace traditional gods with a monotheistic religion. The resulting art period is known as the Amarna style because the pharaoh moved the capital of Egypt to Tell el-Amarna. After Amenhotep's early death, his son-in-law, Tutankhamen, reestablished the old religion, and the period of experimentation was over.

The Egyptians covered most interior and exterior surfaces with some type of decoration—often scenes that were either painted or carved in low relief and subsequently painted blue, green, yellow, and red. **Fresco secco**, or painting on a dry surface, was used by the Egyptians, although it was subject to flaking and much has been lost. In the New Kingdom, **cavo-relievo** was sometimes used. In this technique, the artisan carved a silhouette into the surface rather than removing the background, making it less time-consuming. Subjects included daily activities, such as hunting, fishing, planting, harvesting, and those that told a story or extolled the deeds or virtues of individuals. In the New Kingdom, scenes associated

with the daily lives of individuals were added. In religious structures, the scenes often depicted festivals associated with the gods or interactions between the gods and pharaohs. Any representation of an activity or object in tombs was considered equal to reality in the afterlife.

Most figures stood on a ground line rather than being suspended in space. The Egyptians did not use perspective, and figures were represented above or below others to indicate their positions in the background or foreground. Relative size of figures denoted their importance, not their distance from one another. The pharaoh was established by relative size as the most important individual, men were drawn larger than women, slaves were smaller yet, and scribes were shown sitting on the floor with their legs crossed and a papyrus scroll in their laps. Nudity indicated inferiority and was reserved for prisoners or slaves.

While the head was shown in profile, the eye was shown frontally. The shoulders, too, were frontal, allowing both arms to be shown. Fingers were curved and all were the same length. While the legs were drawn in profile, on men the hips were often turned to enable the navel to be shown. Usually, the back leg was slightly forward, serving as a means of displaying gender. The big toes were both drawn on the same side. Faces were represented ideally without signs of aging and the body with ideal proportions and form. Males were drawn with reddish brown skin, women with lighter yellowish brown skin. Birds, fish, and most other animals were shown in profile although it was important to represent distinguishing features. Horned animals had their faces turned forward so the curvature of both horns could be seen.

Sphinxes combined the body of a lion with the head of either a human or another animal—most typically the ram. Human-headed sphinxes, or **androsphinxes**, such as the Great Sphinx at Giza (2990 BC) illustrated the monarch as a conqueror and usually featured the false beard and headdress of the pharaoh. Influences from Mesopotamia gave some later sphinx forms wings.

Cartonnage employed plaster reinforced with alternating layers of linen. When dry, objects retained their shape and could be gilded or painted. Cartonnage was often used for coffin cases because it could be easily conformed to the

contours of the body. Egyptian artisans soldered wire to a metal base plate forming **cloisons**, or enclosed two-dimensional spaces, into which glass or semiprecious stones were glued. The Egyptians also used embossing, **repoussé**, and **chased** work to make jewelry. Repoussé and chasing were techniques executed by hammering out a design on metal. Repoussé designs were hammered out from the back, raising the design on the front. Chased designs were hammered out from the front leaving the design recessed.

Hippopotamus ivory (from the teeth of the animal) was used for amulets, but imported elephant ivory from Nubia and Syria during the New Kingdom was used even more extensively for containers, jewelry, figurines, handles for mirrors and fans, and combs. Bone was sometimes used in less expensive articles to emulate ivory.

Most motifs used had some religious symbolism, so imbued with religion was Egyptian society. The sun disk, representing the sun god, was the most consistent as befitted an agrarian culture. The cobra, or uraeus (*pl. uraei*), sometimes winged, was a royal symbol associated with wisdom and life. The guilloche, palmette, lotus, papyrus, wave, and spiral were used in Egyptian band and diaper patterns. (See Motifs 2.2.)

— INFLUENCE 2.10

Napoleon adopted several Egyptian motifs and architectural forms for use in furniture, and his wife Josephine used the Egyptian bee as a personal symbol. These forms became part of the Empire Style, which began in France.

Egyptian Architecture

Ancient Egypt had more wood than does the modern country. Tamarisk,[3] sidder,[4] dom and date palms, acacia, and sycamore-fig were indigenous. Cedar was imported from Byblos, ebony from Nubia, and myrtle and other woods from the Land of Punt. One hieroglyphic temple inscription boasts of cedar flagstaffs covered with copper and tipped with **electrum** and doors of the best cedar lined with copper and inlaid with

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3 An evergreen that grows up to 45 feet tall.

4 *Zizyphus spina-christi*. This hardwood is also called "Christ's thorn" and "Chinese date."

Motifs 2.2 Egyptian Motifs
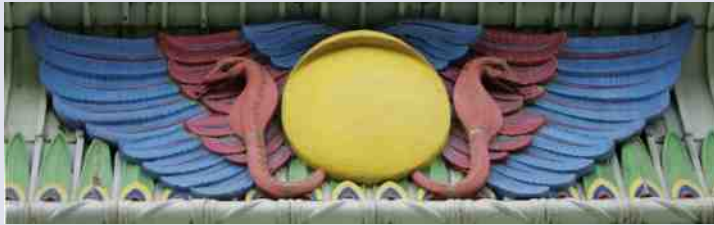
The sun disk was combined with the outstretched wings of the vulture.

The human eye and eyebrow, to which were added the markings from a falcon's head, was the **udjat** eye and symbolized filial piety. It was thought to restore life, and protected against illness.
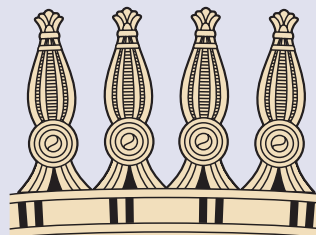

The cobra, or **uraeus**, sometimes winged, was a royal symbol associated with wisdom and life.

The **ankh** symbolized life, and its shape was often used for mirrors.

The **scarab** (dung beetle) symbolized eternal life; here it is shown in a cartouche.
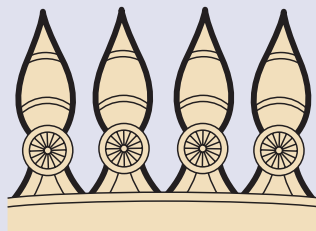
Khekhers were decorative motifs derived from papyrus stalks tied together that projected above the roofline of early Egyptian houses. Khekhers were used as band patterns, and the hieroglyphic sign for khekhers came to mean ornament.