SIXTH EDITION

Buildings Across Time

AN INTRODUCTION TO WORLD ARCHITECTURE

Michael Fazio

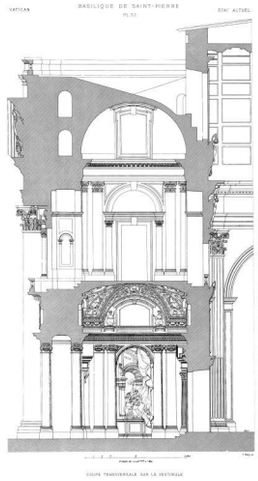
Mc Graw Hill

BUILDINGS ACROSS TIME

Angelo Hornak/Alamy Stock Photo

BUILDINGS ACROSS TIME

AN INTRODUCTION TO WORLD ARCHITECTURE



SIXTH EDITION

Michael Fazio
Mississippi State University

Marian Moffett
The University of Tennessee

Lawrence Wodehouse
The University of Tennessee

Sixth edition revised and updated by Owen Hopkins
Newcastle University, UK

Boston Burr Ridge, IL Dubuque, IA Madison, WI New York San Francisco St. Louis
Bangkok Bogotá Caracas Kuala Lumpur Lisbon London Madrid Mexico City
Milan Montreal New Delhi Santiago Seoul Singapore Sydney Taipei Toronto

BUILDINGS ACROSS TIME: AN INTRODUCTION TO WORLD ARCHITECTURE, SIXTH EDITION

This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 LWI 27 26 25 24 23 22

ISBN 978-1-264-29984-3 (bound edition)
MHID 1-264-29984-2 (bound edition)
ISBN 978-1-265-81101-3 (loose-leaf edition)
MHID 1-265-81101-6 (loose-leaf edition)

Portfolio Manager: *Sarah Remington*
Product Developers: *Francesca King/Jennifer Apt*
Marketing Manager: *Antoinette Moore*
Content Project Managers: *Lisa Bruflodt/Katie Reuter*
Buyer: *Sandy Ludovissy*
Designer: *MPS Limited*
Content Licensing Specialists: *Sarah Flynn*
Cover Image: *bloodua/123RF*
Compositor: *MPS Limited*

Library of Congress Cataloging-in-Publication Data

Cataloging-in-Publication Data has been requested from the Library of Congress

mheducation.com/highered

Contents

CHAPTER 11
RENAISSANCE ARCHITECTURE 287

CHAPTER 12
BAROQUE ARCHITECTURE 341

CHAPTER 13
NEO-CLASSICISM, ROMANTICISM, AND THE ROCOCO 381

Preface

Marian Moffett, Lawrence Wodehouse, and I wrote this survey of world architecture both for students taking introductory courses and for the general reader simply interested in buildings. We have searched out the stories these buildings have to tell, considered the intentions of the people who built them, and examined the lives of those who used them. We begin with prehistory and end with the early twenty-first century. We cover the Western tradition as well as works in the Islamic world, the Pre-Columbian Americas, Africa, China, Southeast Asia, Russia, and Japan.

We have written about this diverse sampling of the built environment in a straightforward but lively style that is rich with detail. The text contains extensive descriptive narrative leavened with focused critical analysis, which both allows the book to stand alone and invites lecturers to impose their studied interpretations on the material without the danger of undue ambiguity or conflict. In a world that grows smaller by the day, it presents a global perspective, and in a discipline that concerns built objects that are often beautiful as well as functional, it is copiously illustrated, intelligently designed, and consistently usable.

Because architecture is at once utilitarian and a visual art, the text and its illustrations are inseparable. This book contains over 800 photographs and line drawings, most of which have discursive captions that can be read in conjunction with the text or appreciated independently. Short illustrated essays accompany almost every chapter. An annotated bibliography at the end of the book provides suggestions for further reading. Also at the end of the book is a glossary that defines the key terms set in bold throughout the text.

New to This Edition

The previous edition of this book, published in 2019, was the final one that Michael Fazio worked on before his sad passing in early 2020. As a result, the present, sixth edition of *Buildings Across Time* is the first to be published without the involvement of any of its three original authors, with Marian Moffett having died in 2004 and Lawrence Wodehouse in 2002.

This new sixth edition remains faithful to Fazio, Moffett, and Wodehouse's work. My task, as revising author, has been to update the text in light of new information, occasionally revise formulations to reflect shifting perspectives and to add a new section to the final chapter to bring the story it tells up to date. All this has been done in the spirit of the approach, vision, and structure established by the original authors, whose book this fully remains.

Owen Hopkins August 2021

Acknowledgments

In writing this book, we have received assistance from many sources. Our colleagues Lynn Barker, Jack Elliott, David Lewis, Daniel MacGilvray, Mark Reinberger, and Julia Smyth-Pinney contributed essays. The following reviewers read portions of the manuscript at various times and made comments that assisted us in clarifying and improving the text: Jane Ostergaard, College of DuPage; Wayne (Mick) Charney, Kansas State University; Lyle Culver, Miami Dade College; Katherine Wheeler, University of Miami-Coral Gables; Eleni Bastea, University of New Mexico-Albuquerque; Phil Gruen, Washington State University-Pullman; Dane Johnson, Ferris State University; Margaret Dale Woosnam, Blinn College; Shelley Roff, University of Texas at San Antonio; Susan Wadsworth, Fitchburg State University; Kestutis Paul Zygas, Arizona State University-Tempe; Douglas Klahr, University of Texas Arlington; Brian Zugay, Texas Tech University. Six students in the School of Architecture at Mississippi State University—Yan Huang, Kai Pan, Charles Holmes, Jared Brown, Kristin Perry, and Rachel McKinley—used their exceptional talents with graphics software to produce line drawings. Mississippi State University architecture students Lara Lynn Waddell and Zachary Henry contributed information on Eladio Dieste and Glenn Murcutt, respectively. Thanks also to School of Architecture librarians Judy Hammett and Susan Hall for bibliographical assistance and having patience with me and with the piles of books and papers that I keep in their library.

Michael Fazio April 2018

Map 1 Central and Eastern Europe and the Middle East

Map 2 Europe and North Africa

Map 3 Western Asia and India

Map 4 North America

Map 5 Central and South America

Map 6 Eastern Asia and Australia

Introduction

You, the reader, are the reason for this book. We, the authors, have drawn on our cumulative experience in teaching and writing about architectural history to convey in words and images information about some of the world's most interesting and important buildings. This book surveys Western architecture in some depth and offers an introduction to non-Western architecture in Africa, India, China, Southeast Asia, Japan, the pre-Columbian Americas, and many Islamic settings. Together the text and illustrations encourage discussion, thought, and analysis. In this introduction, we offer a guide to the effective use of this book.

Architectural history begins with buildings. In order really to see these buildings, one needs to use precise descriptive language. Hence we have tried throughout to present clear, understandable, but provocative prose, and to define basic terminology when it is first introduced. Still, if left at the level of pure information, these words produce little true insight. We have therefore written this book in a way that encourages looking, but more than that, *seeing*; and the difference between the two is considerable. Seeing requires proceeding beyond the image projected on the retina to a process of analysis and the making of critical judgments. This, in turn, calls for placing buildings in their various contexts—social, political, economic, artistic, technological, and environmental—and determining whether they fulfill their obligations to their clients, to other users, and to society at large. To do this, it is necessary to enter the mind of the architect and to suspend modern biases so that we can evaluate the work as the product of a particular time and place.

What is architecture? Certainly it is shelter, but it can be much more. The phrase "frozen music" is often used, but such a description seems to imply that architecture has only an esthetic component. The "shaping of space for human use" seems more obviously useful, but it hardly explains the fascination of the Egyptian pyramids or the symbolism of a state capitol building. The Roman architect and engineer Vitruvius, active around 40 BCE, considered the essentials of architecture to be *firmitas*, *utilitas*, and *venustas*, commonly translated as firmness, commodity, and delight. Here firmness is structural stability, commodity is the meeting of functional requirements, and delight is beauty. One can hardly disagree with the need for firmness and commodity: any building that collapses or does not provide the right kind of space for the client's purposes must be considered a failure. Delight, or beauty, however, is a more elusive term, one with standards that have changed over time. Some have argued that beauty arises naturally from the fulfillment of functional requirements. Others have seen it as an inevitable result of the logical use of building materials and structural systems. Still others have found it in applied ornamentation.

Let us consider the first two terms in Vitruvius's triad in a slightly different way by asking, why and how is architecture produced? In order to erect buildings, people must have a motive—a will to build; materials and a knowledge of how to use them—a means to build; and systems of construction—an ability to build. The will to build certainly includes responses to functional requirements, but often goes well beyond these to address spiritual, psychological, and emotional needs. For some building types, such as industrial buildings, practical concerns naturally predominate. In others, such as civic or religious buildings, meanings may be dramatically revealed through symbolic forms. To most people, for example, the interior of a religious building should elevate the human spirit, while a warehouse must only protect material goods. However, utilitarian high-rise office buildings are usually designed to reflect the corporate image that the CEO and board of directors wish to project, and homeowners commonly modify their houses both inside and out, not only to accommodate changing functional demands but also to express their own personalities and values. All architecture reflects such values, and the best of it expresses the tastes and aspirations of the entire society. More money, finer workmanship and materials, and (often) better design have typically been expended on buildings that shelter activities important to large segments of society. Thus, for many periods, religious buildings have been the principal laboratories for architectural experimentation and have been built to endure, while residential architecture and even commercial buildings have been more transitory, which explains the abundance of religious buildings in a text such as this one.

At the beginning of an architectural project, the client and architect develop a program, or statement, of projected spatial uses, sizes, qualities, and relationships. The program for an apartment building, say, would itemize the number of apartments and their sizes, the common spaces such as lobbies, the service spaces such as mechanical rooms and storage, and also include an allowance for horizontal and vertical circulation (corridors, stairs, ramps, and elevators). Because many designs can satisfy such a program, it is the architect's responsibility to develop alternatives, to select the best ideas from among them, and to present the results in the form of drawings and models from which the building can be erected.

No matter how strong the will to build, people must also have the resources with which to build, which historically has meant local building materials. In turn, materials have strongly influenced architectural character. One of the most

fascinating aspects of studying everyday buildings from the past is noticing how the simplest materials, such as wood, clay, thatch, and stone, have been employed to create architecture. If clay alone was available in abundance, people used tamped earth or made bricks. If people lived in areas that were heavily forested, they built in wood. The ancient Greeks were among the most skilled carvers of stone, but they would hardly have become so without the abundant local marble that could be chiseled with extremely fine detail.

People must also have the ability to build. That is, they must be able to assemble materials into stable systems of construction. Structural materials can be classified according to the way they accept loads: in tension or compression, or a combination of the two. When in compression, the fibers of a material are pressed together; when in tension the fibers are pulled apart. Stone, brick, and concrete are all strong in compression but not in tension. Wood is strong in both tension and compression, as is iron; but iron is also brittle. In the nineteenth and twentieth centuries, metallurgists refined iron into steel, a material to which small amounts of other metals have been added to form alloys that are highly malleable. Because it combines the compressive strength of **concrete** with the tensile strength of embedded steel, reinforced concrete is also strong in both tension and compression.

0.1 Library of Celsus, Ephesus, Asia Minor, 114–117.
Constructed by the Romans, this is an example of post-and-lintel (column-and-beam) construction.
Marian Moffett

All structures respond to the vertical pull of gravity in the form of live and dead loads, and to side loads or lateral forces created by the wind and earthquakes. Live loads are the people (and/or animals) that inhabit a structure. Dead loads are the weight of the building itself and of its inanimate contents such as furniture. Wind loads are accommodated primarily by diagonal bracing, and seismic loads through flexible connections.

Only in the past 150 years has it become possible to quantify the direction and magnitude of loads and to measure the ability of specific building materials to resist external forces, providing designers with the basis for producing mathematical models that predict structural behavior. For the vast majority of buildings considered in this book, however, achieving a stable structure was a matter of trial and error, based upon modifications of what had been done in the past.

Structural systems can be classified into five categories according to the geometric configuration of their members and the way in which loads are resisted: (1) post and lintel (or column and beam); (2) corbel and cantilever; (3) arch and vault; (4) truss and space frame; and (5) tensile. Post-and-lintel systems, formed by vertical and horizontal members, are perhaps the most common type, sometimes known as trabeated systems (Fig. 0.1). The possible distance between **posts** is primarily determined by the spanning capability of the **beams**. Under loading, the beams bend or deflect downward, stretching (or placing in tension) the fibers in the lower half of the member and pressing together (or placing in compression) the fibers in the upper half. Materials such as stone tend to fail quickly if placed in tension, so one can hardly imagine a wire made of stone. Since materials for **lintels** should be equally strong in tension and compression, wood, steel, and reinforced concrete are widely used.

Stone was the most durable building material available to early societies. These civilizations found ways to overcome stone's inherent weakness in tension and so used it to span greater distances than were possible in post-and-lintel construction. The earliest method was through **corbeling** (Fig. 0.2). Stones were laid in horizontal courses, with the last stone in each course projecting slightly beyond the one below it to form a corbeled **arch**. A corbeled **dome** is made up of rings of stones (or even wood), with each succeeding ring smaller and, therefore, projecting beyond the one below it. This same principle has been used in **cantilever** construction, where a beam or beams (often of wood) project beyond their supports to form an overhang, such as an **eave** below a roof or an overhanging second floor or **jetty** (Fig. 0.3).

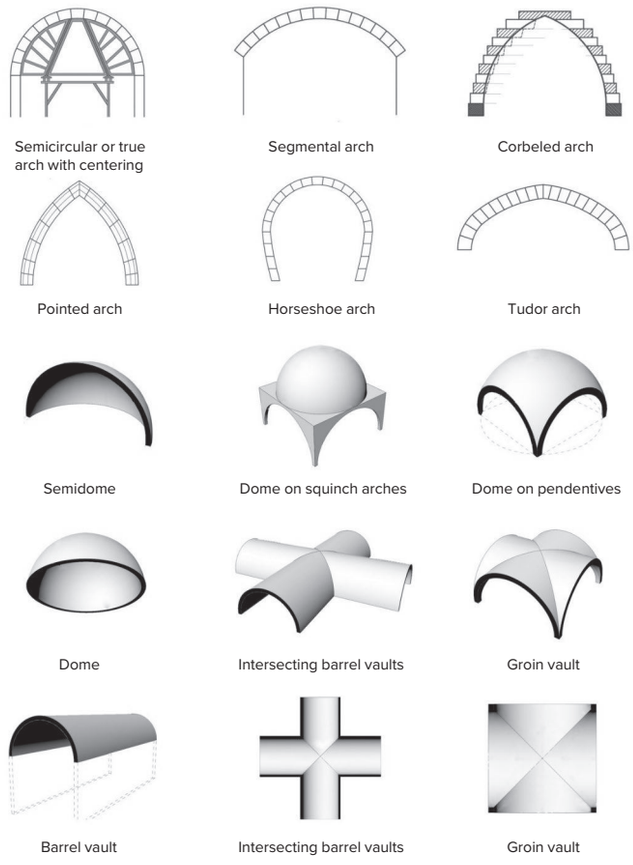
Masonry arches and **vaults** (Figs. 0.4–0.5) are composed of wedge-shaped stones called **voussoirs** that must be supported on a temporary framework, called **centering**, until the arch or vault is completed, at which time the stones press tightly against one another and become self-supporting. Such construction requires firm lateral bracing, as an arch or vault exerts not only a downward thrust but also a lateral thrust, which is an outward, overturning force that must be counteracted if the arch or vault is to remain in equilibrium.

0.2 Arch, Kabah, Mexico, 850–900.
Built by the Maya of Central America, this is an example of corbeled construction. Note that the stones forming the triangular arch are laid in horizontal courses and slightly overlap one another as they rise.
OGphoto/Getty Images

While all arches behave in a similar manner structurally, their profiles vary considerably. Semicircular (or true), segmental, **pointed**, horseshoe, and Tudor arches are among the most important historically. Domes may also vary in profile, from shallow saucer shapes to semicircular or hemispherical to steeply pitched; the steeper the arch or dome's

0.4 Street in Rhodes, 1100–1300.
Buildings here have been braced with arches as a result of earthquakes. Several different arch profiles can be seen, all constructed of wedge-shaped voussoirs.
Marian Moffett

0.3 Barn, Cades Cove, Great Smoky Mountains National Park, Tennessee, 19th century.
This is an example of cantilevered construction. The second-floor loft overhangs the log cribs of the base, supported on long, wooden cantilevers extending to the sides and front-to-back across the width of the barn.
Marian Moffett



0.5 Arch, vault, and dome types.
Understanding masonry vaulting is crucial to understanding most permanent construction from the time of ancient Rome to the development of iron, steel, and reinforced concrete in the nineteenth century.

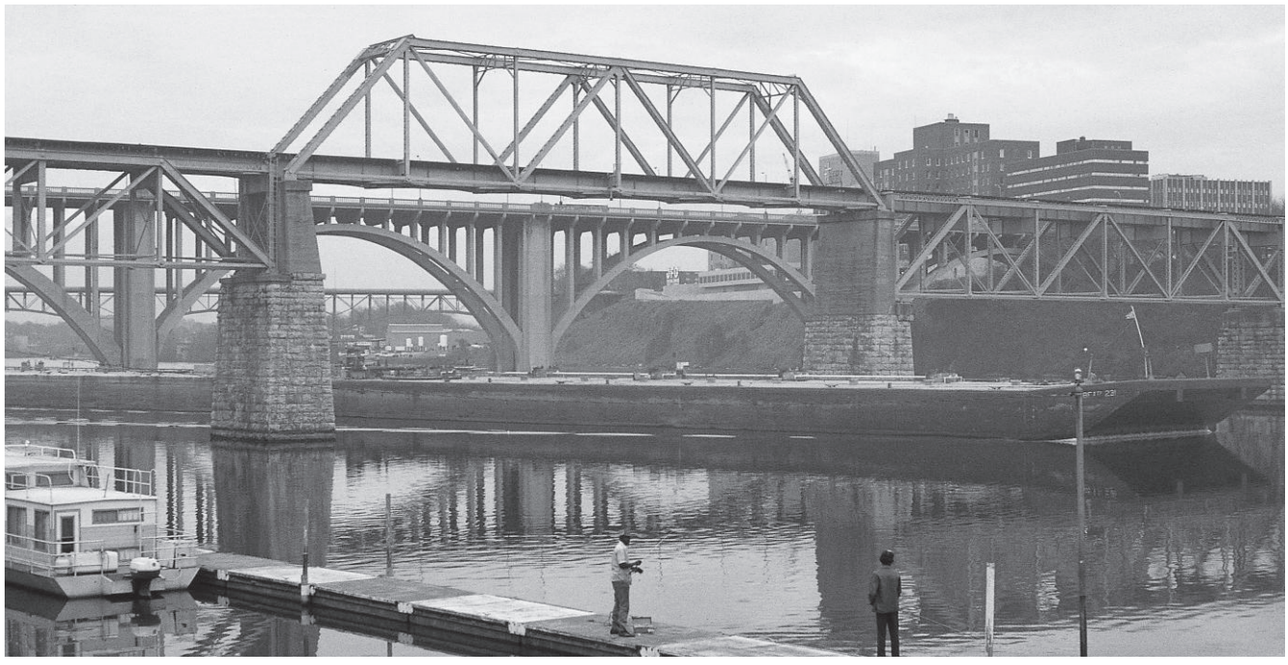
0.6 (above) Goharshad Mosque, Mashhad, Iran, 1418.
This mosque design shows typical Islamic arch profiles and a handsome, bulbous blue-tiled dome.
Marian Moffett

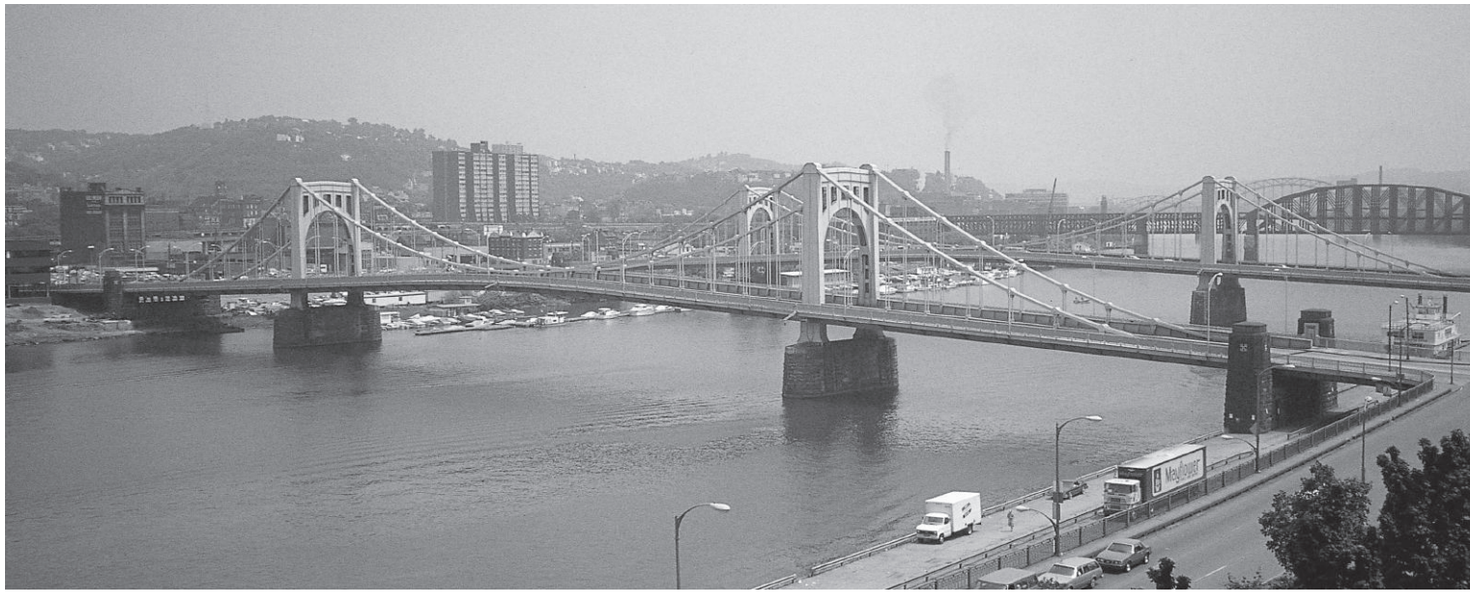
0.7 (below) Railroad bridge, Tennessee River, Knoxville, Tennessee, ca. 1906.
This bridge over the Tennessee River is composed of Warren trusses.
Marian Moffett

profile, the less the lateral thrust (Fig. 0.6). And domes can be supported by squinch arches or pendentives. Vaults, which are linear extensions of arches, can be intersected at right angles, producing a groin vault.

The trussing method of spanning space calls for short wooden or metal elements to be connected in triangular configurations (Fig. 0.7). The Romans developed this technique for wooden bridges, but their experiments were not continued by subsequent societies. In the medieval period, **trusses** in church roofs depended on having one member, the bottom chord, equal in length to the span being covered. Early in the nineteenth century, bridge-builders reinvented the art of constructing trusses using short members, employing first wood and then iron and steel in various triangulated configurations, many of which were patented. The Warren truss, named for its designer and composed of equilateral triangles, is probably the most common today. A truss repeated in three dimensions is known as a space frame, a twentieth-century structural development that is particularly useful for long, clear-span roofs.

Some structures are based largely on the control of tensile forces. Fabric tents with upright posts are examples of tensile structures, as are suspension bridges (Fig. 0.8). In both cases, the load is partly carried by fibers or cables woven or spun together. Builders in China and the Andes of Peru used animal or vegetable fibers such as hair, vines, and sisal to build tension structures, but these were limited in durability by the inherent weakness of the fibers and their tendency to decay. Great progress was made in the development of tensile construction in the nineteenth and twentieth centuries as engineers used iron bars or spun thin strands of steel into cables to support the world's longest bridges. Cables have also been used to suspend floors of multi-story buildings. Pneumatic structures, like balloons, have lightweight membranes supported by pressurized air, and thus are also based on tension.





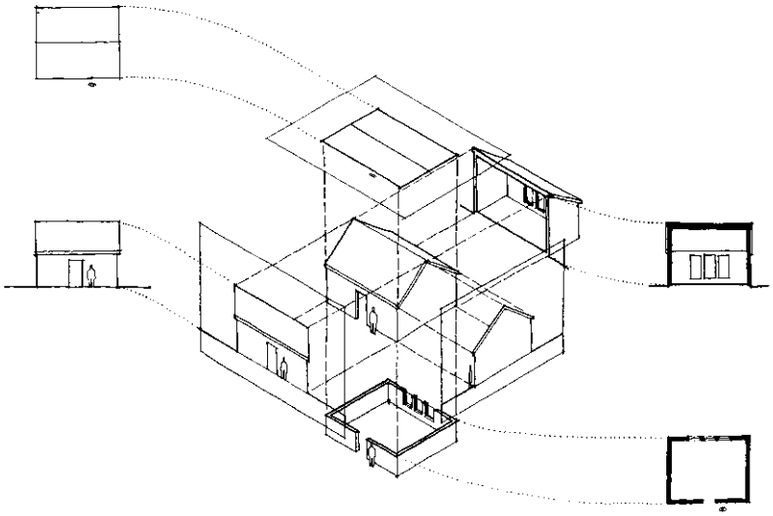
0.8 Seventh Street Bridge, Pittsburgh, Pennsylvania, 1925–1926. This is an example of a suspension bridge structure where vertical loads are carried primarily in tension.
Marian Moffett

The possibilities of these structural systems are vast. In addition, there are hybrid systems such as cantilevered and arched trusses. The selection of any one of them for a particular building depends on available materials, economics, spatial requirements, and the esthetic sensibilities of the architect and client.

Finally, a few words about styles and precedents. During the eighteenth and nineteenth centuries, historians developed taxonomies classifying the architectural work of various periods according to perceived common characteristics. Today, we recognize that the story is often much more complex and that the lines between the chronological classifications are blurred. The reader should take this into account when studying a chapter on, say, the "Renaissance" or the "Baroque." These are convenient terms, but they should be seen as no more than that, conveniences, and should not obscure the diversity and complexity of the historical built environment. Likewise, the buildings discussed here have been carefully chosen. In most cases, they are the so-called canonical buildings; that is, the ones that have been recognized by many scholars over time as best representing a time and place or the work of an individual. The canon has changed and will continue to change, particularly for buildings outside the European context and those of the more recent past. Furthermore, not only historians but also architects themselves have participated in establishing the canon. Throughout history, architects have learned from those who preceded them. The buildings that they admired, studied, and emulated became design precedents. For instance, the exterior of McKim, Mead, and White's Boston Public Library (1887–1893) (see Fig. 14.51) owes much to the principal façade of Henri Labrouste's Bibliothèque Ste.-Geneviève in Paris (1844–1850) (see Figs. 14.10 and 14.11), which, in turn, was based upon the side elevation of Leon Battista Alberti's church of S. Francesco in Rimini (begun ca. 1450) (see Fig. 11.14). At S. Francesco, Alberti was inspired by the arches of the Tomb of Theodoric in nearby Ravenna (ca. 526). A similar backward trajectory can be established for the dome of the U.S. Capitol (1851–1867), designed by Thomas U. Walter, who was inspired by Sir Christopher Wren's design for St. Paul's Cathedral in London (1675–1710) (see Fig. 12.47). Wren's probable precedent was François Mansart's dome of the Val-de-Grâce in Paris (see Fig. 12.37), which was in turn inspired by Michelangelo's dome for St. Peter's in Rome (see Fig. 11.42), which was itself based on Brunelleschi's dome for Florence Cathedral (see Fig. 11.3). Brunelleschi had looked for his inspiration to the ancient Roman Pantheon in Rome (see Fig. 5.21), erected about 125 CE for the Emperor Hadrian. Where Hadrian's architects got their ideas, we leave for you to discover. Throughout the ages, then, architects have been influenced by the works of their predecessors. We hope that you, our readers, whether you are concerned with history or design or both, will be equally informed and inspired by what is presented in the pages that follow.

A Word About Drawings and Images

In this book, there are many drawings as well as photographs of interior and exterior views. Architects have long relied on the convention of orthographic projections—plans, elevations, and sections—to describe buildings. A plan represents a building as seen from above once a horizontal cutting plane has been passed through it, usually just above the height of the window sills, with everything above this cutting plane removed and the lines of the plan cast onto the cutting plane (Fig. 0.9). Elements that have been cut are usually defined by the darkest lines in the drawing or are blackened



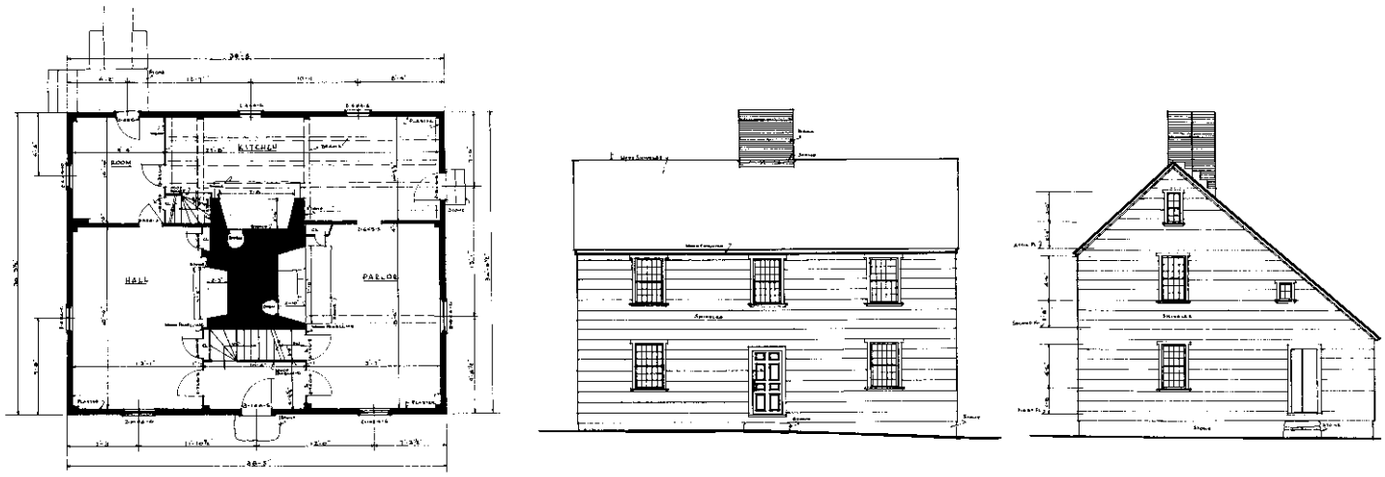
0.9 Plans, elevations, and sections.
This diagram illustrates the basis of orthographic projection in plan, elevation, and section.

in completely. Elements below the cutting plane are drawn with thinner lines, and doors may appear as arcs showing the direction of their swings. Dotted lines in a plan usually indicate ceiling elements above the cutting plane, such as vaults and **coffers**. Thus, in a single, economical drawing, a plan can indicate spatial distribution and dimensions on a particular floor and even give some idea of the structure above.

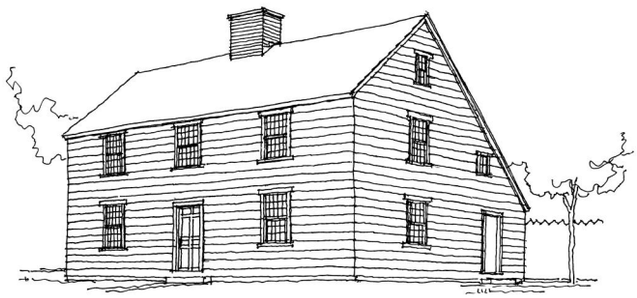
Elevations are obtained by passing a vertical cutting plane down through the ground a few feet in front of one exterior face of a building, with the image of the building then projected onto the cutting plane. Sections also result from a vertical cutting plane, but in this case one passed down inside a building with its image cast upon the plane. By convention, these cutting planes in elevation and section are placed parallel to the building's principal walls. In an elevation, the only line that is intersected by the cutting plane is the ground line, so this line is shown as the darkest in the drawing. In a section, as in a plan, all the building elements that have been cut are usually defined by the darkest lines on the drawing or are blackened in completely, and elements beyond the cutting plane are seen in elevation and, therefore, are drawn with thinner lines. While it may take some experience to "read" orthographic drawings, they are very useful in the building process because dimensions can be scaled directly from them.

Let us see how drawings work by considering the pair of two-story houses shown in Figs. 0.10 and 0.11. They represent a common type built by early colonists in Connecticut, and both were enlarged by a one-story addition at the rear that was covered by extending the existing roof slope. The resulting form was dubbed a "saltbox" because it resembled the bulk salt containers found in nineteenth-century general stores. In Fig. 0.12, we see the plan and two elevations of another saltbox house as documented by the Historic American Buildings Survey, a national record of buildings begun in the 1930s and archived in the Library of Congress. From the plan it is easier to see the rear addition and to understand how the interior of the house was arranged. A perspective drawing, Fig. 0.13a, more closely resembles the photographs in Figs. 0.10 and 0.11, because perspective drawings show all three dimensions through foreshortening, as photography does, with elements that are farther away (the front-left and back-right corners of the house, in this case) diminishing in size. We know that in fact both front corners of the house are the same height, but in a perspective the one closer to the viewer will be taller. Because most of us readily understand perspective drawing, this drawing type provides architects with a powerful tool for communicating the appearance of buildings not yet constructed in a way that non-architects can understand. An axonometric

0.10, 0.11 (left) John Graves House, Madison, Connecticut, 1675; (right) Samuel Daggett House, 1750, Connecticut.
Although these colonial houses are not identical, they share a similar form and massing around a central chimney.
(left) Marian Moffettt; (right) Marian Moffett



0.12 (above) Plan and front and right-side elevations of Ogden House, Fairfield, Connecticut, ca. 1700.
Fine lines on this drawing indicate dimensions taken from the building when it was measured for the Historic American Buildings Survey.

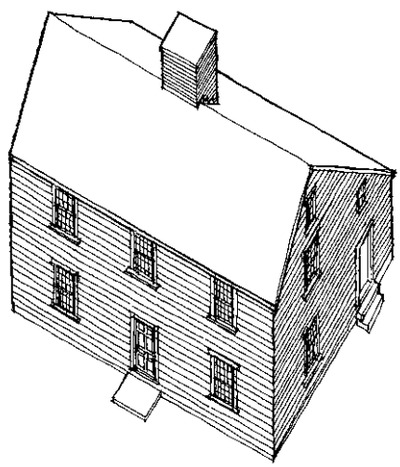


0.13a (above) Perspective drawing of Ogden House.
This view is based on the dimensions of a house measured by the Historic American Buildings Survey.

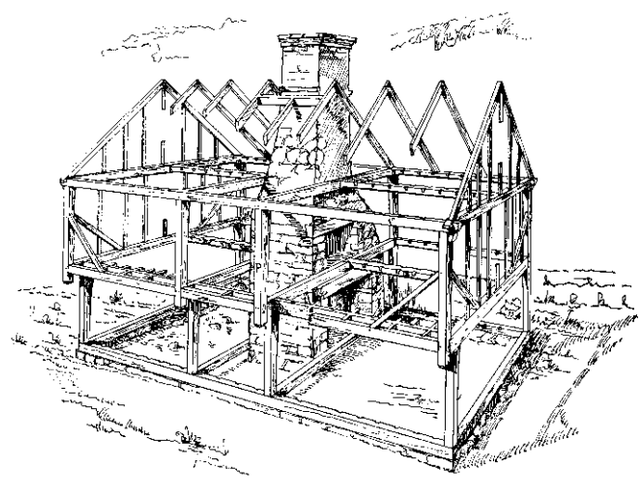
drawing, as in Fig. 0.13b, also depicts all three dimensions, but does so without distorting these dimensions as measured along the axes of height, width, and depth. Something must be distorted to capture a three-dimensional object in two dimensions, however, and in this case it is some of the angles at which these axes intersect. At the front- and right-side elevations, some 90° angles, like those at the right front corner, have become acute angles, while others are now obtuse angles.

One of the specialized uses of drawings is to show conditions that may not be visible in the finished building. Fig. 0.13c shows a perspective view of the structure of a saltbox house, allowing us to see the heavy timber frame that is covered by the exterior siding and also to understand how the massive stone chimney fits into the core. Images of buildings, no matter how detailed, are inevitably abstractions of reality. Even photographs do not show everything "as it really is." Therefore, having multiple images, drawings as well as photographs, aids in understanding a building's structure and spatial arrangement.

0.13b (below) Axonometric drawing of Ogden House.
This view is based on the dimensions of a house measured by the Historic American Buildings Survey. Compare this view with the perspective drawing (Fig. 0.13a) to see how these drawing types differ from one another.



0.13c (below) Analytic perspective of a saltbox house.
With the exterior siding, doors, and windows removed, one can see the heavy timber frame and masonry chimney that comprise the structure of this building.



Chapter 1

The Beginnings of Architecture

Though ancient, the structures that appear in this initial chapter are rich and varied and often sophisticated. Moreover, because they are "ancient" and always local, they are in some ways more exposed to revelation than later structures. That is, they lay bare for consideration certain fundamental principles of architecture and, arguably, certain fundamental aspects of the human condition.

In 1964, polymath architect-engineer-historian Bernard Rudofsky organized a then surprising and ultimately extremely influential exhibition, "Architecture without Architects," at the Museum of Modern Art in New York City. The exhibition created something of a sensation, appearing as it did at a time of general cultural upheaval in the United States, and the subtitle of the book accompanying the exhibition, *A Short Introduction to Non-Pedigreed Architecture*, suggests why it was so sensational or, perhaps more accurately, so iconoclastic. Illustrating, with obvious personal admiration, what he called "vernacular, anonymous, spontaneous, indigenous, rural" architecture, Rudofsky argued for a much more chronologically and geographically inclusive study of the built environment and one that did not cater exclusively to constructions for the wealthy and powerful and did not result exclusively from the efforts of what we might today call academically trained designers. The images of architectural objects that he displayed and analyzed ranged from earth mounds in China to rock-cut dwellings in Turkey, to reverse-action chimneys in Pakistan and much else in among them.

Reading Rudofsky's book and particularly the initial pages of this chapter, you will be directed away from matters of fashion and even style, in favor of "anonymous" but distinctive, even archetypal, forms, and you may come away with a deeper understanding of human responses to particularized environments, to specific local building materials, to elementary but expressively logical structural systems, and to early but nuanced social conditions. You will be able to embrace the essentials of function, space, and meaning by "beginning" with the architecture of prehistory; that is, the era before the appearance of written language.

Ceiling of the red cows, Lascaux, Dordogne, France, 15,000–20,000 BCE.
Discovered in 1940, this cave contains some 2000 painted images—some of abstract signs, some of humans, and some of animals, as seen here. In the absence of written records, the purpose of the paintings remains open to conjecture. Some see them as depictions of past hunting experiences or as the settings for mystical ritual experiences intended to bring hunters success. Some even argue that they depict hallucinogenic visions or are star charts. In 2008 the cave was beset by black mold and has since been closed except for brief, weekly monitoring visits by scientists.
Patrick Aventurier/Getty Images

Prehistory begins as early as 35,000 BCE and extends to about 3000 BCE in the lands of the eastern Mediterranean, and until well after 2000 BCE in parts of western Europe. On the timescale of humankind, these dates correspond to the earliest years of "modern" human evolution from cooperative hunting-and-gathering societies into agricultural civilizations with a fixed settlement area and a ruling class. In the absence of written records, archaeologists and historians must interpret the fragmentary evidence of ancient people—pottery, household implements and rubbish, burials, tombs, and building remains—found in locations scattered across Europe, Africa, and Asia. The most dramatic images from prehistoric times are the Paleolithic cave paintings in France and Spain dating back as far as 33,000 BCE. Depicting mostly animals, often in hunting scenes, they have been variously interpreted as part of religious rituals, as the hallucinogenic visions of shamans, and even as star charts. New technologies have assisted the dating of such artifacts through the use of radioactive carbon 14, thermoluminescence, and dendrochronological analysis (the study of growth rings in trees), but both the methods and the hypotheses derived from them are subject to continual revision as researchers discover new evidence and reexamine old ideas. Reconstructions based on post-holes or masonry foundations help us visualize the simple buildings erected by early societies and provide clues to the more elaborate structures that come later.

PREHISTORIC SETTLEMENTS AND MEGALITH CONSTRUCTIONS

Eastern Europe

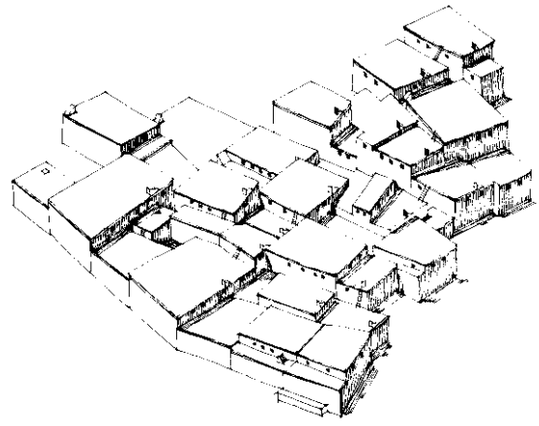
Human settlement seems to have originated at the small clan or family level, with a sufficient number of people living together to provide mutual assistance in hunting and food gathering and joint protection against enemies. Among

Chronology

Beginning of prehistory	**ca. 35,000 BCE**
Sumerians develop a written language	**3500 BCE**
Construction of Stonehenge	**ca. 2900–1400 BCE**
Egyptian Old Kingdom	**2649–2134 BCE**
Construction of the pyramids at Giza	**2550–2460 BCE**
Construction of the Ziggurat at Ur	**2100 BCE**
Egyptian Middle Kingdom	**2040–1640 BCE**
Egyptian New Kingdom	**1550–1070 BCE**

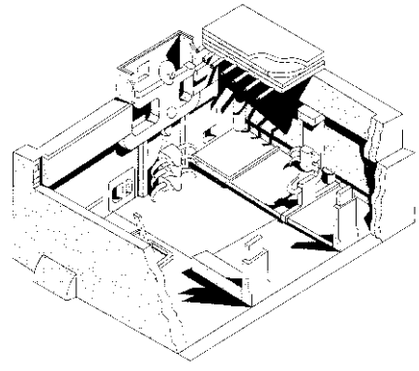
the earliest huts to be discovered are those at sites in the central Russian Plain (today's Ukraine), dated to about 14,000 BCE. Constructed of mammoth bones and pine poles, with a lining of animal skins and a central hearth, the largest dome-shaped hut incorporated skeleton parts from nearly a hundred mammoths in its framework. Archaeologists have also found clusters of skin-covered huts dated to about 12,000 BCE between Moscow and Novgorod. The largest of these huts, measuring about thirty-nine by thirteen feet in plan, had an irregular shape formed by three interlocking cones of inclined tree branches and was open at the top to allow smoke to escape from three hearths.

Excavations of town sites suggest that larger communities were a much later development. The existence of urban settlements depends on an agricultural surplus that enables some people to assume specialized roles (priest, ruler, merchant, craftworker) not directly tied to the production of food. Two of the earliest known urban communities were Jericho, Israel (ca. 8000 BCE) and the trading town of Çatal Hüyük (6500–5700 BCE) in Anatolia, part of present-day Turkey. Jericho was a fortified settlement, with a stone wall up to twenty-seven feet thick enclosing an area of about ten acres. Its earliest dwellings consisted of circular mud huts that may have had conical roofs. The inhabitants were farmers and hunters who buried their dead below the hut floors. Although by contrast Çatal Hüyük appears to have been unfortified, the town was a dense package of dwellings without streets (Figs. 1.1a,b). Residents gained access to the dwellings across roofs, while high openings in the walls were for ventilation. Mud-brick walls and a post-and-lintel timber framework enclosed rectangular spaces that abutted the neighboring houses so that together they established a perimeter town wall. Interspersed with the houses were windowless shrines containing decorative motifs of bulls and cult statuettes of deities. These seem to indicate that the themes of prehistoric cave art—hunting and fecundity—had not been discarded by this early urban society. The settlement at Çatal Hüyük is the precursor of more sophisticated communities that developed in the fertile valleys of the Tigris and Euphrates rivers at the beginning of the fourth millennium.

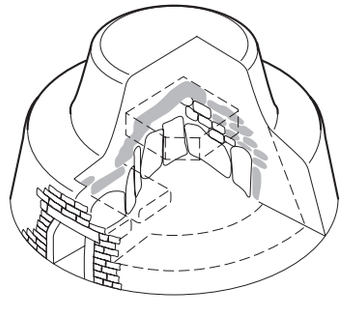


1.1a (above) Reconstruction view of buildings, Çatal Hüyük, Anatolia, ca. 6500–5700 BCE.
Notice how buildings abut one another, forming a continuous grouping broken occasionally by open courtyards. The buildings represent a mixture of dwelling houses, workshops, and shrines, all of which were accessed from the rooftops.

1.1b (below) Reconstruction of shrine room, Çatal Hüyük, Turkey, ca. 6500–5700 BCE.
The central figure on the left-hand wall represents a woman giving birth, while the horned bull skulls suggest masculine properties. Without written documentation, it is difficult to understand completely the significance of other architectural features, such as the stepped floor levels.

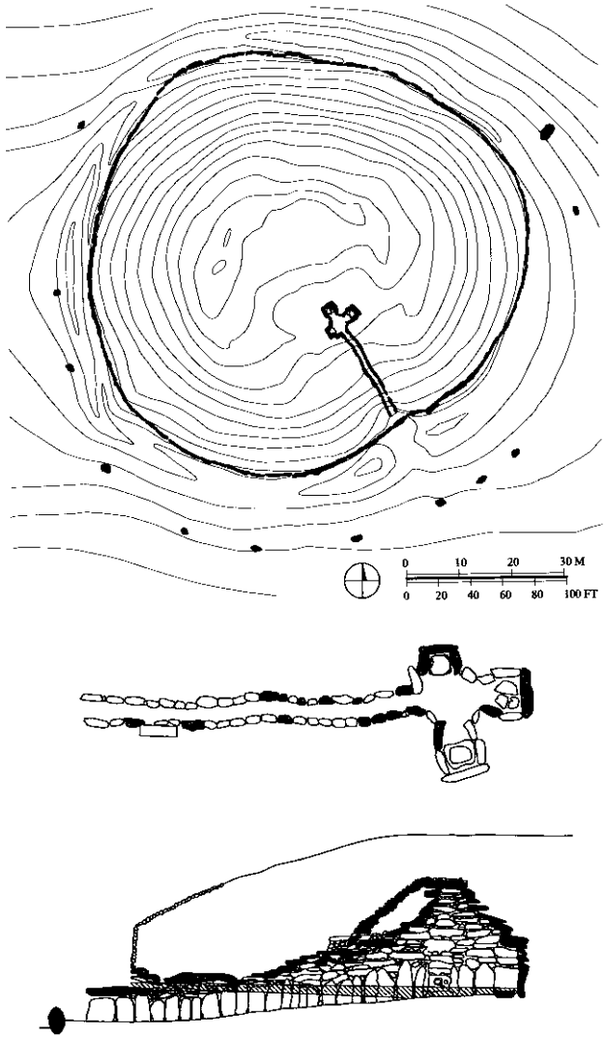


1.2 (below) Megalith tomb, Er-Mané, Carnac, Brittany, France, ca. 4200 BCE.
This structure presents an early example of corbeled construction, in which stones are laid without mortar in layers, with each course projecting slightly beyond the previous one, to enclose space. The same area contains other prehistoric tomb chambers and nearly 300 standing and fallen megaliths set in rows aligned to indicate the direction of sunrise at summer and winter solstices and fall and spring equinoxes.



Western Europe

In western Europe the transition to urban communities was slower in coming, although the shift from hunting-and-gathering societies to larger agricultural groups under the direction of a priest-king was similar to the experience of societies on the eastern rim of the Mediterranean Sea. The significant prehistoric architectural achievements of western Europe were megalith constructions, composed of large stones or boulders (**megalith** literally means "great stone"), many of which were erected for astronomical observatories or communal tombs for the privileged classes. Before 4000 BCE, chambered tombs of dry-wall masonry (stones laid without mortar) with corbeled roofs were constructed in Spain and France. One of the earliest of the megalith tombs, dated to 4200 BCE, is at Er-Mané, Carnac, in Brittany (Fig. 1.2). As



1.3 Plans and section, Newgrange passage grave, County Meath, Ireland, ca. 3100 BCE.
The cruciform chamber of this communal grave is approached through a long passage created by upright stones. The near-horizontal shaded area represents the path of early-morning sunlight on the winter solstice, which illuminates the passage and chamber floor, establishing a connection between the human and celestial worlds.

with many other chambered tombs, this one was stabilized by a covering of earth.

Ireland is particularly rich in megalith tombs, having over 500 documented sites. Constructing these communal graves for cremated or skeletal remains seems to have been not only an expression of reverence for ancestors but also a means of establishing claims to land, and megalith tombs are frequently located on prominent sites. Among the most impressive is the passage grave at Newgrange, County Meath, built about 3100 BCE on the crest of a hill overlooking the Boyne river. An earthen mound nearly 300 feet in diameter and thirty-six feet high covers the tomb, with the weight of the soil providing stability for the megaliths below. Decorated boulders surround the perimeter of the mound. (The white quartz facing is a modern reconstruction based on excavations, providing visibility from a distance.) The south-facing entry leads to a sixty-two-foot-long, upward-sloping passage covered by stone **lintels** terminating in a cruciform chamber covered by a beehive corbeled ceiling twenty feet high. Parts of the stonework in the passage and chamber are decorated with incised patterns, including diamond shapes and spirals, whose meanings are unknown (Figs. 1.3–1.4). The whole construction is carefully oriented so that, in the five days around the winter solstice, light from the rising sun enters through the doorway and a **transom**-like light box creeps along the

1.4 Entranceway, Newgrange passage grave, County Meath, Ireland, ca. 3100 BCE.
This view shows the stone façade as reconstructed by archaeologists. Note the rectangular opening that serves as a "transom light" over the portal, providing the path for sunlight on the winter solstice. Spiral designs on the stone that blocks direct entry may represent sun signs. The old stone door is visible to the right of the opening.
Douglas Pfeiffer/Shutterstock

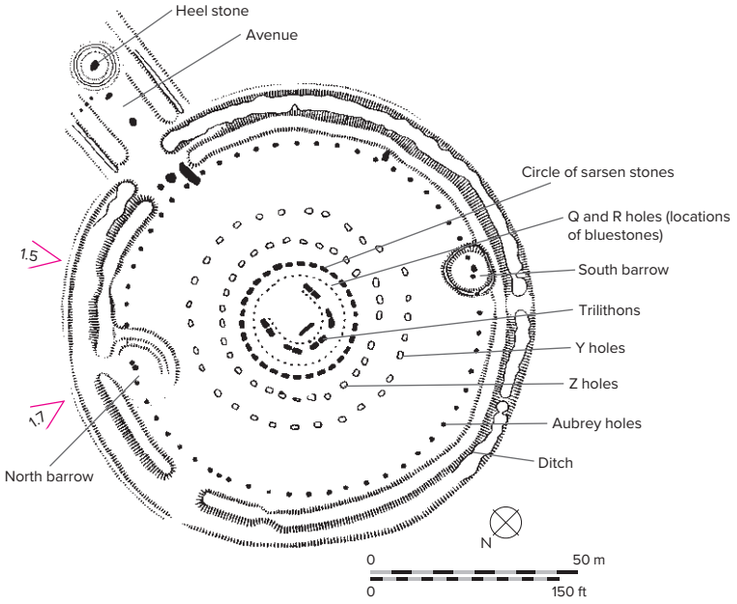
1.5 Stonehenge, Salisbury Plain, England, ca. 2900–1400 BCE. Perhaps the most famous monument from prehistoric times, Stonehenge exemplifies the ability of some early civilizations to organize workers and materials to create evocative ceremonial places. The heel stone stands to the lower left beyond the circle.
Image Hans Elbers/Moment/Getty Images

passage and illuminates the chamber within for about fifteen minutes (Fig. 1.4). To those fortunate enough to witness this annual event (the only time there is any light in the interior), the effect is magical and very moving. Constructing such a massive tomb (and there are two others on the same scale nearby) would have required sustained effort over many years. Available technology provided nothing harder than copper or bronze tools for shaping stone, and there were no wheeled vehicles or draft animals to assist with transport. Nonetheless, ancient builders made the necessary astronomical observations and organized a work force sufficient to maneuver stones weighing up to five tons.

The ability to work large stones and to observe fundamental astronomical phenomena merged in the most celebrated of megalith constructions, Stonehenge, located on Salisbury Plain in southwestern England (Figs. 1.5–1.7).

At least three distinct building phases can be observed. The first phase began about 2900 BCE with excavation of two concentric circular ditches. Inside the perimeter, fifty-six evenly spaced holes (the Aubrey holes) were dug and filled with chalk, while a northeasterly line of sight to the horizon was established from the center across a pointed upright (the heel stone) outside the ditches. About 2400 BCE eighty-two coffin-sized stones of gray-blue dolerite, weighing about two tons each, were transported from quarries in the Preseli mountains of Wales and erected in a double ring of thirty-eight pairs, with six extra stones defining the northeast approach axis. At some point, perhaps before this second phase was completed, the bluestones were removed (their sockets are the so-called Q and R holes). The third and final phase involved transporting thirty-five lintels and forty sarsen stones (a form of sandstone) weighing up to twenty tons each. These were erected in a circle of thirty uprights enclosing five **trilithons** (two uprights capped by a single lintel) arranged in a U-shape to focus on the avenue, the axis leading northeast toward the heel stone. Knobs (**tenons**) left on the tops of the uprights fit into socket holes (**mortises**) carved into the undersides of the lintels so that the stones lock together in a mortise-and-tenon joint when correctly positioned.

To many modern visitors, the sophisticated design and massive construction of the site has seemed beyond the capacities of prehistoric people. Thus the site has been interpreted variously as the work of giants, magicians, people imported from the Aegean, or even extraterrestrials. The truth is more prosaic but ultimately more meaningful: archaeo-astronomer Gerald Hawkins demonstrated that Stonehenge was a great observatory for determining the solstices (thus establishing the annual calendar) and predicting lunar and solar eclipses, knowledge that could have proved very useful in a society without almanacs. Its circular layout



1.6 Plan, Stonehenge, Salisbury Plain, England, ca. 2900–1400 BCE.
This plan includes the original earthworks. The trilithons set in a U-shape establish the axis of the avenue, which passes between perimeter stones to align with the heel stone set outside the circle. On the summer solstice, the sun rises precisely over the heel stone, when viewed from the center of the concentric circles.

1.7 Stonehenge, Salisbury Plain, England, ca. 2900–1400 BCE.
This view from the north shows the present-day configuration of stones. Where the lintels are gone, the knobs (tenons) that held the horizontal stones in place can be seen on top of the uprights. The heel stone is the tall stone to the left.
Marian Moffett

may well reflect a symbolic tie to the heavens, a link between human and celestial realms.

Experience gained in the construction and orientation of megalith tombs enabled early inhabitants of the British Isles to erect one of the most haunting architectural works of all time. Stonehenge represents the culmination of construction skill and scientific observation in the prehistoric era. Its builders met the challenge of moving and shaping massive stones. Bluestones from Wales were transported, largely by water, over 190 miles to the site, being dragged overland for the last leg of the journey. The larger sarsen uprights came from the Marlborough Downs, about fifteen miles from Stonehenge and were probably dragged to the site. Modern experimentation with moving and erecting a trilithon on the scale of Stonehenge shows that erection could be accomplished with simple machines (lever and inclined plane), a sledge and greased track, wooden scaffolds, stout ropes, and about 130 people working together.

ANCIENT MESOPOTAMIA

The distinction between the prehistoric world and historic times involves the development of written language, which was achieved by about 3500 BCE by the Sumerians in the Middle Eastern land of present-day Iraq and Iran. There, in the fertile lands between the Tigris and Euphrates rivers (named Mesopotamia or "between the rivers" by the ancient Greeks), the earliest literate civilizations developed in independent urban communities called city-states. Writing first developed as a means of documenting governmental transactions and was only later employed for what might be called literary purposes, communicating the legends, glorious deeds, hopes, and fears of the people. In about 3000 BCE, perhaps as a result of contacts with Mesopotamia, another center of civilization emerged in northeast Africa, along the banks of the Nile River in Egypt. These two regions, Egypt and Mesopotamia, are considered the cradles of Western history and architecture.

Despite its importance in world history, few cultures seem more remote to the current student of architectural history than that of ancient Mesopotamia. There are strong religious images from Judeo–Christian scripture of flood stories and the Tower of Babel, both with Mesopotamian connections, but such textual images can only go so far, and Hollywood has not seen fit to dramatize the place and its people as they have Egypt and the ancient Egyptians. You can best begin, perhaps, by reading the accompanying essay for some sense of Mesopotamian culture, and then consider the larger picture; that picture begins with rivers.

Mesopotamia encompasses an area about 500 miles long by no more than 300 miles wide. Its southern boundary is the Persian Gulf, the shore of which was about 130 miles farther north during the third millennium than it is today. In addition, shifts in the river channels, climatic changes, and increased salinity of formerly irrigated lands have combined to bring about profound changes in the environment since antiquity. The Tigris and Euphrates rivers flow separately into the gulf. The Euphrates originates in the mountains of eastern Turkey and meanders across the plains in its lower reaches. The more easterly Tigris rises in the same mountains but develops into a more swiftly flowing stream because of its numerous tributaries in the Zagros mountains. As a result, the Tigris was less navigable and did not have as great a unifying effect on settlements along its banks as did the Euphrates.

The Mesopotamian cultures did great things by exploiting their rivers. They regulated them as best they could and from them they constructed elaborate irrigation canals that made possible a fertile, even Edenesque landscape. Within this landscape, they cultivated sufficiently abundant crops to permit the large-scale storage of surplus grain. This relatively stable and plentiful supply of food, in turn, permitted the growth of large urban populations and that corollary of urbanism: specialization. Mesopotamian specialists included not only priests and merchants but also artisans, artists, and architects who could make beautiful objects, express their culture's worldview, and make gestures toward the connection of humankind to the cosmos.

Sumerians, Akkadians, and Neo-Sumerians

The Sumerians are generally credited with forming the world's first civilization, which began to take shape around 4000 BCE. At this time, the people of the fertile lands of southern Mesopotamia mastered arts of agriculture and developed irrigation systems to control the waters of the Euphrates River. Their civilization, which lasted until about 2350 BCE, is known as Sumerian, and the typical form of their settlements was the city-state, a political and religious center devoted to serving gods based on natural elements. These deities included the divine triad of Anu, god of the sky; Enlil, god of the earth; and Ea, god of water; supplemented by Nannar, god of the moon; Utu, god of the sun; and Inanna, goddess of fertility. The Sumerians believed that the sky and earth were two disks that had been blown apart and that all existence was governed by the gods, who represented the unpredictable elements affecting human life. They believed that human beings were created from the alluvial silt deposits in the river valleys to serve the gods and to relieve them of toil. Because the gods benefited from human praise, they had to remain in human favor. Thus there was a balance in the creative and destructive forces of the gods and a mutual inter-dependence between people and gods.

Urban communities developed around religious shrines, the dwelling places of the gods and the repositories for surplus food stores, leading to the development of monumental temple complexes at the hearts of Sumerian cities. The earliest level of Eridu, the oldest city, had a small shrine with a brick altar in front of a wall **niche**, or recess, probably constructed to contain a cult statue, and altars and niches were found in all later Sumerian temples. Rebuildings of this temple at Eridu successively enlarged the relatively

ESSAY
The Sumerian View of the World
by Michael Fazio

1.8 Head of a ewe in sandstone, ca. 3200 BCE, 5¾ inches by 5½ inches by 6¼ inches.
The creator of this small, stony animal captured both its realistic "sheepness" and that enigmatic sense of the eternal to which great religious art aspires.
Kimbell Art Museum/Bridgeman Images

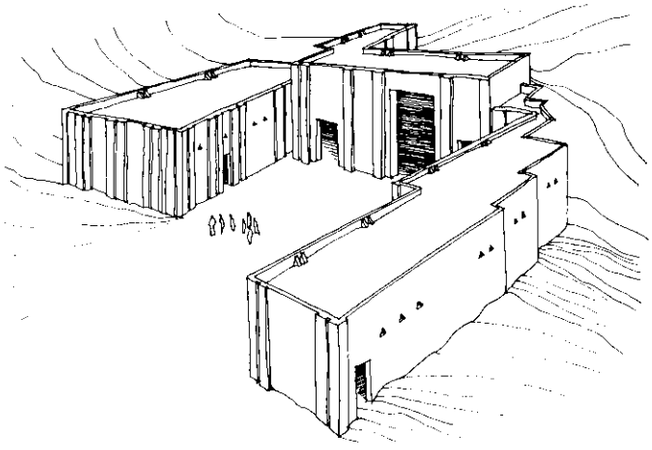
The Sumerians worshiped multiple gods of diverse rank and character and represented them in their art. This small object (Fig. 1.8) is the head of a ewe or female sheep carved by a Sumerian sculptor, perhaps in Uruk, more than five thousand years ago. Its current home is Louis Kahn's Kimbell Art Museum in Fort Worth, Texas (see Figs. 16.33–16.35). Lovingly made, it renders more personal and more accessible these anonymous Sumerians, who created a monumental architecture almost exclusively from mud.

We need to imagine the entire figure, its body intact, and so standing two to three feet high and having about the same length. Curators at the Kimbell interpret it as a symbol of the goddess Dittur, whose son Dumuzi was an important god of shepherding and milk (hence the sheep image), as well as the netherworld.

The ewe's head is worn, so again we need to imagine it as pristine, quite realistic and animate, and appreciate its sympathetic depiction in a society where such animals were essential to human survival. With its wide mouth, flaring nostrils, and alert ears that seem just to have heard the voice of the shepherd or shepherd god, it invites reverent touching, perhaps patting were it not so sacred. Again we can imagine the coarse warmth of its fleece and its quiet breath. We can imagine the artist working to communicate its "sheepness" and to communicate its meaning by drawing out the nature of the soft stone from which it is made.

Its home would have been a place like the White Temple (see Fig. 1.11). Here it would have been attended by priests and worshiped daily. The National Museum of Iraq in Baghdad, which was tragically ransacked during the war in 2003, contained sculpted images of such priests and other worshipful Sumerians (Fig. 1.9). These images are more formally abstract than the ewe, their upper and lower torsos wedge-shaped, like the characters of Sumerian cuneiform writing, and their most striking features are extremely prominent eyes and ritually folded, almost wringing hands, seemingly expressive of a certain anxiety. The Sumerians struggled with a host of insecurities in a land where nature, particularly the weather, vacillated wildly between benevolence and malevolence. They asked the questions we still ask. Where had they come from? How could they exercise some measure of control over their environment? What awaited them after death?

1.9 Sumerian statuette, Tell Asmar, ca. 2900–2600 BCE. Gypsum inlaid with shell and black limestone, approximately 28 inches.
Compare this statuette to the head of the ewe in Fig. 1.8. While the ewe is depicted realistically, the Sumerian figure is stylized. The same phenomenon is found in Egyptian art: lowly subjects were often represented with a high degree of realism, while images of the pharaoh or of a god were abstracted, as if this abstraction might provide some insight into the more imponderable aspects of the human condition.
Leemage/Universal Images Group/Getty Images



1.10 Reconstruction of the Acropolis, Tepe Gawra, Sumer (Iraq), ca. 3800 BCE.
This religious structure was associated with a more complex urban society than those of prehistory. The scale of the building erected on the high point of the city reflects the importance of the society's religion and priestly class. Pilasters strengthened the mud-brick walls. The north temple stands at the upper left and measures about 25 feet by 40 feet.

modest original shrine, and by about 3800 BCE the temple stood on a platform. Its **buttressed** walls enclosed a rectangular shrine room flanked by smaller side chambers. At about the same time Tepe Gawra, nearly 500 miles to the north, featured an **acropolis** with two temples, a shrine, and dwelling houses. Its major buildings formed a U-shaped open court. Their **façades** were articulated by buttressing **pilasters** (Fig. 1.10), a motif that will be seen again in early Egyptian architecture.

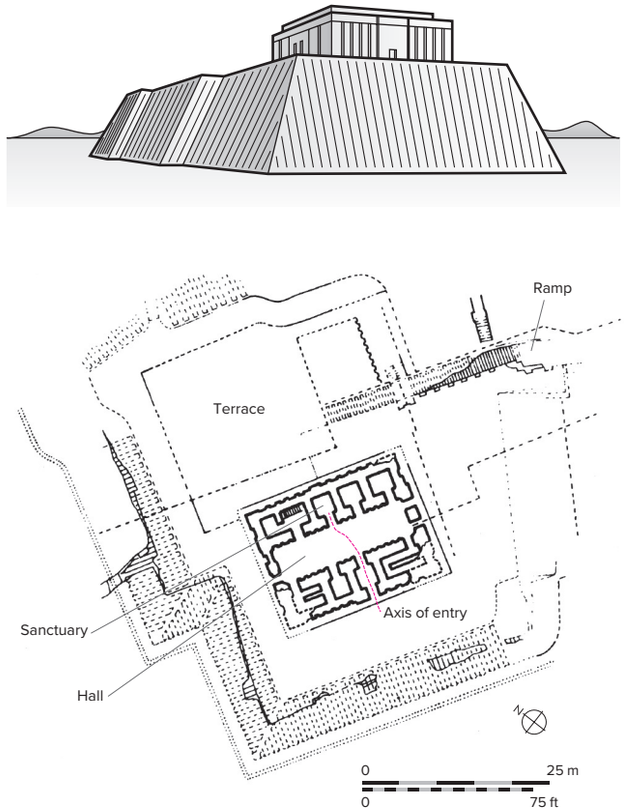
Most Sumerian buildings were laid up in sun-baked brick, a material easily obtained by shaping mud in molds and leaving it to dry for several weeks in the sun, but the resulting brick is not particularly resistant to weathering. As a result, much of Sumerian architecture is known only from foundations and lower sections of walls. Roofs were fabricated from lightweight wooden members or reeds that could not span great distances, so there were no large interior spaces. In both Sumerian and later Mesopotamian architecture, important buildings were given additional durability by having weather-resistant casings for the brick and greater dignity by being raised on an artificial platform.

Such was the case at Uruk, where the so-called White Temple was built (ca. 3500–3000 BCE) on a forty-foot-high base of rubble from earlier buildings and provided with a protective coat of whitewash over its sloping walls of earth covered with sun-dried brick (Fig. 1.11). Entrance to the temple was made through a chamber in one long side so that a "bent axis" led from the outside into the hall and sanctuary.

Contemporary structures excavated in the nearby precinct of Eanna (dedicated to Inanna) include two groups of temples flanking a courtyard ornamented by a **mosaic** of thousands of small **terracotta** cones. The base of each cone was dipped in black, white, or red glaze, and then its apex was inserted into the clay of the wall to form a polychromatic zigzag pattern with circular elements.

In 2350 BCE, Semitic-speaking peoples based principally in the cities of Sipar and Akkad, from which they take their name Akkadian, overthrew Sumerian civilization. Surviving evidence indicates that the Akkadians were fierce, governed not only by a priestly class but also by a warrior-king. They adopted many aspects of Sumerian culture, but their centralized form of government prefigured the hegemony of Babylon some 500 years later.

The Akkadian Empire was in turn overthrown in about 2150 BCE by the Guti, a group of tribes from the mountain regions of Iran. The military influence of the Guti weakened within a century, and political allegiances reminiscent of the first Sumerian city-states returned in what is termed the Neo-Sumerian period (ca. 2150–2000 BCE). This period witnessed the further development of urban temple forms, particularly the temple elevated on a tiered artificial mound, or **ziggurat**. Commonly constructed of sun-dried brick bonded together with bitumen, reed



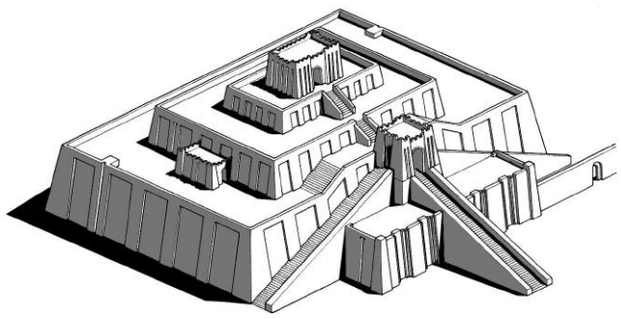
1.11 View and plan of the White Temple, Uruk, Mesopotamia (Iraq), ca. 3500–3000 BCE.
Many temples in Mesopotamia were erected on raised platforms. The base of this temple was made in part with the rubble from previous buildings on the site, buttressed in a regular pattern and protected by layers of whitewash—hence the temple's name.

1.12 Ziggurat at Ur, Mesopotamia (Iraq), ca. 2100 BCE.
The best preserved of the massive temple mounds that once dominated every major Mesopotamian city, this ziggurat served to elevate a temple closer to the gods. Its core is sun-dried brick, overlaid with an outer layer of kiln-fired brick and bitumen as protection against weathering.
HomoCosmicos/iStock/Getty Images

matting, or rope, ziggurats were finished with a weather-resistant exterior layer of kiln-fired brick. From a rectangular base, the ziggurat rose with battered or inward-sloping walls in a series of stepped platforms, culminating in a high temple at the top. A flight of stairs set in the center of one side afforded access to the temple. (Elements so placed in the center of a symmetrical form and aligned toward a terminus are said to be axial.) Ziggurats were designed to elevate the temples to the gods so that the latter might descend from the heavens and ensure the prosperity of the community. Symbolically, the ziggurat may have also represented the mountains whence the Sumerians came. To make their gods feel at home in the lowlands of the river valley, the Sumerians and their successors in Mesopotamia may have aspired to recreate their highland dwelling place. Raising the temple well above the elevation of the valley may also have reflected a desire to protect the sacred precinct from flood waters; it certainly gave it visual prominence in the city.

Little remains of the ziggurats constructed during the brief Neo-Sumerian interlude. Once the outer casing was removed by scavengers, the earthen core of ziggurats eroded considerably. Of those lofty artificial mountains that towered over Mesopotamian cities, only the ziggurat at Ur (ca. 2100 BCE) retains some of its architectural details (Figs. 1.12–1.13). One can still distinguish the three long stairways that converged on a tower gate at the level of the first platform. Shorter flights led to the second and third terraces, to which only the priests were allowed to ascend. These upper levels, together with the crowning temple, have been reduced to crumbled heaps, but archaeologists calculated that the original height was about seventy feet, with a base of about 200 by 150 feet.

In contrast to the grand temple complexes, the houses of the ordinary population were set in densely packed neighborhoods. Plans were roughly orthogonal, and houses were constructed around open courtyards that provided light and fresh air to all rooms (Figs. 1.14a,b). To the street, the houses presented a blank wall, thereby ensuring privacy. Courtyard houses continue to the present day to be typical of Mediterranean and Middle Eastern communities.



1.13 Reconstruction of the ziggurat at Ur, Mesopotamia (Iraq), ca. 2100 BCE.
This drawing shows the original details that are now lost, including recessed panels defined by pilaster strips and parapets. The population below could observe the priestly processions up the successive flights of stairs to the temple on the uppermost platform.

1.14a City of Ur, Mesopotamia (Iraq), ca. 2100 BCE.
This plan shows the walled precinct with the ziggurat and the enclosing city wall. A portion of the residential section that has been excavated can be seen to the southeast of the city center. Note the mazelike arrangement of the houses, contrasting sharply with the larger open spaces of the administrative and ceremonial center.

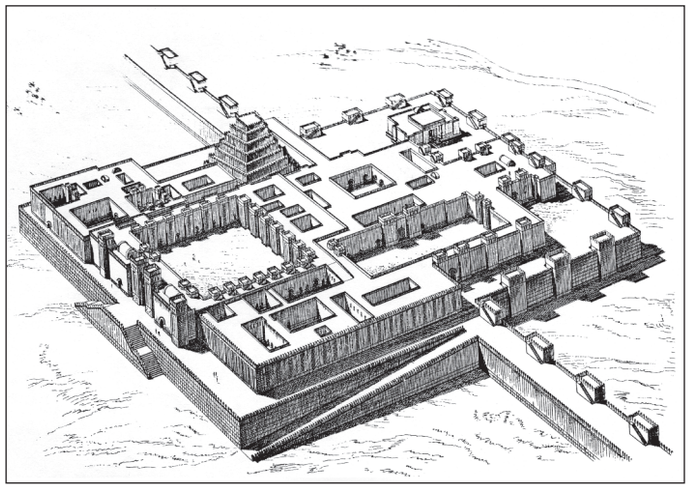
1.14b Plan of the residential quarter, Ur, Mesopotamia (Iraq), ca. 2100 BCE.
Surviving foundations indicate houses laid out on right-angled plans with living spaces organized around courtyards (shown hatched), a configuration that promoted urban density while also providing privacy and fresh air to each dwelling. Later versions of this house type can be found in Mohenjo-Daro (in the Indus Valley), Priene (in western Ionia), and in Islamic cities in the Middle East and North and East Africa.

Babylonians, Hittites, and Assyrians

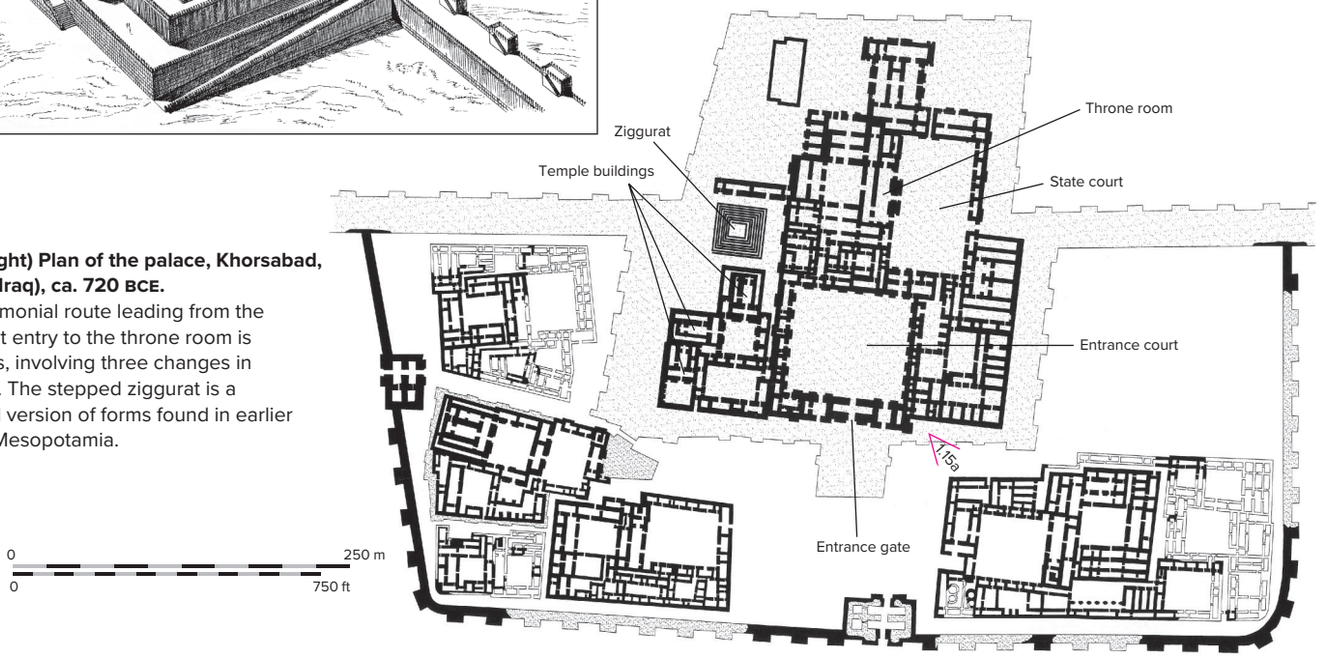
Beginning in 1800 BCE, the Amorite dynasty in the city-state of Babylon dominated Mesopotamia, with the most celebrated Babylonian king being Hammurabi (1728–1686 BCE). In 1830 BCE, the vigorous Indo-European Hittites overran Babylon and took over northern Mesopotamia. Farther south, the Semitic-speaking Assyrians took control and established capitals sequentially at Calah (present-day Nimrud), Dur-Sharrukin (Khorsabad), and Nineveh (Kuyunjik). Strongly fortified citadels built for each capital reflect the Assyrians' relentless warring as well as the ruthless character of their kings.

At Assyrian King Sargon II's royal city of Khorsabad (begun 717 BCE), designers employed both architecture and art to communicate the awe-inspiring power of their ruler. The twenty-five-acre palace (Figs. 1.15a,b) occupied a plateau fifty feet above the level of the city, was organized orthogonally around multiple courts, and was loomed over by a seven-stage ziggurat, 143 feet on a side at its base and representing the cosmic order of Sun, Moon, and five then-known planets. The palace was embedded in the city's massive surrounding wall, which was reinforced by repetitive towers, with access gained through a towered entrance gate. Artistic embellishments began here, where winged bulls with human heads carved in high relief from colossal stone blocks, each weighing over forty tons, once stood guard. Bone and muscle were realistically represented, while feathers, hair, and beard were stylized, forcefully conveying the strength of the monarch: as man, the lord of creation; as eagle, king of the sky; and as bull, fecundator of the herd. Other relief carvings within the palace depicted marching armies burning, killing, and pillaging to emphasize the folly of resistance to Assyrian might. A giant winged bull found in the throne room by excavators is on display at the Louvre in Paris.

Located near Mosul, Khorsabad came under the control of the militant Islamic fundamentalist group known as ISIL or Islamic State in 2015. The site is no longer in their hands, but the extent of damage that they inflicted is still being determined.



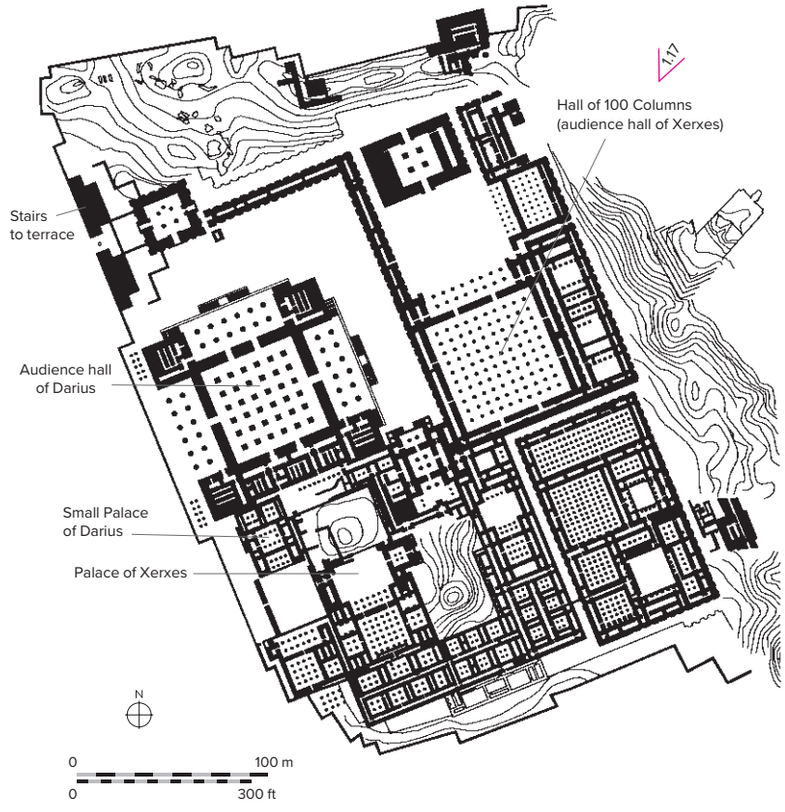
1.15a (left) Reconstruction of the palace, Khorsabad, Assyria (Iraq), ca. 720 BCE.
Fortified walls enclose the palace. The royal audience hall was reached through a sequence of courtyards and smaller chambers. Compare this to the axial layouts typically found in Egyptian architecture.



1.15b (right) Plan of the palace, Khorsabad, Assyria (Iraq), ca. 720 BCE.
The ceremonial route leading from the southeast entry to the throne room is circuitous, involving three changes in direction. The stepped ziggurat is a dwindled version of forms found in earlier cities in Mesopotamia.

The Persians

By 539 BCE, the Persian Empire was ruled by Cyrus II. The Persians had previously overthrown the Medes, and they continued to expand outward from their capital at Susa (in present-day Iran) to conquer all of Mesopotamia, Asia Minor, and even Egypt by 525 BCE. Within a century they controlled territory from the Danube to the Indus and from the Jaxartes to the Nile, failing to subjugate only the Greek peninsula. The greatest surviving architectural contribution of the Persians is an impressive ruin at Persepolis (Fig. 1.16), the city founded in 518 BCE by Darius as a ceremonial capital to supplement Susa, the administrative capital, and Pasargadae as centers of court life. Lacking strong artistic traditions of their own, the Persians borrowed freely from the cultures they conquered. At Persepolis, there are echoes of



1.16 Plan of the palace, Persepolis, Persia (Iran), ca. 518 BCE.
This great complex was created by at least three Persian monarchs as one of the capitals of the Persian Empire. Its ruins reveal architectural influences from other cultures in Mesopotamia, notably the Hittites and Assyrians, as well as the Egyptians.

1.17 View of the ruins of the palace, Persepolis, Persia (Iran), ca. 518 BCE.
Seen here in the foreground is the Hall of a Hundred Columns and in the background the Palace of Xerxes. The armies of Alexander the Great sacked and burned Persepolis.
Stefan Baum/Getty Images

Egyptian temple gates and **hypostyle halls**, Hittite audience chambers, and Mesopotamian sculpted animal motifs. The great palace, used primarily for ceremonies at the New Year and the beginning of spring, occupied a terrace 1500 by 900 feet; it contained reception courts, banquet rooms, and audience halls in a loosely organized orthogonal layout. King Xerxes's throne room, known as the Hall of a Hundred Columns and completed by Artaxerxes, was the largest roofed space in the palace, able to contain 10,000 people within its 250-foot-square plan (Fig. 1.17). Most of the construction was in stone. Stone **columns** supported wooden roof **beams** resting on the unique double-headed **capitals** carved in the form of bulls and lions. Access to the terrace was gained via a flight of stairs flanked by relief sculptures representing delegations from twenty-three nations bringing tribute to the sovereign. These stone figures, shown engaged in the same kind of activities as real-life visitors, provided a foretaste of the pageantry and banquets waiting in the palace above.

The conquests of Alexander the Great ended Persian dominance in 331 BCE. Alexander's armies eventually reached India, where Persian craftsmen appear to have accompanied them and then remained. They helped build the capital at Pataliputra (now Patna) for Chandragupta, where the many-columned halls and animal capitals recall the palace at Persepolis. Persian architecture became one of the major influences for the early stone architecture of India.

ANCIENT EGYPT

Popular culture suffers from no shortage of ancient Egyptian images, be they from epic movies depicting Moses and the pharaohs or classic horror films where Boris Karloff, playing the mummy, wanders around menacingly, doling out ancient justice to naïve archaeologists and greedy tomb raiders. All of this is fun, as is wild speculation about the Egyptian pyramids being built by visitors from outer space using anti-gravity beams, but it threatens to obscure the real accomplishments of everyday men and women in the Nile Valley, albeit those of 5000 years ago. Like the Mesopotamians, the ancient Egyptians produced a great architecture by marshaling the forces of their entire civilization and directing those forces in the service of widely held cultural values. This architecture is much more varied than you may imagine, and it is not only largely understandable to the modern mind but also highly informative about design ideas applicable in any era.

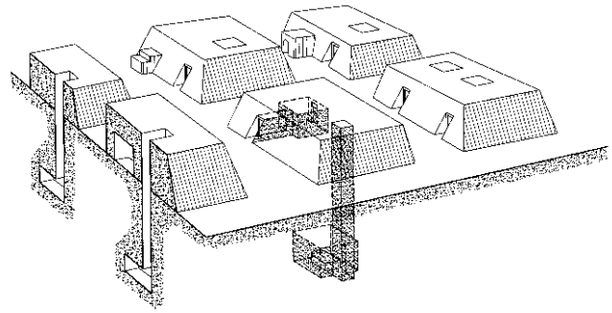
The geography of Egypt is dominated by one great river, the Nile, which originates in the highlands of Uganda and passes through the Sudan and Ethiopia as it traverses more than 2000 miles before flowing out into the Mediterranean Sea to the north. Within the 600 lower miles of the river valley, agriculture is facilitated by the warm climate and the annual flood deposits of organic silt, which renew the fertility of the fields. On the margins of the valley in dynastic times, there were marshes and open lands rich in game.

(Today the desert encroaches on these areas.) Outside the rather narrow fertile band bordering the Nile, great expanses of inhospitable desert provided security from outside invasion, just as the Mediterranean served as a barrier for settlements on the Nile Delta. The culture that developed along the banks of the river was thus predominantly rural agricultural, in contrast to urban-oriented settlements in turbulent Mesopotamia. Egyptian life was organized around the annual flooding of the river, and the cyclical rhythm of the seasons fostered a civilization that remained remarkably stable for more than 2000 years. Two centers of Egyptian civilization, with differing cultural practices, arose in prehistoric times: Lower Egypt in the broad Nile Delta and Upper Egypt in the more narrow southern river valley. At a very early stage, Egyptians also developed writing in the form of hieroglyphs, a system using both pictorial and phonetic symbols to record information.

The history of Egypt begins in about 3000 BCE with the union of Upper and Lower Egypt by Menes, the pharaoh king of Upper Egypt, who established his capital at Memphis, near the junction of the two lands. (Please note that dates in Egyptian history, especially for individual pharaohs in the early dynasties, are still matters of scholarly debate. All dates given here should, therefore, be treated as approximations.) Menes, like all his successors, was both a temporal ruler and a manifestation of the falcon-headed god Horus, the god of pharaohs. When the pharaoh died, he became identified with Osiris, father of Horus and lord of the underworld, and his successor as pharaoh assumed the Horus role. Egyptian theology linked both Osiris and Horus with the sun god Ra, whose symbol in the ancient temple at Heliopolis was the phallic, cone-shaped ben-ben stone, later stylized as a pyramid. The use of pyramid shapes at the top of stone shafts (**obelisks**) or as the building form itself (as in the pyramids) was thus a visual symbol of the connection between the ruler and the sun god.

The Early Dynastic Period and Old Kingdom (First–Eighth Dynasties, ca. 2920–2134 BCE)

Egyptian history is divided into thirty dynasties, encompassing the period from Pharaoh Narmer's accession (ca. 3000 BCE) to the conquest of Egypt by Alexander the Great in 332 BCE. What we know of this early period comes largely from funerary monuments and inscriptions, where the focus is on the transition from the world of the living to that of the dead. Egyptians believed strongly in an afterlife in which the *ka*, or life-force, was reunited with the *ba*, or physical manifestation, to become an *akh*, or spirit. Elaborate rituals were performed inside tomb chambers to ensure that the transformation from life to death was successful. Preservation of the physical body (or at least a temporary forestalling of its putrefaction) after death was of great importance, as was the provision of household furnishings, surrogate servants, food, drink, and a suitable permanent chamber. The *ka* of an important person, especially the pharaoh, who was inadequately prepared for the afterlife might wander unsatisfied about the world and cause mischief for the living. It was, therefore, in society's interest to ensure that the pharaoh's body and spirit were well served. This goal led to the construction of enduring tombs for royalty and the development of mummification to preserve the body. Tombs, rather than temples or palaces, became the most lasting religious structures.



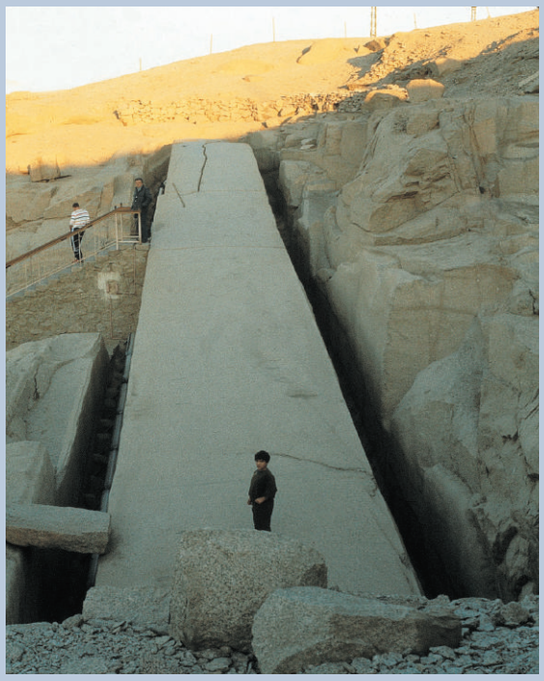
1.18 Drawing of the mastaba tombs.
This aerial view shows the burial chambers beneath the structures and small chambers, or serdabs, provided at ground level for offerings to the spirit of the deceased. It is thought that these tombs, constructed of sun-dried brick or stone, were based on designs of actual dwellings constructed of less durable materials.

Mastabas, the earliest tombs, were built as eternal houses for the departed and were in all likelihood based on the design of the dwellings of the living. Ordinary houses were constructed of reed, thatch, and wood, materials wholly unsuited for a permanent residence, so the builders of mastaba tombs sought greater durability by using brick while retaining characteristic details provided by the customary bundled reeds and wooden supports. The basic mastaba (Fig. 1.18) was a blocklike structure above ground containing a small room for offerings and another chamber for the body and a statue of the deceased. Worldly goods entombed with the dead soon attracted thieves, so an early revision of mastaba design added a deep shaft under the building. The body was placed at its base, and the shaft was then filled with stone and rubble to deter would-be robbers. In the above-ground chamber, or **serdab**, a statue of the deceased would receive offerings. A later change toward increasing permanence involved using stone in the construction of the mastaba.

The First Pyramids

As the religious ritual prescribed by the priesthood evolved to enhance further the significance of the pharaoh, the mastaba was likewise enlarged, eventually producing the pyramid. At death the pharaoh accompanied the sun god on his daily journey across the sky, so he needed to be lifted skyward. The pyramid, initially an upward-stepping form like the ziggurat, whose peak caught the first rays of morning light, was the emblem of the sun god as worshiped at Heliopolis. The shape also makes symbolic reference to the annual rebirth of nature, for as floods recede, the first signs of plant life appear on small hillocks. Thus the stepped and eventually the true pyramid's form represented both daily and yearly rebirth throughout eternity.

ESSAY
“Hydraulic” Civilizations
by Dan MacGilvray



There is but little rain in Assyria. It is this which nourishes the roots of the corn; but it is irrigation from the river that ripens the crop and brings the grain to fullness: it is not as in Egypt, where the river itself rises and floods the fields: in Assyria they are watered by hand and by swinging beams. For the whole land of Babylon, like Egypt, is cut across by canals. The greatest of these is navigable: it runs … from the Euphrates to the Tigris …

… all the land … watered by the Nile in its course was Egypt, and all who dwelt lower down than the city Elephantine (Aswan) and drank of that river’s water were Egyptians.

… there are no men, neither in the rest of Egypt, nor in the whole world, who gain from the soil with so little labour; they have not the toil of breaking up the land with the plow, nor of hoeing … the river rises of itself, waters the fields, and then sinks back again; thereupon each man sows his field and sends swine into it to tread down the seed, and waits for the harvest …

1.19 Obelisk in a quarry, Aswan, Egypt.
Michael Fazio

The Greek historian Herodotus (484–425 BCE) traveled extensively throughout the ancient world and wrote the first narrative history. He was a keen observer of culture, and these quotations define one of the essential characteristics of Mesopotamian and Egyptian civilizations: their dependence on rivers. Water is an essential ingredient of all life, and flowing water is required for the development of civilization, not only for drinking and irrigation but also to remove the human waste that accumulates in areas of dense population. Thus, all of the early civilizations from that of the Indus to the Mayans were founded on rivers. We refer to these as “hydraulic” civilizations.

Of necessity, a hydraulic civilization is a cooperative federation, in contrast to, say, a group of squabbling city-states. In a given watershed, strong centralized control is required for the construction of an interdependent system of canals to divert water for irrigation and drain swamps for cultivation or dams and levees for flood control and water retention. Early hydraulic engineers learned the techniques of surveying and developed the skills to manage large-scale construction projects as they struggled to control the waters that brought both abundance and destruction. As Herodotus notes, the nation of Egypt defined itself by the Nile, and there is no doubt that the engineers of the pyramids learned to survey, to level, and to organize large work forces on the banks of the river. It has also been speculated that, because the farmers were inactive during flood times, they were available for conscription into construction work gangs for massive projects like the pyramids.

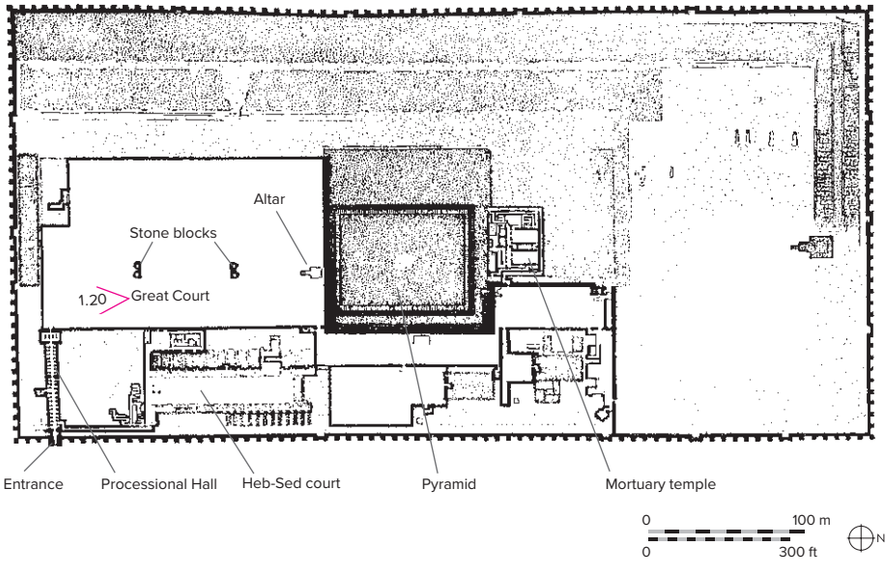
The Tigris, Euphrates, and Nile rivers also served as the primary transportation arteries for the movement of goods between the various communities that lined them. Even today, in the age of jet travel, by far the cheapest means of moving freight per ton-mile is the river barge. In medieval times it was ten times cheaper to move cargo by boat than by ox-cart. And, because of the Nile, the ancient Egyptians had no use for wheeled vehicles or even paved roads; the chariot was a foreign import that arrived late to the water-borne Egyptians, who, not surprisingly, developed sophisticated construction techniques for boats of all sizes. In tomb paintings the largest are shown laden with granite obelisks, such as that in Fig. 1.19, a cargo of up to 1000 tons.

1.20 The stepped pyramid, Saqqara, Egypt, ca. 2630 BCE. As the first monumental stone construction in Egypt, this tomb set the precedent for later pyramids of the pharaohs. Its architect, Imhotep, was remembered for his genius and later revered as a deity.
Danita Delmont/Shutterstock

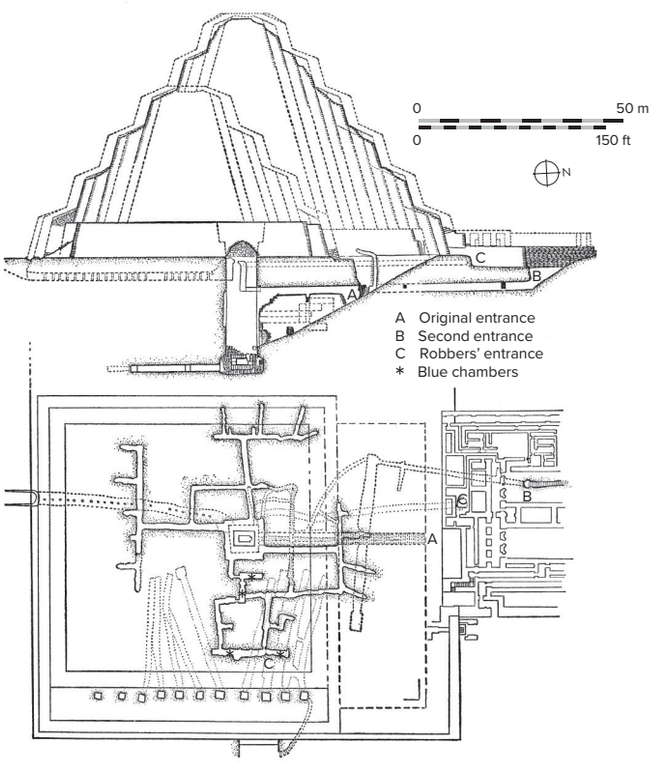
Imhotep, architect to the Third-Dynasty pharaoh Djoser (2630–2611 BCE), is credited with designing the first pyramid, for Djoser's funerary complex at Saqqara, outside Memphis (Fig. 1.20). This was also Egypt's first monumental construction in stone, no small factor in its survival through 4600 years. The complex is a large rectangle in plan, covering thirty-five acres, surrounded by a wall thirty-three feet high and a mile long (Figs. 1.21a,b). There is only one entrance, a small door in the southeast corner that leads into a narrow colonnaded processional hall. At the end of the hall, one enters the main courtyard dominated by Djoser's stepped pyramid, which rises 197 feet above its 397-by-358-foot base. Begun as a mastaba, the pyramid was built up in several stages to attain its present shape, a mass rising in six steps. The exterior of the pyramid was faced with dressed limestone, while the courtyards and surrounding buildings are thought to be representations of Djoser's earthly palace in Memphis, rebuilt here to last for eternity. The appearance and typical details of the original materials are imitated in stone: reed-bundle and papyrus-stalk columns, log ceilings, even a stone hinge for an immobile stone door. North of the pyramid is the mortuary temple in which the pre-burial ritual was performed. A statue of Djoser looking outward sits in a small chamber, with a small aperture cut in the wall in front of the statue's stone eyes being the only access to the outside world.

Djoser's complex includes areas for the practice of rituals that are not completely understood today but that were apparently important symbols of the bond between Upper and Lower Egypt. The great court was the scene of the Heb-Sed race, run annually by the pharaoh to ensure fertility of the fields. The course consisted of four circuits of the court in each direction, clockwise for half of the kingdom and counterclockwise for the other half. Djoser had two burial chambers to symbolize his power and paternity over Upper and Lower Egypt. One chamber, located beneath the pyramid, contained his mummy in an alabaster coffin. The access passage was blocked by a stone plug six feet in diameter and weighing six tons, but this was inadequate protection against robbers, who nonetheless gained access to the tomb in antiquity. In 1928 excavators discovered the second chamber in the south side of the perimeter wall. Although it too had been plundered, the chamber originally contained the embalmed internal organs of the pharaoh, emblematic of his fertility and his protection of Lower Egypt. Grave robbers did not steal the handsome blue **faïence** wall decorations, which are now all that remains of the interior. These tiles are set into horizontal and vertical stone members to represent rush matting between wooden slats attached to larger wooden supports. On one wall is a relief carving depicting Djoser running the Heb-Sed race. Wearing the white crown of Upper Egypt, Djoser is portrayed in the manner peculiar to Egyptian art, with head, legs, and feet shown in profile and the torso shown frontally. In this one view Egyptian artists captured the essential features of the human body with great exactitude, even though the pose is not a "realistic" or natural one.

From its beginnings at Saqqara, the evolution of what we now think of as the "true" pyramid proceeds through at



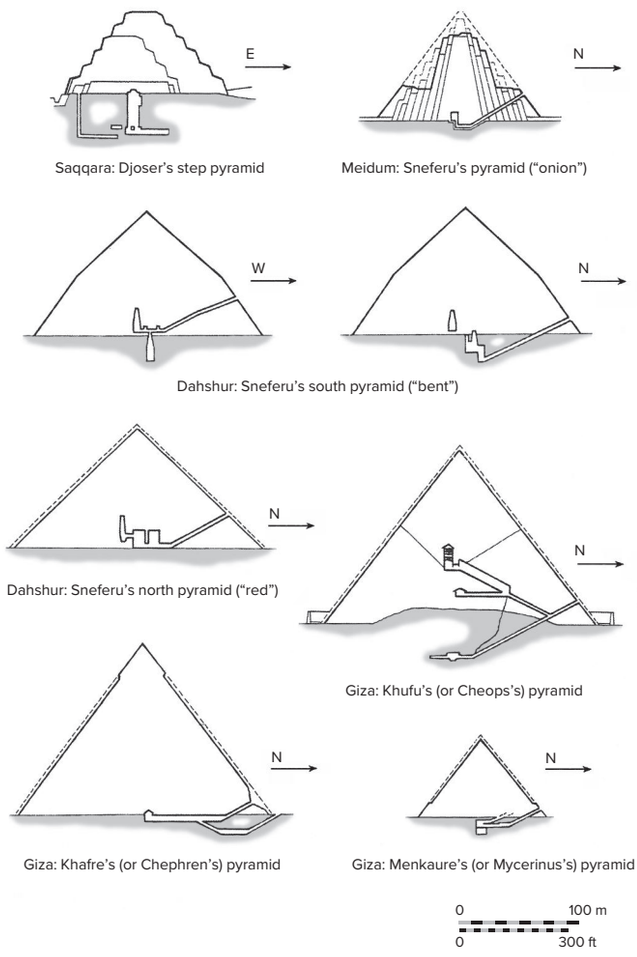
1.21a Plan of Djoser's funerary complex, Saqqara, Egypt, ca. 2630 BCE. The stepped pyramid is the rectangular element in the center, dominating the Great Court, which is reached through the narrow Processional Hall at the lower left. The Egyptians provided the court's two B-shaped stone blocks so that Djoser's *ka* could continue to run the ceremonial race between them, symbolizing for eternity the governmental unity of Upper and Lower Egypt.



1.21b Section and plan of the stepped pyramid, Saqqara, Egypt, ca. 2630 BCE.
The section drawing shows the successive stages of construction, through which the original mastaba form was enlarged to become a pyramid, with the burial chamber under the center. The plan drawing shows the industry of later tomb robbers who tunneled in to recover treasure buried with Djoser.

least three major projects before its culmination in the Fourth-Dynasty tombs at Giza, outside Cairo (Fig. 1.22). All three of these developmental pyramids were built or modified for one of the first pharaohs of the Fourth Dynasty, Sneferu (2575–2551 BCE), whose cult remained active for over 2000 years after his death. At Meidum, six miles south of Saqqara, Sneferu added an outer layer to the pyramid that may have been begun for Huni, the last pharaoh of the Third Dynasty. It began with a stepped core of seven stages, which was transformed into a true pyramid with the addition of two overbuildings. As the third and final outer casing of limestone was being installed, there is evidence that the upper portions of the work collapsed because the pyramid's stonework was insufficiently supported, given the relatively steep angle of inclination (51° 50′ 35″). Had it been completed as planned, the pyramid would have reached nearly 302 feet in height. As it stands, with its stepped core rising above the rubble, it has been given the descriptive name of an "onion" pyramid. Entrance was through a sloping corridor opening off the north side, descending below ground, and then rising a short distance vertically to the burial chamber at the center of the pyramid's base. Corbeled construction in the vault of this chamber marks the first time this technique was employed in stone by the Egyptians, although it had been used earlier in brick.

The collapse of the Meidum pyramid had an impact on another of Sneferu's pyramids under construction at the same time at Dahshur, about twenty-eight miles south of Meidum. There, a partially finished structure was transformed to create the so-called bent pyramid that began with a 616-foot-square base and sides inclined at 54° 27′ 44″. Observing the collapse at Meidum, the builders at Dahshur changed to a lower inclination angle of 41° 22′ when the pyramid was half-built. Eventually reaching a height of 344 feet, the bent pyramid gains added stability from its firm limestone foundation and core, large stone casing blocks that are slightly inclined to the center, and the reduced angle of inclination. These stabilizing design features were incorporated from the beginning in the third pyramid of Sneferu, the north or "red" pyramid, also at Dahshur. (The color name derives from oxidation of the limestone used for its core, exposed after stone scavengers removed the white limestone casing.) From a base 722 feet square, the north pyramid rises at a constant 43° 22′ angle to its apex 344 feet



1.22 Sections through pyramids at Saqqara, Meidum, Dahshur, and Giza, Egypt, ca. 2550–2460 BCE.
These drawings indicate the relative sizes of the major pyramids from the Third and Fourth dynasties. That of Cheops remains the largest pile of stones ever assembled, and, among the pyramids, it also has the most complex array of interior passages and chambers.

above the ground. Its profile is thus relatively low, a testimony to the conservative attitudes of its designers.

Fourth-Dynasty Pyramids at Giza

The trio of large pyramids at Giza (2550–2460 BCE) are the work of Sneferu's descendants, the Fourth-Dynasty pharaohs known as Khufu, Khafre, and Menkaure (or Cheops, Chephren, and Mycerinus in Greek transliteration) (Figs. 1.23–1.24). The largest pyramid of Khufu, who reigned 2551–2528 BCE, was built first and planned from the start to be a true pyramid of unprecedented proportions. The 755-by-755-foot base covers over thirteen acres; the sides rise at an angle of 51° 50′ 40″ to an apex at 481 feet. Most of the stone in the pyramid is limestone, although the large pharaoh's chamber in the center is made of granite. Nothing built in stone before or since has rivaled the Great Pyramid of Khufu for sheer size.

Khufu's pyramid is not completely solid, however. Three burial chambers are built within it, one excavated out of foundation bedrock and the other two constructed as the stone mountain was erected. Although these were once thought to represent changes made in design as work progressed, they are now interpreted as deliberate accommodations. The roughly finished lowest chamber is thought to represent the underworld. The middle chamber, the so-called Queen's Chamber, probably contained an over life-size statue of Khufu and served as his spirit chamber, or serdab. The top, or King's Chamber, beautifully constructed of red granite, contains a granite sarcophagus in which Khufu was in fact buried. To transfer the tremendous weight of the pyramid around the ceiling of the King's Chamber, eleven pairs of granite beams were set as a gabled brace or saddle roof extending into the mass of the pyramid above the chamber. Five massive sets of horizontal granite slabs form relieving chambers stacked between the saddle roof and the flat ceiling of the crypt as a means of reducing weight and pressure from above. The corbeled gallery leading to this chamber is also a construction marvel, rising twenty-six feet in height, a splendid contrast to a four-foot-high ascending passage to which it connects.

Both the King's and Queen's chambers have pairs of small shafts angling upward through the mass of the pyramid that may have been intended for ventilation. Their particular orientation implies connection to the pole star (north side) and Orion (south side), although the precise function and symbolic meaning of these ventilation shafts remain unclear.

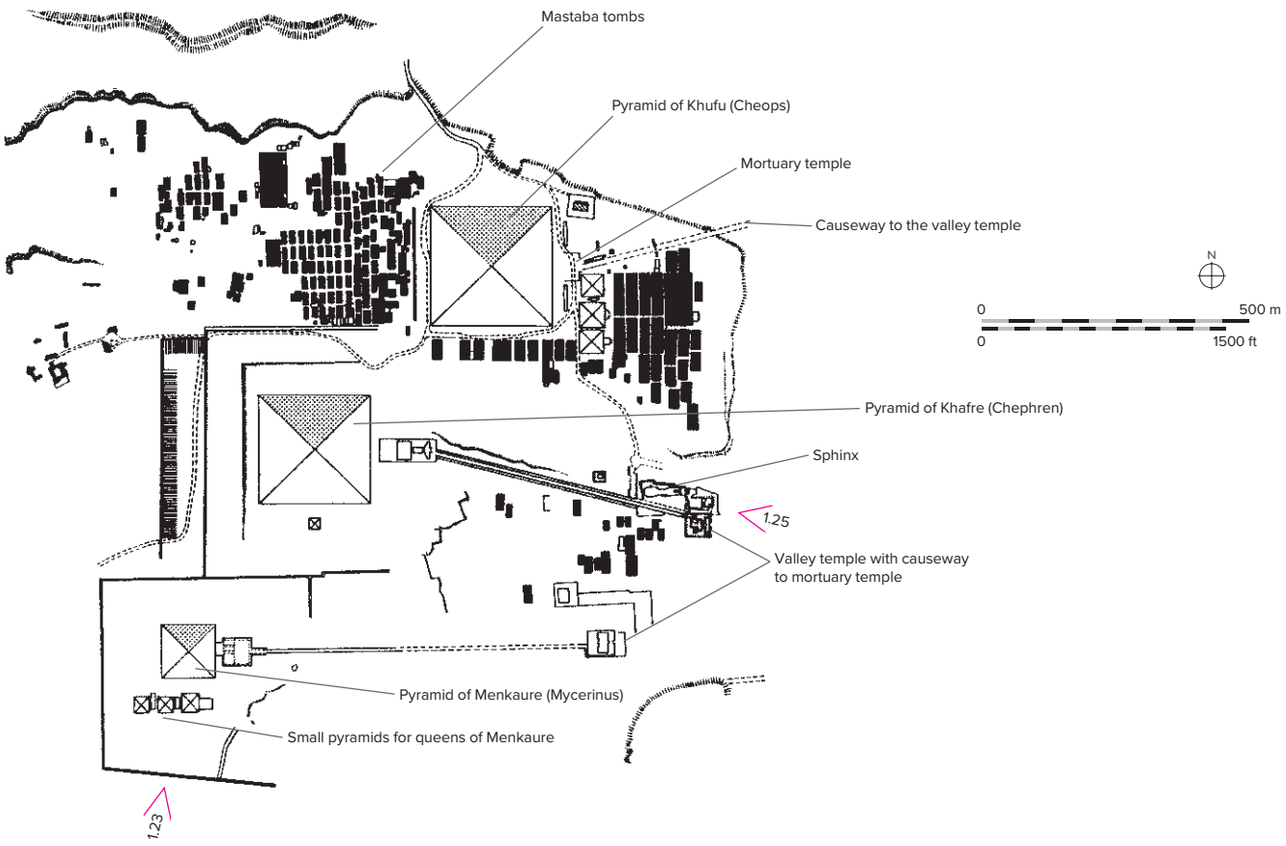
Next in sequence of construction (and only slightly smaller in size) is the pyramid of Khafre, a son of Khufu, who reigned 2520–2494 BCE. Khafre's pyramid is 705 feet square at the base and rises at an angle of 53° 20′ to an ultimate elevation of 471 feet. In many photographs of the Giza pyramids, this one seems the tallest of the three, but this is only because it stands on higher ground than that of Khufu. Khafre's monument is readily distinguished by the substantial fragment of the original smooth limestone casing that survives at the apex. On the inside there is a single tomb chamber in the center of the pyramid at the base level. A passageway in the north side provides access to the room, which, like all the tomb chambers in pyramids, was pillaged in ancient times.

The smallest of the Giza trio of major pyramids belonged to Menkaure, a son of Khafre who reigned 2490–2472 BCE. Containing less than one-tenth of the amount of stone of Khufu's pyramid, Menkaure's tomb seems to have been erected hurriedly and with less care than those of his predecessors. We know that it was not finished before Menkaure died. Its dimensions—335 by 343 feet at the base, a slope of 51° 20′ 25″, and 213 feet high—maintain the general proportions established by the neighboring tombs. Menkaure's successor, Shepseskaf, the last pharaoh in the Fourth Dynasty, chose not to have a pyramid burial, and although pyramids continued to be built by later rulers, the quality and scale of the Giza trio were never exceeded.

Associated with each of the pyramids were ancillary temples that are now largely ruins. Alongside the Nile was a lower or valley temple, where the boat bearing the pharaoh's body would land to disembark its royal cargo. The valley temple may have been the place where the process of mummification took place, although the evidence is not entirely clear on this point.

1.23 (above) Pyramids, Giza, Egypt, ca. 2550–2460 BCE.
Khufu's pyramid is the farthest back, to the right of Khafre's pyramid (distinguished by the remnant of outer casing stones at its peak). In front of Khafre's pyramid is that of Menkaure, while three much smaller pyramids in the foreground belonged to queens of Menkaure.
Dan Breckwoldt/Shutterstock

1.24 (below) Site plan of the pyramids, Giza, Egypt, ca. 2550–2460 BCE.
Khufu's pyramid in particular has a large number of subsidiary tombs located to the west of it, including smaller pyramids and mastabas for members of the court. Khufu's pyramid has the best preserved valley temple and causeway. Note the position of the Sphinx to the north of the causeway leading to Khafre's pyramid.



1.25 Khafre's pyramid and the Sphinx, Giza, Egypt, ca. 2550–2460 BCE.
Remains of the entrance to Khafre's valley temple are visible to the left.
Ravi Tahilramani/Getty Images

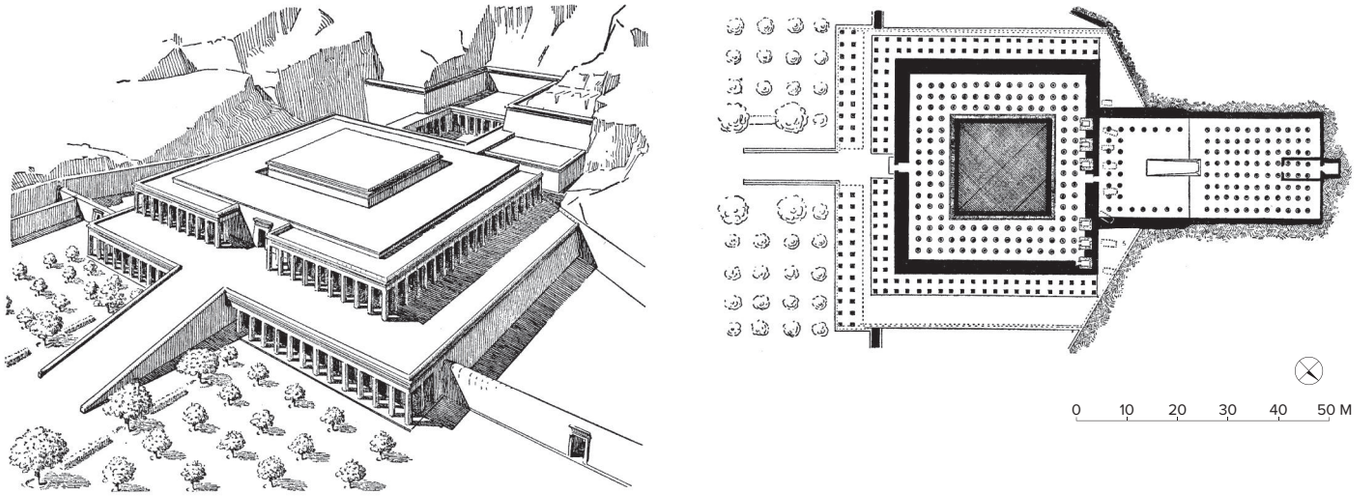
A causeway connected this valley temple to the upper or mortuary temple at the base of the pyramid itself. Here the corpse would receive a final ritual cleansing prior to entombment.

Of all the Giza valley temples, the lower temple of Khafre remains in the best state of preservation. Essentially square in plan, with thick limestone walls encased in red granite, its central hall is an inverted T-shape. Red granite **piers** supported a roof with a **clerestory**; the windows were set so that sunlight coming through them illuminated the twenty-three statues of the pharaoh placed around the edges of the wall. Two levels of narrow storage rooms extended into the solid wall mass. Today the temple stands without a roof or its outer stone facing beside the **Sphinx**, a man-headed lion 187 feet long and sixty-six feet high, carved in situ out of a natural rock ledge (Fig. 1.25). (It has long been presumed that the head on the Sphinx was a likeness of Khafre, but this cannot be proven. Recent speculation that the Sphinx may be significantly older than the pyramids is not generally accepted by Egyptologists.) Khafre's mortuary temple at the base of the pyramid is connected to the valley temple by a causeway running at an oblique angle to the river. The mortuary temple is rectangular in plan, with a series of axially disposed interior spaces. Its limestone structure was probably cased with a finer material, and the floor was alabaster. At the center of the temple was a large courtyard surrounded by enormous pillars, in front of which stood twelve large statues of the pharaoh.

Pyramids, especially the impressive Giza group, have long provoked two questions: How could ancient peoples, working with simple technologies, have built such enormous structures, and why would they have built them? The answer to the first question can be reasonably surmised, although this is still an area of study. Even though the Egyptians lacked metals harder than copper and made no use of the wheel for transport, they were not primitive. Their knowledge of surveying, necessary for reestablishing field boundaries after the annual flood, enabled them to lay out the pyramid's base accurately and to orient the square plan to the cardinal directions. Khufu's pyramid deviates only five and a half minutes of arc from true north; its summit is only one foot off the center of the base; and there is only an eight-inch error in the length of one side of the base. The absence of wheeled vehicles was not a serious handicap, as much of the stone transport would have been made over water or across sand, where wheels would have provided no real advantage over the boats and sledges actually used. Quarrying was accomplished with metal saws for the softer limestones or sandstones, and by repeatedly pounding balls of very hard rock (dolerite) along seams in the harder stones such as granite. The finishing of cut surfaces could be accomplished with stone hammers, chisels, axes, and sand or grindstones. By any method, quarry work was both tedious and backbreaking, and it was probably assigned to prisoners or conscripts. Much of the limestone in the core of the Giza pyramids was quarried on-site. Finer display stone and granite was transported from more distant locations.

Construction of the pyramids was probably done by large teams of laborers during the flood season when agricultural work was impossible. The muscles of men supplied the force to haul blocks into place. Studies of ruined or incomplete pyramids have revealed that there was no single construction method used; least of all is known about the most complete monuments, the Giza trio, because their interiors cannot be inspected closely. In some cases, ramps were erected along with the rising masonry mountain to provide an inclined plane for dragging stone on sledges. It is also possible that the rising stepped core of the Giza pyramids served as a construction staircase for workers pulling and leveraging the blocks onto the upper levels, as the volume of material needed for additional ramps on these enormous buildings and the difficulty of hauling stone around corners would make inclined planes impractical. While the number of men and length of time required to see a major pyramid through to completion are still subject to debate, the Egyptians' ability to organize labor forces and quarrymen in seasonal building campaigns remains a fact and a tribute to the abilities of their engineers.

The question of why the pyramids were built has inspired both serious inquiry and speculative nonsense. Theories ranging from embodiments of standard measures (as defined in English units) to apocalyptic predictions of the end of the world have been offered to explain the dimensional configuration of Khufu's pyramid, but Egyptologists are convinced that the pyramids were first and foremost tombs for the pharaohs. Why people should devote so much effort to what we might regard as a fundamentally useless project is answerable only within the context of the Egyptian worldview. Perhaps no other society before or since has invested so much time and labor to ensure survival after death for its most important



1.26 Reconstruction and plan of Mentuhotep's mortuary temple, Deir-el-Bahari, Egypt, ca. 2061–2010 BCE.
This Middle-Kingdom temple represents an interesting synthesis of an axial temple, hypostyle hall, and burial chamber into a single composition. Its ramps and stepped terraces would be echoed in the New-Kingdom temple of Hatshepsut built about 400 years later on an adjoining site.

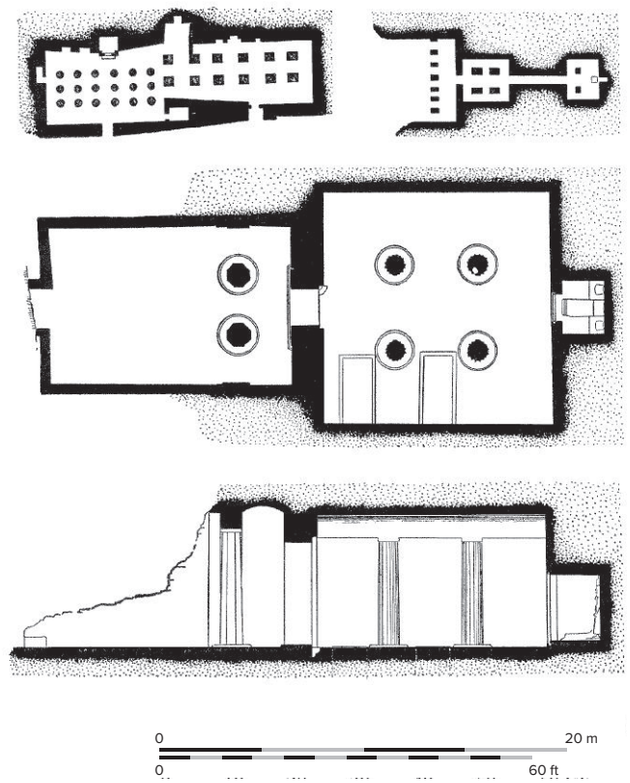
personages. Virtually all Egyptian art and architecture was very practical, intended to assist one's passage to the next world and ensure comfort and pleasant living upon arrival. While the greatest attention was lavished on the setting for the pharaoh's afterlife, all Egyptians believed in their particular view of eternal life and so all had a stake in the creation of an architecture of death and rebirth, from the modest tombs of the poor to the monumental edifices of the rulers.

The Middle Kingdom (Eleventh–Thirteenth Dynasties, ca. 2040–1640 BCE)

The first eight Egyptian dynasties gave way to a period of upheaval when local feudal lords upset the unity achieved by Menes. This era of interregional strife is designated the First Intermediate period, and it was followed by a second phase of centralized government called the Middle Kingdom. During this period, the royal capital was relocated from Memphis to Thebes, and the pharaoh's position was more that of a feudal lord over local vassals than an absolute and divine ruler in the Old-Kingdom tradition. Royal tombs were still of major architectural importance, but Middle-Kingdom tombs generally neither endured nor intimidated grave robbers.

The tomb of Mentuhotep II at Deir-el-Bahari (ca. 2061–2010 BCE) (Fig. 1.26) is an exceptional work of architectural innovation, combining temple and tomb chamber in a single composition. The complex, approached by an axial route from the Nile, had two levels of colonnaded terraces surrounding a masonry mass, long thought to have been a pyramid but more recently interpreted as a flat-roofed hall. (The building is a ruin today, so one cannot be sure of the initial design. The case for a flat-roofed hall is based on there being insufficient foundations to support even a modest pyramid.) The central **axis** continues through layers of square columns, through the flat-roofed hall, through a courtyard, and through a forest of columns until reaching Mentuhotep's actual burial vault carved in the rock cliff. The two levels of columns seen upon approach are dramatized by the contrast of their sunlit shafts with the shadowed recesses behind and anticipate Greek temples with their surrounding **colonnades**. Mentuhotep's tomb would serve as a prototype for the more elaborate adjoining funerary complex built by the New-Kingdom pharaoh Hatshepsut.

More typical of Middle-Kingdom tombs are those at Beni-Hasan, which are cut into rock cliffs and provided with sheltering **porticoes** (Fig. 1.27). Reflecting the political



1.27 Plan and section of rock-cut tombs, Beni-Hasan, Egypt, ca. 2000–1900 BCE.
Even when working amorphous rock, the builders chose to replicate rectangular geometries and to carve details reflecting the wooden and plastered reed construction that doubtless characterized houses. The lower of the two plans corresponds to the section.

1.28 Mortuary temple of Queen Hatshepsut, Deir-el-Bahari, Egypt, ca. 1473–1458 BCE.
In its day, this great temple, with planted terraces and dignified carved colonnades framed by the cliff face, must have been a restful oasis in the dry landscape, a fitting monument to the peaceful reign of Hatshepsut, one of the rare female rulers in antiquity.
Vladimir Wrangel/Shutterstock

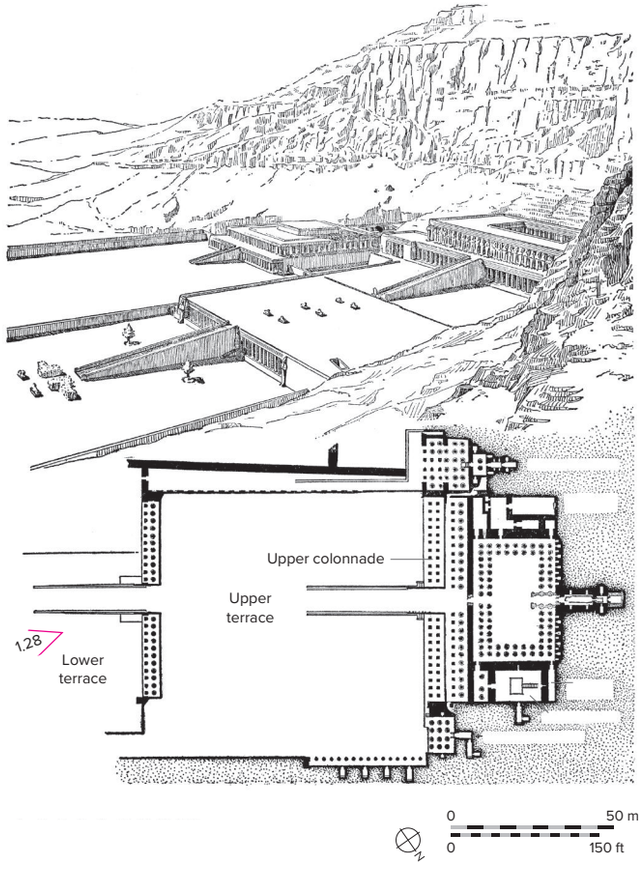
importance of their builders, these tombs were constructed for minor nobles and court officials, who evidently enjoyed considerable influence and wealth. Most of the architectural character was created by excavation, and the builders replicated spaces and details associated with ordinary dwellings, that is, wooden and plastered reed structures with slightly arched roofs composed of mats laid on a frame.

The New Kingdom (Eighteenth–Twentieth Dynasties, ca. 1550–1070 BCE)

The Middle Kingdom was terminated by the arrival of the Hyksos, shepherd-kings who may have come from Asia. Whatever their origins, the Hyksos were the first successful invaders of Egypt in centuries, and they ruled for about 100 years in what is known as the Second Intermediate period. They introduced metallurgy, the two-person chariot, new deities, and new weapons to Egyptian culture, but their rule produced no lasting artistic innovations. With the expulsion of the Hyksos came the New Kingdom, which was characterized by an invigorated dynastic line of pharaohs and an increasingly powerful hereditary priesthood who brought Egypt to new heights of political and cultural brilliance.

The Eighteenth Dynasty, the first of the New Kingdom, continued the Middle-Kingdom tradition of burial in rock-cut tombs, going a stage further by eliminating all suggestions of monumentality. It had escaped no one's notice that all the dynastic tombs had been successfully penetrated by grave robbers. The Giza pyramids were probably plundered during the First Intermediate period. To preserve the worldly remains of the pharaoh and thwart the thieves, Eighteenth-Dynasty builders relied on concealment and improved policing of the royal necropolis. New-Kingdom pharaohs were interred secretly in the desert wilderness beyond Deir-el-Bahari, a region known as the Valley of the Kings, where very modest chambers were hewn out of the cliffs, and the entrances were hidden by dirt and sand. Spiritual nourishment for the deceased was provided at increasingly elaborate separately erected funerary temples.

Among the most splendid of the Eighteenth-Dynasty temples is the funerary complex of Queen Hatshepsut (1473–1458 BCE) at Deir-el-Bahari (Fig. 1.28), notable both for its architecture and for the fact that its patron was a woman. Succession to the throne passed through the female line, but the pharaoh was almost always male. Hatshepsut was the daughter of Thutmose I, and she married her half-brother, who became Pharaoh Thutmose II. During his reign she relegated him to a subsidiary role, and after his death she ruled independently, though ostensibly as regent



1.29 (above) View and plan of Hatshepsut's mortuary temple, Deir-el-Bahari, Egypt, ca. 1473–1458 BCE.
To thwart thieves, New-Kingdom pharaohs arranged for their bodies to be buried in concealed tombs in the Valley of the Kings (behind these cliffs), where priests guarded against robbers. Mentuhotep's earlier tomb is seen just beyond Hatshepsut's monument.

for Thutmose II's son by a concubine, Thutmose III. Her court favorite was a commoner, Senmut, who was also responsible (perhaps as architect) for her funerary temple. Hatshepsut was buried on the other side of the mountain range in the Valley of the Kings, so the temple complex was a mortuary chapel dedicated to the god Amun, the sun god with whom the pharaoh was associated. Ramps lead up from the valley to three broad terraces, each defined by colonnades, which also serve as retaining walls for the next level (Fig. 1.29). The overall design was doubtless inspired by the neighboring temple of Mentuhotep, although Hatshepsut's temple is considerably larger and grander. Columns in the north colonnade of the second terrace are faceted in a manner suggesting the **flutes** of later **Doric** columns (Fig. 1.30). Relief carvings and wall paintings within the sanctuary spaces and in the great hall depict Hatshepsut's divine birth as the child of Amun and the activities of her peaceful reign, including trading expeditions to Punt (perhaps the Somali coast) bearing gold, ivory, baboons, and botanical specimens. Hatshepsut herself is usually depicted as a man, sometimes as the god Osiris, wearing the apron and headdress of a pharaoh.

Today they are sand-covered and barren, but in the Eighteenth Dynasty the terraces of Hatshepsut's temple were embellished with incense trees planted in earth-filled pits to create a garden for Amun's promenades. Buried irrigation pipes supplied water to sustain the plants, and priests placed tributes to the god in the shade beneath the branches. The entire setting of the temple, from the axial-ramp approach to the termination of the processional way at a false door painted on the wall of the final rock-hewn sanctuary, is a masterly blending of architecture into a dramatic landscape including rugged cliff faces. Although Hatshepsut reigned and died peacefully, her successors did everything possible to

1.30 (right) Upper colonnade (detail), Hatshepsut's mortuary temple, Deir-el-Bahari, Egypt, ca. 1473–1458 BCE.
Behind the rectangular piers are cylindrical columns with fluting that has led to their being called proto-Doric. Certainly they are evidence of Egyptian precedent for what in Greek hands would become an aspect of the orders of architecture.
zbg2/Getty Images

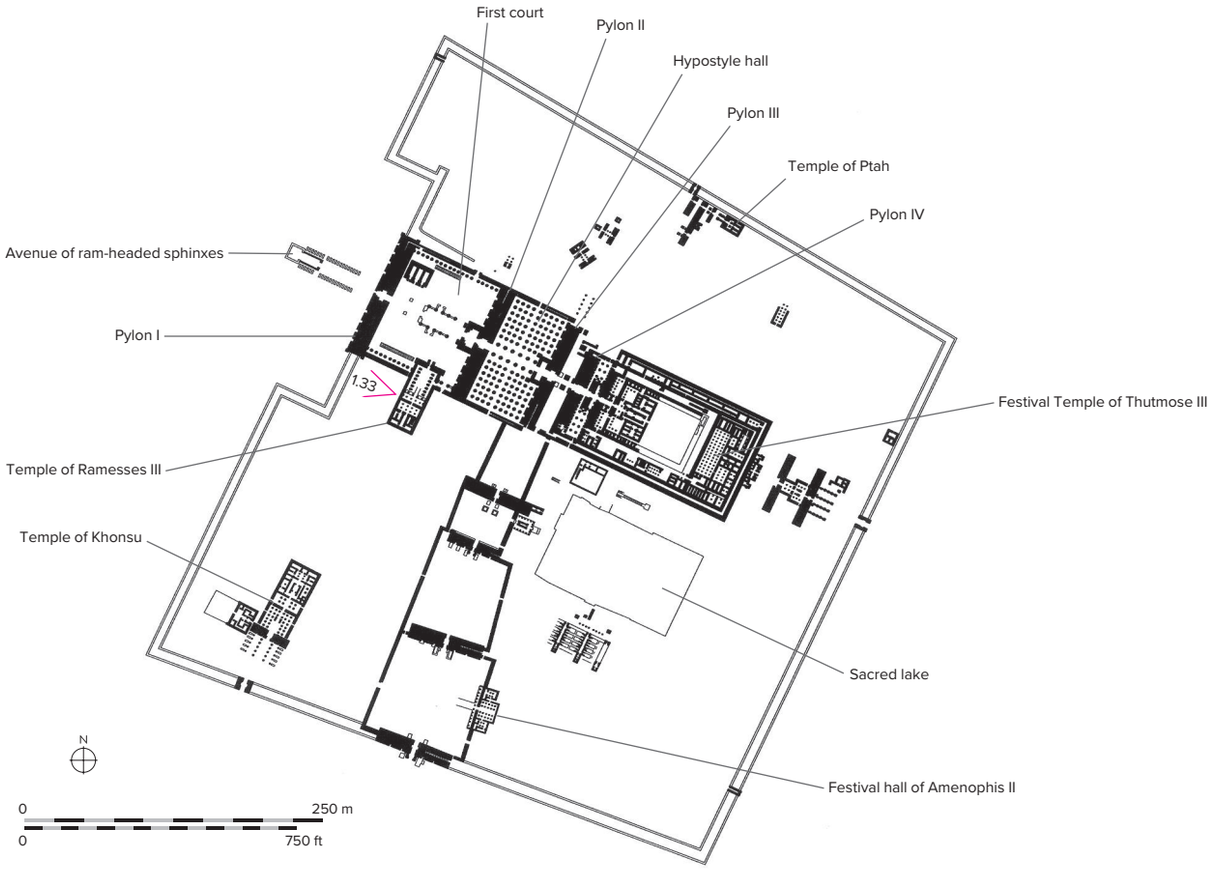
eradicate her memory, erasing her name from inscriptions, smashing almost all of her sculptural representations, and desecrating the burial site of Senmut.

In the course of the Eighteenth Dynasty, temple complexes built to honor both gods and pharaohs became more extensive and elaborate, aided by the establishment of Amun as the main "state" god and the increased power and influence of his priesthood. Successive rulers would add new portions or renovate older temples, creating designs whose chief attribute was overbearing grandeur, not coherence or esthetic delight. The temple at Karnak, across the Nile from Deir-el-Bahari, is an example of this process (Fig. 1.31). Begun about 1550 BCE, it was enlarged by Thutmose I, enriched by obelisks given by his daughter, Hatshepsut, and again expanded with a hypostyle jubilee festival hall constructed by Thutmose III for his own glorification. Yet another hypostyle hall, the largest of all, was built by Ramesses II.

Hypostyle halls are sizeable chambers created by rows of large columns placed closely together. The tight spacing was necessary to support the stone lintels of the roof, while the large column diameter reflected the substantial height of the stone cylinders. The net effect was a dimly lit interior without a sense of spatial expanse. Daylight admitted through slits in the stone clerestory grilles filtered through the incense smoke and the upper volume of the hypostyle columns to create a sense of mystery, the desired effect for religious ritual. The temple was the habitation of the god, who was sheltered, clothed, and fed by the priests, by now a powerful and largely hereditary group. Each day the priests performed purification rites in the sacred lake within the temple precinct, dressed the statue of the deity in rich garments, and presented it offerings at the evening ritual. They carried small statues in processions and placed others in the sun for rejuvenation in special festivals, such as those marking the beginning of the New Year. Monumental masonry entrance gates or **pylons** (Fig. 1.32) lined processional routes to represent the eastern mountains of Egypt through which the divine early-morning sunlight emanated. Despite their rambling plans and numerous additions, New-Kingdom temples maintained axial circulation spaces for the penetration of solar rays and the movement of priestly processions (Fig. 1.33). The pylon gates were not only symbols of the entrance through which the sun was reborn each day but also of the gates to the underworld through which the eternal spirit must pass.

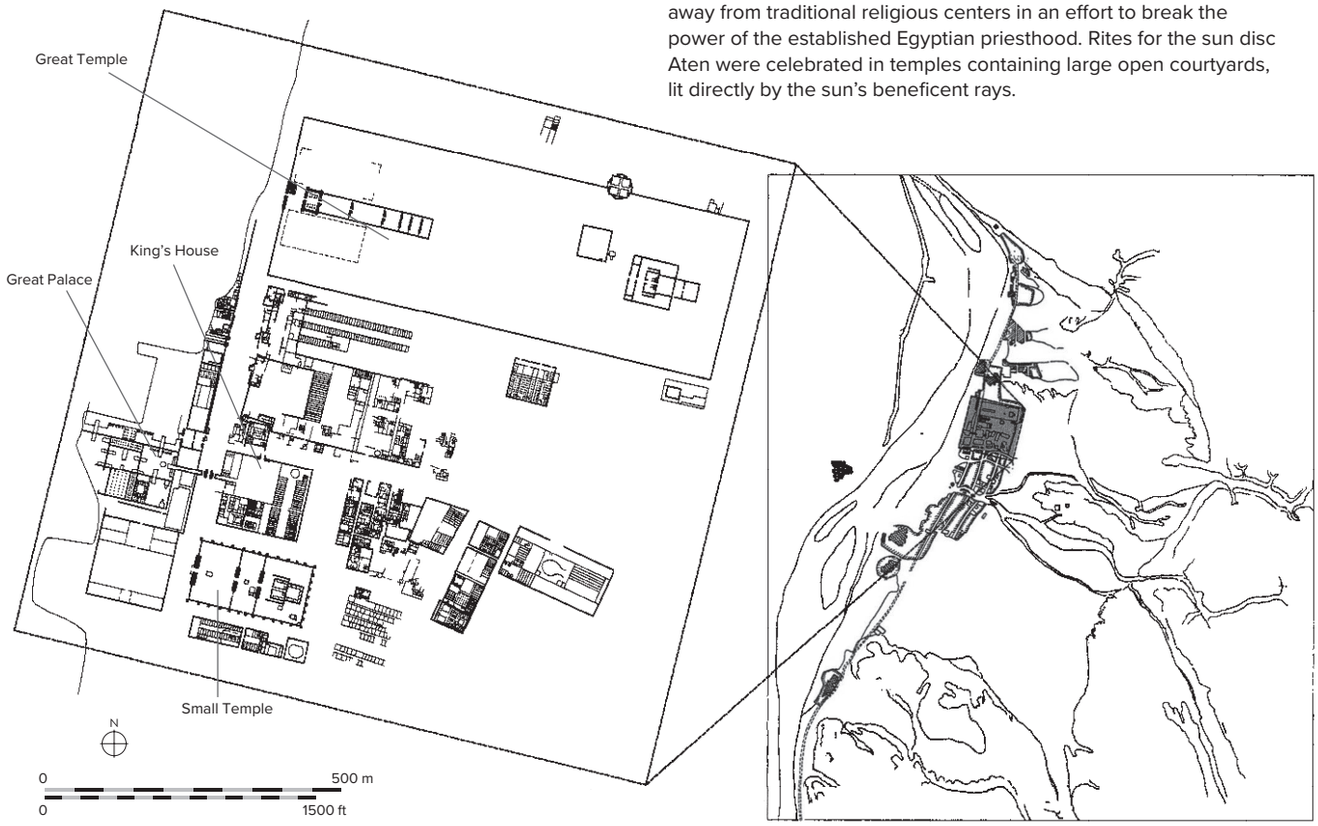
Five generations after Hatshepsut, the pharaoh Amenophis IV (1353–1335 BCE) made a major break with Egyptian religious tradition by disavowing the multitudes of deities and instituting a monotheistic religion devoted to the sun disc

1.31 Plan of the Great Temple of Amun, Karnak, Egypt, begun ca. 1550 BCE.
This temple is celebrated more for its sheer size than for its architectural coherence. Dedicated to the sun god Amun, whose priesthood was powerful during the New Kingdom, the temple maintained a strong sense of axiality and monumental procession through all its additions.



1.32 (above) Pylon gateway, Temple of Edfu, Egypt, 237–57 BCE.
While this pylon dates from the Ptolemaic period after Alexander the Great conquered Egypt, it is similar in form and purpose to those at Karnak. Such a spatial threshold signified the increasing sacredness of the space beyond. The four vertical slots once held obelisks.
Ostill/Getty Images

1.33 (below) Aerial view, Great Temple of Amun, Karnak, Egypt, begun ca. 1550 BCE.
Massive columns and obelisks define an axial path (lower left to upper right), culminating in the Festival Temple of Thutmose III. In the foreground, giant stone lintels span from column to column in the hypostyle hall.
Michael Poliza/Getty Images



1.34 Plan of the central section, Akhetaten (Tell-el-Amarna), Egypt, ca. 1350 BCE.
This was the new capital city of the pharaoh Akhenaten, located away from traditional religious centers in an effort to break the power of the established Egyptian priesthood. Rites for the sun disc Aten were celebrated in temples containing large open courtyards, lit directly by the sun's beneficent rays.

Aten. Changing his name to Akhenaten, which means "all is well with Aten," Amenophis abandoned the old capital at Thebes about 1350 BCE to establish a new capital 300 miles to the north at Akhetaten (the modern Tell-el-Amarna). Judging from incomplete excavations of its ruins, Akhetaten was a linear town nearly seven miles long, bounded on the west by the Nile and on the east by mountains, and lacking a consistent overall plan. Transportation was facilitated by the waterway, and a river road linked the various residential sections (Fig. 1.34). Temples had altars set in open courtyards, and there were no segregated areas for the priest class. Private houses of the wealthy were commodious, walled off from public view, with rooms grouped around open courts with tree-planted gardens. Thick mud-brick walls moderated the extremes of heat and cold. No wall surrounded the city, protection being provided by freestanding guardhouses.

CONCLUSIONS ABOUT ARCHITECTURAL IDEAS

Throughout this chapter, you have seen certain fundamental architectural ideas appear that will be consistently used during every era in every geographical location covered by this text. These ideas have to do with such issues as demarcation, orientation, sequential movement, and surface articulation. A site like Newgrange in Ireland encompasses all of these, as it marks a significant spot, is aligned with cosmic events, involves a path (in this case from profane to sacred space), and includes ornament. In Mesopotamia and Egypt, the ziggurats and pyramid complexes exploited open terrain where the horizon was inescapable. Stepped, then true pyramids became manmade vertical foils for the natural horizontal, and in Egypt the pyramids were eventually superseded as vertical markers by the obelisk. Within both the ziggurat and pyramid environments, participants moved along an axis, toward a terminus, with architectural incidents like gateways providing a rhythm and signaling changes in spatial significance. The principles remained the same at both Middle and New Kingdom funerary complexes, where giant columns emerged as interior architectural features. While the pyramids exhibit a monolithic skin, the surfaces of ziggurats were articulated by means of brick bands and polychromatic glazes. At the funerary temple complexes of Mentuhotep and Hatshepsut, wall articulation evolved to the level of proto-columns, and columns will be the principal elements in the classical architectural language of the ancient Greeks and Romans discussed in coming chapters.

Chapter 2
The Greek World

"Surely, then," wrote the Greek philosopher Plato in *The Republic* (360 BCE), "to him who has an eye to see, there can be no fairer spectacle than that of a man who combines the possession of moral beauty in his soul with outward beauty of form, corresponding and harmonizing with the former, because the same great pattern enters into both." Plato was expressing a commonly held view in ancient Greece: that inward conditions could be expressed through outward appearances and so that moral and ethical matters were intrinsically related to art.

A fundamental means by which the Greeks attempted to communicate this unified view of the world was through proportional relationships. This effort is illustrated by a perhaps apocryphal story involving the Greek mathematician Pythagoras. As the story goes, he was walking past a blacksmith shop as the sounds of hammer to metal came from within. Listening to the tonalities and atonalities, he posed a question: could musical harmonies somehow have a mathematical basis? In order to form an answer, he experimented with the strings of a lyre and discovered that pleasing combinations resulted when two strings with their lengths related by simple ratios, such as 1:1, 1:2, 2:3, 3:4, and 4:5, were simultaneously struck. Here, in the mind of a mathematician, was a glimpse into the very ordering of the cosmos, and it was a short step from audible musical harmonies to dimensions and their ratios or proportions in the visual world.

While we may not accept this condition as an absolute today, we can first say without doubt that beauty mattered to the ancient Greeks and that their culture reached a consensus about it; witness, for instance, the "family resemblance" of so much Greek sculpture. Second, by extending this notion to architecture, we can see that the outward beauty of a Greek building was largely derived from the dimensions of its parts and their relationships to one another. Third, we can appreciate that when proportional beauty was achieved, it yielded in the Greek mind a kind of microscopic view into the inner workings of the cosmos. Heady stuff! Fourth and finally, we can also observe that the Greeks extended such philosophical thinking to the workings of their society. If proper proportioning applied to outer physical beauty, and it also applied to inner moral beauty, this meant that the proper behavior of a Greek citizen (a freeborn male) demanded proper proportioning (or perhaps balance is the better term) in the actions of his life. That is, the good citizen was certainly not to become one of those specialists (like a stonemason or even an architect) made possible by urbanization but was to participate fully and proportionally in the life of the **polis**, or city-state.

And so we can go full circle. The health of the polis demanded balanced lives from its citizens; this balanced life was encoded into the very fabric of ancient Greek temples through proper mathematical proportions and, in turn, these buildings reminded citizens of their proper moral and ethical behavior. The Greek temples became great billboards communicating and reinforcing commonly held values and reflecting the culture's greatest accomplishments and highest aspirations. With this in mind, we can begin our study of Greek architecture by turning first to those Aegean civilizations that preceded classical Greece.

THE AEGEAN CULTURES

The Aegean Sea, bounded by the peninsula of Greece on the west, the mountains of Macedonia on the north, and the coast of Anatolia on the east, is studded with numerous islands. To the south is the island of Crete. By the beginning of the second millennium BCE (about the time of the Middle Kingdom in Egypt), the seafaring people of this region had learned how to exploit natural resources, such as timber, stone, metallic ores, and clay for pottery, to produce distinctive artifacts. With these, in addition to other agricultural products, they engaged in trade with Egypt and settlements along the eastern Mediterranean, where they constructed small fortified communities and agricultural villages on islands and along the coast.

An examination of Aegean artifacts suggests strong influence from Mesopotamia as well as contact with Egypt.

Chronology

Minoan civilization	ca. 3000–1380 BCE
Bronze Age in the Aegean	ca. 2000–750 BCE
Mycenaean civilization	1600–1100 BCE
Trojan War	ca. 1250 BCE
Iliad and *Odyssey* assume final form	8th century BCE
Archaic Greek period	700–500 BCE
Classical Greek period	479–323 BCE
Pericles comes to power in Athens	458 BCE
Construction of the Parthenon	448–432 BCE
Life of Plato	ca. 427–347 BCE
Conquests of Alexander the Great	333–323 BCE

North entrance of the palace, Knossos, Crete, ca. 1700–1380 BCE. This section has been partially restored, including the unusual Minoan columns with bulbous capitals and downward-tapering shafts.
Banet/Shutterstock

Early Cretans worshiped nature deities associated with mountains, trees, and animals (most notably snakes), as well as flowers, including lilies and poppies. Since there are no snakes on Crete, the snake cult appears to be an imported practice, probably derived from the Sumerian water god Ea, whose attributes included creativity, wisdom, magic, and slyness. Bull-baiting was a sport of the Sumerians, and bull-jumping seems to have become a ritual game in Crete. Lions were associated with royal symbolism in both Egypt and Mesopotamia, and lion images also came to be used in fortified royal settlements on the Greek mainland. Egyptian artifacts from the Eighteenth Dynasty have been retrieved from the harbor at Kairatos, Crete, and 1300 pieces of Aegean pottery dating from 1370 to 1350 BCE have been excavated from the rubbish heaps of Akhetaten.

Historians recognize two civilizations in the Aegean during the second millennium: that of the Minoans, based on Crete, and that of the Mycenaeans, established at several sites on the mainland of Greece. They share some artistic and cultural traits, including a reliance on trade with other communities in Egypt, Mesopotamia, Asia Minor, and Cyprus. Both produced luxury goods that were traded extensively around the eastern Mediterranean—Minoan envoys bearing characteristic pottery from Crete are included in Egyptian wall paintings from the reign of Queen Hatshepsut—and Mycenaean sites were involved in the Trojan War (ca. 1250 BCE), chronicled by Homer in the *Iliad*. Both civilizations contributed to the cultural patrimony of classical Greece.

THE MINOANS

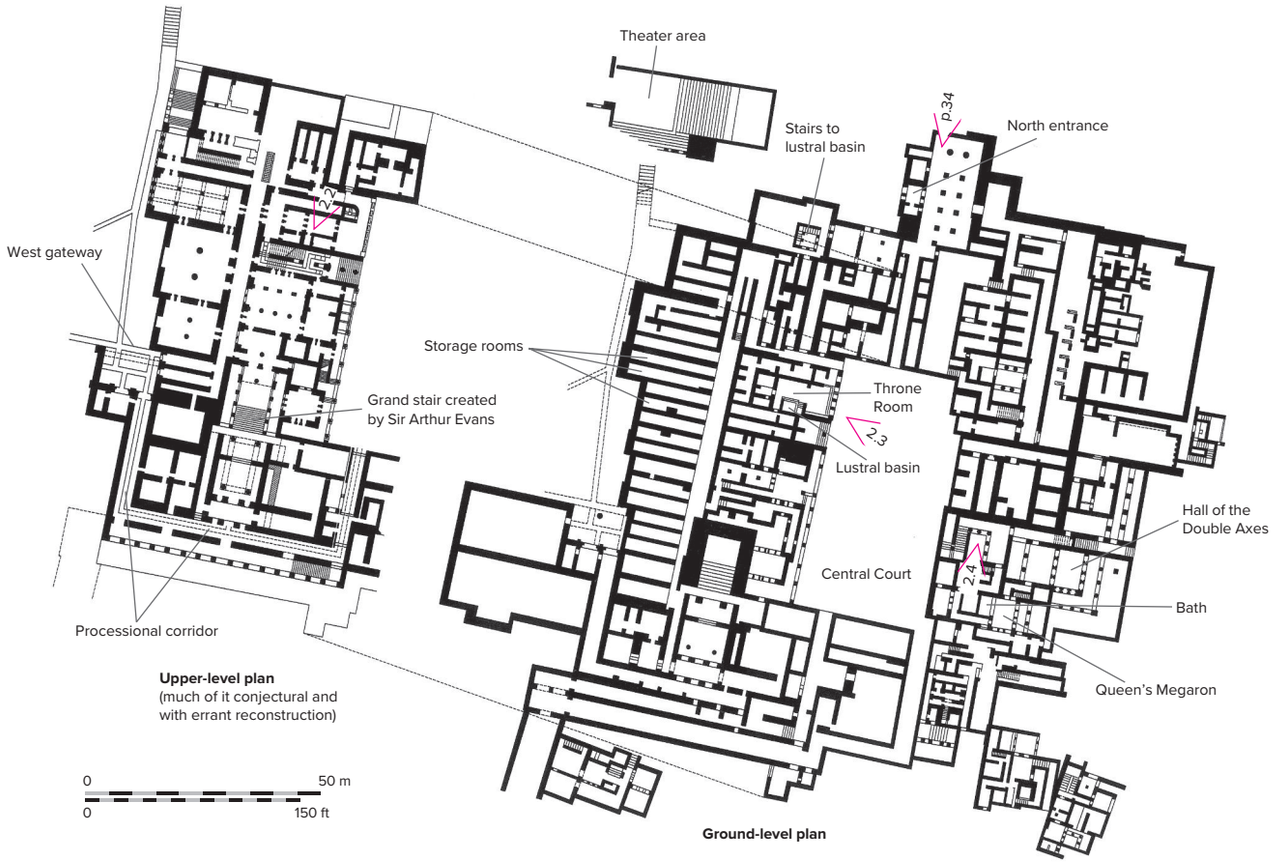
Most of what we know about the Minoan civilization comes from archaeologists, who are still making discoveries and reinterpreting older finds as a result of analysis with more sophisticated scientific tools. Not surprisingly, there is more than one theory related to the development and demise of the Minoans.

The civilization is named for Minos, which might be the name of an early king or simply the title (like pharaoh) that denoted a ruler. The later Greeks created legends associated with King Minos and his palace and **labyrinth** at Knossos, where the fearsome Minotaur, half-man and half-bull, that ate youths and maidens lived. Although numerous Minoan sites have been excavated on Crete, Knossos remains the largest and best known. Four thousand years of Neolithic settlements lie under this Minoan site, which began in about 1900 BCE as a series of detached structures erected around a large rectangular court. When these were destroyed by a major earthquake in about 1700 BCE, the complex was rebuilt in a unified scheme on multiple levels, with ritual or ceremonial rooms, storage areas, and living accommodation connected by long corridors and staircases built around light-wells, open cores that admit sunlight to the lower levels. The courtyard continued as the primary element in the composition. Tablets inscribed in Linear A, a script that has still not been deciphered, appear in the archaeological record in about 1600 BCE. In about 1450 BCE, Knossos and all other Minoan palaces on Crete were destroyed, but Knossos alone was rebuilt. Traces of Mycenaean cultural influences, including writing in the script known as Linear B, an early form of Greek, are found in the rebuilt palace, suggesting either collusion or a forced alliance between Mycenaeans and the Cretans at Knossos. The final destruction of the site, this time by fire, came in about 1380 BCE.

Understanding the extensive ruins at Knossos is no easy task (Fig. 2.1). Sir Arthur Evans started excavations at the ceremonial center in 1900 CE. Archaeological investigation continues on the site today, and the associated town has yet to be unearthed. Evans was confident that he had found the palace of the legendary King Minos, but his chronology and efforts at reconstruction are now regarded as flawed and a recent assessment suggests that what Evans found was actually a sacred center. The function of the building may in fact have changed from a temple to a palace in its final years, but **frescoes** depicting priestesses and celebrants suggest the continuing centrality of religious practice. The charred remains of the final buildings present ambiguous evidence at best. While parts of the lower levels of the building were built in **ashlar** masonry, most of the upper floors were supported on walls built of rubble contained within squared timbers, wooden columns, and large wooden beams, the combustible portions of which were consumed in the conflagration. Evans relied on impressions of the **bases** and capitals where these touched stone to reconstruct the characteristic Minoan column, a downward-tapering shaft with a bulbous **torus** ring and **abacus** block capital (see page 34). (The columns on-site today are concrete.) On the basis of what he found, Evans also reconstructed major ceremonial rooms and several light-wells (Figs. 2.2–2.3).

Even after considerable study, however, the function of the whole complex is a matter of scholarly deliberation. Storerooms containing pottery jars for wine, oil, olives, and grain are unmistakable, but the function of other sections of the building, where several stages of construction can be detected, is still conjectural. The appearance and uses of the upper floors we cannot know, so photographs of the site today can only begin to suggest the grandeur that must have characterized the whole. When one realizes that the mainland Greeks of this period were living in far simpler buildings, it is possible that they preserved memories of the site in the legend of King Minos, using the term "labyrinth" to describe the large, rambling, and complicated plan that is the complex at Knossos. (Although the etymology of the word "labyrinth" is uncertain, the equivalent Egyptian term was applied to an enormous mortuary temple built during the Middle Kingdom for Amenemhet III [1844–1797 BCE] at Hawara.)

So far as we know, Knossos was unfortified. The palace/temple complex sat on a hill overlooking the harbor. Nearly four acres of buildings surround a central courtyard measuring 174 by 87 feet. In the three-story western wing, which contained ceremonial spaces, there is none of the axiality characteristic of Egyptian architecture. Instead, visitors to



2.1 (above) Plan of the palace, Knossos, Crete, ca. 1700–1380 BCE.
The plan is organized around an open rectangular courtyard, off which major reception rooms open. As only the ground level of this three- or four-story building survived destruction, many aspects of its design are conjectural. The grand stair and associated axial sequence were an unfortunate Sir Arthur Evans creation. This portion of the palace is now being restored to its pre-Evans condition.

2.2 (right) Restored light-well, Knossos, Crete, ca. 1700–1380 BCE.
Located on the upper story, this light-well is located directly above the Throne Room (see Fig. 2.3). The fresco shown here is a restoration.

De Agostini Picture Library/Getty Images

2.3 Throne Room, Knossos, Crete, ca. 1700–1380 BCE.
Named for the elaborate "throne," this room is provided with bench seating along the adjacent walls. Frescoes show griffins in lush foliage. Since a lustral basin adjoins this room, it is possible the space was used for religious ritual rather than royal audiences.
Dziewul/Shutterstock

the palace during its final years entered through the west propylaea, or gateway, and then followed a corridor lined with frescoes depicting priestesses and celebrants bearing offerings, before turning left twice to approach the courtyard from the south. On the left (west) wall near the north end of the courtyard was the entrance to the antechamber of a **lustral-basin** (depressed pool) sanctuary called the Throne Room because of an elaborate alabaster seat found there. On a lower level, along the southern edge of the Throne Room, was a lustral basin, one of several found in the complex that is thought to have been used in initiation rituals. This basin, which is only about eighteen inches deep, is concealed by a low wall and a screen of Minoan columns. Cult statues and votive offerings indicate that the site was sacred to a female deity linked to the earth and fertility. Long rows of underground storage rooms occupy the western side of this palace wing, dug into the slope of the hillside, with tall ceramic containers for olive oil, grain, and wine still in position.

Buildings on the eastern side of the courtyard have been interpreted as being residential, although some of the suites may have functioned as textile workshops and others were definitely used as storage areas. Some rooms here had views out over the valley below. The primary entrance to this section was made through a grand staircase approached from the middle side of the central court and illuminated by an open light-well. The stair led down to the Hall of the Double Axes, from which a corridor connected to the room Evans dubbed the Queen's **Megaron**, a pleasant space decorated with frescoes that include rosettes and flying dolphins. Smaller rooms behind the megaron contained a bathtub and a water closet (toilet) connected to the palace's drain system. Standards of water supply and drainage at the complex were exceptional for the time. Terracotta water pipes carried clean water through a series of settling tanks and siphons to supply baths, and sanitary sewers carried off waste water from basins and water closets, although the tub in the so-called queen's apartments had to be emptied by bailing.

At the northwest corner of the complex was the oldest and deepest (six feet) lustral basin, made accessible by a staircase with light-well (Fig. 2.4). Beyond this ran a series of broad steps, set into a slight rise in the ground and connected to the palace proper by a ceremonial road. This area has been labeled as a theater, although its precise use, as with so much else at Knossos, remains unclear. It seems that the large central courtyard provided the setting for theatrical ritual, including perhaps ceremonial games involving acrobatic feats by young men and women performed on running bulls. Frescoes preserved on some palace walls illustrate these amusements or rituals.

The naturalistic portrayal of the young men and women in these frescoes creates the impression that the Minoans