ARCHITECTURE
THE WHOLE STORY

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Foreword by
Richard Rogers &
Philip Gumuchdjian

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◄ Frank Lloyd Wright at a drafting table at Taliesin East in December 1937, surrounded by members of the Taliesin Fellowship.

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FOREWORD

By 2025, almost 80 per cent of the population will live in urban settlements. The urban environment has now conclusively eclipsed the natural one as mankind's primary home. Given this, we will need to redouble our focus on designing buildings that create spaces in cities that energize, that inspire, that bring us together to interact, to share ideas, and to create just societies in real time and real space. Much recent work has gone into rethinking the city as a socially inclusive and environmentally positive place. Our future architecture will play the pivotal role in that quest for a fairer society and a healthier, more beautiful planet.

Architecture: The Whole Story challenges the reader to wonder about the type of architecture that will emerge from a modern society with broadly pluralistic, democratic, permissive, and environmental objectives. It forces us to consider what kind of buildings our new technologies will stimulate and what will be produced once we fully address the fact that unchecked appetites face triggering an environmental disaster of apocalyptic proportions. If climate change is the product of our activities, buildings and cities included, so buildings and cities must be part of the solution.

The book offers a staggering testament to the intellectual and material achievement of our past. From the earliest emergence of shelter in Mesopotamia to the present day, the book tracks the development of that skill into an art form that communicates the ideals, beliefs, and mores of human societies from ancient to modern. And it has done so while searching out beauty in every variety of form, in every climate, and on every terrain. Architecture from the barn to the palace is the product of our human spirit married to the astonishing mechanical power of the human brain. How quickly that art form became the instrument of religious, political, or economic purpose is unclear—maybe the two emerged together. This book offers as many insights as it provokes further questions.

We are reminded that architecture has been used as the primary tool to underpin the ambitions of the powerful and the visions of our visionaries. Architects have achieved this by creating and reworking symbolic forms and by energizing public spaces to inspire wonder and occasionally rival nature itself. It is architecture's power of promotion that has been sought out by leaders throughout the ages. Architecture is the king maker par excellence and has remained so, unrivalled perhaps until this day.

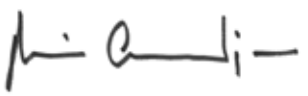
It is not surprising, therefore, that most of the iconic structures published here are the result of commissions by the few, rather than the expression of the many. Some of our greatest buildings represent the ideals of our most inspired leaders. In some cases, the buildings themselves have been catalysts

for positive social change. But just as often, the sophisticated beauty of these structures masks the naked ambition of their patrons. Scratch the surface and the history of "civilized" mankind emerges, warts and all. Great buildings often catalog overstretched empires, cruel religions, dead-end social ambitions, and rampant economies. Architecture celebrates mankind, its humanism and barbarism alike.

But, ironically, the very greatest buildings tend to show longevity and now rub shoulders harmoniously with each other in the formidable living museum that is the modern city. A stadium for gladiators next to a temple for pacifists, a seat of omnipotent power next to an agora of open-minded thinking. Quality architecture has an ability to survive and be transformed by subsequent generations.

Each generation shows a constant willingness to reinterpret, to regroup, to pull itself together and pursue new utopias, new ideals. In this search, we connect to our origins and to our history, find inspiration from all our innovations and all expressions of harmony and beauty.

Architecture is surely one of the most optimistic of art forms. Our networked, pluralistic society will face up to our challenges with as yet unimaginable technologies, buildings, and cities.



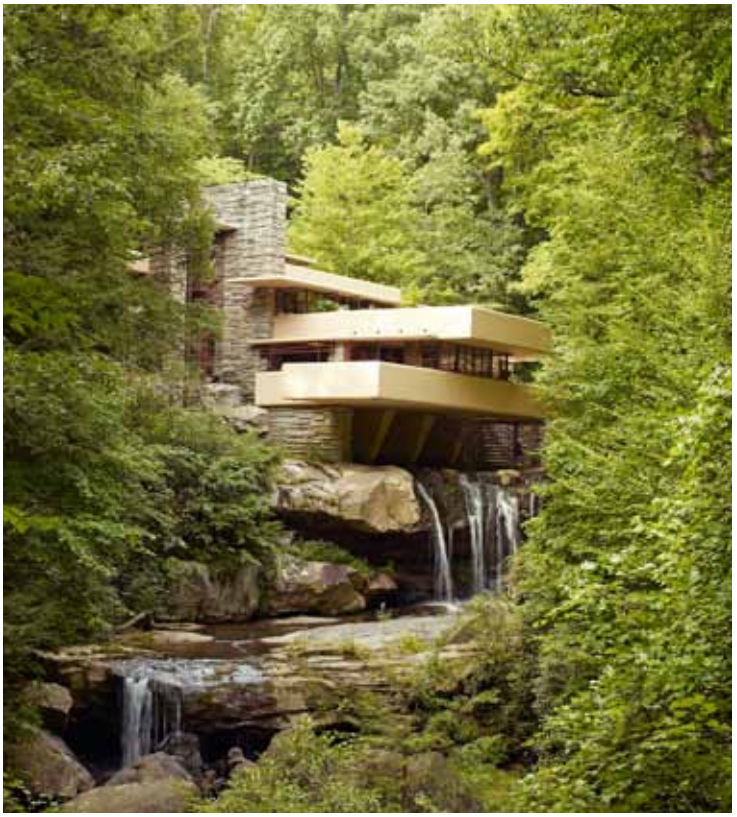
RICHARD ROGERS &
PHILIP GUMUCHDJIAN

INTRODUCTION

Invited by David Chipperfield (b.1953), director of the 13th International Architecture Biennale, Venice, to provide an inspirational image for a display at the exhibition, Richard Rogers (b.1933) chose the 14th-century Guinigi Tower in Lucca, Italy. At the top of this square, red-brick and stone building, high above the city, grows a grove of oak trees. Breezes circulate through tall arcades near the summit, accessed by a multistory staircase. Short ladders terminate the climb and launch visitors through a trapdoorlike opening into an urban arcadia where oaks have grown for hundreds of years. Guinigi Tower embodies the familiar Vitruvian commandment to "build well," but it also represents architecture as a reflection of society, and a tool with which to change society. These are qualities that have been captured by each of the buildings featured in *Architecture: The Whole Story*, from the Persian Empire's ancient *qanat* water system to the humane cowsheds that Gion Caminada (b.1957) designed in 1999 in his native Vrin, Switzerland.

Architectural history and formal analysis—the visual structure and character of buildings—are the foundation of *Architecture: The Whole Story*, but they are not "the whole story." This book also attempts to counter a Western parochial bias and demonstrate how architecture has a long history of benefiting from cultural and religious cross-fertilization, such as the Kusheeite temples on the Island of Meroe, Sudan (8th century BC–AD 4th century), which show a heterogeneous mix of Pharaonic, Sahelian African, and Classic Greek and Roman architecture. Well-known buildings are highlighted and discussed

▼ Guinigi Tower (14th century) in Lucca, Italy, was built by the influential Guinigi family. The oak trees at the top were intended to be a symbol of rebirth.



◄ Fallingwater House (1939) was designed by Frank Lloyd Wright for Edgar and Liliane Kaufmann, whose son was studying with Wright at the Taliesin Fellowship. Wright chose to place the house on top of the waterfall in order to create a direct connection between the inhabitants and nature. The sound of breaking water can be heard throughout the house.

throughout, but so too are less familiar structures, such as the "mole-like" Olivetti Residence Hall (1971; see p.440) in Ivrea, Piedmont, Italy, by Roberto Gabetti (1925–2000) and Aimaro Isola (b.1928).

From the Neolithic settlements of hunter-gatherers in the Middle East, which reveal the early development of structured communities, through Neo-Palladianism, once seen as the purest form of architecture in Europe and the United States, to the shift toward digital architecture marked by buildings such as the Guggenheim Museum Bilbao, Spain (1997), by Frank Gehry (b.1929), *Architecture: The Whole Story* chronicles centuries of innovation in the history of architecture. Essays on vernacular buildings—the "good ordinary"—are found in each chapter. The influence of such architecture—not only its typically small scale, but also its reflection of local materials and building techniques—is a common thread throughout the book. Marc-Antoine Laugier's engraving of the "primitive hut" in the second edition of his *Essay on Architecture* (1755) was a major influence on modern architecture's pursuit of the simplicity and pureness represented by small, simple structures. It is an architectural Holy Grail that is still sought after today: the 21st-century mini-house movement in the United States is a product not only of economic downturn, but also of disillusionment with consumption and capitalism and a desire to return to basics. This same desire spurred designer William Morris (1834–96) in the 19th century, motivated Indian architect Laurie Baker (1917–2007) in the 20th century, and is an influence on the rising appreciation in 21st-century China of the values of Confucianism. "Simplify! Simplify!" Henry Thoreau admonished in the 19th century when he built his famed cabin on Walden Pond, Massachusetts.

Frank Lloyd Wright (1867–1959) reinterpreted elements of the vernacular in his masterpiece Fallingwater House in Pennsylvania (1939), which incorporated

▲ The brise soleil on Le Corbusier's Palace of Assembly (1963) in Chandigarh was designed according to his Modulor system of proportion, which was based on the golden ratio.

▼ *Mashrabiya* screens such as this one at the Alhambra (begun 1238) in Granada, Spain, have been used in Islamic architecture for centuries. As well as providing privacy, they also enable cool air to be distributed around the building's interior.

elements of Japanese architecture to create a feeling of harmony between the inhabitants and nature. A similar sense of space was produced in his Usonian houses, such as Pope-Leighey House (1940) in Virginia, which has an open, interconnecting plan, where Wright differentiated between use and meaning via room heights. Low ceilings created a sense of shelter (as did his ubiquitous hearth and fireplace), whereas higher ceilings created the illusion of greater space and of "sky." Antecedents for the careful crafting of space include Blackhouses in Scotland and Norse-era longhouses in Iceland. The latter feature a small, wood-lined "closet bed" tucked to the side of the main open hall, with an interior bolt mechanism to help ensure security.

Le Corbusier (1887–1965)—arguably the 20th century's most influential architect—was not alone in being influenced by the "good ordinary." He may have believed that old buildings were "worn out tackle," but that did not prevent him from being influenced by them. In *Le Corbusier: The Noble Savage* (1999), Adolf Max Vogt postulated Corbusier's debt to Neolithic pile houses on Swiss lakes. He also made the case that 18th- and 19th-century stilt houses, admired by Corbusier as he sailed the Turkish Bosphorus, influenced his pilotis in the "Five Points of a New Architecture." Others cite the influence of North African and South American sunscreens on Corbusier's development of the brise soleil, as used in his Palace of Assembly in Chandigarh, India (1963). The monumental yet human-scale buildings of Louis Kahn (1901–74), such as the Indian Institute of Management, Ahmedabad, Gujarat, India (1974), also contributed to the revival of vernacular traditions. Paul Rudolph (1918–87) furthered this changing attitude in his criticism of Modernism's failure to consider the context of buildings—a result, perhaps, of over-idealization of the isolated hut.

The atavistic desire to "revolve back to a better future," coupled with what architecture critic Martin Pawley described as Modernism's "magnificent mutiny" against Historicism, Revivalism, and (incorrectly) the vernacular, is evidence of Friedrich Nietzsche's "eternal hourglass of existence" rather than a linear, progressive theory of history. The hourglass of vernacular traditions continues to increase in importance in the 21st century. Resiliency is a watchword for 21st-century architecture and signifies a growing concern

to design and program buildings to be responsive to natural disasters and custodians of finite natural resources. Resurgent interest in parts of Europe and North America for self-build, timber-frame (post and beam construction) homes may be due in part to ideas of Resiliency and self-sufficiency, but is also reflective of concerns for healthy buildings. In South Korea there is a growing re-evaluation of traditional underfloor-heated, mud-brick and thatched houses as potentially curative for chronic illnesses such as asthma and eczema. The ascendancy of vernacular building traditions—particularly when reassessed by architects such as Gion Caminada—is in inverse proportion to the declining popularity of solutions such as the "Molecular Engineered House (For the Year 2020)" (2003) by John Johansen (1916–2012), in which buildings were intended to be coded and grown from vats of chemicals.

Architecture: The Whole Story represents the resurgence of history and formal analysis of architecture after decades dominated by the primacy of theory. In 2012, *The Architectural Review* introduced the theory of Integral Architecture. Despite itself introducing a new theory, the editorial acknowledged the detrimental effect on architecture of hijacking architectural theory from literary or philosophical treatises. This practice proliferated throughout the 20th century, giving rise to movements such as Deconstructivism, which influenced Frank Gehry's (b.1929) design for the Walt Disney Concert Hall (2003) in Los Angeles. The editorial concluded by saying that over-reliance on theory "must now be regarded as woefully misguided, as

▼ The fragmented, sail-like form of the Walt Disney Concert Hall (2003) in Los Angeles is a prime example of Deconstructivist architecture. Architect Frank Gehry originally planned to clad the building in stone, but was urged to make the exterior metal after the success of his titanium design for the Guggenheim Museum Bilbao (1997).

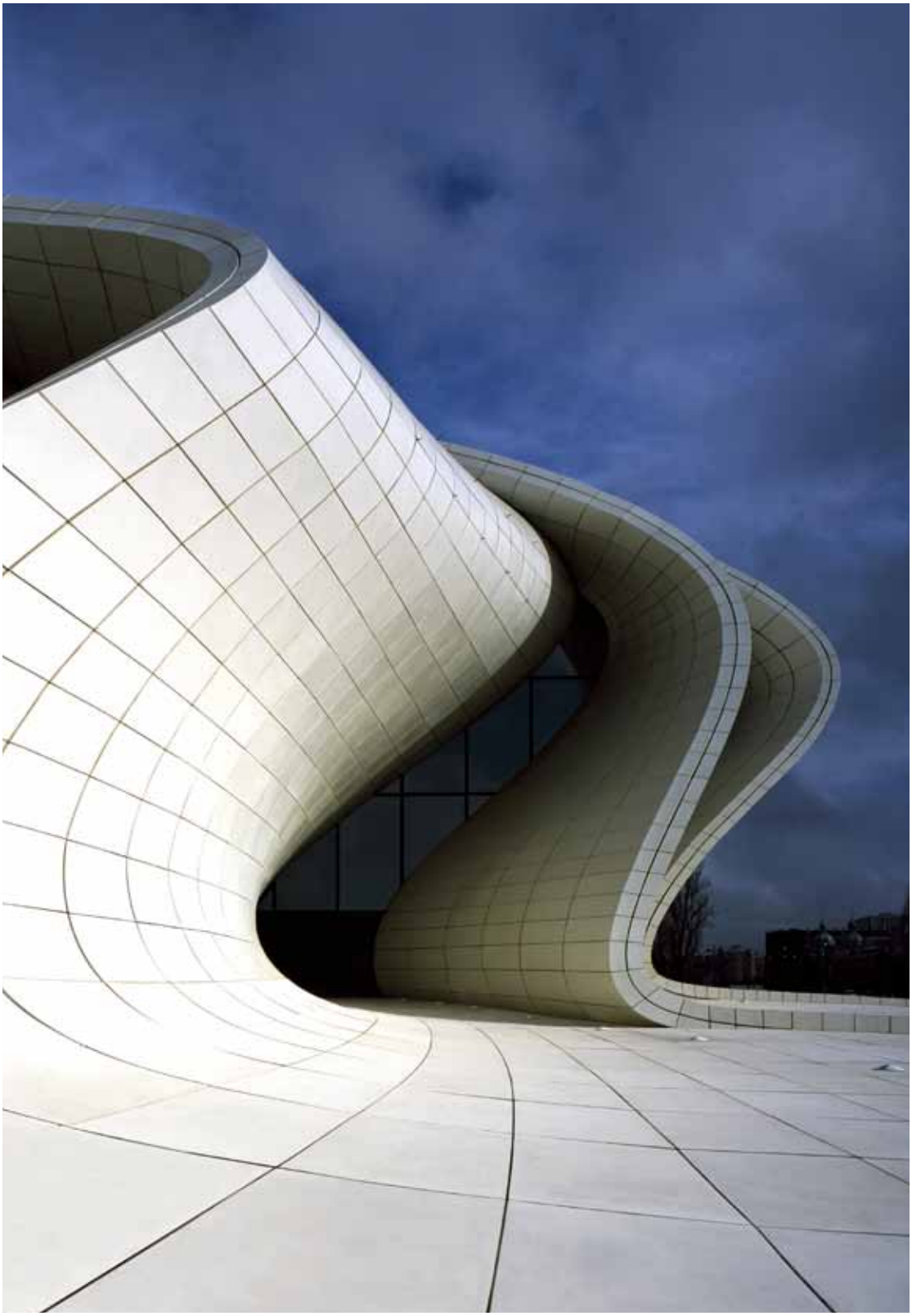
► **Herman Hertzberger designed Centraal Beheer (1972) in Apeldoorn, the Netherlands, so that the building's occupants "would have the feeling of being part of a working community without being lost in the crowd."**

it disconnects architecture from historical, cultural, and experiential reality." Architecture critic Edwin Heathcote is one of many who decry "barely readable academic jargon," in which he probably includes *The Autopoiesis of Architecture* (2010), the generative theory manifesto for computational architecture by Patrik Schumacher (b.1961), director of Zaha Hadid Architects. Schumacher is a proponent of the style known as parametricism, in which digital models use variable factors such as daylight or material costs to decide a building's form. Examples of parametric buildings include the sweeping Heydar Aliyev Center (2012) in Baku, Azerbaijan, by Zaha Hadid (b.1950). However, many of the essays in *Architecture: The Whole Story* offer contrasting views to Schumacher's belief that "only theoretically informed building design constitutes architecture," and his assertion that "architecture advances as a progression of styles."

Although "the whole story" must use images to support the history, *Architecture: The Whole Story* seeks to avoid what Joseph Grima of *Domus* magazine criticized in 2011 as the "nonstop stream of 'pornographic' form-led images of architecture." The "good ordinary" buildings that are featured in this book temper what critic Christopher Hawthorne deems over-reliance on "supremely photogenic" architecture. In 2014, *The Architect's Newspaper* published "A Manifesto from the Architecture Lobby," in which architects declared that they no longer wanted to be known only for design; rather, the media must showcase them as "keepers of sustainable spatial intelligence." It demanded that architects write a letter of protest for "every article in every journal and newspaper discussing only form." Although it is undeniable that the media focuses on form, it is equally true that programming—a building's ability to function well for its users—is not always seen as a priority. This is a result, says Mohsen Mostafavi, dean of Harvard Graduate School of Design, of programming being viewed as non-glamorous work.

However, Centraal Beheer (1972; see p.480) in Apeldoorn, the Netherlands, is an exception. It is a leading example of what can be achieved when architects prioritize what the vessel holds (programming) over the form of the vessel. Rejecting sculptural expression and the primacy of the exterior to focus instead on reciprocity of form and function, the Centraal Beheer office building by Herman Hertzberger (b.1932) became a beloved "city" and "workshop" where employees fulfilled Hertzberger's dream of "a world in which architects make neutral things that inspire the people who use them to do something with them." Archive footage confirms that employees used the building as Hertzberger hoped. It is tempting to wonder if Steve Jobs knew of Hertzberger's

► **Zaha Hadid used the fluid form of the Heydar Aliyev Center (2012), Baku, Azerbaijan, to establish a relationship between the building's interior and the surrounding plaza. The shape of the building's curves was inspired by Islamic calligraphy.**



◄ **Building 20 (1943) at the Massachusetts Institute of Technology was said to have been designed in a single day. It comprised six wings, which were built out of wood due to the scarcity of steel at the time of its construction. The building was adapted frequently by its residents to meet the demands of their research projects.**

human-scale workers' village when he lobbied for Apple's headquarters to be designed to encourage serendipitous encounters and casual, rather than mandated, intellectual exchange. Or whether the designers of the "communal environments" and "spaces for social exchange" prioritized in headquarters for social media companies such as Google in London and Weebly in San Francisco realize their debt not only to Centraal Beheer, but also to structures such as Building 20 (1943) at the Massachusetts Institute of Technology.

Built cheaply and quickly during World War II as a low-slung temporary structure, Building 20 was notorious for leaks, poor ventilation, inferior insulation, and cheap materials. But it became well known during its fifty-year life span as a crucible for innovation and one of the most consistently creative spaces in the world, quantifiable by the patents, inventions, theories, and awards accumulated by its residents. Although designed by an architect, Building 20 behaved like a vernacular, adaptable building. As at Centraal Beheer, residents were allowed to treat Building 20 like home. It was laid out on a horizontal plan, referred to by U.S. writer Stewart Brand as a "low road" structure, which unlike narrow, tall towers had more research variety on each floor and thus greater opportunities for the chance encounters that led to creative breakthroughs for its multidisciplinary residents. The Council on Tall Buildings and Urban Habitat reports that the popularity of tall towers among developers is undiminished in the 21st century—particularly in Asia and the Middle East—despite widespread knowledge that low-rise "groundscrapers" are less expensive to build. Low-rise buildings also provide more rentable space because less of their area is taken up by lift shafts and their floor space is not reduced by the tapered form that is often employed in contemporary skyscrapers, such as the Al Hamra Tower (2004) in Kuwait City, Kuwait. Yet, despite growing reappreciation for Hertzberger's Centraal Beheer, the clamor for space in urban centres will mean more, not fewer, skyscrapers.

Architecture: The Whole Story is a prompt to learn more, to visit the buildings discussed in its pages and to discover those that are not, such as St. Petri Church (1966) by Sigurd Lewerentz (1885–1975) in Klippan, Sweden, where water drips from the baptismal font into an irregular hole in the floor. Its dark pool looks limitless, as though a visitor could stand on its edge and dive into eternity. In his Royal Institute of British Architects Gold Medal speech in 2012, Herman Hertzberger called for architects to make the ordinary special. The diverse selections in *Architecture: The Whole Story* highlight the extraordinary and the ordinary, and demonstrate the limitless potentials of architecture.

◄ **The Al Hamra Tower (2004) in Kuwait City, Kuwait, was designed by Skidmore, Owings, & Merrill LLP, a company renowned for its glass and steel skyscrapers. The building is among the world's tallest, with a height of 1,354 feet (413 m).**

1 | NEOLITHIC–900

NEOLITHIC

1 **Carved stone pillar (*c.*8500 BCE)**
Architect unknown
Gobekli Tepe, Turkey

2 **Remains of a communal store (*c.*9000 BCE)**
Architect unknown
Dhra', Jordan

3 **Reconstructed wooden house (5000–4500 BCE)**
Architect unknown
Hemudu, China

Architectural advances are an important part of the Neolithic period (10,000–2000 BCE), during which some of the major innovations of human history occurred. The domestication of plants and animals, for example, led to both new economies and a new relationship between people and the world, an increase in community size and permanence, a massive development of material culture, and new social and ritual solutions to enable people to live together in these communities. New styles of individual structures and their combination into settlements provided the buildings required for the new lifestyle and economy, and were also an essential element of change.

The earliest and most closely researched expression of the Neolithic took place in the Middle East. The first settlements were composed of structures that differed substantially from earlier shelters constructed by hunter-gatherers. There was a focus on the community rather than individual family or household units, as indicated by the discovery in 2009 of Structure O75 (*c.*9600 BCE; see p.20) in Wadi Faynan, southern Jordan. As the economy became increasingly dependent on a limited number of harvests and the community wished to stay in one place, secure storage of food between harvests became essential. The produce from the harvests was kept in communal stores, such as those found at Dhra' in Jordan (see image 2), which were often designed with raised floors to minimize damage from pests such as mice. Processing of cereals also grew in importance, and some buildings appear to have been designed primarily for this task, with one or two stone mortars built into the plaster floors at the center of the structures. Some of these workshops were

KEY EVENTS

*c.*10,000 BCE	*c.*9600 BCE	*c.*8500 BCE	*c.*8000 BCE	7400 BCE	7000 BCE
The earliest identified Neolithic settlements arise in the Middle East out of increasingly sophisticated hunter-gatherer societies.	The rapid development of purpose-made structures includes buildings for communal storage, reflecting agricultural production cycles.	Spectacular carved stone pillars are set into circular structures at Gobekli Tepe in Turkey, probably built during ceremonial gatherings.	Multistory buildings are built as populations grow and settlements become more dense. Basements begin to serve as private storage areas.	Catalhöyük in Turkey grows to be a large but isolated settlement. Good archaeological preservation shows a lifestyle rich in symbolism.	A settlement process starts in China, characterized by the growth of communities there.

built with substantial floors but insubstantial wattle and daub screen walls, with a ring of wooden posts supporting a light roof. Other, more solid roofs appear to have been built with a series of timbers, placed at right angles to one another, that supported brushwood and reeds on which insulating mud layers were placed. In some cases stones appear to have been placed around the edges of the roofs, presumably to stop water run-off eroding the mud.

Other, more dramatic buildings were erected as part of the need to restructure human society to enable habitation in increasingly big groups. A large stone tower was built at Jericho in Palestine (*c.*9500–8500 BCE), inside the wall that was constructed around part of the settlement and possibly protected it from floods. The tower appears not to have had any defensive function, but as a monumental and highly visible construction served a communal ceremonial role. The site of Gobekli Tepe in Turkey (begun *c.*8500 BCE) consists of a series of circles of stone pillars, many covered with animal carvings (see image 1). The pillars themselves appear to have represented people. Gobekli Tepe was probably a regional center where groups from different areas came together.

As populations rose and the processes of domestication took hold, there was a shift to greater privacy, growing evidence for the idea of ownership, and a focus on the household. Multiroomed structures appeared, with storage hidden within the houses. Settlements became densely packed, with rectangular architecture replacing circular and elliptical buildings, and multistory buildings became common. Even ritual activities became more private, or at least restricted in who could participate, as the shrines of the later Neolithic were smaller than the large open spaces that preceded them.

Development did not take place at the same time around the world. In some places, such as the Middle East, China, and Mesoamerica, the Neolithic was an entirely local innovation with its own distinctive history. Areas where the Neolithic arrived ready-made from outside, such as Europe, show a very different sequence that begins not with development but replacement. This was followed by local modification that gradually transformed the Neolithic into something adapted to local conditions, such as at Skara Brae in Scotland (3200–2200 BCE; see p.22), where cellular architecture is protected by thick layers of sand and refuse.

Architectural traditions vary enormously. Good preservation produced by waterlogged conditions demonstrates that in some areas wood construction was important. Rapidly accumulating evidence from China shows that sophisticated carpentry techniques were used to build extensive wooden buildings above lakes, such as at Hemudu (see image 3). Similar levels of preservation have been encountered at sites in Switzerland, where buildings were erected on piles over the edge of lakes, and in the Western Isles of Scotland, where artificial islands, or crannogs, were created. From wood, through cobb and mud-brick, back to wood, almost every vernacular architectural technique has a Neolithic origin. **BF**

6500 BCE	5500 BCE	4400 BCE	4000 BCE	*c.*3000 BCE	*c.*2500 BCE
Pottery, an important Neolithic technology, is adopted in the Middle East, although it had appeared much earlier in China and Japan.	The Neolithic starts to spread across Western Europe, characterized by settlements of wooden long-houses.	The Neolithic comes to an end in the Middle East as innovations in copperworking commence.	The Neolithic reaches the British Isles, spreading fairly rapidly up to Orkney.	Plants in North America are domesticated, well after the independent appearance of agriculture in Mesoamerica and South America.	The working of bronze becomes established at the end of the European Neolithic.

Structure O75 *c.*9600 BCE

ARCHITECT UNKNOWN

Structure O75,
Wadi Faynan, Jordan

A surprising aspect of the architecture in the earliest Neolithic settlements is the presence of community structures. In southern Jordan, a small site called WF16 has provided a very early example. An elliptical structure named O75 is composed of a large central mud-plastered area bordered by benches. The building technique is similar to the way in which the other structures on site were made, regardless of their size or function. A pit was excavated into the underlying deposits made up of the remains of older buildings and refuse. A stone foundation was laid around the vertical faces of the pit, and a wet mud mixture was used to build the walls lining the face. This mud was mixed with a plant temper made of chaff, possibly from the wild barley that had recently begun to be cultivated. Some collapsed sections suggest that parts of walls above ground were built around a core of sun-dried mud bricks. In contrast to the idea that early architecture is largely about shelter from the elements, this structure served an important public role, possibly bringing together a community for tasks that required combined labor, such as the harvest. It also represents a substantial project in terms of construction and maintenance. **BF**

NAVIGATOR

FOCAL POINTS

1 BENCHES

The central space is bordered by two tiers of benches, each about 3 feet (1 m) deep and 1½ feet (0.5 m) high, well preserved on one side and badly eroded on the other. Their form suggests that they provided a place for people to watch the activity being performed in the central area.

2 CHANNELS

The herringbone pattern of channels looks as if it should drain liquid to the center. However, the curvature would not have allowed the channels to act as drains. They all have holes where wooden posts have been removed, and it seems likely that they divided the floor space.

3 GRINDING STONES

The presence of two symmetrically placed grinding stones, embedded in slightly raised platforms at one end of the structure, suggests that food processing was the focus of the public activity. The harvest of new cereal crops would have been an important occasion in the community.

▲ The faces of some of the benches are decorated with a pattern of lines. The mud plaster is neither hard-wearing nor weather-proof, and these faces have been repeatedly replastered, suggesting regular maintenance.

NEOLITHIC RITUAL

Archaeologists often categorize buildings as either ritual or domestic. Such a division is inappropriate in the early Neolithic, when it is unlikely that people divided the world in such a manner and when many buildings incorporated ritual space, frequently in the form of underfloor burials that were later reopened for modification (such as skull removal). At the same time that lime plaster was introduced as a construction material for floors, it was also used to create plaster faces on skulls for display (right). The incorporation of items such as pairs of horns within walls, and their repeated replastering, suggests that the building process itself was often imbued with meaning and ritual.

Skara Brae 3200–2200 BCE

ARCHITECT UNKNOWN

Skara Brae,
Mainland, Orkney,
Scotland

Skara Brae, on the west coast of the Scottish island Mainland, Orkney, represents a settlement lying at the extreme edge of the spread of the Neolithic from the Middle East across Europe. By the time the Neolithic had become established in Orkney, it had already ended in the Middle East. The village settlement at Skara Brae was well adapted to its local environment and building conditions. This tradition of Neolithic architecture is distinctively Orcadian, and similar sites have been found near to Skara Brae, including settlements at Barnshouse village and at the Ness of Brodgar. Association with the nearby stone circle of the Ring of Brodgar, the standing stones at Stenness, and the impressive burial mound of Maes Howe, with its corbeled ceiling, is linked to an increasing appreciation that some of the buildings in the settlements may have had ritual functions. For example, Structure 8 at Barnshouse has an entrance that is aligned with midsummer sunrise, and there is a massive, apparently symbolic, wall that isolates the Ness of Brodgar site on its peninsula. These suggest that the settlement was constructed within an extraordinary built landscape, highly charged with symbolic meaning. **BF**

NAVIGATOR

FOCAL POINTS

1 FLOOR COMPARTMENTS
Full advantage was taken of the local sandstone to create internal floor compartments. It was also used to construct beds, dressers, hearths, a drainage system below the floors, and stone boxes, which may have been used to store bait for fishing.

2 CELLULAR STRUCTURE
The buildings at Skara Brae are clustered together like cells, insulated by thick layers of material full of refuse. The soft piles of waste and sand would have been easy to dig in, and placing structures within this would have made them stronger and more sheltered.

3 CORRIDORS
Although the site is made up of a series of well-defined separate cellular structures, these are all interlinked by covered corridors. This connectivity suggests a tightly linked community, and one with a low requirement for privacy.

◄ The most striking internal features are the impressive dressers. These are thought to have displayed some of the well-made material goods present on the site and also to have provided storage space.

NEOLITHIC STYLES

The amazing levels of preservation at Skara Brae result from a lucky combination of the circumstances of burial and the use of the local flat stone slabs. Inevitably, such well-preserved sites have become iconic representations, when in reality they may have been exceptional. Architectural styles varied widely through the Neolithic in Scotland—patterns of post holes in the ground suggest long timber houses in the east (right), while in the Hebrides there were timber sub-rectangular houses—yet none is as well known as the Skara Brae architecture. The interior structures at Skara Brae, the dressers and beds, look just like stone versions of wooden objects, but whether similar furniture was made of wood elsewhere is unknown.

ANCIENT EGYPT

Modern imaginings of ancient Egypt are heavily influenced by the surviving traces of monumental architecture. Many formal styles and motifs were established at the dawn of the pharaonic state, around 3100 BCE. The inspiration for many of these styles lay in the organic elements used in early buildings made from perishable materials. While the original structures are almost totally unknown, stylized motifs of plants continued to be replicated and adapted well into the Roman period. The endurance of forms over such a long period means that pharaonic architecture is easily recognizable today, and has been widely imitated by architects in modern times.

An important material in Egyptian architecture is the humble brick, made from unfired Nile mud. Mud bricks were used in construction throughout the pharaonic period, but were employed on a vast scale during the Early Dynastic period (*c.*3100–2600 BCE). Large funerary enclosures of this period display a niched "palace facade" design probably derived from neighboring Mesopotamia, where the large-scale building of cities was already well established. Yet, the Egyptians manipulated mud-brick architecture to create their own distinctive styles, and even the term "adobe" derives from the ancient Egyptian word *djebet*, meaning "brick."

The dominance of stone in Egypt arrived with the Step Pyramid complex of King Djoser at Saqqara (2667–2648 BCE), which heralded the beginning of

KEY EVENTS

2667–2648 BCE	*c.*2589–2566 BCE	2375–2345 BCE	2055–2004 BCE	1870 BCE	*c.*1473–1458 BCE
The Step Pyramid of King Djoser at Saqqara (see p.28) signals the beginning of major stone architecture worldwide.	King Khufu builds the Great Pyramid of Giza—Egypt's largest pyramid, and the last surviving wonder of the ancient world.	The Pyramid of King Unas at Saqqara is the first to contain extensive hieroglyphic inscriptions.	King Mentuhotep II builds an innovative terraced temple-tomb at Deir el-Bahri.	King Senwosret II is the first to build a pyramid constructed from unfired mud brick at Lahun.	The graceful terraced Temple of Queen Hatshepsut is built at Deir el-Bahri.

the Old Kingdom or "Pyramid Age" (*c.*2686–2125 BCE). The first smooth-sided pyramid was built by King Sneferu, who ruled from *c.*2613 to 2589 BCE. This was an important leap toward an abstract geometrical shape—perhaps representing the mound of creation—as opposed to an obviously organic form. Huge amounts of limestone were extracted from quarries relatively close to the sites of the pyramids. Granite from Aswan, more than 373 miles (600 km) to the south, was often used to line burial chambers. One of Sneferu's pyramids is one of the few identifiable architectural failures from ancient Egypt—the so-called "Bent Pyramid." Structural problems necessitated a reduction in the angle of the slope, creating a bent appearance.

Sneferu's son Khufu reigned from 2589 to 2566 BCE and built the Great Pyramid of Giza (see image 1), the last surviving wonder of the ancient world. At 456 feet (139 m) tall, it is the largest pyramid in Egypt. The most spectacular internal feature is the high corbeled Grand Gallery (see image 2). As with non-royal tombs of this period, the style is spare, almost minimalist, and with an absence of text and image inside, the religious function of the architecture is not made explicit. After the Fourth Dynasty (Old Kingdom), a shift in priorities occurred. There was a sharp decrease in the size of pyramids, and an increase in the scale and decoration of surrounding temples. This coincided with the first appearance of extensive hieroglyphic inscriptions inside the pyramids during the Fifth and Sixth Dynasties (both Old Kingdom), which may reflect a change in the religious interpretation of the royal afterlife.

By the end of the Old Kingdom, the cavetto cornice (concave molding) had been introduced. This decorative element would go on to accentuate the top of almost every formal pharaonic building. Also at this time, those who might be recognized as architects—Overseers of the King's Works—tended to be members of the royal family. No formal plans or pattern books survive, and the question of exactly how the pyramids were built continues to provoke debate.

The scale and ambition of royal tombs depended on political circumstances. At times of decentralized government, such as during the First Intermediate Period (*c.*2160–2055 BCE), provincial governors appropriated and adapted styles in royal funerary architecture. For instance, King Mentuhotep II, who began his reign in *c.*2055 BCE, built his innovative temple-tomb at Deir el-Bahri as a terraced edifice with veranda-style walkways. The pyramidal tomb reappeared later in the Middle Kingdom (*c.*2055–1650 BCE), although the pyramids were often built of limestone-clad mud brick rather than solid stone.

By the New Kingdom (*c.*1550–1069 BCE), security concerns led to a separation between a temple for the celebration of the king's memory and a hidden, subterranean tomb. Thus, the Valley of the Kings (with a naturally pyramid-shaped mountain above it) became the royal cemetery with deep, elaborately decorated passageways leading to a pillared burial chamber. A special settlement, now known as Deir el-Medina, was created in the desert

1

2

1 Great Pyramid of Giza (*c.*2589–2566 BCE)
Hemiunu
El Giza, Egypt

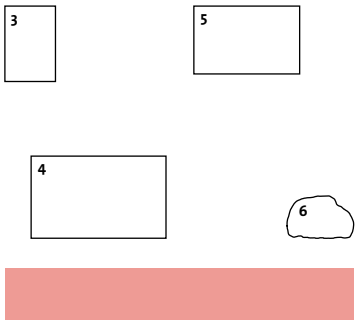
2 Grand Gallery (*c.*2589–2566 BCE)
Hemiunu
El Giza, Egypt

1390–1352 BCE	1279–1213 BCE	*c.*1184–1153 BCE	700 BCE	380–342 BCE	332–30 BCE
The architect Amenhotep, son of Hapu, becomes one of the few ordinary people to be worshipped at his own palace.	The rock-cut temples of Abu Simbel are inaugurated for the worship of King Ramesses II and Queen Nefertari.	The innovative Syrian-inspired "Migdol" gate is built by Ramesses III at his memorial temple, Medinet Habu.	High official Petamenope commissions the largest Egyptian non-royal tomb at the Assasif in western Thebes.	The last native pharaohs, Nectanebo I and II, undertake a major temple-building program in the Nile Delta.	Macedonian Ptolemaic kings sponsor extensive religious constructions throughout the Nile Valley.

near the valley to house the workers and artisans who built the tombs. Later, royal sepulchres are less well known, but tended to be more modest in size and were located within temple enclosures to protect the rich burial goods inside.

While monumental royal tombs varied in scale, temple architecture seems to have consistently gained in scale and ambition with time. Religious structures of the Predynastic period (5500–3100 BCE) and Old Kingdom appear to have been made of perishable materials. During the Middle Kingdom, there was a "petrification" of temples, which saw most religious structures rendered in stone. A standard temple plan was fully developed by the New Kingdom. The basic function of an Egyptian temple was to act as the dwelling place of the god. The temple represented a "cosmos" in stone, a copy of the original mound of creation on which the god could rejuvenate himself and the world. It was fronted by a massive twin gateway (pylon), such as that at Karnak (see image 4), symbolizing the hills of the horizon, and had columned halls symbolizing a primeval papyrus thicket. From the entrance courtyard through a series of hallways of decreasing size, the floor level rose steadily and ceiling heights became lower until the sanctuary was reached, where the god's cult statue was kept. Carved wall scenes emphasize the ritual maintenance of the universe by the king. Chaotic elements were kept safely outside, with scenes of battle restricted to exterior walls. Many later temples were fortified with undulating brick enclosure walls that were both defensive and represented the waves of the primordial ocean from which the island of creation (the temple) emerged.

The temple complex of Karnak is one of the largest religious sites in the world and best illustrates the desire of successive kings to expand structures with the addition of courtyards, shrines, statuary, and obelisks. Reuse of older building material was common, and many structures deliberately evoked or included elements of much older features. Kings who built extensively—and whose buildings survive—thus dominate the historical record. King Seti I and his son Ramesses II, who reigned consecutively from *c.*1294 to 1213 BCE, were responsible for the Hypostyle Hall (see image 3), which covers 59,201 square feet (5,500 sq m) and is the largest of its kind in Egyptian architecture. The hall roof rests on 124 columns, each in the shape of a stylized papyrus stalk, up to 69 feet (21 m) in height, with a raised nave and light provided by clerestory windows. Smaller hypostyle halls were common in temples from the New



Kingdom onward. All temples would have been brightly painted, and texts survive describing fixtures and fittings of precious metals and inlays.

A notable experiment in sacred architecture is the crenellated Migdol gate of Ramesses III, ruler from *c.*1184 to 1153 BCE, at his memorial temple at Medinet Habu; the gate imitates Syrian fortified towers encountered by the Egyptians on military campaigns. Other innovations combined traditional motifs. One of the most graceful is the memorial temple of the female pharaoh Hatshepsut (*c.*1473–1458 BCE) at Deir el-Bahri. The temple rises in elegant terraces, rather than successive courtyards, fronted by colonnades—likely inspired by the much earlier temple of Mentuhotep II nearby. Hatshepsut's colonnades, like those of other temples, integrate sculptures of the pharaoh against pillars (see image 5), although the statues themselves are not load-bearing, like Greek caryatids. In comparison to this temple's elegant proportions, later Ramesside memorial temples adopt a more Baroque style (see p.222), with columns and engaged statues of a more squat appearance.

A surge in temple building occurred with the last native Egyptian pharaohs, Nectanebo I and II, who ruled successively from 380 to 342 BCE. Despite being made of granite and basalt, those temples built in the delta to the north have been almost entirely destroyed. Ptolemaic and Roman temples in the Nile Valley, such as Philae Temple (380 BCE–CE 117; see p.30), are much better preserved. They continued to employ traditional pharaonic components, with subtle embellishments such as an increased range of column capital designs. Religious architecture had a strong political dimension, with the aim of presenting a non-Egyptian ruler as maintaining divine order in time-honored pharaonic fashion. Many of the earlier motifs are preserved only in these Graeco-Roman versions and these in turn have inspired modern, Egyptianizing designs.

While monumental structures loom large in our impression of ancient Egypt, domestic architecture survives in only the rarest circumstances. Exceptions include workers' settlements located on the desert edge that were abandoned rather than destroyed or built on. Tomb scenes and three-dimensional funerary models give some idea of the upper stories of homes of the elite (see image 6). More is known about palaces, which were, in general, built of mud brick. Notable preserved examples include the palace built for the jubilee celebrations of Amenhotep III (*c.*1390–1352 BCE) at Malkata, Thebes, which included an artificial lake and a stage for rituals. Surviving paint shows how vibrant the interiors must have been. **CP**

3 Hypostyle Hall (*c.*1294–1213 BCE)
Architect unknown
Karnak Temple Complex, Luxor, Egypt

4 Khonsu Temple Pylon (*c.*1184–1153 BCE)
Architect unknown
Karnak Temple Complex, Luxor, Egypt

5 Temple of Hatshepsut (*c.*1473–1458 BCE)
Architect unknown
Deir el-Bahri, Egypt

6 Funerary model of a house (*c.*1900 BCE)
Egypt

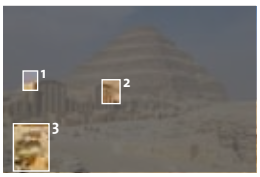
Step Pyramid 2667–2648 BCE

IMHOTEP *c.*2650–2600 BCE

Step Pyramid,
Saqqara, Egypt

The Step Pyramid at Saqqara has a good claim to be the first monumental stone building ever constructed. Built as a tomb for King Djoser of the Third Dynasty (*c.*2667–2648 BCE), it was conceived as a single flat *mastaba* (eternal house) structure. Six such structures were layered one on top of another to reach the impressive height of 196⅞ feet (60 m). A large vertical shaft under the pyramid leads to a granite-lined, subterranean burial chamber. A warren of tunnels leads to other burial apartments, including an underground "palace." The pyramid itself is surrounded by a complex of other structures and courtyards. Religious buildings that had been made out of perishable materials were rendered for the first time in limestone, their organic details designed to last for eternity. Thirty chapels of at least three different types reflect varying local traditions. All are of solid masonry and could only be entered by the king's spirit after death. Later non-royal tombs (*c.*750–100 BCE) in the area imitate the arrangement of a paneled enclosure and deep burial shaft, the latter being a key security feature. Most of the standing structures, including the one gateway to the complex, are actually modern reconstructions by French architect Jean-Philippe Lauer (1902–2001). **CP**

NAVIGATOR



FOCAL POINTS

1 TORUS MOLDING

Djoser's complex includes the first preserved instance of this typical pharaonic motif. Torus molding most likely originated in the corner posts of early structures built of brick or matting. In later structures, it is often paired with a cavetto cornice, probably representing a stylized frieze of palm fronds.

2 ENGAGED COLUMNS

Several forms of engaged columns feature in Djoser's complex, before three-dimensional versions became functional, load-bearing elements in architecture. Djoser's elegant examples imitate stylized papyrus stalks and the original bundles of reeds that would once have supported roofs of structures.

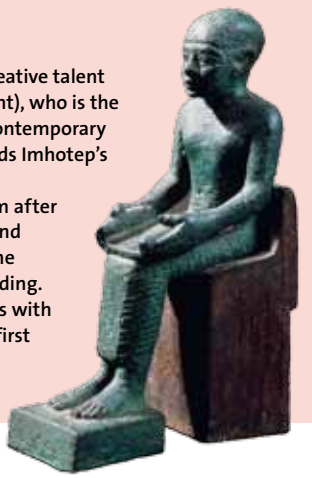
3 ENCLOSURE WALL

The entire Step Pyramid complex is surrounded by a 908¾ x 1,784¾ foot (277 x 544 m) rectangular enclosure wall, with one true gate and fourteen false ones. A recessed niche design (imitating the elaborately decorated facade of the royal palace) was carved into previously laid courses of stone.

◄ The underground burial apartments of the pyramid complex were covered with vibrant blue-green faience tiles, in imitation of bundles of reed matting.

IMHOTEP

The innovative Step Pyramid complex at Saqqara is more closely associated with one creative talent than any other building from ancient Egypt. That genius was a man called Imhotep (right), who is the first recognized architect and engineer in history. Very little is known about him from contemporary sources, but the chance find of a statue base belonging to his master, King Djoser, records Imhotep's titles as "high priest," "sculptor," and "carpenter"—terms that qualify him well as the mastermind behind Djoser's complex. However, graffiti written more than a millennium after the Step Pyramid was built records the wonder of passing visitors to the monument, and credit King Djoser (rather than his well-known architect) as the "opener of stone." Some sources cite Imhotep as being the first to use columns to support the structure of a building. Centuries after his death, Imhotep (whose name means "the one who comes in peace, is with peace") was still revered, before being deified as the god of healing and wisdom in the first millennium BCE. He was worshipped throughout Egypt into the Roman period as the son of the god of craftsmen, Ptah, born to a human mother named Khereduankh.



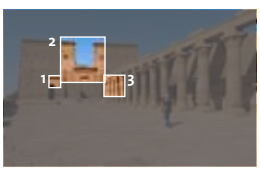
Philae Temple 380 BCE–CE 117

PTOLEMAIC KINGS AND ROMAN EMPERORS

Philae Temple, Agilkia Island, Lake Nasser, Aswan, Egypt

The temple complex of Philae is among the best preserved from ancient Egypt. The main structures are dedicated to the worship of the goddess Isis, and were embellished and enlarged by several Ptolemaic kings and Roman emperors between *c.*380 BCE and CE 128. Expansions had to take account of the island's limited space, resulting in a more irregular layout than is seen in other temple complexes. Standard elements, such as the forecourt, pronaos (inner area of the portico), and hypostyle hall, were reoriented, the light proportions of the hall's columns suggesting Hellenistic influence. What can be seen today is a mixture of styles and influences. The temple's main features are classically Egyptian: fronted by pylon gateways and decorated with traditional scenes of the pharaoh. Philae boasts perhaps the most beautiful "birth house" in Egypt, dating to the reign of Ptolemy VIII (170 to 116 BCE). The columned structure may be intended to evoke papyrus thicket, in which Isis supposedly reared her son, Horus, hidden from his evil uncle, Seth. As is typical in Greco-Roman temple architecture, intercolumnar walls provide decorative space and screen the rituals inside from view. Philae's most iconic structure is Trajan's Kiosk; called "Pharaoh's bed," it was the entrance to the island from the river. With its picturesque ruins and traces of wall paint, Philae contributed greatly to the romantic image of Egypt in the Western imagination. **CP**

NAVIGATOR



FOCAL POINTS

1 WINGED DISK
The sun disk with feathered wings represents a form of the falcon god Horus, son of Isis, triumphant over his enemies. The image was also a common protective device over temple entrances. Winged disks are a popular motif in modern Egyptianizing architecture.

2 PYLON GATEWAY
Two massive towers, flanking a central gateway, form a stylized representation of the horizon. Philae is one of the few temples in Egypt to preserve both pylons to their full height. Recesses in the facade would have held tall wooden flag staffs to fly colorful pennants.

3 EASTERN COLONNADE
This Roman addition to the approach to the Temple of Isis has sixteen columns, each with a different capital design. This abandons the pharaonic preference for regular patterns and symmetry. Some capitals are unfinished, showing the stages before final carving.

◄ The temple complex of Philae was moved to higher ground, on neighboring Agilkia Island, in the 1960s. This was to avoid flooding by the waters of Lake Nasser caused by the construction of the Aswan High Dam.

EGYPTIAN REVIVAL

Ancient Egyptian architecture continues to exert a hold over popular imagination. Revivals in the 19th and 20th centuries often led to corrupted pastiches, but a uniquely original modernist concrete complex, centered on a grand Egyptian-style slanted pylon, was built in Valinhos, Brazil, between 1929 and 1938. The Fazenda Capuava (right) was designed and built by Flávio De Carvalho (1899–1973). Trained as a civil engineer and employed as a concrete engineer, De Carvalho evolved into a multidisciplinary artist and theatrical personality, which may explain his choice of an Egyptian pylon—a monumental gateway—as the focal point of his complex. In an adaptation of the original Egyptian design, De Carvalho built two verandas on either side of the central room that spread like the wings of the Egyptian falcon god Horus from the main pylon body.

ANCIENT GREECE

1

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3

1 **Temple of Segesta (fifth century BCE)**
Architect unknown
Calatafimi-Segesta, Trapani province, Sicily, Italy

2 **Porch of the Maidens at Erechtheum (421–405 BCE)**
Architect unknown
Athens, Greece

3 **Plan of a peripteral temple**

From the tenth century BCE, monumental structures rarely seen since the corbeled vaults of tholos (dome-shaped) tombs, palaces, and megalithic fortifications of the Bronze Age began to re-emerge. Early structures, such as the vast apsidal hall at Lefkandi on the island of Euboea, sought monumentality through sheer length. Surrounded by a colonnade of wooden posts supporting a thatched roof, the hall was of uncertain function; however, it was seen as the source of Greek peripteral temple design, which features a single row of columns on each side (see image 3). In the seventh century BCE, the introduction of cut stone—worked with chisels, perhaps under Egyptian influence—and tiled roofs transformed architecture. Around 630 BCE, figural decoration brought a dazzling polychromy to Archaic temples: painted wooden panels on walls and sculpted terracotta images on the upper part of the building (entablature) and roofs communicated heroic genealogies. In the sixth century BCE, stone cornices were painted with red and blue palmettes. The contemplation of this spectacle of temple images was as much part of the ritual of the early Greek sanctuary as the processions, sacrifices, games, and dress.

The Doric order (see image 5) was established by the first quarter of the sixth century BCE. All recognizable elements, such as fluted columns, Doric capitals, triglyph and metope frieze, cornices with projecting blocks (mutules) on the underside of eaves, and sculpted pediments, are present in the Temple of Artemis at Corfu (*c.*580 BCE), which presents the familiar *opisthodomos* (rear false porch) and a *cella* (inner area) roofed on two rows of columns.

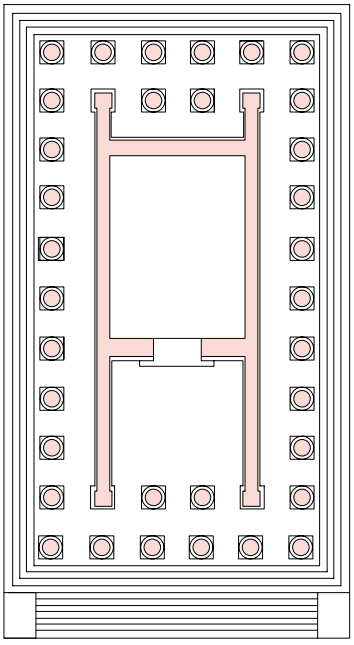
KEY EVENTS

*c.*580 BCE	*c.*550 BCE	480 BCE	447 BCE	429 BCE	405 BCE
A long-distance aqueduct is built to supply fresh water to Samos. It includes a mountain tunnel designed by Eupalinus of Megara.	Croesus, the last king of Lydia, dedicates the columns in the third Temple of Artemis at Ephesus.	Xerxes I, king of Persia, leads his troops in the sack of Athens, in which many buildings of the Agora are destroyed.	Construction of the Temple of Athena Parthenos, or Parthenon, begins. The structure is intended to show the wealth and power of Athens.	The "age of Pericles" comes to an end when the great statesman, orator, and general of Athens dies from the plague.	The Erechtheum in Athens is completed. The caryatids on the southern portico are one of its most striking features.

The largest projects, however, were in Asia Minor and the Greek colonies of southern Italy and Sicily. The huge Doric structures begun at the end of the sixth century BCE at Selinus and Acragas, Sicily, were never roofed satisfactorily and were left incomplete. It was there, too, that relationships in ground plan and elevation were developed through experiments with geometry.

The Ionic order (see image 5) seen at Didyma, Ionia, and the Greek island of Samos differed sharply from the Doric structures in southern Italy. Doric temples are low, ship-like structures almost sculpted into the landscape, their *cella* walls ringed by a single *peripteros*, whereas Ionic temples are higher, spacious structures, in which the *cella* is surrounded by a forest of columns. Ionic columns and entablature present a greater depth of architectural ornament: column drums at the third Temple of Artemis at Ephesus (*c.*550 BCE), sculpted with figures in relief, probably stood just below the capital, rather than at the base, and the entablature moldings consisted of abstract forms painted for greater visibility. In the western Greek colonies, these elements were also inserted into the Doric order: at Poseidonia (Paestum), the floral ornament on the neck of Doric capitals of the first Temple of Hera (*c.*550–520 BCE; see p.36) was followed by the Ionic-like division of the entablature in the Temple of Athena (sixth century BC). Columns were sometimes replaced by anthropomorphic images, telamons (male figures) or caryatids (female figures; see image 2).

From the second quarter of the fifth century BCE, standardization was evident in mainland Greece and the West. Many Doric temples were designed according to modular principles, based on the width of the triglyph as a determinant of the width of the bays between columns; accordingly, the design of the Doric temple was driven by the facade instead of the plan. At the unfinished Temple of Segesta in Sicily (see image 1), the design process can be reconstructed: the lifting bosses were left on the blocks of the *peripteros*, but the foundations of the *cella* walls had not yet been laid, thereby suggesting that it was normal practice to build the *peripteros* before the *cella*, although several examples suggest the reverse procedure. Modular design also encouraged refinements, such as curvature of the stylobate (continuous base that supports the columns), to prevent the appearance of sagging; entasis or swelling of the profile of columns; and tapering or inclination of columns and entablatures. These refinements reached their apogee at the Acropolis, Athens, in the Temple of Athena Parthenos (447 BCE) and the Propylaea (437–432 BCE; see p.38), where the adjustments are extremely minimal yet contribute to the impact of the architectural setting. In both buildings, the refined modular Doric was combined with an Ionic order. The smaller Temple of Athena Nike overlooked the new entrance to the Acropolis on a bastion of the older fortification. It was rebuilt in *c.*424 BCE as an amphiprostyle temple, a form that has a portico at each end. The style occurs several times in Athens around this time and also fifty years later at the Phoenician Sanctuary of Eshmun in Sidon.

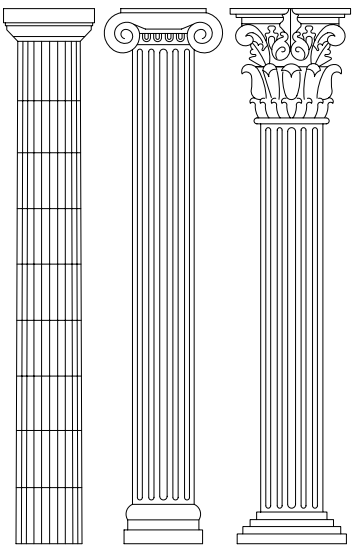


*c.*380 BCE	*c.*357 BCE	*c.*353 BCE	323 BCE	*c.*300–100 BCE	*c.*170 BCE
Architect Theodoros of Phocaea writes his treatise on the Doric tholos at Delphi. The monument was the only peripteral tholos of its time.	A series of colonnaded courts containing altars and temples and offering far-reaching views of the sea is built at the Sanctuary of Asclepius at Cos.	Mausolus, Persian satrap of Caria, dies. He is best known for his tomb, the Mausoleum (353–351 BCE), one of the seven wonders of the world.	The death of Alexander the Great marks the beginning of the Hellenistic kingdoms in southwest Asia and northeast Africa.	The Theater of Epidaurus (see p.40) is built. The design of the auditorium is renowned for its excellent acoustics.	Work begins on the frieze at the Altar of Pergamon. The classicizing sculptures of Telephos contrast with the flamboyance of the exterior decoration.

The final part of this project, the Erechtheum, reorganized the site of the old Temple of Athena, resolving the uneven terrain through three separate porches on different levels. The best known, the Porch of the Maidens, saw its caryatids successively copied at the Forum of Augustus in Rome, at Hadrian's Villa in Tivoli and, centuries later, in twin versions at the church of St. Pancras in London (1819–22; see p.282). Even more influential was the anthemion frieze of alternating palmette and lotus, replicated in Augustus's Forum and subsequently a ubiquitous emblem of the Greek Revival (see p.280).

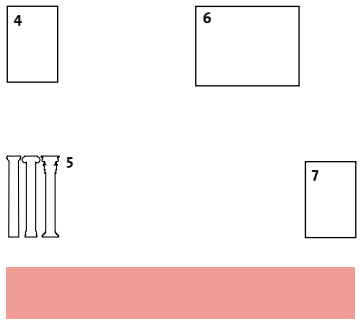
The architect of the Parthenon, Ictinus, also designed the more elongated Temple of Apollo Epikourios at Bassae (*c.*420 BCE). The interior was ringed by three-quarter columns and, opposite the entrance, there was a single column with a Corinthian capital (see image 5), which supported two mythological friezes. This new order, more embellished than Doric or Ionic with a double volute and acanthus leaves, developed in Athens, where it supported Phidias's statue of Athena Parthenos (438 BCE) in the Parthenon. During the fourth century BCE, the order decorated the interiors of the Temple of Athena Alea and the tholos at Epidaurus as a particularly sacred form, but found no exterior use before the Lysicrates Monument, where it was built into the blind walls of the tholos and supported a Dionysiac frieze. The decorated monumental simplicity of this design, roofed by rounded tiles diminishing in size toward the conical summit, crowned by a finial, was reproduced during the Greek Revival, seen in the open colonnade on Edinburgh's Calton Hill (1830–31) and the crowning of St. John's Church in Chichester, West Sussex (1812).

From the fourth century BCE, the Ionic order was the dominant mode of monumental temple design. The Temple of Athena Polias at Priene (see image 4) was, with a highly decorative entablature and cornice, the product of a geometrical scheme by the architect Pytheos: its six-by-eleven *peripteros* was established in plan by a grid of squares with sides of 12 Attic feet. To this plan, the architect Hermogenes added a high substructure and deep frontal stair in the Temple of Dionysus at Teos (second century BCE). His Temple of Artemis at Magnesia (*c.*150–130 BCE) was more original. Its eight frontal columns by fifteen along the flanks provided a spacious peristasis (porch or hall). Facing west like other Artemis temples, the front pediment was pierced by three rectangular openings intended for the appearance of cult statues on festivals, and through the main door the gilded statue of the *cella* was illuminated at the full moon. Hermogenes also prescribed a set of proportional relationships for temple intercolumniations, which formalized aesthetic awareness of the height and spacing of temple porticoes.



Greek architectural accomplishments were not confined to temple architecture. In mainland Greece, civic architecture is little attested before the late sixth century BCE, and only then in buildings of rudimentary design. Yet, some parts of the Greek world saw precocious innovation. At the Greek colony of Metapontum in southeast Italy, the second phase of the monumental building northeast of the agora (public space for meetings, etc.), dateable to the middle of the sixth century BCE, consisted of two banks of seats on either side of a rectangular space forming all together an almost perfectly circular assembly building (*ekklesiasterion*). This conception provides an architectural correlate of early philosophical thinking about the disc-shaped cosmos.

No less evocative, tholos structures grounded in earth had held associations with the underworld since the Mycenaean period (*c.*1600–1100 BCE). The tholos of the Sanctuary of Athena Pronaia at Delphi (see image 6) is thought to have been connected with chthonic (underworld) cults. Probably designed by architect Theodoros of Phocaea, its raised floor rested on a three-stepped podium and supported an outer ring of twenty Doric columns, a circular *cella* wall and an inner ring of ten Corinthian columns standing on a



bench-like socle of black limestone. The *cella* was paved with slabs of the same stone, apart from a circle of sparkling white Pentelic marble in the center, which contributed to a multicolored effect. The tholos of the Sanctuary of Asclepius at Epidaurus (third century BCE) had twenty-six outer Doric and fourteen inner Corinthian columns as well as a pavement of alternate black and white limestone diamond-shaped stones around a central opening to a sacred pit.

The tholos form was adapted for memorial structures of the Macedonian kings in the Philippeum at Olympia (*c.*339–300 BCE) and Arsinoeum at Samothrace (288–250 BCE). At the latter site, the Propylon of Ptolemy II (*c.*282 BCE), built over a tunnel that is one of the earliest examples of vaulted stone architecture, gave the Corinthian capital a new structural use in the facade. An inscription in squared lettering was displayed on the architrave; previously, such dedications had been placed low down on the stylobate. The sacred aspect of Corinthian architecture was suggested by a common hierarchical use of the orders in Hellenistic architecture. In the *temenos* (sacred enclosure) of the ruler cult at Pergamon, for example, a Doric courtyard led through an Ionic colonnade to a Corinthian shrine. Even more influential on later architecture was the stoa form. Although this simple open portico, with a single row of supports to hold a wooden truss roof and a rear wall, had a long history of use along the edges of sanctuaries and civic spaces since the Archaic period (650–480 BCE), its potential as an interior space was realized in the long Stoa of Attalus at Athens (see image 7), reconstructed in the twentieth century. This spacious construction also extended the potential for monumental inscriptions, now in larger letters across the architrave.

Monumental Greek architecture was predominantly based upon squared stone construction, perfected through techniques such as dressing the edges of the stone's outer face and anathyrosis on the sides of blocks to enable them to fit closely together. However, the common assumption that mortar was not used until the Roman period (146 BCE–CE 330) is incorrect. Although mortars were not used in Greek architecture for bonding squared stone masonry, where instead iron clamps were employed, they found an application as rendering on interior surfaces. In hydraulic structures, water-resistant mortars made from lime, sand, and volcanic materials were used from the Archaic period to coat cisterns and, later, to bond walls in harbor structures. Mortars were even used to bond walls of rubble in houses from the early Hellenistic period (323–30 BCE). **EVT**

4 Temple of Athena Polias (fourth century BCE)
Pytheos
Priene, Aydin province, Turkey

5 Left to right: Doric, Ionic, and Corinthian orders

6 Tholos of the Sanctuary of Athena Pronaia (380–360 BCE)
Theodoros of Phocaea
Delphi, Greece

7 Stoa of Attalus (*c.*150 BCE)
Architect unknown
Athens, Greece

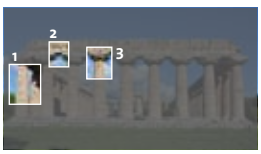
Temples of Hera *c.*550 – *c.*460 BCE

ARCHITECT UNKNOWN

Temple of Hera I, Paestum, Italy

Two adjacent limestone temples dedicated to the goddess Hera face east at the southern end of the Greek colony of Poseidonia (Paestum). The more southerly was built in *c.*550 to 520 BCE. Although some of its decorative forms are similar to those of temples in mainland Greece, it was not a derivative colonial product, but a strongly independent work. Planned with a rear porch (*opisthodomos*), it was built instead with an innovative rear inner shrine that became typical of the western Greek colonies. A single row of columns formed a central spine in an archaic manner in the raised *cella*. Two doors into the *cella* and the *adyton* (restricted area) beyond may have accommodated ritual processions or served a double cult. The second temple, built some sixty years later, is larger but more compact. Its *opisthodomos* and steps to a *cella* show the influence of mainland Greece. It is thought to be the purest surviving Doric temple, with refinements that include a slight curvature at the center of the stylobate, to correct the optical illusion of sagging, inward inclination of the columns and angle contraction with the corner intercolumniations of fronts and flanks reduced to center the triglyphs over the columns. The columns were stuccoed to make the travertine look like marble. **EVT**

NAVIGATOR



FOCAL POINTS

1 COLUMN SHAFT

The bulge in the column shafts was known as entasis (tension), which metaphorically expressed a column's load-bearing function. Ancient architects honed this visual refinement into the much less pronounced swelling of the second Hera temple and the very delicate curves of the Erechtheum and other buildings of classical Athens.

2 ARCHITRAVE

The architrave was separated from the frieze by a sandstone string course, originally decorated with leaf-like patterns. The ends of the backing blocks preserve the large cut "U"-shapes used to hold rope to lift the blocks into place. These blocks are all that remain of the frieze. No metopes or triglyphs of the frieze survive.

3 CAPITAL AT WEST END

The necks of the capitals are decorated with carved floral patterns offering parallels with northwest Greece. At the rear of the temple, some capitals have further decoration, composed variously of lotus flowers, rosettes, tendrils, and palmettes. Originally more prominent through the use of paint, they may represent the work of different sculptors.

FRAGMENT OF CARVED AND PAINTED TERRACOTTA REVETMENT

The roofline of the temples was decorated in conventional style with architectural terracottas. Nothing is left above the frieze course, but numerous painted terracotta antefixes (upright ornaments) from the eaves of the roof have been found. This fragment (right), dating from *c.*520 BCE, comes from one of the long sides of the roof of the first Temple of Hera. It consists of a *sima* (upturned roof edge that serves as a gutter) decorated with palmettes and lotus flowers, with fantastical lion's head water spouts.

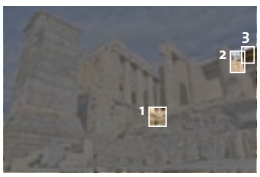
Propylaea 437–432 BCE

MNESICLES

Propylaea,
Athens, Greece

Mnesicles's design repeated the main elements of the previous entrance to the Acropolis in Athens—a gate structure to receive processions, with spaces on either side—but turned the gatehouse into a unified complex, reoriented to face the ramp ascending to the sanctuary. On the inner side, this had the effect of offering a three-quarter view of the Parthenon's north and west faces. In order to accommodate extensive processions, the passageway was almost doubled in breadth: the central intercolumniation of the new six-column facade was widened with three metopes and two triglyphs, instead of the two metopes and single triglyph typical of the Doric order. From here, the Athenian procession filed through an inner court, with a ceiling supported by two rows of Ionic columns. The outer dining room was situated perpendicular to the gatehouse and hung with paintings. Its columnar front was repeated opposite; crowning statues of horsemen emphasized these western projections flanking the deep-set center in a stage-like arrangement. On the northern side, an inner wing with a columned hall added depth. This formula of a central building flanked by wings was recycled for monumental entrances from the Roman period onward. **EVT**

NAVIGATOR



FOCAL POINTS

1 STYLOBATE

To serve the higher order of the central building, yet maintain the unity of the complex, a fourth step was added below the usual three of the stylobate. The lowest step was distinguished by dark Eleusian stone instead of the white Pentelic marble of the others.

2 INNER IONIC ORDER

The inner hall is supported on the west side by a huge Ionic order: two rows of columns flanking the processional passageway. It had a symbolic function, mirrored in the back room of the Parthenon temple, proclaiming Athens's Ionian identity against Dorian Sparta.

3 IONIC ARCHITRAVE

The architraves are reinforced with iron bars. Unlike the use of steel reinforcement in modern concrete beams, this was not done to exploit the material's tensile strength, but to prevent the marble ceiling beams falling directly on the central part of the architrave.

◄ In the southwest wing, perhaps for the first time in Greek architecture, a narrow rectangular pillar was used instead of the familiar circular column. It supported an architrave and frieze, which, unusually, lacked triglyphs. This variant of the Doric order also facilitated access to the small Athena Nike Sanctuary.

MNESICLES

The Propylaea is Mnesicles's only certain work, although he has also been credited with the Erechtheum (421–405 BCE; right) and the Stoa of Zeus (*c.*425–410 BCE) in the ancient Agora. He used innovative expedients to reshape the Doric order, interweaving it with the Ionic, or introducing Ionic elements such as the bed molding of the Doric cornice, to produce a unified entrance complex on a site where the Acropolis rock was still rising toward the summit. Some argue that he intended a fully symmetrical structure with the northern wing matched by corresponding structures on the south, but Mnesicles's genius was to conceal the asymmetry of the arrangement by the symmetrical impression of the entrance court.

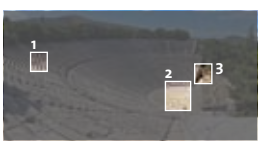
Theater of Epidaurus Third century BCE

ARCHITECT UNKNOWN

Theater of Epidaurus, Epidaurus, Greece

In the second century CE, traveler and geographer Pausanias considered this theater in the Sanctuary of Asclepius to be the finest in Greece, attributing it to the architect Polykleitos the Younger, who lived in the middle of the fourth century BCE. However, the discovery of reused blocks in the foundations of the lower part of the auditorium and in the ramps leading to the stage have led to a redating of the theater to the third century BCE, with the auditorium extended and the stage widened in the second century BCE. Nevertheless, the building took several decades to construct and was probably not completed until the third century BCE at the earliest. Its gradual development is belied by the structure's unified appearance. It consists of a steep curved auditorium, extending more than a semicircle around the orchestra, with rows of stone seats symmetrically arranged up the hillside. The lowest rows formed the seats of honor, for magistrates and state visitors. The stage, or scene building, is set on a tangent to the orchestra; a later Hellenistic innovation was the raised stage (proscenium) added along the facade, adapted to the direct engagement between actors and audience. The building's influence on theatrical space and identity has been felt abroad, notably at the National Theatre in London, designed by Denys Lasdun (1914–2001). This building houses three venues, based on different historical models, and the Olivier (opened in 1976) derived its open stage and fan-shaped auditorium from the model of Epidaurus. **EVT**

NAVIGATOR



FOCAL POINTS

1 SEATING

The wedge-shaped blocks of seating are separated by stairways; above the horizontal gangway, the stairways occur twice as frequently, and the steeper slope produces taller seats, making cushions necessary for comfort. Estimates have suggested an original capacity of more than 12,000.

2 ORCHESTRA

This circular space traditionally commemorated the dithyrambic dance in honor of Dionysus. Its paradigm was the dance platform at Knossos, Crete, designed by architect Daedalus. Defined by a circle of white stone, with a stone altar at the center, it follows five-sixths of the curve of the lowest benches.

3 ENTRANCE GATEWAYS

Gateways on either side of the stage not only funneled spectators into the theater, but also helped to overcome the lack of connection between the seating blocks and scene building. The wider entrance to the left admitted spectators, while the narrower opening gave access to a ramp leading to the stage.

ACOUSTICS

In the belief that the human voice was diffracted in circles like ripples but also rose vertically, Vitruvius suggested that the ascending rows of seats in Greek theaters were designed to receive the actors' voices harmoniously using mathematical rules and musical methods. When Peter Hall directed the *Oresteia* by Aeschylus at Epidaurus in 1982, he explained the architecture of the theater there as an embodiment of Aristotle's principle of catharsis, because treating the soul contributes to more general bodily therapy. The acoustics, he claimed, were imperfect because the human body was not perfectly symmetrical. The ancient architect had wanted his theater to feel human, not geometrically perfect, in keeping with the healing sanctuary where ailing bodies were in a state of disharmony. The superb acoustics at the Olivier Theatre, London (right), can present a challenge to directors because they pick up the slightest sound.