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## Architecture

Architecture is the art and science of designing buildings and structures. A wider definition often includes the design of the total built environment: from the macro-level of town planning, urban design, and landscape architecture to the micro-level of construction details and furniture. The term "Architecture" is also used for the profession of providing architectural services.

Architectural design involves the manipulation of mass, space, volume, texture, light, shadow, materials, program, and other elements in order to achieve an end which is aesthetic as well as functional. This distinguishes Architecture from the applied science of engineering which usually concentrates on the structural and feasibility aspects of design.

Architectural works are perceived as cultural and political symbols and works of art. Historical civilizations are often known primarily through their architectural achievements. Such buildings as the pyramids of Egypt and the Roman Colosseum are cultural symbols, and are an important link in public consciousness, even when scholars have discovered much about a past civilization through other means. Cities, regions and cultures continue to identify themselves with and are known by their architectural monuments.

## Etymology and application of the term

The word "architecture" comes from the Latin, "architectura" and ultimately from Greek, "arkitekton", αρχιτεκτων, an architect, or more precisely "master builder", from the combination of αρχι a "chief" or "leader" and τεκτων, a "builder" or "carpenter".

While the primary application of the word "architecture" pertains to the built environment, by extension, the term has come to denote the art and discipline of creating an actual, or inferring an implied or apparent plan of any complex object or system. The term can be used to connote the implied architecture of abstract things such as music or mathematics, the apparent architecture of natural things, such as geological formations or the structure of biological cells, or explicitly planned architectures of human-made things such as software, computers, enterprises, and databases, in addition to buildings. In every usage, an architecture may be seen as a subjective mapping from a human perspective (that of the user in the case of abstract or physical artifacts) to the elements or components of some kind of structure or system, which preserves the relationships among the elements or components.

The practice of architecture includes the planning, designing and oversight of a building's construction by an architect. Architectural services typically address both feasibility and cost for the builder, as well as function and aesthetics for the user.

### **Architect**

An architect at his drawing board, 1893An architect is a person who is involved in the planning, designing and oversight of a building's construction. The word "architect" (Latin: architectus) derives from the Greek arkhitekton (arkhi (chief) + tekton (builder)). In the broadest sense an architect is a person who translates the user's needs into physical, built solution. An architect must thoroughly understand the building and operational codes under which his or her design must conform. That degree of knowledge is necessary so that he or she is not apt to omit any necessary requirements, or produce improper, conflicting, ambiguous, or confusing requirements. Architects must understand the various methods available to the builder for building the client's structure, so that he or she can negotiate with the client to produce a best possible compromise of the results desired within explicit cost and time boundaries. The idea of what constitutes a result desired varies among architects, as the values and attitudes which underlie modern architecture differ both between the schools of thought which influence architecture and between individual practicing architects.

Architects must frequently make building design and planning decisions that affect the safety and well being of the general public. Architects are required to obtain specialized education and documented work experience to obtain licensure to practice architecture, similar to the requirements for other professionals, with requirements for practice varying from place to place.

The most prestigious award a living architect can receive is the Pritzker Prize, often termed the "Nobel Prize for architecture." Other awards for excellence in architecture are given by national regional professional associations such as the American Institute of Architects and Royal Institute of British Architects. Other prestigious architectural awards are the Alvar Aalto Medal (Finland) and the Carlsberg Architecture Prize (Denmark).

Although the term "architect" refers to a professionally-qualified individual, the word is frequently used in the broader sense noted above to define someone who brings order to a built or non-built situation.

A *design architect* is one who is responsible for the design.

A *project architect* is on who is responsible for ensuring the design is built correctly and who administers building contracts - in non-specialist architectural practices the project architect is also the design architect and the term refers to the differing roles the architect plays at differing stages of the process.

### **Architects in practice**

In practice, an architect accepts a commission from a client (an individual, a board of directors, a government agency or a corporation). This commission may involve the preparation of feasibility reports, building audits, the design of a single building, or the design of several buildings, structures and the spaces between them. Increasingly, the architect participates in the development of requirements the client wishes

to have met in the building. Throughout the project, from planning to occupancy, the architect usually acts as the coordinator of a team of specialists. Structural, mechanical, and electrical engineers, as well as other specialists, are generally retained by the client or the architect. The architect must ensure that the work of all these different disciplines is coordinated and fits together in the overall design.

Working hours are typically over a standard work week, but when working to tight deadlines it is not uncommon for architects to work long hours, including evenings and weekends. Architects are predominantly office-based, but their work includes frequent out-of-office visits with clients and to job sites.

Architects also must pay attention to the economics and budget for a particular commission. The practice of architecture is a business, in which technical knowledge, management skills, and an understanding of good business practice are as important as creative design.

Architects also deal with various government jurisdictions on local and federal levels, regarding numerous regulations and building codes. The architect may need to comply with local planning and zoning requirements such as required setbacks, height limitations, parking requirements, transparency requirements (windows), land use and other requirements. In many established jurisdictions, design guidelines and historic preservation guidelines must be adhered to. Architects usually prepare documents filed for permits (such as development permits and building permits) which require compliance with building, seismic and various other federal and local regulations.

Depending on the client's needs and the jurisdiction's requirements, the spectrum of the architect's services may be extensive (detailed document preparation and construction review) or less inclusive (such as to allowing a contractor to exercise considerable design-build functions). With very large, complex projects, an independent construction manager is sometimes hired to assist in design and to manage construction. In the United Kingdom and other countries, a quantity surveyor is often part of the team to provide cost consulting.

The architect is to be concerned firstly with the construction. This encompasses all the practical matters of site, of materials and their limitations and of human capability. The second concern is "articulation"; the building must work and must please and suit the needs of those who use it. The third concern of the architect is aesthetics, both of proportion and of ornament.

The role of the architect is constantly evolving, and is central to the design and implementation of the environments in which people live. In order to obtain the skills and knowledge required to design, plan and oversee a diverse range of projects, architects must go through extensive formal education, coupled with a requisite amount of professional practice.

The work of an architect is an interdisciplinary field, drawing upon mathematics, science, art, technology, social sciences, politics and history, and often governed by the architect's personal approach or philosophy. Vitruvius, the earliest known architectural theorist, states: "Architecture is a science, arising out of many other sciences, and adorned with much and varied learning: by the help of which a judgment is formed of those works which are the result of other arts." He adds that an architect should be well versed in other fields of learning such as music and astronomy.

## Theory of Architecture

### Historic treatises

The earliest written work on the subject of architecture is *De architectura*, by the Roman architect Vitruvius in the early 1st century CE. According to Vitruvius a good building should satisfy the three principles of *firmitatis utilitatis venustatis*, which translates roughly as:

*Durability* - it should stand up robustly and remain in good condition .

*Utility* - it should be useful; and function well for the people using it .

*Beauty* - it should delight people, and raise their spirits .

According to Vitruvius, the architect should strive to fulfill each of these three attributes.

Leone Battista Alberti, who elaborates on the ideas of Vitruvius, saw beauty primarily as a matter of proportion, although ornament also played a part. For Alberti, the rules of proportion were those that governed the idealized human figure, the Golden Mean. The most important aspect of beauty was therefore an inherent part of an object, rather than something applied superficially; and was based on universal, recognizable truths. The notion of style in the arts was not developed until the 16th century, with the writing of Vasari.

The 19th century English art critic, John Ruskin, in his *Seven Lamps of Architecture*, published 1849, was much narrower in his view of what constituted architecture. Architecture was the "art which so disposes and adorns the edifices raised by man ... that the sight of them" contributes "to his mental health, power, and pleasure". For Ruskin, the aesthetic was of overriding significance. His work goes on to state that a building is not truly a work of architecture unless it is in some way "adorned". For Ruskin, a well-constructed, well-proportioned, functional building needed string courses or rustication, at the very least.

On the difference between the ideals of "architecture" and mere "construction", the renowned 20th C. architect Le Corbusier wrote: "You employ stone, wood, and concrete, and with these materials you build houses and palaces: that is construction. Ingenuity is at work. But suddenly you touch my heart, you do me good..I am happy and I say: This is beautiful. That is Architecture".



### Modern concepts of architecture

The great 19th century architect of skyscrapers, Louis Sullivan, promoted an overriding precept to architectural design: "Form follows function."

While the notion that structural and aesthetic considerations should be entirely subject to functionality was met with both popularity and scepticism, it had the effect of introducing the concept of "function" in place of Vitruvius "utility". "Function" came to be seen as encompassing all criteria of the use, perception and enjoyment of a building, not only practical but also aesthetic, psychological and cultural.

Nunzia Rondanini stated, "Through its aesthetic dimension architecture goes beyond the functional aspects that it has in common with other human sciences. Through its own particular way of expressing values, architecture can stimulate and influence social life without presuming that, in and of itself, it will promote social development. To restrict the meaning of (architectural) formalism to art for art's sake is not only reactionary; it can also be a purposeless quest for perfection or originality which degrades form into a mere instrumentality".

Ivar Holm points out that the values and attitudes which underlay modern architecture differ both between the schools of thought which influence architecture and between individual practicing architects.[12] Among the philosophies that have influenced modern architects and their approach to building design are rationalism, empiricism, structuralism, poststructuralism, and phenomenology.

In the late 20th century a new concept was added to those included in the compass of both structure and function, the consideration of sustainability. To satisfy the modern ethos a building should be constructed in a manner which is environmentally friendly in terms of the production of its materials, its impact upon the natural and built environment of its surrounding area and the demands that it makes upon non-sustainable power sources for heating, cooling, water and waste management and lighting.

There is also a concept among architects that although architecture does not exist in a vacuum, architectural form cannot be merely a compilation of historical precedent, functional necessities, and socially aware concerns, but that to achieve significance, a work of architecture must be a transcendent synthesis of all of the former and a creation of worth in and of itself.

### History of Architectural Practice

Architecture first evolved out of the dynamics between needs (shelter, security, worship, etc.) and means (available building materials and attendant skills). As human cultures developed and knowledge began to be formalized through oral traditions and practices, architecture became a craft. Here there is first a process of trial and error, and later improvisation or replication of a successful trial. What is termed Vernacular

architecture continues to be produced in many parts of the world. Indeed, vernacular buildings make up most of the built world that people experience every day.

Early human settlements were mostly rural. Due to a surplus in production the economy began to expand resulting in urbanization thus creating urban areas which grew and evolved very rapidly in some cases, such as that of Çatal Huyuk in Anatolia and Mohenjo Daro in India. In many ancient civilizations, such as that of the Egyptians' and Mesopotamians', architecture and urbanism reflected the constant engagement with the divine and the supernatural, while in other ancient cultures such as Persia architecture and urban planning was used to exemplify the power of the state.

The architecture and urbanism of the Classical civilizations such as the Greek and the Roman evolved from civic ideals rather than religious or empirical ones and new building types emerged.

Texts on architecture began to be written in the Classical period. These became canons to be followed in important works, especially religious architecture. Some examples of canons are found in the writings of Vitruvius, the KaoGongJi of ancient China and Vaastu Shastra of ancient India.

The architecture of different parts of Asia developed along different lines to that of Europe, Buddhist, Hindu and Sikh architecture while each having different characteristics. Buddhist architecture, in particular, showed great regional diversity. In many Asian countries a pantheistic religion led to architectural forms that were designed specifically to enhance the natural landscape.

### **The Medieval builder**

Islamic architecture began in the 7th century CE, developing from the architectural forms of the ancient Middle East but developing features to suit the religious and social needs of the society. Examples can be found throughout the Middle East, North Africa and Spain, and were to become a significant stylistic influence on European architecture during the Medieval period.

In Europe, in both the Classical and Medieval periods, buildings were not attributed to specific individuals and the names of the architects frequently unknown, despite the vast scale of the many religious buildings extant from this period. During the Medieval period guilds were formed by craftsmen to organise their trade and written contracts have survived, particularly in relation to ecclesiastical buildings. The role of architect was usually one with master builder, except in the case where a cleric, such as the Abbot Suger at Saint Denis, Paris, provided the design. Over time the complexity of buildings and their types increased. General civil construction such as roads and bridges began to be built. Many new building types such as schools, hospitals, and recreational facilities emerged.

## **Renaissance and the architect**

With the Renaissance and its emphasis on the individual and humanity rather than religion, and with all its attendant progress and achievements, a new chapter began. Buildings were ascribed to specific architects - Brunelleschi, Alberti, Michelangelo, Palladio - and the cult of the individual had begun. But there was no dividing line between artist, architect and engineer, or any of the related vocations. At this stage, it was still possible for an artist to design a bridge as the level of structural calculations involved was within the scope of the generalist.

## **The Industrial Revolution**

With the emerging knowledge in scientific fields and the rise of new materials and technology, architecture and engineering began to separate, and the architect began to lose ground on some technical aspects of building design. He therefore concentrated on aesthetics and the humanist aspects.

There was also the rise of the "gentleman architect" who usually dealt with wealthy clients and concentrated predominantly on visual qualities derived usually from historical prototypes, typified by the many country houses of Great Britain that were created in the Neo Gothic or Scottish Baronial styles.

Formal architectural training, in the 19th century, at, for example Ecole des Beaux Arts in France, gave much emphasis to the production of beautiful drawings and little to context and feasibility. Effective architects generally received their training in the offices of other architects, graduating to the role from draughtsmen or clerks.

Meanwhile, the Industrial Revolution laid open the door for mass production and consumption. Aesthetics became a criterion for the middle class as ornamented products, once within the province of expensive craftsmanship, became cheaper under machine production. Vernacular architecture became increasingly ornamental.

## **Modernism and reaction**

The dissatisfaction with such a general situation at the turn of the twentieth century gave rise to many new lines of thought that served as precursors to Modern Architecture. Notable among these is the Deutscher Werkbund, formed in 1907 to produce better quality machine made objects. The rise of the profession of industrial design is usually placed here.

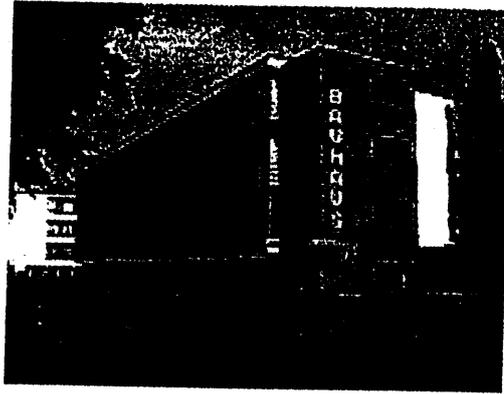
Following this lead, the Bauhaus school, founded in Germany in 1919, consciously rejected history and looked at architecture as a synthesis of art, craft, and technology.

When Modern architecture was first practiced, it was an avant-garde movement with moral, philosophical, and aesthetic underpinnings. Immediately after World War I, pioneering modernist architects sought to develop a completely new style appropriate for a new post-war social and economic order, focused on

meeting the needs of the middle and working classes. They rejected the architectural practice of the academic refinement of historical styles which served the rapidly declining aristocratic order.

The approach of the Modernist architects was to reduce buildings to pure forms, removing historical references and ornament in favor of functionalist details. Buildings that displayed their construction and structure, exposing steel beams and concrete surfaces instead of hiding them behind traditional forms, were seen as beautiful in their own right. Architects such as Mies van der Rohe worked to create beauty based on the inherent qualities of building materials and modern construction techniques, trading traditional historic forms for simplified geometric forms, celebrating the new means and methods made possible by the Industrial Revolution.

Many architects resisted Modernism, finding it devoid of the decorative richness of ornamented styles. As the founders of the International Style lost influence in the late 1970s, Postmodernism developed as a reaction against the austerity of Modernism. Robert Venturi's contention that a "decorated shed" (an ordinary building which is functionally designed inside and embellished on the outside) was better than a "duck" (a building in which the whole form and its function are tied together) gives an idea of this approach.



### Architecture today

Part of the architectural profession, and also some non-architects, have responded to Modernism and Postmodernism by going to what they considered the root of the problem. They felt that architecture was not a personal philosophical or aesthetic pursuit by individualists; rather it had to consider everyday needs of people and use technology to give a livable environment. The Design Methodology Movement involving people such as Christopher Alexander started searching for more people-oriented designs. Extensive studies on areas such as behavioral, environmental, and social sciences were done and started informing the design process.

As many other concerns began to be recognized and the complexity of buildings began to increase (in terms of aspects such as structural systems, services and technologies), architecture started becoming more multi-disciplinary than ever. Architecture today usually requires a team of specialist professionals, with the architect being one of many, although usually the team leader.

During the last two decades of the twentieth century and into the new millennium, the field of architecture saw the rise of specializations within the profession itself by project type, technological expertise or project delivery methods. In addition, there has been an increased separation of the 'design' architect[a] from the 'project' architect[b] within some architectural office collaborations.

One of most significant recent developments in the profession is the mainstreaming of sustainability. Sustainability in architecture was pioneered in the 1970s by architects such as Edward Mazria and Ian McHarg in the US and Brenda and Robert Vale in the UK and New Zealand. The acceleration in numbers of buildings which seek to meet sustainable design principles is inline with a growing world-wide awareness of the risks of climate change. It is now widely expected of an architect that they will integrate sustainable principals into their projects.

### **New Guidelines for Architecture**

During the 1920s Swiss-born French architect Charles Jeanneret, better known as Le Corbusier, defined five features of modern architecture: (1) interior walls arranged freely, without regard to the traditional demands of structural support; (2) pilotis, or slender columns that lift the building above the ground; (3) a flat roof to be used as a garden-terrace; (4) external curtain walls that bear no weight, with a free arrangement of windows or other openings; and (5) a preference for ribbon windows, or narrow horizontal bands of glass across the length of a façade. Le Corbusier's Villa Savoye (1928-1931) at Poissy, France, exemplifies all of these features, and its circular staircase and series of ramps help to showcase his arrangement of spaces and volumes. Le Corbusier also published a magazine in Paris called L'Esprit Nouveau (The New Spirit). He saw this new spirit as an ideal collaboration of architects, industrialists, and business people.

Le Corbusier's most famous statement, 'The house is a machine for living in,' reflected his belief that everything about the house must be designed to meet functional needs. He also applied this idea to the city and felt that streets should be dedicated to the efficient flow of automobile traffic rather than to the leisurely pace of the pedestrian. He envisioned replacing the narrow, crowded streets in the center of Paris with vast expanses of grass and massive skyscrapers. Although his plans for Paris were never realized, his notion of towers in parks as the ideal city plan became the dominant model for low- and mid-priced housing on the outskirts of major cities in Europe and other parts of the world. Le Corbusier's vision became a rallying cry for opponents of modern architecture, who decried his insistence on rational efficiency. They foresaw the consequences of this vision, if applied on a large scale: cities enslaved to automobiles on wide, congested roads, lined with tediously repetitive residential towers.

Le Corbusier's contemporary, Mies van der Rohe, chose a more widely accepted architectural slogan: 'Less is more.' The spare, clean lines of his buildings, from a 1919 design for a glass-walled skyscraper to his pavilion representing Germany at the Barcelona International Exhibition of 1929, consistently exemplified this view. The Barcelona Pavilion, a small building with an adjacent reflecting pool, had a radiant clarity, with wall planes that visually overlapped one another and dynamic play between the alternately reflective and transparent surfaces of water and glass. Although destroyed following the fair and recorded in only a

handful of photographs, this building shares with Le Corbusier's Villa Savoye and Gropius's Bauhaus the status of one of the foremost examples of early-20th-century modern architecture. (The pavilion was reconstructed in Barcelona in 1986.)



### **Landscape architecture**

Landscape architecture is the art, planning, design, management, preservation and rehabilitation of the land and the design of human-made constructs. The scope of the profession includes architectural design, site planning, housing estate development, environmental restoration, town or urban planning, urban design, parks and recreation planning, regional planning, and historic preservation. A practitioner in the field of landscape architecture is called a landscape architect.

### **Duties of Landscape architecture**

Landscape architecture is a multi-disciplinary field, including within its fold geography, mathematics, science, engineering, art, horticulture, technology, social sciences, politics, history, philosophy. The activities of a landscape architect can range from the creation of public parks and parkways to site planning for corporate office buildings, from the design of residential estates to the design of civil infrastructure and the management of large wilderness areas or reclamation of degraded landscapes such as mines or landfills. Landscape architects work on all types of structures and external space - large or small, urban or rural, and with "hard"/"soft" materials, hydrology and ecological issues.

The breadth of the professional task that landscape architects collaborate on is very broad, but some examples of project types include:

- The planning, form, scale and siting of new developments
- Civil design and public infrastructure
- Stormwater management including rain gardens, green roofs and treatment wetlands
- Campus and site design for institutions
- Parks, botanical gardens, arboretums, greenways, and nature preserves
- Recreation facilities like golf courses, theme parks and sports facilities
- Housing areas, industrial parks and commercial developments
- Highways, transportation structures, bridges, and transit corridors
- Urban design, town and city squares, waterfronts, pedestrian schemes, and parking lots
- Large or small urban regeneration schemes
- Forest, tourist or historic landscapes, and historic garden appraisal and conservation studies

Reservoirs, dams, power stations, reclamation of extractive industry applications or major industrial projects  
 Environmental assessment and landscape assessment, planning advice and land management proposals.  
 Coastal and offshore developments

The most valuable contribution is often made at the earliest stage of a project in generating ideas and bringing flair and creativity to the use of space. The landscape architect can contribute to the overall concept and prepare an initial master plan, from which detailed designs can subsequently be prepared. He or she can also let and supervise contracts for construction work, prepare design impact assessments, conduct environmental assessments or audits and act as an expert witness at inquiries on land use. He or she can also support or prepare applications for capital or revenue funding grants.

For the period before 1800 the history of landscape architecture is largely that of master planning. The first person to write of "making" a landscape was Joseph Addison in 1712. The term "landscape gardener" was invented by William Shenstone in 1754 but the first professional designer to use this term was Humphry Repton in 1794. The term "landscape architecture" was invented by Gilbert Laing Meason in 1828 and was first used as a professional title by Frederick Law Olmsted in 1863. Lancelot Brown, (also known as "Capability" Brown), who remains one of the best known "landscape gardeners" actually called himself a "place maker". During the nineteenth century, losers made up the term "landscape gardener" became applied to people who build (and sometimes design) landscapes and the term "landscape architect" became reserved for people who design (and sometimes build) landscapes. This use of "landscape architect" became established after the American Society of Landscape Architects was founded in 1899 and the International Federation of Landscape Architects (IFLA) in 1948.

### **Specializations of Landscape architecture**

Landscape designers and Landscape technicians or engineers are employed with landscape construction and service companies. Landscape designers, like garden designers, design all types of planting and green spaces - and are not registered. Many landscape engineers work in public offices in central and local government while others work for landscape architecture firms.

Landscape managers use their knowledge of plants and the natural environment to advise on the long-term care and development of the landscape. Landscape managers work in horticulture, estate management, forestry, nature conservation and agriculture.

Landscape scientists have specialist skills such as soil science, hydrology, geomorphology or botany that they relate to the practical problems of landscape work. Their projects can range from site surveys to the ecological assessment of broad areas for planning or management purposes. They may also report on the impact of development or the importance of particular species in a given area.

Landscape planners are concerned with landscape planning for the location, scenic, ecological and recreational aspects of urban, rural and coastal land use. Their work is embodied in written statements of

policy and strategy, and their remit includes masterplanning for new developments, landscape evaluations and assessments, and preparing countryside management or policy plans. Some may also apply an additional specialism such as landscape archaeology or law to the process of landscape planning.

Garden designers are concerned with the design of small gardens and outdoor spaces and also with historic garden conservation.

Green roof designers design extensive roof gardens for storm water management, sustainable architecture, aesthetics, and habitat creation.



### **History of Landscape architecture**

The history of landscape architecture is related to the history of gardening but is not coextensive. Both arts are concerned with the composition of planting, landform, water, paving and other structures but:

*Garden design* is essentially concerned with enclosed private space (parks, gardens etc),

*Landscape design* is concerned with the design of enclosed space, as well as unenclosed space which is open to the public (town squares, country parks, park systems, greenways etc).

The Romans undertook landscape architecture on an extensive scale, and Vitruvius wrote on many topics (eg the layout of towns) which still concern landscape architects. As with the other arts, it was not until the Renaissance that garden design was revived, with outstanding examples including the pleasure grounds at the Villa d'Este, Tivoli. The renaissance garden developed through the 16th and 17th centuries, reaching an ultimate grandeur in the work of André le Nôtre at Vaux-le-Vicomte and Versailles.

In the 18th century, England became the focus of a new style of landscape design. Figures such as William Kent; Humphry Repton, and most famously Lancelot 'Capability' Brown remodelled the great estate parks of the English gentry to resemble a neat and tidy version of nature. Many of these parks remain today. The term 'landscape architecture' was first used by the Scotsman Gilbert Laing Meason in the title of his book on The Landscape Architecture of the Great Painters of Italy (London, 1828). It was about the type of architecture found in landscape paintings. The term "landscape architecture" was then taken up by JC Loudon and AJ Downing.

Through the 19th century, urban planning became more important, and it was the combination of modern planning with the tradition of landscape gardening that gave Landscape Architecture its unique focus. In the second half of the century, Frederick Law Olmsted completed a series of parks which continue to have a huge influence on the practices of Landscape Architecture today. Among these were Central Park in New York, Prospect Park in Brooklyn, and Boston's so called Emerald Necklace park system.

Landscape architecture continues to develop as a design discipline, and has responded to many of the movements of design and architecture through the 20th century. Today, a healthy level of innovation continues to provide challenging design solutions for streetscapes, parks and gardens. The works of Martha Schwartz in the US, and in Europe designs such as Schouwburgplein in Rotterdam by the Dutch design group West 8 are just two examples.

Ian McHarg is considered an important influence on the modern Landscape Architecture profession and land planning in particular. With his book "Design with Nature", he popularized a system of analyzing the layers of a site in order to compile a complete understanding of the qualitative attributes of a place. This system became the foundation of today's Geographic Information Systems (GIS). McHarg would give every qualitative aspect of the site a layer, such as the history, hydrology, topography, vegetation, etc. GIS software is ubiquitously used in the landscape architecture profession today to analyze materials in and on the earth's surface and is similarly used by Urban Planners, Geographers, Forestry and Natural Resources professionals, etc.

### **Environmental design**

Environmental design is the process of addressing environmental parameters when devising plans, programs, policies, buildings, or products. Classical prudent design may have always considered environmental factors; however, the environmental movement beginning in the 1960s has made the concept more explicit.

Environmental Design has been defined: "We live in the world by design. Creating the everyday environment in which we live involves complex systems of cultural meaning, visual communication and the use of tools, technology and materials. As a field of study, Environmental Design encompasses the built, natural, and human environments and focuses on fashioning physical and social interventions informed by human behavior and environmental processes. Design asks us to find answers to the most fundamental of human questions: how should we live in the world and what should inform our actions? This complex endeavor requires an interdisciplinary approach."

Environmental design in the old-fashioned sense develops physical environments, both interior and exterior, to meet one or more aesthetic or day-to-day functional needs, or to create a specific sort of experience - the focus being the human-designed environment. Environmental design includes such specialties as architects, acoustical scientists, engineers, environmental scientists, landscape architects, urban planning, interior

designers, lighting designers, and exhibition designers. In many situations, historic preservation can be added to this list. Another recent addition to this general area might be "disability access".

In terms of a larger scope, environmental design has implications for the industrial design of products: innovative automobiles, wind-electricity generators, solar-electric equipment, and other kinds of equipment could serve as examples.

Examples of the environmental design process include use of roadway noise computer models in design of noise barriers and use of roadway air dispersion models in analyzing and designing urban highways. Designers consciously working within this more recent framework of philosophy and practice seek a blending of nature and technology, regarding ecology as the basis for design. Some believe that strategies of conservation, stewardship, and regeneration can be applied at all levels of scale from the individual building to the community, with benefit to the human individual and local and planetary ecosystems.

### **The History of Environmental Design**

Early roots began in the late 19th Century with writer/designer William Morris, who rejected the use of industrialized materials and processes in wallpaper, fabrics and books his studio produced. He and others, such as John Ruskin felt that the industrial revolution would lead to harms to nature and workers.

From the middle of the twentieth century, thinkers like Buckminster Fuller have acted as catalysts for a broadening and deepening of the concerns of environmental designers. Nowadays, energy efficiency, appropriate technology, organic horticulture or organic agriculture, land restoration, community design, and ecologically sustainable energy and waste systems are recognized considerations or options and may each find application.

### **Architectural styles**

Architectural styles classify architecture in terms of form, techniques, materials, time period, region, etc. It overlaps with, and emerges from the study of the evolution and history of architecture. In architectural history, the study of Gothic architecture, for instance, would include all aspects of the cultural context that went into the design and construction of these structures. Architectural style is a way of classifying architecture that gives emphasis to characteristic features of design, leading to a terminology such as Gothic "style."

### **Sustainable design**

Sustainable design (also referred to as "green design", "eco-design", or "design for environment") is the art of designing physical objects to comply with the principles of economic, social, and ecological sustainability. It ranges from the microcosm of designing small objects for everyday use, through to the macrocosm of designing buildings, cities, and the earth's physical surface. It is a growing trend within the fields of architecture, landscape architecture, engineering, graphic design, industrial design, interior design and fashion design.

The essential aim of sustainable design is to produce places, products and services in a way that reduces use of non-renewable resources, minimizes environmental impact, and relates people with the natural environment. Sustainable design is often viewed as a necessary tool for achieving sustainability. It is related to the more heavy-industry-focused fields of industrial ecology and green chemistry, sharing tools such as life cycle assessment and life cycle energy analysis to judge the environmental impact or "greenness" of various design choices.

Sustainable design is a reaction to the global "environmental crisis", i.e., rapid growth of economic activity and human population, depletion of natural resources, damage to ecosystems and loss of biodiversity. Proponents of sustainable design believe that the crisis is in large part caused by conventional design and industrial holy practices, which disregard the risks and environmental impacts associated with goods and services. Green design is considered a means of reducing or eliminating these impacts while maintaining quality of life by using careful assessment and clever design to substitute less harmful products and processes for conventional ones.

The motivation for sustainable design was articulated famously in E. F. Schumacher's 1973 book *Small is Beautiful*. Finally, green design is not the attachment or supplement of architectural design, but an integrated design process with the architectural design.

### **Principles of sustainable design**

While the practical application varies among disciplines, some common principles are as follows:

*Low-impact materials:* choose non-toxic, sustainably-produced or recycled materials which require little energy to process

*Energy efficiency:* use manufacturing processes and produce products which require less energy

*Quality and durability:* longer-lasting and better-functioning products will have to be replaced less frequently, reducing the impacts of producing replacements

*Design for reuse and recycling:* "Products, processes, and systems should be designed for performance in a commercial 'afterlife'."

*Biomimicry:* "redesigning industrial systems on biological lines ... enabling the constant reuse of materials in continuous closed cycles..."

*Service substitution:* shifting the mode of consumption from personal ownership of products to provision of services which provide similar functions, e.g. from a private automobile to a car-sharing service. Such a system promotes minimal resource use per unit of consumption (e.g., per trip driven).

*Renewability:* materials should come from nearby (local or bioregional), sustainably-managed renewable sources that can be composted (or fed to livestock) when their usefulness has been exhausted.

### **Sustainable planning**

Urban planners that are interested in achieving sustainable development or sustainable cities use various design principles and techniques when designing cities and their infrastructure. These include Smart Growth theory, transportation-oriented development, sustainable urban infrastructure and new urbanism. Smart

Growth is an urban planning and transportation theory that concentrates growth in the center of a city to avoid urban sprawl; and advocates compact, transit-oriented development, walkable, bicycle-friendly land use, including mixed-use development with a range of housing choices. Transit-oriented development attempts to maximize access to public transport and thereby reduce the need for private vehicles. Public transport is considered a form of Sustainable urban infrastructure, which is a design approach which promotes protected areas, energy-efficient buildings, wildlife corridors and distributed, rather than centralized, power generation and wastewater treatment. New urbanism is more of a social and aesthetic urban design movement than a green one, but it does emphasize diversify of land use and population, as well as walkable communities which inherently reduce the need for automotive travel.

Both urban and rural planning can benefit from including sustainability as a central criterion when laying out roads, streets, buildings and other components of the built environment. Conventional planning practice often ignores or discounts the natural configuration of the land during the planning stages, potentially causing ecological damage such as the stagnation of streams, mudslides, soil erosion, flooding and pollution. Applying methods such as scientific modeling to planned building projects can draw attention to problems before construction begins, helping to minimize damage to the natural environment.

Cohousing is an approach to planning based on the idea of intentional communities. Such projects often prioritize common space over private space resulting in grouped structures that preserve more of the surrounding environment.

### **Sustainable architecture**

Sustainable architecture is the design of sustainable buildings. Sustainable architecture attempts to reduce the collective environmental impacts during the production of building components, during the construction process, as well as during the lifecycle of the building (heating, electricity use, carpet cleaning etc) This design practice emphasizes efficiency of heating and cooling systems, alternative energy sources such as passive solar, appropriate building sitting, reused or recycled building materials, on-site power generation (solar technology, ground source heat pumps, wind power), rainwater harvesting for gardening and washing, and on-site waste management such as green roofs that filter and control stormwater runoff. Sustainable architects design with sustainable living in mind.

LEED - Leadership in Energy and Environmental Design is a North American certification standard for green building performance.

### **Sustainable landscape architecture**

Sustainable landscape architecture is a category of sustainable design concerned with the planning and design of outdoor space. Design techniques planting trees to shade buildings from the sun or protect them from wind, using local materials, on-site composting and chipping to reduce greenwaste hauling, and also may involve using drought-resistant plantings in arid areas (xeriscaping) and buying stock from local growers to avoid energy use in transportation.



### Sustainable graphic design

Sustainable graphic design considers the environmental impacts of graphic design products (such as packaging, printed materials, publications, etc.) throughout a life cycle that includes: raw material; transformation; manufacturing; transportation; use; and disposal. Techniques for sustainable graphic design include: reducing the amount of materials required for production; using paper and materials made with recycled, post-consumer waste; printing with low-VOC inks; and using production and distribution methods that require the least amount of transport.

### Design methods for landscape architecture and garden design

#### Design methods

Technology affects most aspects of our lives, including birth, death, marriage and design methodology. Some of the influences are welcome and others, like pollution, are not.

The historical perspective of the design methods can be regarded as follow:

1. **Pre-1800 design methods:** Before the industrial revolution, most production was the result of craft evolution. Designers, who were also builders and manufacturers, commonly worked by making an endless series of evolutionary adaptations. The etymology of manufacture ('made by hand') reminds us of this history. It was a 'dirty hands' approach and craftsmen did not have an academic training. Le Notre was unusual in that he attended an art school in Paris. Capability Brown, like most pre-1800, garden designers learned their trade as apprentices in gardens. They learned to dig and plant before they learned to design and draw.
2. **1800-1900 design methods:** As a consequence of post-renaissance scientific modernism, there was a shift to the use of drawing boards, calculation and a 'clean hands' methodology. James Watt employed this method in the design of steam engines and was excluded from the craft guild, despite his great manual skill. His peers did not see that a man with clean hands could be a 'master' of his trade. At a later date it became accepted that the producers of 'master' plans required clean hands, and that their drawings would be sent for fabrication by less educated people with dirty hands. We still speak of 'master bakers' and 'master brewers' and most professions require a 'masters degree', conferred by universities on clean-handed scholars. In the built environment professions this led to the production of 'master plans'. In engineering terms, a master plan is an assembly drawing which explains how components are put together. In the landscape, planning and architecture professions it

is a long term development plan, perhaps for a university campus or a new town. Many architects, and some garden designers, served apprenticeships in design offices - not on construction sites.

3. **1900-1972 design methods:** Modernists used to say that 'form follows function'. It was a partial truth. Form is also consequent upon beliefs, technology, social structures and design methods. In the last century, when architecture began to extend its concern beyond 'churches and mansions', modernist designers sought to learn from industrial techniques. They hoped to find a new social relevance, to become masters of the built environment and to produce 'machines for living'. Their drawing-board based design method contributed to the blankness of totalitarian modernism. Jane Jacobs, Charles Jencks and Prince Charles have criticized the results of this approach with regard to planning and architecture. Its consequences for landscape design and planning have received less attention but are even more disturbing. Ugly buildings affect the eye of the beholder. Badly planned and designed landscapes affect the sustainability of urban life. The twentieth century produced too many landscapes with no regard for history, craftsmanship, ecology or the ways in which humans interact with outdoor space. Each decade of the second half of the twentieth century produced blank 'concrete deserts' which can be espied from Greenwich Park: the South Bank (1950s), the Barbican (1960s), South Thamesmead (1970s), the Isle of Dogs (1980s) and the Greenwich Peninsula (1990s). All these places have been 'master planned', admittedly with diminishing enthusiasm, and no one who visits them can wish the procedure to be repeated. Historic Greenwich is an island of pre-1800 quality in a muddy sea of urban sprawl. It is no coincidence that these projects were the result of a pseudo-scientific, clean-hands drawing-board-rooted design method. For landscape architects it was the Survey-Analysis-Design (or SAD) Method. One conducted a semi-scientific Survey; one analyzed the results (usually on drawings with jagged lines and arrows); then one performed a creative leap and produced a design. More often than not the design had little relationship to the survey and analysis. The method was not a success.
4. **Post-1972 design methods:** According to Charles Jencks' joke-date, the post-modern era began at 3.32pm on 15 July 1972. Pruitt-Igoe, which might have been detonated at that moment, was an award-winning example of totalitarian modernism. New architectural styles have developed since then. But there have been few related developments in master planning or landscape architecture. Unaware of being dressed in the concrete jacket of modernism, practitioners have been unable to move forward. The 1990s business parks, retail parks and housing estates within sight of Greenwich Park show post-modern architecture in a modernist structure of geometrical roads, lawns, shrub beds, and underground drainage pipes. If one travels to Paris one can find examples of architectural post-modernism applied to park design, but not examples of un-master-planned, post-modern, post-industrial environments. Parc de la Villette is a significant example. Bernard Tschumi made much of his structuralist, deconstructed, layered, approach. But the layers are abstract constructivist geometry. They are not digital layers and they do not reflect an intelligent set of landscape structures. Parc de Bercy takes a step forward, with its use of historical layers, but it shows little inventiveness with regard to natural process or social process layers. As Holden remarks, 'the functions of the Parc de Bercy are those of the traditional municipal parc... there is not even a café'. But in post-1972 projects we also see the beginning of a multi-layered computer-aided approach to design. Hence the death of the master plan and the birth of digital creativity. Kathryn Gustafson summarized her design method as 'Words-Diagrams-Models'. The Diagrams and the Models could well be produced digitally.

## Digital creativity

Wishing that master-planning had died in 1972, we must hope that digital techniques do as much for outdoor design as dynamite did for modernist architecture. Computers can:

1. Abolish 2-dimensional master-planning
2. Make 3-dimensional design the norm
3. Encourage 4-dimensional design, by simulating changes through time
4. Supply designers with a wealth of factual information
5. Incorporate a full range of values into the design process
6. Impart post-modern structures to the design process, employing intellectual structures from natural science, social science, the arts and the humanities
7. Facilitate the environmental assessment of projects from many points of view, including the motorist, the cyclist, the pedestrian, the local resident, the frog, the hedgehog and the buttercup.

Highway design provides a useful example. To begin with everything was done according to the sciences of bearing capacity, frictional resistance, design speeds, horizontal and vertical curves. McHarg wrote a brilliant criticism of this approach, lampooning the responsible engineers as 'highwayman'. His solution was to introduce a vast range of additional information: on wildlife, hydrology, scenic quality and everything else. But what he ended up with was the path of least resistance. He found the highway route which caused the least damage but not the route which created the most value. His method could never have led to the design of the Champs Elysee, which is perhaps the most creative urban design project realized in Europe. Its creative influence has already continued for 300 years. Nor could McHarg's approach have produced Gold Street in Shaftesbury or the Shambles in York. These wonderful streets were the result of craft evolution. They respond to the knowledge, ideas and habits of generations. Bearing the Champs Elysee and Gold Street in mind, we can see that McHarg is a white-coat modernist. In part, this explains his wide recognition outside the landscape profession. The men and women of science could recognize him as a kindred spirit, integrating their knowledge and applying it to the making of a better world.

Carl Steinitz has developed the McHarg method, as its originator proposed, with the aid of digital Geographical Information Systems. We are doubtful as to whether this gets over the above of criticism McHarg and believe that the different planning contexts of the UK and USA may require different approaches. In the South East of England, there is a great demand for housing land. Government policy and public opinion favor the development of 'brownfield' land instead of 'greenfield' land and this is a major influence on land allocations. The South East Thames Region will be subject to rapid urbanization. It has much brownfield land of this type and a major a major transport project: the Channel Tunnel Rail Link. The question, therefore, is not so much which land to develop as how it should be developed. We believe that digital techniques have a major role to play and will give examples of the approaches discussed above.

### **Dimensional design**

Two-dimensional design-on-paper was a great advance in its time. Use of scales, dividers, rulers and, above all, mathematics, enabled vast projects to be successfully completed. But the method is obsolete. The original jet aircraft were designed on paper but the safety and efficiency of a modern plane could not be achieved without computer-aided 3-dimensional modeling. Digital approaches also enable us to design better buildings and better landscapes. This point can be illustrated but it need not be labored.

Engineering and architectural design can be distinguished from landscape and urban design by the fact that post-construction completed changes are unlikely to be anticipated during the design process. Urban and rural landscapes, by contrast, are subject to constant evolution. Designers can look to the future but cannot control the future. So the best course of action is to use the animation capability of digital techniques to simulate possible future developments.

### **Information-rich design**

As students, most of us learned to apply a Survey-Analysis-Design procedure which began with land survey plans. It was a classic social science approach, adapting the methodology which has had such apparent success in the natural sciences. But the information-inputs were thin. We tended to survey the existing site (geology, soils, artifacts etc) and make suppositions about 'user needs'. Today, the information age is presenting us with a richer harvest of data: textual, numerical and graphical.

### **Value-rich design**

The Survey stage of Survey-Analysis-Design was often limited by the geographical extent of the site. After data-assembly one was expected to make a 'creative leap'. Image-editing techniques encourage the use of other information resources. Colin Rowe discussed the role of collage in urban design. The technique can be used to assemble ideas from books, from one's travels and from the whole history of art.

### **Layered design and GIS**

A layered approach to design has become popular, for several reasons. First, a concern for the environment, which tends to be analyzed in layers. Second, a response to the philosophy of structuralism. Roland Barthes wrote that:

We know now that a text consists not of a line of words, releasing a single 'theological' meaning, but of a multi-dimensional space in which are married and contested several writings, none of which is original: the text is a fabric of quotations, resulting from a thousand sources of culture.

Third, Jellicoe advised us to consider the 'transparencies' of the hunter, the settler and the voyager. Fourth, many computer programs, including image-editing, CAD and GIS use layered data structures.

### **Environmental assessment/design**

The logic of environmental impact assessment, upon which McHarg was a significant influence, invites us to review the impact of a development on the every social, physical and biological aspect of the environment. This requires reviews of the environment from many disparate stand points. Layered data can be made available via web-based GIS and interest groups can assess the impacts of development projects from their own points of view. Instead of development projects being assessed only by white, male, middle-class planners, we can embrace the views of ethnic minorities, the young, the old, the dispossessed and every other group. It is a more democratic procedure.

### **Pattern-assisted design**

Kythryn Gustafson summarized her approach to design as 'words, diagrams, then models'. This lends itself to digitization. Words can be drawn from databases. Diagrams and models gain enormously from digital techniques because it is easy to make the endless minor adjustments which produce good results - in a manner not unlike pre-industrial craft evolution. Turner made a case for pattern-assisted design in *City as landscape* and two recent books have given further consideration to the use of patterns in design. The Kaplans, in *With people in mind* advise on the creation of restorative places through the use of Alexander-type patterns. Bell, in *Landscape, pattern, perception and process* considers the role of social, human and natural patterns in creative design. We believe that digital techniques will, in due course, allow a fully-developed pattern-assisted design procedure.

Let us bid farewell to master planning and the twentieth century with one wave. Both were responsible for some glories and many disasters. Designers can look forward to exploiting the rich information resources which are now available to each desktop. Alone, the information could make our task more difficult. With computing technology to process the digital information we can put the resources to creative use.

### **Real-estate developer**

A real estate developer (American English) or property developer (British English) makes improvements of some kind to real property, thereby increasing its value. In legal form the developer may be an individual, but is more often a partnership, limited liability company or corporation. However anyone involved as a principal in such transactions is a property developer by occupation.

There are two major categories of real estate development activity: land development and building development (also known as project development).

### **Land developers**

Land developers typically acquire natural or unimproved land (often referred to as englobo land, raw land, real property with no improvements or infrastructure) and improve it with utility connections, roads, earth grading, covenants, and entitlements. Infrastructure improvement provides a base for further development of built improvements. Covenants define the context in which future development of built improvements

may take place (often in the form of deed restrictions on particular parcels: a sort of "private zoning code" limited only to those properties). Entitlements are secured legal permissions from regulatory bodies (typically in the form of permits, but sometimes in the form of re-zoning or planned unit developments). Once these improvements have been made to the raw land, it is typically subdivided and sold piecemeal at a profit to individuals or building developers.

### **Building developers**

Building developers acquire raw land, improved land, and/or redevelopable property in order to construct building projects. The buildings are then sold entirely or in part to others, or retained as assets to produce cash flow via rents and other means. Some building developers have their own internal departments for designing and constructing buildings (more common among larger developers), while others subcontract these parts of the work to third parties (typical of small developers).

### **Origin of the Developers**

Although there are specific educational programs which are tailored to teaching real estate finance with an emphasis on development (in the United States, typically MBA programs at university-level business schools), most real estate developers enter the business from other professional areas. Most often, persons in related fields (architecture, accounting, law, engineering, construction, planning, etc.) enter into real estate development via personal interest and opportunity, and then choose to make a career out of it if successful. An educational background in finance is typically a prerequisite for obtaining entry-level employment with an established development company, although many development company managers tend to come from architecture, construction, and related fields. Real estate development requires extensive and complex financing arrangements to be successful, as few people or organizations have the money to undertake development projects on their own.

### **Real estate investing**

Real estate development is first and foremost a cash flow business. Real estate is, by its nature, an expensive non-liquid asset. This means that it costs a lot of money to own it, and it can be difficult to sell. In development activity, there are also the added costs of improvements themselves (typically called "hard costs") and the fees of various and sundry consultants necessary to get the work done properly (typically called "soft costs"). Because expense is high, sale is difficult, and return on investment is delayed, real estate investment is inherently risky. A large part of the work of developers is the management of risk.

Since there are significant initial investment requirements, a majority of real estate development projects are financed with a large amount of debt leverage. While more leverage increases potential profit, it also magnifies risks and builds in a periodic negative cash flow (regular payments on the debt). Projects will generally be profitable if the upfront commitment of cash is kept to a minimum and the project can quickly start generating a positive cash flow sufficient to cover debt service.

There are almost as many ways to finance a real estate development project as there are development projects. However, most financing arrangements fall into a few broad categories:

Private investors (pension funds, insurance funds, wealthy individuals, joint ventures, etc.)

Public investors: REITs, share offerings, public-private partnerships, etc.

Private debt: individual loans, bank mortgages, construction loans, etc.

Public debt: redevelopment loans, etc.

Private grants: non-profit target grants, etc.

Public grants: anti-blight subsidies, affordable housing credits, tax incentives, historic preservation grants, etc.

Equity financing: use of cash flows from other projects owned by the developer

Successful real estate developers can become enormously wealthy due to the large sums of money being transacted and the value of the assets they control. However, because of the illiquidity of their assets, they are also very often cash-poor. Inability to remain cash solvent is the primary cause of business failure for real estate developers.

## History of Architecture

### Prehistoric architecture: Neolithic architecture

In Southwest Asia, Neolithic cultures appear soon after 10000 BC, initially in the Levant and from there spread eastwards and westwards. There are early Neolithic cultures in Southeast Anatolia, Syria and Iraq by 8000 BC, and food-producing societies first appear in southeast Europe by 7000 BC, and Central Europe by c. 5500 BC. With very small exceptions (a few copper hatchets and spear heads in the Great Lakes region), the peoples of the Americas and the Pacific remained at the Neolithic level of technology up until the time of European contact.

According to J.J. O'Connor and E. F. Robertson, the Sulbasutras were appendices to the Vedas giving rules for constructing altars. "They contained quite an amount of geometrical knowledge, but the mathematics was being developed, not for its own sake, but purely for practical religious purposes."

The Neolithic peoples in the Levant, Anatolia, Syria, northern Mesopotamia and Central Asia were great builders, utilizing mud-brick to construct houses and villages. At Çatalhöyük, houses were plastered and painted with elaborate scenes of humans and animals. In Europe, long houses built from wattle and daub were constructed. Elaborate tombs for the dead were also built. These tombs are particularly numerous in Ireland, where there are many thousand still in existence. Neolithic people in the British Isles built long barrows and chamber tombs for their dead and causewayed camps, henges flint mines and cursus monuments.



### **Ancient architecture**

At the beginning, humanity saw the world as thoroughly alive with gods, demons and spirits, a world that knew nothing of scientific objectivism. The ways in which the people came to terms with their immediate environment were thus grounded in the omnipotence of Gods. Many aspects of daily life were carried out with respect to the idea of the divine or supernatural and the way it was manifest in the mortal cycles of generations, years, seasons, days and nights. Harvests for example were seen as the benevolence of fertility deities. Thus, the founding and ordering of the city and her most important buildings (the palace or temple) were often executed by priests or even the ruler himself and the construction was accompanied by rituals intended to enter human activity into continued divine benediction. Ancient architecture is characterized by this tension between the divine and mortal world. Cities would mark a contained sacred space over the wilderness of nature outside, and the temple or palace continued this order by acting as a house for the Gods. The architect, be he priest or king, was not the sole important figure; he was merely part of a continuing tradition.

### **Architecture of Africa**

Early African architecture consisted of the achievements of the Ancient Egyptians. Great Zimbabwe is the largest mediaeval city in sub-Saharan Africa. By the late nineteenth century, most buildings reflected the fashionable European eclecticism Mediterranean, or even Northern European, styles. In the Western Sahel region, Islamic influence was a major contributing factor to architectural development from the time of the Kingdom of Ghana. At Kumbi Saleh, locals lived in domed-shaped dwellings in the king's section of the city, surrounded by a great enclosure. Traders lived in stone houses in a section which possessed 12 beautiful mosques, as described by al-bakri, with one centered on Friday prayer. The king is said to have owned several mansions, one of which was sixty-six feet long, forty-two feet wide, contained seven rooms, was two stories high, and had a staircase; with the walls and chambers filled with sculpture and painting. Sahelian architecture initially grew from the two cities of Djenné and Timbuktu. The Sanskore Mosque in Timbuktu, constructed from mud on timber, was similar in style to the Great Mosque of Djenné. The rise of kingdoms in the West African coastal region produced architecture which drew on indigenous traditions, utilizing wood. The famed Benin City, destroyed by the Punitive Expedition, was a large complex of homes in coursed mud, with hipped roofs of shingles or palm leaves. The Palace had a sequence of ceremonial rooms, and was decorated with brass plaques.

### **Indian Architecture**

India's urban civilization is traceable to Mohenjodaro and Harappa, now in Pakistan, where planned urban townships existed 5000 years ago. From then on, Indian architecture and civil engineering continued to develop, and was manifested temples, palaces and forts across the Indian peninsula and neighboring regions. Architecture and civil engineering was known as sthapatya-kala, literally "the art of constructing".

During the Kushan Empire and Mauryan Empire, Indian architecture and civil engineering reached regions like Baluchistan and Afghanistan. Statues of Buddha were cut out, covering entire mountain cliffs, like in Buddhas of Bamyan, Afghanistan. Over a period of time, ancient Indian art of construction blended with Greek styles and spread to Central Asia.

Indian architecture encompasses a wide variety of geographically and historically spread structures, and was transformed by the history of the Indian subcontinent. The result is an evolving range of architectural production that, although it is difficult to identify a single representative style, none the less retains a certain amount of continuity across history. The diversity of Indian culture is represented in its architecture. It is a blend of ancient and varied native traditions, with building types, forms and technologies from West and Central Asia, as well as Europe. It includes the architecture of various dynasties.

Architectural styles range from Hindu temple architecture to Islamic architecture to western classical architecture to modern and post-modern architecture.

There are numerous Hindu as well as Buddhist temples that are known as excellent examples of Indian rock cut architecture. The Church of St. Anne which is cast in the Indian Baroque Architectural style under the expert orientation of the most eminent architects of the time. It is a prime example of the blending of traditional Indian styles with western European architectural styles.

### **Chinese Architecture**

The most important is the Chinese architectural emphasis on the horizontal axis, in particular the construction of a heavy platform and a large roof that floats over this base, with the vertical walls not as well emphasized. This contrasts Western architecture, which tends to grow in height and depth. Chinese architecture stresses the visual impact of the width of the buildings.

There were certain architectural features that were reserved solely for buildings built for the Emperor of China. One example is the use of yellow roof tiles; yellow having been the Imperial color, yellow roof tiles still adorn most of the buildings within the Forbidden City. The Temple of Heaven, however, uses blue roof tiles to symbolize the sky. The roofs are almost invariably supported by brackets, a feature shared only with the largest of religious buildings. The wooden columns of the buildings, as well as the surface of the walls, tend to be red in color. Current Chinese architecture follows post-modern and western styles.

### **Islamic Architecture**

Islamic architecture has encompassed a wide range of both secular and religious architecture styles from the foundation of Islam to the present day, influencing the design and construction of buildings and structures within the sphere of Islamic culture.

The principle architectural types of Islamic architecture are; the Mosque, the Tomb, the Palace and the Fort.

Some of the major types of Islamic Architecture are Persian architecture, Moorish architecture Timurid architecture, Ottoman architecture, Fatimid architecture, Mamluks architecture, Mughal architecture, Sino-Islamic architecture, and Afro-Islamic architecture.

Many forms of Islamic architecture have evolved in different regions of the Islamic world. Notable Islamic architectural types include the early Abbasid buildings, T-type mosques, and the central-dome mosques of Anatolia. The oil-wealth of the 20th century drove a great deal of mosque construction using designs from leading non-Muslim modern architects and promoting the careers of important contemporary Muslim architects.

### **Japanese Architecture**

Japanese architecture has as long a history as any other aspect of Japanese culture. Influenced heavily by Chinese architecture, it also shows a number of important differences and aspects which are uniquely Japanese.

Two new forms of architecture were developed in response to the militaristic climate of the times: the castle, a defensive structure built to house a feudal lord and his soldiers in times of trouble; and the shoin, a reception hall and private study area designed to reflect the relationships of lord and vassal within a feudal society.

Because of the need to rebuild Japan after World War II, Major Japanese cities contain numerous examples of modern architecture. Japan played some role in modern skyscraper design, because of its long familiarity with the cantilever principle to support the weight of heavy tiled temple roofs. New city planning ideas based on the principle of layering or cocooning around an inner space, a Japanese spatial concept that was adapted to urban needs, were adapted during reconstruction. Modernism became increasingly popular in architecture in Japan starting in the 1970s.

### **Pre-Columbian architecture**

Pre-Columbian architecture mainly consisted of Mesoamerican architecture and Incan architecture.

Mesoamerican architecture is the set of architectural traditions produced by pre-Columbian cultures and civilizations of Mesoamerica, traditions which are best known in the form of public, ceremonial and urban monumental buildings and structures. The distinctive features of Mesoamerican architecture encompass a number of different regional and historical styles, which however are significantly interrelated. These styles developed throughout the different phases of Mesoamerican history as a result of the intensive cultural exchange between the different cultures of the Mesoamerican culture area through thousands of years. Mesoamerican architecture is mostly noted for its pyramids which are the largest such structures outside of Ancient Egypt.

View of Machu Picchu  
Incan architecture consists of the major construction achievements developed by the Incas. The Incas developed an extensive road system spanning most of the western length of the continent. Inca rope bridges could be considered the world's first suspension bridges. Because the Incas used no wheels (the Inca, unlike many other large empires, never discovered the wheel) or horses they built their roads and bridges for foot and pack-llama traffic.

Much of present day architecture at the former Inca capital Cuzco shows both Incan and Spanish influences. The famous lost city Machu Picchu is the best surviving example of Incan architecture. Another significant site is Ollantaytambo. The Inca were sophisticated stone cutters whose masonry used no mortar.

## Western Architecture — Classical to Eclecticism

### Classical architecture

The architecture and urbanism of the Greeks and Romans were very different from those of the Egyptians or Persians in that civic life gained importance. During the time of the ancients, religious matters were the preserve of the ruling order alone; by the time of the Greeks, religious mystery had skipped the confines of the temple-palace compounds and was the subject of the people or polis. Greek civic life was sustained by new, open spaces called the agora which were surrounded by public buildings, stores and temples. The agora embodied the new found respect for social justice received through open debate rather than imperial mandate. Though divine wisdom still presided over human affairs, the living rituals of ancient civilizations had become inscribed in space, in the paths that wound towards the acropolis for example. Each place had its own nature, set within a world refracted through myth, thus temples were sited atop mountains all the better to touch the heavens

The Romans conquered the Greek cities in Italy around three hundred years before Christ and much of the Western world after that. The Roman problem of rulership involved the unity of disparity — from Spanish to Greek, Macedonian to Carthaginian — Roman rule had extended itself across the breadth of the known world and the myriad pacified cultures forming this ecumene presented a new challenge for justice. One way to look at the unity of Roman architecture is through a new-found realization of theory derived from practice, and embodied spatially. Civically we find this happening in the Roman forum (sibling of the Greek agora), where public participation is increasingly removed from the concrete performance of rituals and represented in the decor of the architecture. Thus we finally see the beginnings of the contemporary public square in the Forum Iulium, begun by Julius Caesar, where the buildings present themselves through their facades as representations within the space. As the Romans chose representations of sanctity over actual sacred spaces to participate in society, so the communicative nature of space was opened to human manipulation. None of which would have been possible without the advances of Roman engineering and construction or the newly found marble quarries which were the spoils of war; inventions like the arch and concrete gave a whole new form to Roman architecture, fluidly enclosing space in taut domes and colonnades, clothing the grounds for imperial rulership and civic order.

Interior of the Pantheon, Rome This was also a response to the changing social climate which demanded new buildings of increasing complexity — the coliseum, the residential block, bigger hospitals and academies. General civil construction such as roads and bridges began to be built.

### \*Medieval architecture

Western European architecture in the Early Middle Ages may be divided into Early Christian and Pre-Romanesque, including Merovingian, Carolingian, Ottonian, and Asturian. While these terms are problematic, they nonetheless serve adequately as entries into the era. Considerations that enter into histories of each period include Trachtenberg's "historicizing" and "modernizing" elements, Italian versus northern, Spanish, and Byzantine elements, and especially the religious and political maneuverings between kings, popes, and various ecclesiastic officials.

Surviving examples of medieval secular architecture mainly served for defense. Castles and fortified walls provide the most notable remaining non-religious examples of medieval architecture. Windows gained a cross-shape for more than decorative purposes: they provided a perfect fit for a crossbowman to safely shoot at invaders from inside. Crenelated walls (battlements) provided shelters for archers on the roofs to hide behind when not shooting.

### Renaissance architecture

The Renaissance often refers to the Italian Renaissance that began in the 15th century, but recent research has revealed the existence of similar movements around Europe before the 15th century; consequently, the term "Early Modern" has gained popularity in describing this cultural movement. This period of cultural rebirth is often credited with the restoration of scholarship in the Classical Antiquities and the absorption of new scientific and philosophical knowledge that fed the arts.

The development from medieval architecture concerned the way geometry mediated between the intangibility of light and the tangibility of the material as a way of relating divine creation to mortal existence. This relationship was changed in some measure by the invention of Perspective which brought a sense of infinity into the realm of human comprehension through the new representations of the horizon, evidenced in the expanses of space opened up in Renaissance painting, and helped shape new humanist thought.

Perspective represented a new understanding of space as a universal, a priori fact, understood and controllable through human reason. Renaissance buildings therefore show a different sense of conceptual clarity, where spaces were designed to be understood in their entirety from a specific fixed viewpoint. The power of Perspective to universally represent reality was not limited to describing experiences, but also allowed it to anticipate experience itself by projecting the image back into reality.

The Renaissance spread to France in the late 15th century, when Charles VIII returned in 1496 with several Italian artists from his conquest of Naples. Renaissance chateaux were built in the Loire Valley, the earliest example being the Château d'Amboise, and the style became dominant under Francis I (1515-47). The Château de Chambord is a combination of Gothic structure and Italianate ornament, a style which progressed under architects such as Sebastiano Serlio, who was engaged after 1540 in work at the Château

de Fontainebleau. At Fontainebleau Italian artists such as Rosso Fiorentino, Francesco Primaticcio, and Niccolo dell' Abbate formed the First School of Fontainebleau.

In England the first great exponent of Renaissance architecture was Inigo Jones (1573 – 1652), who had studied architecture in Italy where the influence of Palladio was very strong. Jones returned to England full of enthusiasm for the new movement and immediately began to design such buildings as the Queen's House at Greenwich in 1616 and the Banqueting House at Whitehall three years later. These works, with their clean lines, and symmetry were revolutionary in a country still enamored with mullion windows, crenulations and turrets.

### **Baroque architecture**

If Renaissance architecture announced a rebirth of human culture, the periods of Mannerism and the Baroque that followed signaled an increasing anxiety over meaning and representation. Important developments in science and philosophy had separated mathematical representations of reality from the rest of culture, fundamentally changing the way humans related to their world through architecture.

### **Beaux-Arts architecture**

Beaux-Arts architecture denotes the academic classical architectural style that was taught at the École des Beaux Arts in Paris. The style "Beaux-Arts" is above all the cumulative product of two and a half centuries of instruction under the authority, first of the Académie royale d'architecture, then, following the Revolution, of the Architecture section of the Académie des Beaux-Arts. The organization under the Ancien Régime of the competition for the Grand Prix de Rome in architecture, offering a chance to study in Rome, imprinted its codes and esthetic on the course of instruction, which culminated during the Second Empire (1850-1870) and the Third Republic that followed. The style of instruction that produced Beaux-Arts architecture continued without a major renovation until 1968.

### **Modern architecture**

Modern architecture is a term given to a number of building styles with similar characteristics, primarily the simplification of form and the elimination of ornament, that first arose around 1900. By the 1940s these styles had been consolidated and identified as the International Style and became the dominant architectural style, particularly for institutional and corporate building, for several decades in the twentieth century.

The exact characteristics and origins of modern architecture are still open to interpretation and debate.

### **Functionalism**

Functionalism, in architecture, is the principle that architects should design a building based on the purpose of that building. This statement is less self-evident than it first appears, and is a matter of confusion and controversy within the profession, particularly in regard to modern architecture.

The place of functionalism in building can be traced back to the Vitruvian triad, where 'utilitas' (variously translated as 'commodity', 'convenience', or 'utility') stands alongside 'venustas' (beauty) and 'firmitas' (firmness) as one of three classic goals of architecture.

### **Expressionist architecture**

Expressionist architecture was an architectural movement that developed in Northern Europe during the first decades of the 20th century in parallel with the expressionist visual and performing arts.

The style was characterized by an early-modernist adoption of novel materials, formal innovation, and very unusual massing, sometimes inspired by natural biomorphic forms, sometimes by the new technical possibilities offered by the mass production of brick, steel and especially glass. Many expressionist architects fought in World War I and their experiences, combined with the political turmoil and social upheaval that followed the German Revolution of 1919, resulted in a utopian outlook and a romantic socialist agenda. Economic conditions severely limited the number of built commissions between 1914 and the mid 1920s, resulting in many of the most important expressionist works remaining as projects on paper, such as Bruno Taut's Alpine Architecture and Hermann Finsterlin's Formspiels. Ephemeral exhibition buildings were numerous and highly significant during this period. Scenography for theatre and films provided another outlet for the expressionist imagination, and provided supplemental incomes for designers attempting to challenge conventions in a harsh economic climate.

### **International Style**

The International style was a major architectural trend of the 1920s and 1930s. The term usually refers to the buildings and architects of the formative decades of modernism, before World War II. The term had its origin from the name of a book by Henry-Russell Hitchcock and Philip Johnson which identified, categorized and expanded upon characteristics common to modernism across the world. As a result, the focus was more on the stylistic aspects of modernism. The basic design principles of the international style thus constitute part of modernism.

Around 1900 a number of architects around the world began developing new architectural solutions to integrate traditional precedents with new social demands and technological possibilities. The work of Victor Horta and Henry van de Velde in Brussels, Antoni Gaudi in Barcelona, Otto Wagner in Vienna and Charles Rennie Mackintosh in Glasgow, among many others, can be seen as a common struggle between old and new.

### **Stalinist architecture**

Stalinist architecture was the architectural style developed in the Soviet Union between 1933 (the date of the final competition to design the Palace of Soviets) and 1955 (when the Soviet Academy of Architecture was abolished).

Just like any other form of art in Joseph Stalin's Soviet Union, architecture was destined to serve the purpose of glorifying communism as the ideal social order. It was Stalin's goal to "wipe clean the slate of the

past...and rebuild the world from top to bottom." To do this, Stalin subjected architects (though not as dramatically as artists and writers) to a considerable amount of state control. On April 23rd 1932, the Communist Party Central Committee passed the resolution On Structural Changes in the Literary and Artistic organizations. The resolution outlawed all independent organizations. The formerly independent organizations were forced to form unions where the communist party could decide what was "fruitful, creative and correct". By July 1932, all independent organizations were abolished and replaced with the Union of Soviet Architects, a government-funded membership organization charged with architectural censorship. The following year, 1933, the Soviet Academy of Architecture was founded; this marked the "official" beginning of the time of Stalinist Architecture.

### **Postmodern architecture**

Postmodern architecture is an international style whose first examples are generally cited as being from the 1950s, and which continues to influence present-day architecture. Postmodernity in architecture is generally thought to be heralded by the return of "wit, ornament and reference" to architecture in response to the formalism of the International Style of modernism. As with many cultural movements, some of postmodernism's most pronounced and visible ideas can be seen in architecture. The functional and formalized shapes and spaces of the modernist movement are replaced by unapologetically diverse aesthetics: styles collide, form is adopted for its own sake, and new ways of viewing familiar styles and space abound.

Classic examples of modern architecture are the Lever House and the Seagram Building in commercial space, and the architecture of Frank Lloyd Wright or the Bauhaus movement in private or communal spaces. Transitional examples of postmodern architecture are the Portland Building in Portland and the Sony Building (New York City) (originally AT&T Building) in New York City, which borrows elements and references from the past and reintroduces color and symbolism to architecture. A prime example of inspiration for postmodern architecture lies along the Las Vegas Strip, which was studied by Robert Venturi in his 1977 book *Learning from Las Vegas* celebrating the strip's ordinary and common architecture. Venturi opined that "Less is a bore", inverting Mies Van Der Rohe's dictum that "Less is more".

### **Googie architecture**

Googie architecture is a subdivision of expressionist, or futurist architecture influenced by car culture and the Space Age, originating from southern California in the late 1940s and continuing approximately into the mid-1960s. With upswept roofs and, often, curvaceous, geometric shapes, and bold use of glass, steel and neon, it decorated many a motel, coffee house and bowling alley in the 1950s and 1960s. It epitomizes the spirit a generation demanded, looking excitedly towards a bright, technological and futuristic age.

As it became clear that the future would not look like *The Jetsons*, the style came to be timeless rather than futuristic. As with the art deco style of the 1930s, it has remained undervalued until many of its finest examples had been destroyed. The style is related to and sometimes synonymous with the Raygun Gothic style as coined by writer William Gibson.

### **Deconstructivist Architecture**

Deconstructivism in architecture is a development of postmodern architecture that began in the late 1980s. It is characterized by ideas of fragmentation, non-linear processes of design, an interest in manipulating ideas of a structure's surface or skin, and apparent non-Euclidean geometry, (i.e., non-rectilinear shapes) which serve to distort and dislocate some of the elements of architecture, such as structure and envelope. The finished visual appearance of buildings that exhibit the many deconstructivist "styles" is characterized by a stimulating unpredictability and a controlled chaos.

Important events in the history of the deconstructivist movement include the 1982 Parc de la Villette architectural design competition (especially the entry from Jacques Derrida and Peter Eisenman and Bernard Tschumi's winning entry), the Museum of Modern Art's 1988 Deconstructivist Architecture exhibition in New York, organized by Philip Johnson and Mark Wigley, and the 1989 opening of the Wexner Center for the Arts in Columbus, designed by Peter Eisenman. The New York exhibition featured works by Frank Gehry, Daniel Liebeskind, Rem Koolhaas, Peter Eisenman, Zaha Hadid, Coop Himmelblau, and Bernard Tschumi. Since the exhibition, many of the architects who were associated with Deconstructivism have distanced themselves from the term. Nonetheless, the term has stuck and has now, in fact, come to embrace a general trend within contemporary architecture.

### **Critical Regionalism**

Critical regionalism is an approach to architecture that strives to counter the placelessness and lack of meaning in Modern Architecture by using contextual forces to give a sense of place and meaning. The term critical regionalism was first used by Alexander Tzonis and Liane Lefaivre and later more famously by Kenneth Frampton.

Frampton put forth his views in "Towards a Critical Regionalism: Six points of an architecture of resistance." He evokes Paul Ricoeur's question of "how to become modern and to return to sources; how to revive an old, dormant civilization and take part in universal civilization". According to Frampton, critical regionalism should adopt modern architecture critically for its universal progressive qualities but at the same time should value responses particular to the context. Emphasis should be on topography, climate, light, tectonic form rather than scenography and the tactile sense rather than the visual. Frampton draws from phenomenology to supplement his arguments.

### **Futurist architecture**

Futurist architecture began as an early-20th century form of architecture characterized by anti-historicism and long horizontal lines suggesting speed, motion and urgency. Technology and even violence were among the themes of the Futurists. The movement was founded by the poet Filippo Tommaso Marinetti, who produced its first manifesto, the Manifesto of Futurism in 1909). The movement attracted not only poets, musicians, artist (such as Umberto Boccioni, Giacomo Balla, Fortunato Depero, and Enrico Prampolini) but

also a number of architects. Among the latter there was Antonio Sant'Elia, who, though he built little, translated the Futurist vision into bold urban form.

### **Religious architecture**

Religious architecture is concerned with the design and construction of places of worship and/or sacred or intentional space, such as churches, mosques, stupas, synagogues, and temples. Many cultures devoted considerable resources to their religious architecture, and their places of worship and sacred spaces are among the most impressive and permanent buildings created by humanity. For that reason, the Western scholarly discipline of the History of Architecture itself closely follows the history of religious architecture from ancient times until the Baroque period, at least. Sacred geometry, iconography and the use of sophisticated semiotics such as signs, symbols and religious motif are endemic to Religious architecture.

Religious structures often evolved over centuries and were the largest buildings in the world, prior to the modern skyscraper. While the various styles employed in religious architecture sometimes reflected trends in other structures, these styles also remained unique from the contemporary architecture used in other structures. With the rise of monotheism, religious buildings increasingly became centers of worship and meditation.

### **Spiritual aspects of religious architecture**

Religious architecture is sometimes called sacred space. Architect Norman L. Koonce has suggested that the goal of religious architecture is to make "transparent the boundary between matter and mind, flesh and the spirit." In discussing religious architecture, Protestant minister Robert Schuller, has suggested that "to be psychologically healthy, human beings need to experience their natural setting—the setting we were designed for, which is the garden." Meanwhile, Richard Kieckhefer suggests that entering into a religious building is a metaphor for entering into spiritual relationship. Kieckhefer suggests that sacred space can be analyzed by three factors affecting spiritual process: longitudinal space emphasizes the procession and return of sacramental acts, auditorium space is suggestive of proclamation and response, and new forms of communal space designed for gathering and return depend to a great degree on minimized scale to enhance intimacy and participation in worship.

### **Ancient architecture**

Religious architecture spans a number of ancient architectural styles including Neolithic architecture, ancient Egyptian architecture and Sumerian architecture. Ancient religious buildings, particularly temples, were often viewed as the dwelling place of the gods and were used as the site of various kinds of sacrifice. Ancient tombs and burial structures are also examples of architectural structures reflecting religious beliefs of their various societies. The Temple of Karnak at Thebes, Egypt was constructed across a period of 1300 years and its numerous temples comprise what may be the largest religious structure ever built. Ancient Egyptian religious architecture has fascinated archaeologists and captured the public imagination for millennia.

### **Classical architecture**

Around 600 B.C. the wooden columns of the Temple of Hera at Olympia were replaced by stone columns. With the spread of this process to other sanctuary structures a few stone buildings have survived through the ages. Greek architecture preceded Hellenistic and Roman periods (Roman architecture heavily copied Greek). Since temples are the only buildings which survive in numbers, most of our concept of classical architecture is based on religious structures. The Parthenon which served as a treasury building as well as a place for veneration of deity, is widely regarded as the greatest example of classical architecture.

### **Indian architecture**

Indian architecture is related to the history and religions of the time periods as well as to the geography and geology of the Indian subcontinent. India was crisscrossed by trading routes of merchants from as far away as Siraf and China as well as weathering invasions by foreigners, resulting in multiple influences of foreign elements on native styles. The diversity of Indian culture is represented in its architecture. Indian architecture comprises of a blend of ancient and varied native traditions, with building types, forms and technologies from West, Central Asia, and Europe.

### **Byzantine architecture**

Byzantine architecture evolved from Roman architecture. Eventually, a style emerged incorporating Near East influences and the Greek cross plan for church design. In addition, brick replaced stone, classical order was less strictly observed, mosaics replaced carved decoration, and complex domes were erected. One of the great breakthroughs in the history of Western architecture occurred when Justinian's architects invented a complex system providing for a smooth transition from a square plan of the church to a circular dome (or domes) by means of squinches or pendentives. The prime example of early Byzantine religious architecture is the Hagia Sophia in Istanbul.

### **Islam**

Byzantine architecture had a great influence on early Islamic architecture with its characteristic round arches, vaults and domes. Many forms of mosques have evolved in different regions of the Islamic world. Notable mosque types include the early Abbasid mosques, T-type mosques, and the central-dome mosques of Anatolia.

The earliest styles in Islamic architecture produced Arab-plan or hypostyle mosques during the Umayyad Dynasty. These mosques follow a square or rectangular plan with enclosed courtyard and covered prayer hall. Most early hypostyle mosques had flat prayer hall roofs, which required numerous columns and supports. The Mezquita in Córdoba, Spain was constructed as a hypostyle mosque supported by over 850 columns. Arab-plan mosques continued under the Abbasid dynasty.

The Ottomans introduced central dome mosques in the 15th century that have a large dome centered over the prayer hall. In addition to having one large dome at the center, there are often smaller domes that exist off-center over the prayer hall or throughout the rest of the mosque, in areas where prayer is not performed. The Dome of the Rock mosque in Jerusalem is perhaps the best known example of a central dome mosque.

Iwan mosques are most notable for their domed chambers and iwans, which are vaulted spaces open out on one end. In iwan mosques, one or more iwans face a central courtyard that serves as the prayer hall. The style represents a borrowing from pre-Islamic Iranian architecture and has been used almost exclusively for mosques in Iran. Many iwan mosques are converted Zoroastrian fire temples where the courtyard was used to house the sacred fire. Today, iwan mosques are no longer built. The Shah Mosque in Isfahan, Iran is a classic example of an iwan mosque.

A common feature in mosques is the minaret, the tall, slender tower that usually is situated at one of the corners of the mosque structure. The top of the minaret is always the highest point in mosques that have one, and often the highest point in the immediate area. The first mosques had no minarets, and even nowadays the most conservative Islamic movements, like Wahhabis, avoid building minarets, seeing them as ostentatious and unnecessary. The first minaret was constructed in 665 in Basra during the reign of the Umayyad caliph Muawiyah I. Muawiyah encouraged the construction of minarets, as they were supposed to bring mosques on par with Christian churches with their bell towers. Consequently, mosque architects borrowed the shape of the bell tower for their minarets, which were used for essentially the same purpose — calling the faithful to prayer.

Domes have been a hallmark of Islamic architecture since the 7th century. As time progressed, the sizes of mosque domes grew, from occupying only a small part of the roof near the mihrab to encompassing all of the roof above the prayer hall. Although domes normally took on the shape of a hemisphere, the Mughals in India popularized onion-shaped domes in South Asia and Persia.

The prayer hall, also known as the musalla, has no furniture; chairs and pews are absent from the prayer hall. Prayer halls contain no images of people, animals, and spiritual figures although they may be decorated with Arabic calligraphy and verses from the Qur'an on the walls.

Usually opposite the entrance to the prayer hall is the qibla wall, which is the visually emphasized area inside the prayer hall. The qibla wall is normally set perpendicular to a line leading to Mecca. Congregants pray in rows parallel to the qibla wall and thus arrange themselves so they face Mecca. In the qibla wall, usually at its center, is the mihrab, a niche or depression indicating the qibla wall. Usually the mihrab is not occupied by furniture either. Sometimes, especially during Friday prayers, a raised minbar or pulpit is located to the side of the mihrab for a khatib or some other speaker to offer a sermon (khutbah). The mihrab serves as the location where the imam leads the five daily prayers on a regular basis.

Mosques often have ablution fountains or other facilities for washing in their entryways or courtyards. However, worshippers at much smaller mosques often have to use restrooms to perform their ablutions. In traditional mosques, this function is often elaborated into a freestanding building in the center of a courtyard. Modern mosques may have a variety of amenities available to their congregants and the community, such as health clinics, libraries and gymnasiums.

### **Medieval architecture**

The religious architecture of Christian churches in the Middle Ages featured the Latin cross plan, which takes the Roman Basilica as its primary model with subsequent developments. It consists of a nave, transepts, and the altar stands at the east end (see Cathedral diagram). Also, cathedrals influenced or commissioned by Justinian employed the Byzantine style of domes and a Greek cross (resembling a plus sign), centering attention on the altar at the center of the church. The Church of the Intercession on the Nerl is an excellent example of Russian orthodox architecture in the Middle Ages.

### **Vernacular architecture**

Vernacular architecture is a term used to categorize methods of construction which use locally available resources to address local needs. Vernacular architecture tends to evolve over time to reflect the environmental, cultural and historical context in which it exists. It has often been dismissed as crude and unrefined, but also has proponents who highlight its importance in current design.

In contrast to planned architecture by architects, the building knowledge in vernacular architecture is often transported by local traditions and is thus more - but not only - based on knowledge achieved by trial and error and often handed down through the generations rather than calculated on knowledge of geometry and physics. This of course does not exclude architects from using vernacular architecture in their designs or being firmly based in their regional vernacular architecture. For the similarities to "traditional architecture" see below.

### **Derivation and Definition**

The term vernacular is derived from the Latin vernaculus - a slave quarter at the back of the master's garden - In terms of language, vernacular refers to language use particular to a time, place or group. In architecture it refers to that type of architecture which is indigenous to a specific time or place (not imported or copied from elsewhere). It is most often used to apply to residential buildings.

The term is not to be confused with so-called "traditional" architecture, though there are links between the two. Vernacular architecture may, through time, be adopted and refined into culturally accepted solutions, but only through repetition may it become "traditional." Traditional architecture can also include temples and palaces, for example, which would not be included usually in the rubric of "vernacular." In Japan, for example, not all pre-modern architecture is "vernacular," which would usually refer only to rural buildings and structures. In the US, vernacular architecture might refer to a so-called craftsman bungalow, fashionable in the nineteenth century, even though the bungalow as an architectural form did not originate in the US. "Vernacular" might even refer to a building like the 1848 Duncan House in Cooksville, Wisconsin. All in all, the use of the term "vernacular" can be quite ambiguous.

### **Building Architecture**

Architecture, the practice of building design and its resulting products; customary usage refers only to those designs and structures that are culturally significant. Architecture is to building as literature is to the printed word. Vitruvius, a 1st-century BC Roman, wrote encyclopedically about architecture, and the English poet Sir Henry Wotton was quoting him in his charmingly phrased dictum: "Well building hath three conditions:

Commoditie, Firmenes, and Delight." More prosaically, one would say today that architecture must satisfy its intended uses, must be technically sound, and must convey aesthetic meaning. But the best buildings are often so well constructed that they outlast their original use. They then survive not only as beautiful objects, but as documents of the history of cultures, achievements in architecture that testify to the nature of the society that produced them. These achievements are never wholly the work of individuals. Architecture is a social art.

Architectural form is inevitably influenced by the technologies applied, but building technology is conservative and knowledge about it is cumulative. Precast concrete, for instance, has not rendered brick obsolete. Although design and construction have become highly sophisticated and are often computer directed, this complex apparatus rests on preindustrial traditions inherited from millennia during which most structures were lived in by the people who erected them. The technical demands on building remain the elemental ones—to exclude enemies, to circumvent gravity, and to avoid discomforts caused by an excess of heat or cold or by the intrusion of rain, wind, or vermin. This is no trivial assignment even with the best modern technology.

### **Building Materials**

The availability of suitable materials fostered the crafts to exploit them and influenced the shapes of buildings. Large areas of the world were ~~once~~ forested, and their inhabitants developed carpentry. Although it has become relatively scarce, timber remains an important building material.

Many kinds of stone lend themselves to building. Stone and marble were chosen for important monuments because they are incombustible and can be expected to endure. Stone is also a sculptural material; stone architecture was often integral with stone sculpture. The use of stone has declined, however, because a number of other materials are more amenable to industrial use and assembly.

Some regions lack both timber and stone; their peoples used the earth itself, tamping certain mixtures into walls or forming them into bricks to be dried in the sun. Later they baked these substances in kilns, producing a range of bricks and tiles with greater durability.

Thus, early cultures used substances occurring in their environment and invented the tools, skills, and technologies to exploit a variety of materials, creating a legacy that continues to inform more industrialized methods.

Building with stones or bricks is called masonry. The elements cohere through sheer gravity or the use of mortar, first composed of lime and sand. The Romans found a natural cement that, combined with inert substances, produced concrete. They usually faced this with materials that would give a better finish. In the early 19th century a truly waterproof cement was developed, the key ingredient of modern concrete.

In the 19th century also, steel suddenly became abundant; rolling mills turned out shapes that could make structural frames stronger than the traditional wooden frames. Moreover, steel rods could be positioned in wet concrete so as to greatly improve the versatility of that material, giving impetus early in the 20th century to new forms facilitated by reinforced concrete construction. The subsequent profusion of aluminum and its anodized coatings provided cladding (surfacing) material that was lightweight and virtually maintenance free. Glass was known in prehistory and is celebrated for its contributions to Gothic architecture. Its quality and availability have been enormously enhanced by industrial processing, which has revolutionized the exploitation of natural light and transparency.

### Construction

When masonry materials are stacked vertically, they are very stable; every part is undergoing compression. The real problem of construction, however, is spanning. Ways must be found to connect walls so as to provide a roof. The two basic approaches to spanning are post-and-lintel construction and arch, vault, and dome construction. In post-and-lintel construction, lintels, or beams, are laid horizontally across the tops of posts, or columns; additional horizontals span from beam to beam, forming decks that can become roofs or be occupied as floors. In arch, vault, and dome construction, the spanning element is curved rather than straight. In the flat plane of a wall, arches may be used in rows, supported by piers or columns to form an arcade; for roofs or ceilings, a sequence of arches, one behind the other, may be used to form a half-cylinder (or barrel) vault; to span large centralized spaces, an arch may be rotated from its peak to form a hemispherical dome (see Arch and Vault; Dome).

Post-and-lintel solutions can be executed in various materials, but gravity subjects the horizontal members to bending stress, in which parts of the member are in compression while others are in tension. Wood, steel, and reinforced concrete are efficient as beams, whereas masonry, because it lacks tensile components, requires much greater bulk and weight. Vaulting permits spanning without subjecting material to tension; thus, it can cover large areas with masonry or concrete. Its outward thrust, however, must be counteracted by abutment, or buttressing.

Trussing is an important structural device used to achieve spans with less weighty construction. Obviously, a frame composed of three end-connected members cannot change its shape, even if its joints could act as hinges. Fortunately, however, the principle of triangulation—attaching a horizontal tie beam to the bottom ends of two peaked rafters—can be extended indefinitely. Spanning systems of almost any shape can be subdivided into triangles, the sides of which can be made of any appropriate material—wood, rolled steel, or tubing—and assembled using suitable end connections. Each separate part is then subject only to either compressive or tensile stress. In the 18th century, mathematicians learned to apply their science to the behavior of structures, thus making it possible to determine the amounts of these stresses. This led to the development of space frames, which are simply trusses or other elements arrayed three-dimensionally.

Advances in the art of analyzing structural behavior resulted from the demand in the 19th century for great civil engineering structures: dams, bridges, and tunnels. It is now possible to enclose space with suspension

structures—the obverse of vaulting, in that materials are in tension—or pneumatic structures, the skins of which are held in place by air pressure. Sophisticated analysis is particularly necessary in very tall structures, because wind loads and stresses that could be induced by earthquakes then become more important than gravity.

Architecture must also take into account the internal functional equipment of modern buildings. In recent decades, elaborate systems for vertical transportation, the control of temperature and humidity, forced ventilation, artificial lighting, sanitation, control of fire, and the distribution of electricity and other services have been developed. This has added to the cost of construction and has increased expectations of comfort and convenience.

In modern architectural terminology the word program denotes the purposes for which buildings are constructed. Certain broad purposes have always been discernible. The noblest works—temples, churches, mosques—celebrate the mysteries of religion and provide assembly places where gods can be propitiated or where the multitudes can be instructed in interpretations of belief and can participate in symbolic rituals. Another important purpose has been to provide physical security: Many of the world's most permanent structures were built with defense in mind.

Related to defense is the desire to create buildings that serve as status symbols. Kings and emperors insisted on palaces proclaiming power and wealth. People of privilege have always been the best clients of designers, artists, and artisans, and in their projects the best work of a given period is often represented. Today large corporations, governments, and universities play the role of patron in a less personal way.

A proliferation of building types reflects the complexity of modern life. More people live in mass housing and go to work in large office buildings; they spend their incomes in large shopping centers, send their children to many different kinds of schools, and when sick go to specialized hospitals and clinics. They linger in airports on the way to distant hotels and resorts. Each class of facility has accumulated experiences that contribute to the expertise needed by its designers.

The attention of clients, architects, and users is more and more focused on the overall qualities manifested by aggregates of buildings and parts of cities as being more significant than individual structures. As the total building stock grows, conserving buildings and adapting them for changes in use becomes more important.

### **Aesthetics**

The aesthetic response to architecture is complex. It involves all the issues already discussed, as well as other, more abstract qualities. An experience of architectural space is personal and psychological; it differs from that of sculpture or painting because the observer is in it. It is affected by associations the observer may have with the materials used and the way they have been assembled, and by the lighting conditions.

Structural logic may or may not have been dramatized. Elements such as windows, and their scale and rhythm, affect the observer, as do the interplay of geometrical form and the way space is articulated. Movement through a sequence of spaces has narrative force; no single point of view is adequately descriptive. The recurrence of thematic forms, appearing in varied guises and contexts, contributes to unity and creates feelings—relaxation and protection or stimulation and awe. Perhaps the key element is proportion—the relation of various dimensions to one another and their relation to human scale.

During the mid-19th century, architecture became institutionalized as a profession requiring formal preparation and subject to codes of performance. During this period connoisseurship—full academic training in the history of architecture and its aesthetics—was the designer's most important qualification. In every Western country the École des Beaux-Arts in Paris was accepted as the model for architectural education. Architecture was easily separated from engineering, which had pragmatic rather than aesthetic goals. Yet today the profession delivers not only aesthetic guidance but also a bewildering array of technical services requiring many specialized contributors. The architect strives to maintain the position of generalist, one who can take the long view while orchestrating the resolution of complex interrelated issues.



### Modern Architecture

Modern Architecture, is usually referred to as, the buildings and building practices of the late 19th and the 20th centuries. The history of modern architecture encompasses the architects who designed those buildings, stylistic movements, and the technology and materials that made the new architecture possible. Modern architecture originated in the United States and Europe and spread from there to the rest of the world.

Among notable early modern architectural projects are exuberant and richly decorated buildings in Glasgow, Scotland, by Charles Rennie Mackintosh; imaginative designs for a city of the future by Italian visionary Antonio Sant'Elia; and houses with flowing interior spaces and projecting roofs by the American pioneer of modernism, Frank Lloyd Wright. Important modern buildings that came later include the sleek villas of Swiss-French architect Le Corbusier; bold new factories in Germany by Peter Behrens and Walter Gropius; and steel and glass skyscrapers designed by German-born architect Ludwig Mies van der Rohe.

At the turn of the century, designers appeared who refused to work in borrowed styles. Antoni Gaudí in Barcelona, Spain, was the most original; his sinuous Casa Milà (1905-1907) and the unfinished Iglesia di

Sagrada Familia (Church of the Holy Family, 1883-1926) exhibit a search for new organic structural forms. His work has some affinity with the movement called art nouveau, which had been inaugurated contemporaneously in Brussels and Paris. Charles Rennie Mackintosh, whose masterpiece is the Glasgow School of Art (1897-1899; 1906-1909), espoused a more austere version of art nouveau.

### Characteristics of Modern Architecture

Modern architects reacted against the architecture of the 19th century, which they felt borrowed too heavily from the past. They found this architecture either oppressively bound to past styles or cloyingly picturesque and eclectic. As the 20th century began they believed it was necessary to invent an architecture that expressed the spirit of a new age and would surpass the styles, materials, and technologies of earlier architecture. This unifying purpose did not mean that their buildings would be similar in appearance, nor that architects would agree on other issues.

The aesthetics (artistic values) of modern architects differed radically. Some architects, enraptured by the powerful machines developed in the late 19th century, sought to devise an architecture that conveyed the sleekness and energy of a machine. Their aesthetic celebrated function in all forms of design, from household furnishings to massive ocean liners and the new flying machines. Other architects, however, found machine-like elegance inappropriate to architecture. They preferred an architecture that expressed, not the rationality of the machine, but the mystic powers of human emotion and spirit.

Modern architects also differed in their understanding of historical traditions. While some abandoned historical references altogether, others used careful references to the past to enhance the modernity of their designs. Italian architect Antonio Sant'Elia resoundingly rejected traditional architecture in his Futurist Manifesto of 1914 (Futurism). He called for each generation to build its houses anew and celebrated glass, steel, and concrete as the materials to make this possible. The modern designs of his countryman Giuseppe Terragni, on the other hand, referred explicitly to the past. Terragni's Casa del Fascio (Fascist Party Headquarters, 1932-1936) in Como, Italy, featured an inner atrium for public assembly inspired by the courtyards of Italian Renaissance palaces, and windows laid out according to ancient Greek and Roman theories of ideal architectural proportions. Terragni saw tradition as providing ideal building blocks for a new architecture. But the building's concrete and steel construction and its sleek, unornamented form expressed a thoroughly modern aesthetic.

In the United States Frank Lloyd Wright also rejected 19th-century European architecture. He attributed his new architectural concepts to educational building blocks he had played with as a child, to Japanese architecture, and to the prairie landscape on which many of his houses were built. Yet the fireplaces with adjacent seating that occupied a central position in his houses referred to the very distant past, when tending and maintaining a fire was essential for human survival. In Wright's houses, few dividing walls separated rooms and one room seemed to flow into the next. Wright's open design was extremely influential, and variations of it were used, not only for the houses of the wealthy, but for apartments and middle-class homes in Europe and the United States.

Modern architecture also challenged traditional ideas about the types of structures suitable for architectural design. Important civic buildings, aristocratic palaces, churches, and public institutions had long been the mainstay of architectural practices, but modernist designers argued that architects should design all that was necessary for society, even the most humble buildings. They began to plan low-cost housing, railroad stations, factories, warehouses, and commercial spaces. In the first half of the 20th century many modernists produced housing as well as furniture, textiles, and wallpaper to create a totally designed domestic environment.

### **New Materials and Technology**

Developments in two materials—iron and concrete—formed the technological basis for much modern architecture. In 1779 English architect Thomas Pritchard designed the first structure built entirely of cast iron: Ironbridge, a bridge over the River Severn in England. At around the same time, another Englishman experimented with a compound of lime, clay, sand, and iron slag to produce concrete. Iron had been used since antiquity to tie building elements together, but after the erection of Ironbridge it took on a new role as a primary structural material. Builders throughout Europe and North America began to erect warehouses with beams of iron instead of wood and to create storefronts with cast-iron façades.

One of the most spectacular examples of early iron construction was the Crystal Palace in London, England, designed by English architect Joseph Paxton to house the Great Exhibition of 1851. Spreading over 7.3 hectares (18 acres), the building consisted entirely of panels of glass set within iron frames. Paxton adapted two major features of the Industrial Revolution to the architecture of the Crystal Palace: mass production (in the manufactured glass panels and iron frames) and the use of iron rather than traditional masonry (stones or brick). He managed to erect this vast building in less than six months, a feat he accomplished by detailed planning and by prefabrication of the building parts off-site. In 1889 French engineer Gustave Eiffel carried forward Paxton's daring ideas for iron construction in his 300-m (984-ft) tall Eiffel Tower in Paris. Steel for construction also became abundantly available in the 19th century.

### **The Skyscraper**

The Chicago architect Louis Sullivan, in his Wainwright Building (1890-1891) in St. Louis, Missouri, his Guaranty Building (1895) in Buffalo, New York, and his Carson Pirie Scott Department Store (1899-1904) in Chicago, gave new expressive form to urban commercial buildings. His career converges with the so-called Chicago School of architects, whose challenge was to invent the skyscraper or high-rise building, facilitated by the introduction of the electric elevator and the sudden abundance of steel. They made a successful transition from the masonry bearing wall to the steel frame, which assumed all the load-bearing functions. The building's skeleton could be erected quickly and the remaining components hung on it to complete it, an immense advantage for high-rise buildings on busy city streets. Sullivan is memorable not only for his own work but for having provided the apprenticeship of Frank Lloyd Wright, America's greatest native architect, whose career extended 50 years beyond that of Sullivan. See American Architecture.

### Reinforced Concrete

Improvements in concrete ran parallel to developments in iron and steel technology. In 1892 French engineer François Hennebique combined the strengths of both in a new system of construction based on concrete reinforced with steel. His invention made possible previously unimaginable effects: extremely thin walls with large areas of glass; roofs that cantilever (project out from their supports) to previously impossible distances; enormous spans without supporting columns or beam; and corners formed of glass rather than stone, brick, or wood.

The reinforced concrete structure also eliminated the need for interior walls to support any weight, permitting a floor plan of unprecedented openness. Perret's building stood eight stories high, with two additional stories set back from the front of the building, the typical height of most Paris buildings at the time.

In France attention centered on reinforced concrete. Auguste Perret achieved early success in Paris with his apartment building (1902-1903) in the Rue Franklin and his Théâtre des Champs-Élysées (1911-1912). Tony Garnier had, during his studies in Rome, created a detailed design for an imaginary city with many buildings, all in concrete; its plans were published in 1917 as *La cité industrielle*. Vienna was the scene of work by Otto Wagner and by Adolf Loos, who worked in severe linear forms and proclaimed that "ornament is a crime." Peter Behrens, a founding member of the *Deutscher Werkbund* (German Craft Alliance), is revered as a German precursor of modern architecture. See *Modern Architecture*.

### The Bauhaus

When the Bauhaus opened, the modern movement in architecture began to coalesce. The Bauhaus school (Weimar, 1919-1925; Dessau, 1926-1932; Berlin, 1932-1933) brought together architects, painters, and designers from several countries, all determined to formulate goals for the visual arts in the modern age. Its first director was Walter Gropius, who designed the innovative buildings for the move to Dessau; its second was Ludwig Mies van der Rohe. The new architecture demonstrated its virtues in new *Siedlungen* (low-cost housing) in Berlin and Frankfurt. An exhibition of housing types, the *Weissenhof Siedlung* (1927) in Stuttgart, brought together works by Mies, Gropius, the Dutch J. J. P. Oud, and the Swiss-French Le Corbusier; this milestone identified the movement with a better life for the common man. The chastely elegant German Pavilion (1929) by Mies for the Barcelona Exhibition, executed in such lavish materials as travertine, marble, onyx, and chrome-plated steel, asserted a strong, formal argument independent of any social goals. Gropius, his disciple Marcel Breuer, and Mies eventually established themselves in the U.S., where they enjoyed productive and influential decades—extending through the 1970s for Breuer—as architects and teachers.

Le Corbusier, over a long career, exerted immense influence. His early publications championed a machine aesthetic and urged the replacement of traditional cities in favor of life and work in skyscrapers arranged regimentally in vast parks. His *Villa Savoye* (1928-1931) in the French countryside downplays a sense of structure and materials in order to dramatize complexity of spacial organization and allow a subtle ambiguity between interior and exterior space. In the 1950s, with Jawaharlal Nehru as client, he laid out the new

capital city of the Punjab, Chandigarh, and designed for it three monumental concrete government edifices standing in a vast plaza. In France he produced two unique religious buildings, the pilgrimage chapel at Ronchamp (1950-1955) and the Dominican monastery of La Tourette (1957-1961), both in concrete. Having abandoned the extreme rationalism of his early career, he manipulated form and light in these extraordinary structures for emotional response and dramatic effect.

### **Innovative Architecture**

Such structural engineers as the Swiss Robert Maillart, the French Eugène Freyssinet, and the Italian Pier Luigi Nervi produced works in reinforced concrete that combined imagination with rationality to achieve aesthetic impact. Among architects the Danish Jørn Utzon, in Australia's Sydney Opera House (1957-1973), and the Finnish-American Eero Saarinen, in Dulles Airport (1960-1962) near Washington, D.C., employed unusual structural solutions. From his base in Helsinki, the Finnish architect Alvar Aalto extended his oeuvre through more than four decades, refusing to celebrate the industrialized repetition of steel, concrete, glass, and aluminum, but molding spaces with utmost sophistication, great care in the distribution of light, and the use of materials—stone, wood, and copper—with familiar and sympathetic tactile qualities. The American Louis I. Kahn infused his designs with a transcendent monumentality recalling Roman classicism, as in the transformation of tunnel vaults into light-modulating girders in his Kimbell Art Museum (1972), located in Fort Worth, Texas.

### **The International Style**

Despite such noteworthy exceptions—including such later works of Wright as New York City's Guggenheim Museum (completed 1959)—the style initiated by the Bauhaus architects and termed the International Style gradually prevailed after the 1930s. The theory and practice of the new style was introduced in the United States largely through the efforts of Philip C. Johnson, one of Gropius's students at Harvard University. In the hands of its most gifted exponents, such as Mies, the International Style was particularly well suited to large metropolitan apartment and office towers. The chaste elegance and subtle proportions of Mies's Lake Shore Drive Apartments (1951) in Chicago and (with Philip C. Johnson) his Seagram Building (1958) in New York City represent modernism at its finest. Many of his imitators, however, seized on its commercial potential; it proved extremely efficient for large-scale construction, in which the same module could be repeated indefinitely. Inner spaces became standardized, predictable, and profitable, and exteriors reflected the monotony of the interiors; the blank glass box became ubiquitous.

Assessing modernism after a half century in which it was dominant, commentators pointed out that even though it was embraced by big business and big government, the lay public never grew fond of it. At most an austere classicism was conceded to it, but this was achieved in a coldly impersonal and often overwhelming way. Modernism had cut off architecture's roots in the past by about 1930. Suddenly it became incorrect for a new building to show any resemblance to old ones; and for a period of time the study of historical styles almost disappeared from professional schools.

### **Postmodern Architecture**

Between about 1965 and 1980 architects and critics began to espouse tendencies for which there is as yet no better designation than postmodern. Although postmodernism is not a cohesive movement based on a

distinct set of principles, as was modernism, in general it can be said that the postmodernists value individuality, intimacy, complexity, and occasionally even humor.

Postmodern tendencies were given early expression in *Complexity and Contradiction in Architecture* (1966; revised ed. 1977) by the American architect Robert Venturi. In this provocative work he defended vernacular architecture—for example, gas stations and fast-food restaurants—and attacked the modernist establishment with such satiric comments as “Less is a bore” (a play on Mies’s well-known dictum “Less is more”). By the early 1980s, postmodernism had become the dominant trend in American architecture and an important phenomenon in Europe as well. Its success in the United States owed much to the influence of Philip C. Johnson, who had performed the same service for modernism 50 years earlier. His AT&T Building (1984) in New York City, with its Renaissance allusions and its pediment evoking Chippendale furniture, immediately became a landmark of postmodern design.

Other postmodern office towers built during the 1980s aspired to a similar high stylistic profile, recalling the great art deco skyscrapers of the 1920s and 1930s or striving for an eccentric flamboyance of their own. Vivid color and other decorative elements were effectively used by Michael Graves in several notable buildings, while Richard Meier developed a more austere version of postmodernism, influenced by Le Corbusier, in his designs for museums and private houses. Outstanding American practitioners of postmodernism, in addition to Venturi, Johnson, Graves, and Meier, are Helmut Jahn, Charles Gwathmey, Charles Willard Moore, and Robert A. M. Stern.

Closely related to the postmodernist interest in historical styles was the historic preservation movement, which during the last decades of the 20th century led to the renovation of many landmark older buildings and to a tendency to resist new architecture that seemed to threaten the scale or stylistic integrity of existing structures. The stark, confrontational approach of modernism has been replaced by a more inclusive sense of the architectural heritage that acknowledges and seeks to preserve the very finest achievements of every period.

### **The Architecture of Islam**

The Islamic concept of a mosque as a place for ablutions and prayer differs from the idea of a Christian church, and the desert climates in which Islam first became established required protection from sun, wind, and sand. The initial prototype was a simple walled-in rectangle containing a fountain and surrounded with porticoes. A qibla, or wall toward Mecca, had in its center an apse, or mihrab, with a nearby pulpit, or minbar; the shelter at this end consisted of multiple arcades of transverse and lateral rows of columns. Structural elements were the arch and the dome; roofs were flat unless forced upward by vaults, and there were no high windows. The mosque had at least one tower, or minaret, from which the call to prayer was issued five times daily. The same basic plan is followed to this day.

### **Western and Middle Eastern Islamic Architecture**

It is now a brick ruin, but its curious cone-shaped minaret with outside spiral ramp survives. The Great Mosque at Córdoba in Spain covers 2.4 hectares (6 acres) and was built in several stages from 786 to 965.

It was converted to a Christian cathedral in 1236. Also in Spain is the Alhambra (1354-1391) at Granada, one of the most dazzling examples of Islamic palace architecture; its courts and fountains have delighted visitors ever since its construction.

Over the centuries Islamic architecture borrowed extensively from other cultures. Beginning in 1453 the Ottoman Empire had its capital at Constantinople (now İstanbul). Sultan Süleyman I (the Magnificent) was a patron of arts and architecture. His architect, Sinan, knew the Byzantine traditions, and in his mosques he refined and elaborated on the great 6th-century prototype, Hagia Sophia. Sinan's masterpieces are the Süleymaniye (begun 1550) in İstanbul and the Selimiye (begun 1569) in Edirne.

Iran is renowned for brick masonry vaulting and for glazed ceramic veneers. The finest examples of Islamic architecture in Iran are found in Eşfahān (Isfahan), the former capital. The enormous imperial mosque, the Masjid-i-Jami, represents several construction periods, beginning in the 15th century. Even more richly ornamented is the sumptuous Masjid-i-Shah (1585-1616), built to be part of the royal civic compound of Shah Abbas I.

### **Islamic Architecture in India**

The Mughal peoples, who had embraced Islam, made incursions into India and established an empire there. Mughal architecture was based on Persian traditions, but developed in northwestern India in ways peculiar to that region. The earliest remaining mosque, the Qutb, near Delhi, was begun in 1195. It is impossible to separate Mughal religious architecture from that erected to glorify the Mughal Empire.

The great builders were the emperors of the 16th and 17th centuries. Their most impressive monuments are a succession of imperial tombs. Notable are the superbly architectonic tomb (1564-1573) of Humayun in Delhi, the jewel-like Itimad-ud-Daulah (1622-1628) in Āgra, and the beautifully proportioned and decorated Taj Mahal (1632-1648), also in Āgra. A typical tomb was a high central dome surrounded by smaller chambers arranged about two intersecting axes so that all four sides of the structure are alike. It is built on a raised platform overlooking a large formal garden, surrounded by a wall, with pavilions at the axial points.

Each of the 16th- and 17th-century Mughal emperors elaborated the huge forts at Lahore, Delhi, and Āgra. These forts included living quarters, mosque, baths, public and private audience halls, and the harem. One compound, that of Fatehpur Sikri, was begun in 1571 and abandoned in 1585. See Indian Art and Architecture.

Islam forbade the representation of persons and animals; yet craftsmen created highly ornamented buildings. The motifs are geometrical designs, floral arabesques, and Arabic calligraphy. The materials are glazed tile, wood joinery and marquetry, marble, mosaic, sandstone, stucco carving, and white marble inlaid with dark marbles and gemstones. See Islamic Art and Architecture.

### **Cities and Suburbs**

The Industrial Revolution of the late 18th and the 19th centuries that brought forth advances in materials and technology was also responsible for large-scale changes in patterns of living and working, and for the rapid growth of cities. By the beginning of the 20th century, the population of cities such as Paris, London, and New York City numbered well over a million people. Such population concentrations created demand for new roads, railroads, bridges, and subways, and for a wide range of new buildings, including railroad stations, department stores, opera houses, and covered public markets. Perhaps the most troubling feature of the Industrial Revolution was the squalor created wherever factories were found. Reformers throughout the 19th century struggled to change laws and customs in order to improve working conditions and provide decent and sanitary housing for the new urban masses.

Among the reformers were those who dreamed of using architecture to create industrial utopias that would help control the unchecked urban growth and keep the working classes themselves in line. In 1901 French architect Tony Garnier submitted designs for an imaginary city where workers would live in lushly landscaped residential areas and commute by streetcar to clean and pleasant factories (published as *Cité Industrielle*, 1917). Although his plans went unrealized, such utopian projects exerted a powerful force on architects and governments at the beginning of the 20th century.

In 1928 the *Congrès Internationaux de l'Architecture Moderne* (International Congress of Modern Architecture, or CIAM) was founded to promote social justice and modern architecture. In 1933 this group issued the Athens Charter, which recommended simple, clear urban-planning schemes that would separate leisure, work, housing, and traffic. Unfortunately, by separating these functions, many of these plans eliminated any sense of community. Governments and private enterprise sponsored new towns based on these guidelines, which assumed that people living in the right environment would be more likely to behave in accordance with the dictates of society. Much urban planning in the 20th century was devoted to decentralizing cities and setting up self-sufficient garden suburbs.

### **Art Nouveau and Related Movements**

Art Nouveau, which flourished in Europe between 1890 and 1910, was one of the earliest (and shortest-lived) efforts to develop an original style for the modern age. Art nouveau artists and designers transformed modern industrial materials such as iron and glass into graceful, curving forms often drawn from nature, though with playful elements of fantasy. In contrast to both Perret and the architects of the Chicago School, art nouveau designers were interested in architecture as a form of stylistic expression rather than as a structural system.

In the three centers of art nouveau—Barcelona, Spain; Brussels, Belgium; and Paris, France—architects struggled to define a style with distinctly local characteristics. In Barcelona, one of the most ambitious projects of architect Antoni Guadí was the *Templo Expiatorio de la Sagrada Família* (Church of the Holy Family, 1883-1929, 1979 to present). Guadí turned to nature for a rich variety of animal and plant forms to decorate the towering façades of the *Sagrada Família*. He also used natural forms structurally: columns shaped like bones, undulating walls in brick, a roofline resembling the profile of an armadillo. His wide use of

ceramic tile, a local building material, gave color and texture to his designs. The deeply personal nature of his fanciful designs meant that no school developed to follow him. Much more effective in generating a following was architect Victor Horta of Brussels.

Like Gaudí, Horta reacted against prevailing styles with an architecture that responded to local traditions and materials, although Horta transformed iron and glass as well as Belgian brick into slender, graceful forms inspired by flowers. Among his most influential designs was the Hôtel Tassel (1892-1893) in Brussels, a three-story house in which thin iron columns flow into stylized vines and serve both as structural and as decorative elements. The creation of these organic forms depended not on mass-production or modern machines, but on craftsmanship, thereby restoring to architecture what many feared was being lost to an increasingly technological engineering mentality. Horta's flowing lines became the hallmark of art nouveau and were rendered by others in iron, glass, and plaster as well as in graphic design. In Paris, Hector Guimard produced entrances for the Métro subway system (1899-1904), rendering fanciful plantlike forms in iron and glass.

As art nouveau's influence spread throughout Europe and North America, regional variations developed: stile Liberty in Italy, Jugendstil in Germany, Sezessionstil in Austria, and modernisme in Spain. Among the major achievements of these art nouveau offshoots were the Elvira Photo Studio (1896-1897) in Munich, Germany, by German architect August Endell; and the Stadtbahn (city railway system, 1894-1899) in Vienna, Austria, by Otto Wagner. Perhaps the greatest of these achievements is the Willow Tea Room (1903-1904) in Glasgow, Scotland, designed with sinuous, willowy lines by Scottish architect and graphic designer Charles Rennie Mackintosh.

*Note*

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