10 Louis Sullivan and Dankmar Adler, Guaranty Building, Buffalo, NY, 1894, detail

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industrialization and the city: the skyscraper as type and symbol

The architects of this land and generation are now brought face to face with something new under the sun – namely that evolution and integration of social conditions, that special grouping of them, that results in a demand for tall office buildings ... Problem: How shall we impart to this sterile pile, this stark, staring exclamation of eternal strife, the graciousness of those higher forms of sensibility and culture that rest on the lower and fiercer passions? How shall we proclaim from the dizzy height of this strange, weird modern housetop, the peaceful evangel of sentiment, of beauty, the cult of a higher life?
Louis Sullivan, 1896.

While the ideas which formed the theoretical scaffolding of modern architecture were first assembled in rarefied treatises, the realization of forms occurred within the calculations and mechanisms of the industrial city. It would be pointless to try to single out a particular time, place or personality as the exact starting point of a later worldwide movement, but it is striking how many tendencies professing the value of the 'new' came into being in the 1890s. Evidently a reaction against tired social, philosophical and aesthetic values was rumbling into life in urban centres as diverse as Paris, Vienna, Glasgow, Brussels, Barcelona and Chicago. The very notion and significance of 'modernity' differed from place to place, even from mind to mind, but the essential pre-conditions included the mechanization of the city, the introduction of materials like iron, glass and steel, experimental clients, and creative architects intent on expressing the new state of things in spaces and forms.

The above-mentioned cities were among the places to combine these conditions, but they each lived in different national histories which influenced the way in which architecture was perceived. The Viennese avant-garde emerged from the cracks of a declining imperial system as part of a short-lived revolt against the deadweight of previous cultural forms. The Art Nouveau which sprouted in Brussels was related to new industrial wealth, both its celebration in the world of the effete, aesthetic interior, and its critique in the politics of social reform. The formal innovations of both Glasgow and Barcelona were rooted in a consciousness of regional difference and in the evocation of 'identity' through the vernacular and natural analogies. The new tendencies in France necessarily took stock of an Enlightenment tradition, a technocratic model of national development, and the stifling effects of an 'official' Beaux-Arts view. In short, European aspirations towards a new architecture derived part of their point, much of their tension, and even some of their meaning from the destabilization or inversion of immediately preceding norms.

In North America the situation was somewhat different for the obvious reason that traditions were shorter, imported, and much less entrenched. The eventual elaboration of modern architectural ideals occurred against the backdrop of energetic

laissez-faire economic development, technological pragmatism and chaotic urbanization. The new cities were themselves the hubs of vast new railway or steamship routes linked to westward expansion one way, and to immigration from the Old World the other. Nothing expresses the instrumentalism of American growth more directly than the land ordinance grid of the late eighteenth century mapping out future national territory for colonial expansion and occupation: a total abstraction ignoring differences of topography and obliterating all traces of indigenous memory. As a rule, the North American town was also laid out following a rectilinear system (Figs. 20, 21) and (unlike its Catholic colonial relative to the south) was based upon the principle of free-standing objects surrounded by spaces (rather than patios and plazas surrounded by buildings). Translated into the grids and blocks of the American industrial city, and the rectangular boxes and structural frames of commercial buildings, this mentality produced a neutral vernacular of a kind – a straightforward graph of land speculation and standardized modules of space: virtually an unconscious American style.

While the North American industrial city was different in plan and constitution from its European relatives (which normally possessed layers of urban fabric deposited over the centuries), the processes of technological modernization had certain broad features in common wherever they occurred. Coal and steam power, ferrous metals and engineering know-how were at the core of it all, and together with the concentration of capital, the transposition of labour from country to city, and the opening up of both national and international lines of trade and communication, they transformed the cultural landscape in a matter of decades. The large urban centres on both sides of the Atlantic expanded upwards, outwards, even underground, to cope with the pressure of people, traffic and goods. Baron Georges Haussmann characterized mid-nineteenth-century Paris as 'a great consumer's market, a vast workshop, an arena of ambitions'. His plans for the city (dating from the 1850s) cut wide boulevards through the old fabric and combined the agendas of the time: to render the capitalist instrument of the city more efficient by liberating its circulation; to celebrate the monuments and glory of empires past and present by linking focal points with vistas; to let

11 Haussmann's Paris: the newly created avenue de' l'Opéra seen from the roof of Garnier's Opéra in the 1870s

12 Aerial view of King's Cross area, London, showing George Gilbert Scott's Midland Hotel fronting St Pancras Station (1865–71) and Lewis Cubitt's King's Cross Station (1851–2)

13 Gustave Doré, *Over London by Rail*, engraving, 1872

in light, air and greenery for the bourgeoisie, but push the poor elsewhere; to turn the boulevard into a social stage, but also a vector of military control.

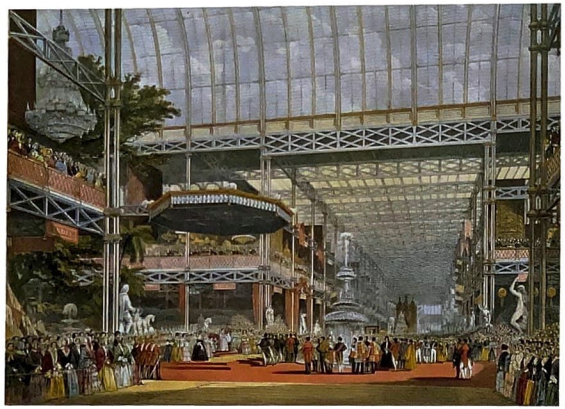
Mobility was the key to the new kind of city, and circulation had a major impact on its form. The railway which permitted such concentrations of goods and people was both fact and symbol: it caused change but also represented it. It cut the finite city in pieces, demolished old boundaries between urban and rural worlds and brought the slag of the mine and the waste of the factory to the outskirts. If one result was a new 'middle landscape', another was a civic chaos in which old hierarchies between institutions were confused. Industrialization changed the size, shape and relationship of buildings in the cityscape, disturbing pre-existing conventions of representation and exacerbating uncertainties about the basis of style. The railway station itself epitomized the semantic confusion: a utilitarian shed on one side, an urban façade of uncertain form on the other. If George Gilbert Scott's Midland Hotel fronting St Pancras Station (1865–71) in London took the form of a Gothic château, Lewis Cubitt's King's Cross Station

(1851–2) alongside took the more direct solution of a large frontispiece of wide brick arches signalling the presence of the sheds behind. This was not 'functionalism' so much as the representation of function: a bold and direct image evoking associations with viaducts and bridges.

The infrastructures of industry obeyed none of the traditional rules for the handling of urban space and made it more and more difficult to formulate a coherent image of the city as a whole. When designing for Berlin in the 1820s and 1830s, Schinkel had adapted the ideas of classical decorum to handle the transition from monumental to utilitarian and from city to country: the Altes Museum (Fig. 3) being given the full regalia of a classical order, the Bauakademie (Fig. 33) being treated to stripped pilasters almost like an industrial frame, and the Court Gardener's House at Potsdam working with a combination of picturesque, rustic and primitivist modes. But the concentration of new industrial functions upset the scale of values, so that private buildings for trade and business such as warehouses, factories and (later) skyscrapers towered above public buildings of civic or religious importance. The city of process gradually replaced the city of finite form.

The very image of the machine could excite contrasting reactions in nineteenth-century minds. On the one hand it could be seen as the instrument of progress, offering new frontiers over land and sea, generating wealth, creating a new culture based upon science and rationality. On the other it could be seen as the great destroyer which raped nature, obliterated identity and region, and enslaved the working classes in an endless cycle of drudgery. In Pugin's *Contrasts*, published in 1836, there had been a comparison between the 'modern', 'utilitarian' way of handling the poor – the centralized mechanism of a *Panopticon* in which a single guard could survey all inmates from a single point – and the supposed medieval approach combining monastery and Christian charity. In this vision of things the machine was the epitome of inhuman authoritarianism and social alienation. The commercial structures of capitalism may have produced daring new architectural forms, but they rested upon a grimy and exploitative base. The slum, no less than the railway, the mill and the skyscraper, had a repetitive and standardized character wherever it appeared:

> ... row above row of windows in the mud coloured surface, upwards, upwards, lifeless eyes, murky openings that tell of barrenness, disorder, comfortlessness within ... Acres of these edifices, the tinge of grime declaring the relative dates of their erection; millions of tons of brute brick and mortar, crushing the spirit as you gaze. Barracks in truth; housing for the army of industrialism, an army fighting with itself, rank against rank, man against man, that the survivors may have whereon to feed.



14 Joseph Paxton, Crystal Palace, London, 1850–1, from *Dickinsons Comprehensive Pictures of the Great Exhibition of 1851*, 1854

15 Gustave Eiffel, Eiffel Tower, Paris, 1889

16 Victor Contamin and Charles Louis Ferdinand Dutert, Palais des Machines, Paris, 1889

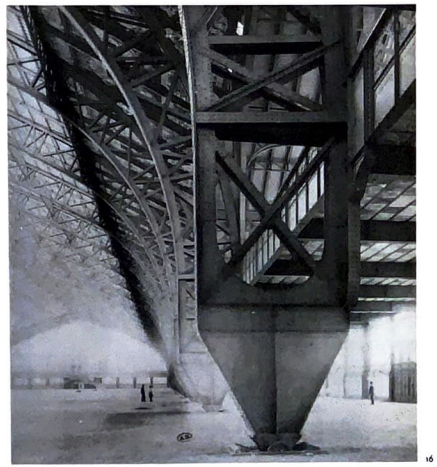
In the mid-nineteenth century squalid conditions were the source of both revolutionary fervour and reformist fantasy. For Karl Marx and Friedrich Engels, the question of an improved physical environment could only be answered in a post-revolutionary state; they tended to regard plans for alternative cities as hopeless attempts at imposing individual will on the unavoidable forces of history. For Utopian socialist visionaries with their ideal communities the problem was to release the working class from the alienation and exploitation of machine work and to rediscover the total personality split by the division of labour. And so the possibilities were considered of taking the town out to nature, or of putting nature in the town; of installing people in communal villages or collective palaces; of reordering the modern city so that it would function as a perfect machine or as a healthy, breathing organism (see Chapter 14). Given the nineteenth-century background of soot, disease, overcrowding and lack of open space, it is not altogether surprising that schemes of urban reform in the early twentieth century should have made so much of light, space, greenery, hygiene and transparency.

But the later images of salvation relied upon technologies that emerged in mostly pragmatic circumstances. The glazed shed fabricated with standardized iron components was a virtual leitmotif of the industrial city after mid-century on both sides of the Atlantic. Variations on this type occurred in railway stations, market halls, exhibition structures, shopping arcades, galleries, museums, even conservatories in the houses of the rich. Iron was molten and fluid and obeyed none of the traditional rules of masonry construction. It allowed wide spans and large areas of glass; it dissolved away mass and opened up space; it reduced supports from columns or piers to slender stanchions; it allowed girders to be made from standard flats and small fillets welded or riveted together; it encouraged the invention of new structural systems in bridges and towers and recast the roles of architect and engineer; it permitted tensile curves of unusual profile and prompted analogies not only with the skeletons of Gothic architecture, but also with those of nature. The Crystal Palace of 1850–1, which housed the Great Exhibition, was designed by a horticulturalist/engineer, Joseph Paxton, who, in effect, transferred the greenhouse from one context to another. This vast glazed shed was assembled entirely from standardized pieces of iron, wood and glass, and was built to display the gadgetry and products of competing economic powers, but it soared above these mundane concerns, dissolving into trees and sky and revealing a virtually unprecedented sense of space, transparency and lightness.

We see a delicate network of lines without any clue by means of which we might judge their distance from the eye or the real size … the eye sweeps along an unending perspective which fades into the horizon. We cannot tell if this structure towers a hundred or a thousand feet above us, or whether the roof is a flat platform or is built up from a succession of ridges, for there is no play of shadows to enable our optic nerves to gauge the measurements … all materiality is blended into atmosphere …

The Crystal Palace forced many to realize that 'the standards by which architecture had hitherto been judged no longer held good'. To Rationalists it was evidence of a new architecture. Romantics compared the effects of light and space to the dissolution of the elements in J. M. W. Turner's late paintings. Semper (in an essay of 1852 entitled *Science, Industry and Art – Wissenschaft, Industrie und Kunst*) deplored the vulgarity of objects on show and warned against 'the depreciation of material that results from its treatment by machines'. Ruskin equated engineering standardization with brutal materialism and the death of craft. Meanwhile, the structure itself evaded easy categorization. It stood in Hyde Park with trees inside it, like a colossal conservatory, evoked a shopping arcade with the crowds of people pouring through, and was constructed rapidly following a method of serial production, like a railway. 'It should not be suggestive of a pyramid, a temple, or a palace,' the Building Committee in charge of the competition had stated: 'The object should determine the design. That is to say, the design should be altogether subordinate to the uses of the building, and should be of the kind that would express them, or at least, harmonize with them.'

The Crystal Palace took over a standard technology and gave it a coherent form. The rolled iron girder was the unit from which much of the industrial world was made: the railways themselves, the iron bridges of huge span, the stations and sheds, even the frames of the skyscrapers in the 1880s and 1890s, which could be thought of as vertical railways with elevators replacing the trains. Iron had revealed its formidable potential in the bridges of Telford and Brunel earlier in the century, and would do so again in the masterly designs of Gustave Eiffel, not only in the bridge over the Douro in Portugal of 1876, and the Pont du Garabit of 1880–4 in the Massif Central, but also in the Eiffel Tower, centrepiece of the Paris 1889 Exhibition, where Victor Contamin and Charles Louis Ferdinand Dutert's huge steel spans in the Palais des Machines also lent ferrous metals a monumental presence. Iron, and its relative steel



(the Bessemer process allowing economic production of this second material was patented in 1856), were increasingly able to establish their own aesthetic conventions, and in the 1889 exhibition were even involved in the expression of technological power as an instrument of national progress. In an essay written in the 1930s entitled 'Paris, Capital of the Nineteenth Century', Walter Benjamin evoked the crisis of representation brought about by rapid technological change:

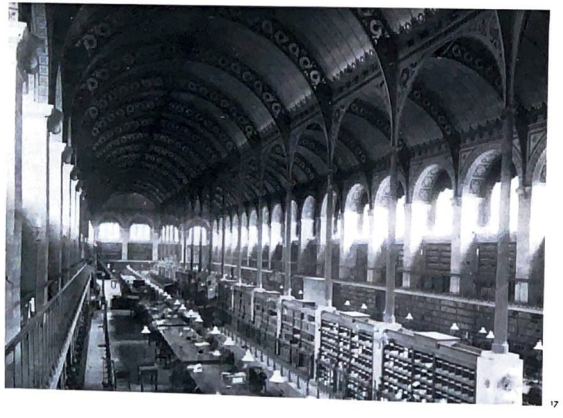
> The development of the forces of production reduced the wish symbols of the previous century to rubble even before the monuments representing them had crumbled. In the nineteenth century this development emancipated constructional forms from art, as in the sixteenth century the sciences freed themselves from philosophy.

If the objects of engineering could be portrayed as brute equipment lacking the ennobling endowments of the art of architecture, the opposite case could also be made that the historically bound activities of the architectural profession were being made redundant by the verve and skill of the engineers. The latter point of view was to become a standard piece of the folklore of the modern movement in the twentieth century, and was well represented eventually in the writings of Sigfried Giedion, who saw the nineteenth century as a schizophrenic age, torn between the 'true' culture of structural integrity and the 'false' one of dying schemes of architectural representation. In fact this overstated the case, since architects as varied in their persuasions as Henri Labrouste (the Bibliothèque Ste-Geneviève of 1843–50) and Thomas Deane and Benjamin Woodward (the Oxford Museum of 1855–60) had effective and deliberate recourse to skeletal iron structures on the insides of their buildings. These were carefully conceived works in which the juxtaposition and contrast of slender metal members and articulated masonry walls was an essential and complementary aspect of the architectural idea. Labrouste's building submitted technology and craft to the governing image of a civic institution of learning with sober, arcuated stone exteriors of no particular historical style, and a single airy, well-lit interior space for 'enlightenment' (permitted by the spanning capacities of iron). Deane and Woodward's Museum worked with the bold contrast between Ruskinian Gothic ornament, geological associations and a slender metal and glass roof illuminating the natural specimens in the central court. Whatever the medieval pedigree of the design as a whole, the iron was forged to fit a Rationalist vision of Gothic, and even to echo the skeletons of creatures on display. The combination

17 Henri Labrouste, Bibliothèque Ste-Geneviève, Paris, 1843–50

18 Joseph Paxton, Crystal Palace, London 1851, under construction

19 Thomas Deane and Benjamin Woodward, Oxford Museum, Oxford, 1855–60



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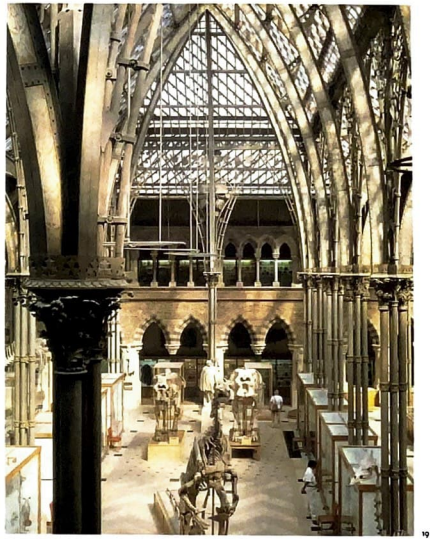
of 'natural', traditional and mechanical was integral to the institutional interpretation, and added to the material and metaphorical richness of the result.

The stone or brick casket with a metallic cage or frame let down inside it was a recurrent and basic structural type throughout the nineteenth century which even continued into the early twentieth. The fact that several notable engineers succeeded in demonstrating the intrinsic qualities of iron and steel in their designs for towers and bridges did not automatically render this type obsolete. What really changed was the nature of the relationship between load and support, cladding and frame, especially when much taller buildings like skyscrapers were needed towards the end of the century. For in these circumstances masonry could only go so high before it became an impractical encumbrance, and so iron and steel were commandeered to do more and more of the actual work. By degrees the skeleton made its presence felt in the overall form, in the façade composition and in the tectonic stresses of the building – but not directly, for it was usually sheathed in protective layers of brick, stone or terracotta which served as fireproofing, insulation or ornament. The actual structural frame was made manifest as some sort of *visual* frame in which the interplay between pier, spandrel, moulding,



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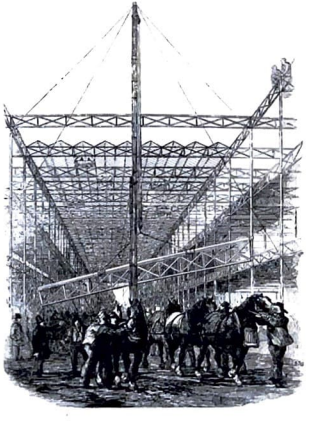

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plate glass, lintel and arch afforded a new aesthetic.

Nothing reveals the struggle to reconcile engineering and architecture more clearly than the commercial buildings produced in the Midwest of the United States in the last two decades of the nineteenth century. The problem was to find forms for a range of mercantile functions from warehouse to tall office building. Needed were cheap, utilitarian buildings that were quick to construct, flexible in use, and fireproof. As the rectangular perimeters should be filled out to maximize floor space, and as light courts were wasteful, large apertures were desirable to admit light and air deep into the blocks. The typical arrangement combined a utilitarian cage with wide-bayed windows, elevators tucked out of the way, and a grid of structural supports in plan. This skeleton posed teasing problems of architectural expression. Should it be left alone as engineering dictated? Should it be clothed or decorated in some appeasing historical

style? Or should it be interpreted as a cultural fact worthy of a new symbolic expression? At issue was the question of appropriateness. What were these new buildings supposed to look like and what did they really represent?

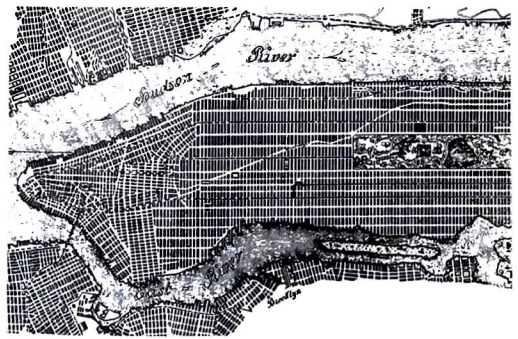
Although the skyscraper had become a general phenomenon in America by the end of the nineteenth century, the first major proliferation of the type was in the Chicago of the 1880s and 1890s. Chicago was the main depot, nerve centre and clearing house for the great railroad expansion to the West which occurred from mid-century onwards. It was the diagram of capitalism in its crude form and, after the fire of 1871, the flat site by Lake Michigan offered a *tabula rasa* for a boom in rapid construction. The skyscraper was, essentially, a white-collar building type, a direct expression of the division of labour between management and manufacturing. It was part of the same world as the typewriter, the telegraph, the electric light and the mechanical heating system – all of which contributed to its own commercial viability. The pressure to build upwards came from the desirability of concentrating everybody in the downtown 'loop', an area only nine blocks long and wide, delineated by the Chicago river and the railroad yards, but it also arose from the desire to extract maximum profit from single, rectangular lots of land in the urban grid. The steel wire and the Otis elevator permitted the tall office building to happen.

The skyscraper's uncertain identity touched upon the very problem of a modern architecture, and upon an inheritance of American dilemmas concerning the relative values of 'cultural', 'vernacular', and 'industrial' forms. The country was, after all, a colonial invention: it had imported European styles from the start, gradually adjusting them to deal with local conditions. In the early nineteenth century, classicism was given the stamp of approval for the new Republic by Thomas Jefferson, and it returned later under various guises. In the ensuing decades America experienced some of the same architectural crises as Europe, with Greek, Roman, Gothic and other revivals taking on a slightly different accent. It was in the years immediately following the Civil War that a new mood of integration and national identity influenced the arts, emphasizing the 'falsehood' of imported imitations. The writings of Horatio Greenough, praising the craft, elegance and economy of ships, gave expression to a native functionalism. The speculations of Ralph Waldo Emerson, David Thoreau and Walt Whitman opened vistas on a transcendentalism rooted in the American landscape. These antidotes to fickle revivalism and vulgar materialism were accompanied by other signs of cultural independence: in the democratic 'wildernesses' of Frederick Law Olmsted's urban parks (which invaded the grid of the capitalist city in order to make it more humane) and in the architecture of Henry Hobson Richardson, models of 'nature' were used to civilize the machine.

Richardson was a special case of his own: a 'modern' architect with the ancient sense who was broad enough to encompass the energy of the railway age while returning to first principles in tradition. He worked with bold masses of brick or stone that were cut by arches, abutted by towers and surmounted by dramatic roofs. His polychrome surfaces, romantic silhouettes, and ornamental patterns celebrated craft, while the robust order of his buildings transcended matters of personal style to evoke the social forces of an America in transition from rural to urban realities. Having studied at the École des Beaux-Arts in Paris in the 1860s, he never lost sight of the hierarchical plan or the discipline of the conceptual sketch, an inner image making itself felt in every part and detail. But his sources were medieval and vernacular as well as classical, and his 'system' could be adjusted to handle a wide range of tasks in the new cultural landscape – from churches and commercial buildings in the city to railway stations and libraries in suburbia, to rural retreats and wealthy homes in the countryside. Richardson's architecture straddled the Old World and the New, recalling both the elemental values of the French Romanesque and the rock formations of the American landscape: his colossal semicircles in stone were capable of alluding to the huge wheels of locomotives, or of rhyming with Roman aqueducts. Without theoretical pretension or undue show, he took on nineteenth-century dilemmas over the basis of style and forged an eclectic solution in the deepest sense.

Richardson was first in a line of proudly 'American' architects which included Louis Sullivan, John Wellborn Root and Frank Lloyd Wright; he also supplied the rock on which the Chicago School would stand. For a viable commercial style would result only when some coherent way had been discovered for combining the sculptural masonry tradition with skeletal thinking about the structural frame. The latter was well represented by William Le Baron Jenney's First Leiter Building of 1879, a cut-to-the-bone rectangular solution shorn of adornment which reflected the sensibility of a Civil War engineer and relied upon Viollet-le-Duc's notion of a new architecture based upon a direct expression of structure and programme. It avoided the fussiness of the cast-iron storefronts designed by James Bogardus and others in the 1850s in New York, and concentrated upon a stark rectangular aesthetic of spandrel and pier. There was a faint reminiscence of pilasters and a cipher of a cornice, but that is as far as history was allowed to go. If there were antecedents, they probably lay in the realm of mill and factory design, or possibly in

20 Bird's-eye view of the business district of Chicago, *c.*1898



21 Map of New York City, showing the grid of streets on Manhattan Island, with Frederick Law Olmsted's Central Park, designed in the 1850s

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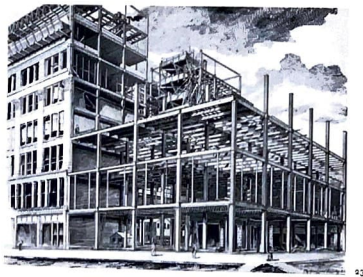
the kind of restrained cast-iron compositions achieved in some warehouse and shop designs in Glasgow and Liverpool in the 1860s.

Richardson's major contribution to American commercial architecture was the Marshall Field Wholesale Store constructed in Chicago between 1885 and 1887. Here the utilitarian requirements of a giant purchasing warehouse were submitted to the rigours of a symmetrical and hierarchical plan and a dominant sculptural idea. The internal construction followed that of the typical elevator building with cast-iron columns carrying floors and roof, and wrought-iron beams increasing the structural spans, but the exterior was made from weight-bearing walls in sandstone resting on a rough granite base. The block as a whole was treated as a single monolith into which a dignified row of arches was cut. The combination of an exterior masonry armature and interior 'shelves' of floors was expressed deftly in the spandrels and horizontals of the fenestration system. Two entirely different technologies and ideas of construction, stone arch, trabeated metal frame – one old, the other new – reached a point of tense coexistence and equilibrium. Louis Sullivan described the building in these terms:

> Four-square and brown, it stands, in physical fact, a monument to trade, to the organized commercial spirit, to the power and progress of the age, to the strength and resource of individuality and force of character; spiritually it stands as the index of a mind, large enough, courageous enough, to cope with these things, master them, absorb them and give them forth again, impressed with the stamp of large and forceful personality; artistically it stands as the oration of one who knows well how to chose his words, who has something to say and says it – and says it as the outpouring of a copious, direct, large and simple mind.

Richardson not only had something to say, he also had a mature language with which to say it. The Marshall Field Store worked its way towards civic monumentality on his scale of values, while holding to the stark 'objectivity' of American vernacular construction; palatial and stately, it none the less evoked 'the vitality of the rising city'. It stood midway between the age of the machine and the age of craft; between the world of industrialism and the wide western wilderness full of raw materials where Richardson had only recently erected the Ames Monument as a rugged stone cairn to mark the meeting of the railway lines between east and west. But if the building had a continental grandeur about it, it was also pervaded by a general classical sense. Its immediate nineteenth-century ancestor may have been Labrouste's Bibliothèque Ste-Geneviève, but its longer-range pedigree surely included the



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22 William Le Baron Jenney, First Leiter Building, Chicago, 1879

23 William Le Baron Jenney, the steel frame of the Fair Store, Chicago, from *Industrial Chicago*, 1891

24 Henry Hobson Richardson, Marshall Field Wholesale Store, Chicago, 1885–7

25 Pont du Gard, near Nîmes, Roman aqueduct, 1st century AD

26 Henry Hobson Richardson, early sketch for the Marshall Field Wholesale Store, 1885. Pencil, crayon and wash on buff paper, heightened with white 11¼ x 20 in (28.5 x 50.1 cm). Houghton Library, Harvard University, Cambridge

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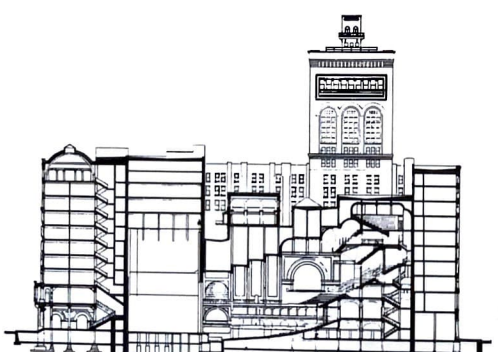
27 Louis Sullivan and Dankmar Adler, Auditorium Building, Chicago, 1886–9

28 Auditorium Building, longitudinal section

brown-textured stone palaces of the Florentine quattrocento (built for an earlier mercantile class), if not the basic type of the Roman aqueduct (the Pont du Gard comes to mind). Richardson was here on the knife edge between utilitarian form and symbolic representation.

The Auditorium Building in Chicago of 1886–9 by Louis Sullivan and the engineer Dankmar Adler was one of several buildings to extend Richardson's seminal lessons for ennobling 'industrial civilization'. The programme had a civic aspect, since it was necessary to combine an opera house and a hotel with offices in a single structure. The site offered breathing space, views and a façade in an easterly direction towards Lake Michigan. Whatever his theoretical claims at making form 'follow' function, Sullivan (who had spent a short time at the École des Beaux-Arts, and also at the new school at Massachusetts Institute of Technology) was aware of the need to transform types from history when dealing with the unprecedented problems of



commercial construction. The overall massing of the Auditorium Building, with its tower to one side, suggested an ingenious transposition of a medieval *palazzo pubblico*. Crammed into this shape was a very different creature, relying upon wide spans in iron, and incorporating modern heating and ventilation equipment. Adler's solution to the spanning of the auditorium allowed uninterrupted visibility and an arched acoustic ceiling, while the entire structure was brought down on to wide-footed foundations dealing with the marshy subsoil conditions. As subsidence was expected to be uneven, the building was weighted unequally.

The exteriors of the Auditorium Building reveal Sullivan's struggle to reconcile a masonry syntax with the stretching of internal possibilities permitted by the structural frame. The bold sculptural massing, the varying degrees of rustication, the huge arches and the visual expression of inner tension, placed the building broadly in a Richardsonian lineage, but the vertical attenuation and flattening of the main shafts and piers anticipated some of Sullivan's later solutions for the tall building. The dense and vegetal ornament in the bar (vaguely like Art Nouveau) also hinted at his interest in geometrical systems based upon nature. The Auditorium was a transitional work in Sullivan's search for an adequate tectonic expression for the new means of construction; the division of the block into base, middle and top, and the accentuation of vertical lines of force with linear ornament would be developed and clarified in later designs. But the building revealed broader dilemmas related to industrialization itself. It grappled with the problem of imposing a civic image on raw standardized technology, and with the role of 'higher sensibility' in a commercial setting.

The Monadnock Building by John Wellborn Root and Daniel Burnham of 1884–91 also confronted these questions but, by contrast, was a completely resolved sculptural entity – a work of invincible directness and clarity. It was also the end of the line for monolithic masonry construction on this scale in Chicago office buildings of the late nineteenth century. The design was evolved gradually between 1884 and 1890, then constructed in the following year. The client Peter Brooks (a Boston real estate developer) insisted throughout on simple lines and an avoidance of unnecessary clutter. The Monadnock stood on a narrow half-block, so presenting a slender profile at each end, and a cliff-like façade on the longer sides. As the site was oblong, there was no need to include a light court, and the office windows were bowed to draw light and air into the dense mass of the shaft. The main weight of the Monadnock was born by the colossal brick walls, which were battered outwards towards the base to supply an earth-bound socle in granite. There was also some lateral steel bracing in the structure to stabilize the building in high winds, and to lock in the window bays. The uniform brick surfaces were sliced and cut to deny the sense of mass, and tapered gradually before being flared outwards at the top where the wall was coextensive with a completely abstracted 'cornice'. The tension of the design relied, in part, on the interplay between glass planes and sheer masonry. The Monadnock Building combined grim solemnity and stern utilitarianism; it had the inevitability of a geological fact.

Montgomery Schuyler, a perceptive American critic of the time, called the Monadnock 'the most effective and successful of the commercial structures to which the elevator has literally "given rise"'. He suggested that its quality relied upon 'a series of subtle refinements and nuances that bring out the latent expressiveness of what without them would be as bald as a factory'. Among these 'refinements' was the detailing of the corners, which were sharp and angular at the base, but increasingly flared, flattened and rounded towards the top. The vertical bays introduced a sober rhythm and seemed to swell from the primary mass. The windows were handled in such a way that one had the sensation of an entire glass skin inside a sheath of masonry. Thus the tectonic order of the whole building relied upon denials of visual weight, as well as their emphasis. The resulting form possessed a muscular sense of pressure and resistance, an inner energy, as if it were alive. The Monadnock took the mundane facts of construction and spiritualized them through a control of form and idea and through a distillation of principles drawn from history. Root was sophisticated and well-read in theoretical matters, knew Semper's ideas on 'origins' and types, and was surely aware of the plate in Owen Jones's *Grammar of Ornament* (1856) tracing the Egyptian column to Nile valley plant forms such as the lotus and the

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29 John Wellborn Root and Daniel Burnham, Monadnock Building, Chicago, 1884–91

30 Monadnock Building, plans of typical floor and ground floor

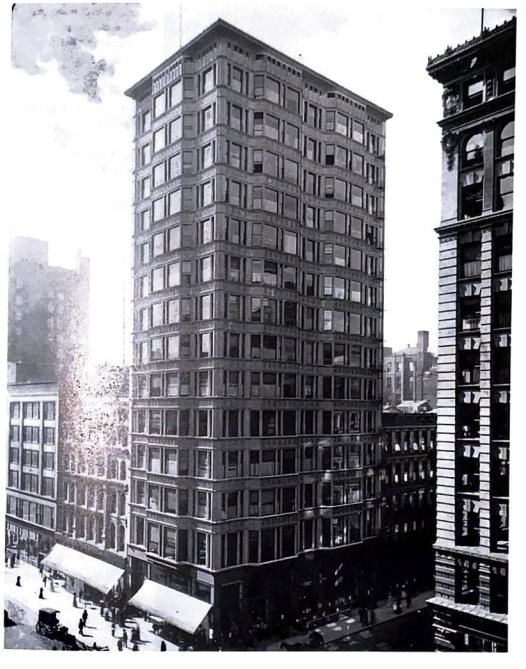
31 Burnham and Root, main designer Charles Atwood, Reliance Building, Chicago, 1890–4

papyrus. He was initially hesitant about working with a brick box but revealed that 'the heavy sloping lines of an Egyptian pylon had gotten into his mind as the basis of this design, and that he would throw the whole thing up without a single ornament'.

Root was determined to see beyond the transient facts of the capitalist city to some realm of higher values and spoke of the 'Ideals of modern business life – simplicity, stability, breadth, dignity', and of the need for skyscrapers to convey 'by their mass and proportion ... in some large elemental sense an idea of the great, stable, conserving forces of modern civilization'. Root fully understood the broader implications of what he and his Chicago colleagues were doing. In response to unprecedented American conditions they were realizing an architecture that was distinctly modern, yet based upon fundamentals:

> In America we are free of artistic traditions. Our freedom begets licence, it is true. We do shocking things; we produce works of architecture irremediably bad; we try crude experiments that result in disaster. Yet somewhere in this mass of ungoverned energies lies the principle of life. A new spirit of beauty is being developed and perfected, and even now its first achievements are beginning to delight us. This is not the old thing made over; it is new. It springs out of the past, but it is not tied to it; it studies the traditions, but is not enslaved by them. Compare the best of our recent architecture – some of Richardson's designs for example – with the most pretentious buildings recently erected in Europe. In the American works we find strength and fitness, and a certain spontaneity and freshness ...

With the Reliance Building in Chicago of 1890–4 (by Burnham and Root, main designer of project Charles Atwood), the steel frame broke free of masonry traditions altogether and opened up an entirely new world of delicate transparency and reflective planes. The bay window, a constituent feature of both business and apartment blocks, became an object in its own right, a perforated membrane with faceted sides for ventilation, a fixed central pane for illumination, and slender vertical mullions (a type known as the 'Chicago window'). The spandrels were coated in light-coloured terracotta and made to read as continuous horizontal bands. The image of the whole was an apparently weightless cage, hovering above a shadowy base, with a slender slab closing off the top of the composition. As usual, the design was rooted in practical considerations such as the maximum provision of light, and the increase in office space



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achieved by cantilevering the bays from the slabs. The Reliance Building was a drastic simplification of certain of the façade ideas expressed in William Holabirde and Martin Roche's Tacoma Building of 1887–8, a breakthrough design technically, since it hung the façades off the metal structure as a type of 'curtain wall'. Equally the Reliance seemed to reconfirm some of the aesthetic potentials of skeleton construction announced in earlier structures such as the Crystal Palace: ordered repetition, lightness, a network of visual stresses. It is understandable that Giedion should have looked upon it as a 'true ancestor' of the transparent buildings of the 1920s, such as Mies van der Rohe's or Le Corbusier's Utopian projects for glass skyscrapers. However, it needs saying that the sentiments were altogether different: the Chicago School scarcely anticipated the radical social content of the later European modern movement.

Aside from Root, Louis Sullivan was the most theoretically minded of the Chicago architects, and in an essay published in 1896, entitled 'The Tall Office Building Artistically Considered', he outlined his ideas on the skyscraper. These reflections relied upon discoveries made in his Wainwright Building in St Louis, Missouri of 1890–1 and in his Guaranty Building in Buffalo, New York of 1894–5 (both designed with Adler) and had the character of post-rationalizations. For Sullivan, the skyscraper was the inevitable product of social and technological forces, truly a new type in search of an appropriate morphology. Armed with ideas derived from Viollet-le-Duc, Semper, Greenough and others, he tended to look at the situation in 'organic' terms, meaning that the function must have an inherent and specific identity striving for direct and honest expression. He described the elements of the problem in a pragmatic way – a lower portion for shops and entrance, a mezzanine, a repeating stack of offices, a turn-around for elevators at the top, a core for vertical circulation, a frame for the structure – and decided that this functional layout led 'naturally' to a tripartite division of base, middle and top. Beyond function there was expression, and Sullivan decided that the skyscraper should have a *vertical* emphasis:

> We must now heed the imperative voice of emotion. It demands of us, what is the chief characteristic of the tall office building? And at once we answer, it is lofty ... It must be tall. The force and power of altitude must be in it, the glory and pride of exultation must be in it. It must be every inch a proud and soaring thing, rising in sheer exultation that from top to bottom it is a unit without a single dissenting line ...

The steps in the argument from function and structure to idea and expression suggest a progression from a 'Rationalist' definition of the task to a 'symbolic' interpretation in a manner that recalls Semper's observations on the way utilitarian constructions were elevated to the level of art in past eras. Sullivan did not hesitate to accentuate or deny 'objective' structure to suit his sculptural instincts, and in the Wainwright Building, for example, every other pier in the office shaft was structurally

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32 Louis Sullivan and Dankmar Adler, Wainwright Building, St Louis, 1890–1

33 Karl Friedrich Schinkel, Bauakademie, Berlin, 1831–6

34 Louis Sullivan and Dankmar Adler, Guaranty Building, Buffalo, 1894–5

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redundant. Moreover, despite the rejection of 'rules and other impedimenta', it was obvious that Sullivan's theorem and image of the skyscraper relied upon an elemental redefinition of the classical column or pilaster, if not a more general tripartite principle in nature (feet, body, head; roots, trunk, branches). As for Sullivan's actual architectural elements, they recalled early nineteenth-century neo-classicism, especially Schinkel's distillations of classical piers and mouldings. Schinkel's Bauakademie in Berlin of 1831–6 takes its place in the pedigree of the Chicago inventions of the 1890s without too much difficulty.

Although the Wainwright Building in St Louis preceded Sullivan's theoretical generalizations by several years, it amounted to a polemical definition of the tall building as a type. It was not so much the frame, as an *idea* of the frame which was orchestrated and accentuated through plastic means to convey the underlying impulse of an aspiring vertical form. While the basic scheme was tripartite, the corner piers rose straight from street to cornice, a secondary rhythm being set in motion by alternating ground-level piers. The main office shaft was expressed as a vertical grid of smaller piers resting on a projecting ledge above the mezzanine, the textured spandrels of the windows being recessed behind the façade plane. Material and ornament were used to reveal the underlying pattern of visual stresses. The ground floor was treated to a smooth, warm-coloured ashlar that blended almost imperceptibly into the brick of the middle portion, while the vegetal motifs in the spandrels and upper registers were in richly modelled terracotta. The slender piers of the office shaft were in turn detailed with small brick roundels and grooves on their corners (a typical St Louis vernacular device), and with capitals and bases which seemed to be 'stretched'. Thus the web of masonry cladding over the skeletal structure was reduced to a tense pattern of piers, lintels and shafts incised with lines of shadow to enhance the 'force and power of altitude' and to reinforce the sense of 'a proud and soaring thing'.

Sullivan's Guaranty Building (designed with Adler) of 1894–5 belonged to a parallel, but slightly different line of research, using arches. The Walker Warehouse of 1889 was one of the clearest statements of this theme, but it was reused in a more 'elastic' way in the Schiller Building of 1892, and with more pomp in the Stock Exchange Building of 1893. Ultimately these solutions were haunted by the seminal image of Richardson's Marshall Field Store, but with the important difference that they symbolized and expressed the skeletal nature of the new steel construction, albeit through the medium of masonry cladding or ceramic ornament. The Guaranty made much of the transparency of the lowest floor, and of the free-standing nature of the supporting columns, which were cylindrical and

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took on a truly anthropomorphic character. The vegetal ornament and the punctured roundels at the crest of each bay emphasized the character of growth, and dramatized the turnaround of elevators and pipes in the actual anatomy of the structure. There was a shift from the notion of mechanism to the idea of a tall building as a living organism, whose weight, pressure, tension and resistance might be experienced through empathy in a direct, almost physical way.

The architects of the Chicago School devoted their attention to the form of the individual skyscraper, but gave relatively little thought to the form of the skyscraper city with its increasingly cavernous, noisy and polluted streets, its lack of civic amenities and its curious overall impression of an endless repetition of mute rectangles. The dilemma of the industrial city as a whole was not so very different from that of the individual building – at what point should *laissez-faire* forces be bridled by aesthetic considerations? Still, the new geometrical urban landscape had an odd presence of its own. Like the grid of the American landscape and the grid of the American city, it was a reminder that America was an Enlightenment invention, a projection of rationalism as well as pragmatism: a phenomenon of daring abstraction. Just before the turn of the century, the French novelist Paul Bourget described the skyscraper city of the New World in these terms:

> At one moment you have around you only 'buildings'. They scale the sky, with their eighteen, their twenty storeys. The architect who has built them, or rather who has plotted them, has renounced colonnades, mouldings, classical embellishments. He has frankly accepted the conditions imposed by the speculator; multiplying as many times as possible the value of the bit of ground at the base in multiplying the supposed offices. It is a problem capable of interesting only an engineer, one would suppose. Nothing of the kind. The simple force of need is such a principle of beauty, and these buildings so conspicuously manifest that need, that in contemplating them you experience a singular emotion. The sketch appears here of a new kind of art, an art of democracy, made by the crowd and for the crowd, an art of science in which the certainties of natural laws give to the most unbridled audacities in appearance the tranquillity of geometrical figures .

In 1893, the World's Columbian Exposition or Chicago World's Fair took place. Most of the structures were designed in a frankly Beaux-Arts, grand classical manner, a popularized version of the Second Empire mode. They revealed the full impact of Parisian taste on the American architectural establishment and the general public. The 'White City' also introduced a new model of urbanism combining axes, boulevards, focal points, and the full panoply of classical rhetoric for civic spaces and public institutions. Louis Sullivan designed the Transportation Building at the Fair in a restrained but formal style with a portal of telescoped golden arches, inspired by 'exotic' sources such as Abbasid gateways and Moghul domes, but it was to become increasingly obvious that the ideals for which he stood would remain localized in the Midwest, or else in the fields of commercial or small-scale construction. The architects of the Chicago School found themselves confronted at the Fair by a different set of prescriptions which promised 'instant' beautification and urbanity: plaster-of-Paris classicism that was supposed to 'civilize' the machine.

The immediate future for civic buildings lay with the more 'scholarly' architects, such as McKim, Mead and White, Richard Morris Hunt, Cass Gilbert, or Daniel Burnham (who straddled several fences). Sullivan's own capacities for monumentality were confined to several tombs in the 1890s (Wainwright, Getty etc.) and to small town banks in the rural Midwest in the first two decades of the twentieth century; in these he revealed a prodigious capacity to fuse sources from diverse cultures (including Islamic in the case of the tombs) into a species of universal grammar. Meanwhile, his design for the Schlesinger Mayer (later Carson Pirie Scott)

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35 Louis Sullivan, Carson Pirie Scott store, Chicago, 1899–1904

36 Chicago World's Fair, 1893, contemporary print

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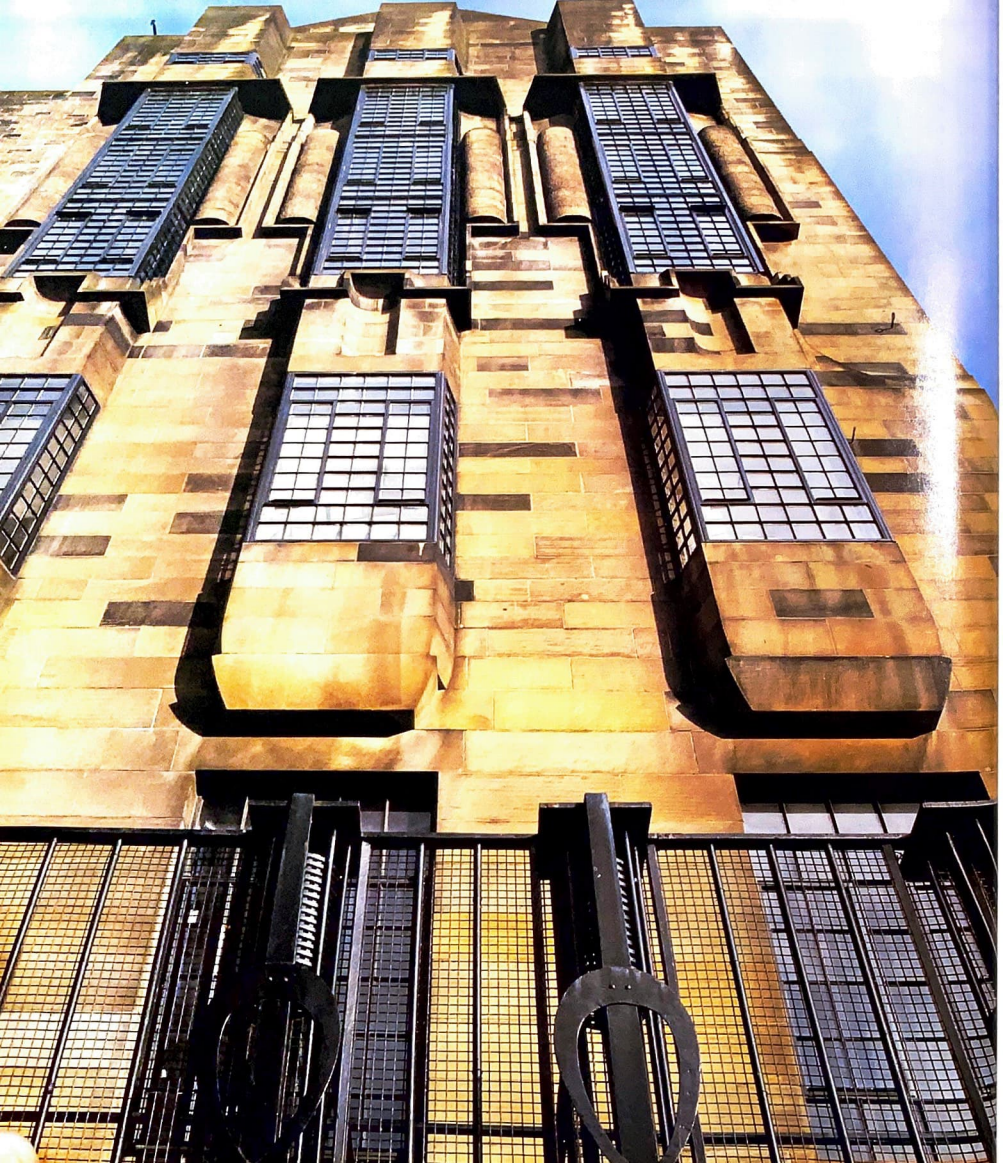
Store in Chicago of 1899 to 1904 revealed him at the height of his powers. Here the frame was given a notably horizontal emphasis with subtle variations in the height of bays vitalizing the overall form. But this was Sullivan's last major Chicago commission. In ensuing years he withdrew increasingly into the hermetic world of his elaborate ornament, a microcosm of pantheistic and cosmic themes. American industrial society seemed to have less and less place for this artist's 'cult of a higher life'.

The Chicago of the late nineteenth century demonstrated with diagrammatic crudity the fundamental forces and typical components of the capitalist city in the age of steam and steel. It also laid out the generic problems and cultural contradictions of the skyscraper as a type, and identified several possible solutions. In reality, the skyscraper was part of a wider system which included the railroads at a distance, and the suburbs closer to. For the pastoral atmosphere and romantic domesticity of the middle-class world at the end of the trolley lines was the essential 'counterform' to the white-collar business city in its harsh environment of rectangular grids. While the terms might change, and the formal definitions vary, the skyscraper would henceforth play a central role in most industrial cities to come, even in Utopian images that tried to put these cities right. Through a happy coincidence of circumstance and talent, Chicago was the forcing ground of a new synthesis of technology and form. Here and there, the raw conditions and standardized equipment of capitalism were transformed into architectural works of high poetic intensity. By facing industrial realities head on, and reflecting on the essence of their art, the Chicago architects contributed a major foundation to a more universal ideal, that of a modern architecture.



37 Charles Rennie Mackintosh, Glasgow School of Art, 1897–1909, library wing, *c.* 1908

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the search for new forms and the problem of ornament

... the whole basis of the views of architecture prevailing today must be displaced by the recognition that the only possible point of departure for our artistic creation is modern life.
Otto Wagner, 1895

There is an old debate in the history of architecture concerning the relative primacy of formal and structural inventions. On the one side are those who see major revolutions in style as the direct result of new materials or methods of construction; on the other are those who argue that changes in world-view or aesthetic intention adapt techniques to their expressive aims. Where the emergence of modern architecture is concerned there is truth in both positions, although the previous chapter should be enough to warn against determinism. The iron or steel frame and the commercial programme suggested some directions more than others, but it was because there were also architects who could see these raw data as relevant to the quest for a new architecture that the Chicago School arrived at its results. Nor should it be forgotten that two of the greatest works of the period, the Marshall Field Store and the Monadnock Building, were realized by relatively conservative structural means.

The economic and cultural conditions that permitted all this to happen in the American Midwest did not find a direct equivalent in Europe, but there were some areas of overlap. The pioneer stages of modern architecture took several routes, but they all shared a revulsion against weak and arbitrary reuses of the past, and against dead cultural forms. As early as 1873, Friedrich Nietzsche had written in an essay, 'The Use and Abuse of History', of Europe's need to rid itself of its historical baggage, and to liberate a repressed inner potential. Time and again in the years around the turn of the century one encounters the theme of renewal after a period of supposed corruption and decay; time and again one hears the rallying cry that a new, modern man is emerging, whose character an avant-garde is best able to intuit. Thus, in assembling the fragments of the pre-First World War architectural world into a larger picture, it is essential to balance up the local contexts and individual intentions of architects with their piecemeal contributions to a new tradition. We have to deal here not with a simple evolutionary path, but with the tentative groundwork towards a later rough consensus.

Since the emphasis is on forms and not just ideas or techniques, it seems reasonable to concentrate next on Art Nouveau, and therefore to concur with Henry-Russell Hitchcock's assessments that 'it

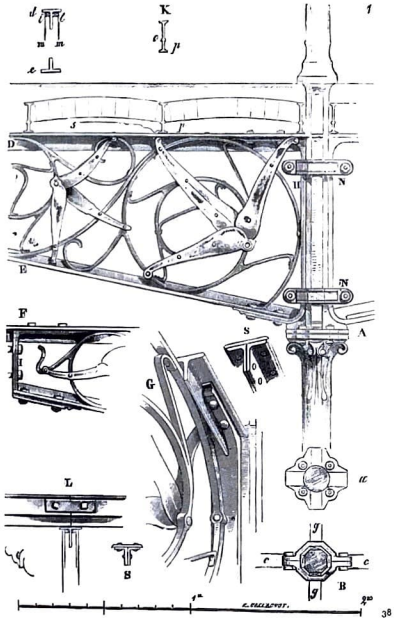
offered the first international programme for a basic renewal that the nineteenth century actually set out to realize' and that 'Art Nouveau was actually the first stage of modern architecture in Europe, if modern architecture be understood as implying primarily the total rejection of historicism.' But if Art Nouveau artists rejected historicism, they could not altogether reject tradition, for even the creator intent on producing new forms will rely, in some degree, on old ones. Indeed, what is often meant when the claim is made that such-and-such a movement was 'new' is that it switched its allegiances from recent and nearby traditions to ones more remote in space or time.

Even so, it is possible to distinguish between innovations which extend the premises of a pre-existing tradition, and more drastic breaks. Art Nouveau was of this second sort and embodied a strong reaction against the Beaux-Arts classicism widely practised in the 1870s and 1880s. Instead of ponderous monumentality it proposed fresh inventions exploiting the lightness and airiness permitted by glass and metal construction, and drawing inspiration from nature. As such it was a major step towards the intellectual and stylistic emancipation of modern architecture. However, the path from the curved abstractions and slender vegetal forms in metal of Art Nouveau to the stripped, white rectangular geometries of the 1920s was neither simple nor straightforward.

In architecture the most creative phase of Art Nouveau was from 1893 to about 1905 – a little more than a decade. The beginnings of the style have been variously dated. Arguably it first emerged in graphics and the decorative arts. Pevsner claimed a start in the early 1880s in England.

If the long, sensitive curve, reminiscent of the lily's stem, an insect's feeler, the filament of blossom, or occasionally a slender flame, the curve undulating, flowing and interplaying with the others, sprouting from the corners and covering asymmetrically all available surfaces, can be regarded as a leitmotif of Art Nouveau, then the first work of Art Nouveau which can be traced is Arthur H. Mackmurdo's cover of his book on Wren's city churches published in 1883.

Of course this is said with the knowledge of hindsight: Mackmurdo's design would be written off as a minor incident stemming from certain arabesques of the Pre-Raphaelites, the linear patterns of William Blake, and the fascination with natural forms of John Ruskin, if there had not



38 Eugène Viollet-le-Duc, proposal for a wrought iron bracket, from *Entretiens sur l'architecture*, 1863–72

39 Aubrey Beardsley, *Toilet of Salome II*, 1894. Drawing, 8¹/₄ × 6¹/₄ in (22.2 × 16 cm). British Museum, London

40 Victor Horta, Hôtel Tassel, Brussels, 1892–3

subsequently been a broader indulgence in the formal qualities Pevsner outlines. There is little evidence that Mackmurdo's design was the start of a sequence. Rather it was an early manifestation of a broad shift in sensibility in the 1880s, also sensed in such diverse examples as the ornamental designs of Louis Sullivan, Antoni Gaudí, and William Burges, the melancholic and erotic drawings of Aubrey Beardsley, the symbolist paintings of Paul Gauguin and Maurice Denis. A consolidation did not occur until the early 1890s, particularly in Brussels, in the work of Fernand Khnopff, Jan Toorop, and a group of painters known as 'Les Vingt', and in the architecture of Victor Horta, which seemed a three-dimensional equivalent to the painters' two-dimensional linear inventiveness.

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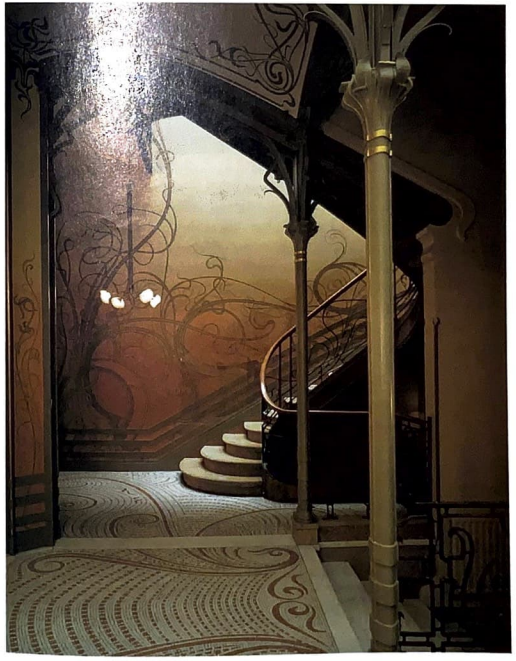

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So revolutionary does Horta's breakthrough appear in retrospect that it is irritating that so little is known about his preceding development. He was born in 1861 in Ghent, studied art and architecture at the local academy, worked in the studio of an architect by the name of Jules Debuysson in Paris, entered the École des Beaux-Arts in Brussels, and then became a draughtsman for a minor neo-classical architect, Alphonse Balat. In the mid-1880s he designed some uninteresting houses in Brussels. Next we have the Hôtel Tassel of 1892–3, a work of complete assurance, outstanding for its synthesis of architecture and the decorative arts and its declaration of new formal principles.

These were evident not in the somewhat bald façade with its bowing central volume, its restrained use of stonework and its discreet introduction of an exposed iron beam, but in the ample space of the stairwell. The principal innovations lay in the frank expression of metal structure and in the tendril-like ornamentation which transformed gradually into the vegetal shapes of banisters, wallpaper, and floor mosaics. The emphasis on the direct use of a modern material, and even the inspiration of natural forms for the metal ornament, recall Viollet-le-Duc's explorations in iron, while the expression of the effects of growth and tension call to mind the contemporary interests in 'empathy' and fascinations with organic analogies. Evidently Horta knew of wallpaper designs by C. F. A. Voysey and perhaps even of Owen Jones's *Grammar of Ornament* (1856); in either case he will have sensed a feeling for natural forms combined with a deliberate freshness and exoticism. Thus the first mature statement in the new style was a synthesis of formal inspiration from the English Arts and Crafts, of the structural emphasis of French Rationalism, and of shapes and structures abstracted from nature.

Horta extended his style in a number of other town house designs in Brussels in the 1890s. These subtly evoked an inward-looking world by creating scenarios for a well-to-do, urbane, fin-de-siècle clientele which could afford the indulgence of exotic tastes and delicate aestheticism. The props for the mood were the spacious stairwells, the long internal vistas through dining rooms and over winter gardens; the rich contrasts of coloured glass, silk stuffs, gold, bronze, and exposed metal, and vegetal forms of vaguely decadent character. Yet Horta's

41 Victor Horta, Maison du Peuple, Brussels, 1896–9, auditorium

42 Furniture designed by Henry van de Velde for his own house at Uccle, near Brussels, 1895. The embroidery on the wall, *Angels Keep Watch*, was also designed by Van de Velde, 1893

buildings never lapsed into mere theatricality; there was always a tense, underlying formal order; and the sequence of spaces from halls, up stairs, over galleries was tightly orchestrated. In the Hôtel Solvay of 1895–1900, his newly found style was successfully carried through in all aspects of the design, including the linking of interior volumes and the treatment of the façade, where an appropriately linear ornament was displayed.

While Horta clearly grasped the meaning of the way of life of his luxurious clients, his social concerns and range of expression were not restricted to this class. This is clear from his design for the Maison du Peuple of 1896–9, also in Brussels, built as the headquarters of the Belgian Socialist Party. The site was a difficult one, extending around a segment of a circular urban space and part of the way along two radial streets. The façade combined convex and concave curves, and the main entrance was placed on one of the shorter convex protrusions. The visible expression of the iron skeleton was every bit as 'radical' as Sullivan's contemporary skyscraper designs in Chicago (where the structure was usually immersed in masonry cladding, brick or terracotta sheathing). In part this treatment was no doubt inspired by earlier nineteenth-century engineering structures like train-sheds and exhibition buildings, but the choice of materials and the emphasis on lighting the interiors through infill panes of glass seem to have had moral overtones related to the institution as well:

> ... it was an interesting commission as I saw straight away – building a palace that wasn't to be a palace but a 'house' whose luxury feature would be the light and air that had been missing for so long from the working-class slums ...

The integration of material, structure, and expressive intentions was even more successful in the interior, especially in the main auditorium at the top of the building where the roof was formed from a sort of hammer-beam system in steel. The side walls and fenestration were reduced to thin infill screens, and the effect of the whole was an organic unity in which ornamentation and the visual accentuation of actual structure worked tightly together. The ceilings were ingeniously corrugated to control reverberation, and a double gallery was hung from the roof trusses and used to contain heating pipes. Thus despite its fantastic character, this 'attic' space was strongly conditioned by practical demands. As the architect himself exclaimed, paraphrasing an observer,

> 'What a fantasist this architect is – he must have his alternating lines and curves – but he really is a "master" at them.' ... but I am fuming: – 'You idiot, don't you see that everything is thought out in terms of architecture as construction, faithful to the brief to the point of sacrifice?'

Horta's experimentation with iron and steel was continued in another large-scale scheme, also for Brussels, the À l'Innovation Department Store of 1901, in which these materials were chosen for their capacity for large internal spans and wide openings. Practical considerations were again transcended in a façade composition in which delicate screens and large plates of glass provided a forward-looking image to a relatively new building type. One has to turn to Chicago to find any equivalent to this frankness of expression, and probably to the work of Louis Sullivan in particular (e.g. the near-contemporary Carson Pirie Scott Store). However, with the European example there is not the same sense of the frame as a normative, almost vernacular product, nor the underlying classical discipline. Horta's building has more the aspect of deliberate personal gesture, even of a manifesto. In Belgium, at least, Art Nouveau could be perceived as virtually a national, if not a Flemish invention, and therefore a cultural expression of independence from the dominance of French Beaux-Arts models.

Horta continued to work in Brussels for another thirty years but rarely achieved the freshness of his earliest experiments. Another Belgian artist to continue the new-found mode well into the twentieth century was Henry van de Velde, who seems to have had a more theoretical turn of mind than Horta, and to have turned his hand to a broader range of activities. The son of a chemist in Antwerp, Van de Velde became a painter and was much influenced by the Impressionists, the social-realist imagery of Millet, and eventually the paintings of Gauguin. In the 1890s his interest in the crafts grew, under the impact of William Morris's theoretical teachings, and he devoted himself to the applied arts. If Viollet-le-Duc was important to one branch of Art Nouveau for having encouraged the notion of a new style based on the expression and accentuation of the constructional possibilities of new materials like iron, Morris was crucial as another forefather for having expressed the ideal of aesthetic and moral quality in all the objects of daily use. In due course one of the aims of Art Nouveau designers (one senses it already in Horta's houses) would be 'the total work of art' in which every detail, down to the last light fixture, would bear the same aesthetic character as the overall building.

In 1894–5, Van de Velde designed a house for himself at Uccle, near Brussels, for which the furniture was specially created. His chair designs manifested an interest in expressive, organic structure; dynamic forces were intended to heighten the functions of the various members, giving the chairs a consciously lifelike or anthropomorphic character. Van de Velde made a distinction between 'ornamentation' and 'ornament', the former being attached, the latter being a means for frankly revealing the inner structural forces or functional identity of a form. This interest in the frank expression of structure and function led him in his interior for Haby's Barber Shop in Berlin (1901) to expose water pipes, gas conduits and electrical ducts. Van de Velde admired what the machine might do in mass production, so long as a strong control over quality was maintained by the craftsman who designed the prototype; he felt that a subjective artistic element must always be present if banality was to be avoided. The French critic,

Edmond de Goncourt, coined the phrase 'yachting style' in assessing Van de Velde's designs when they were first made known in Paris. The artist himself claimed that his means were:

> ... the same as those which were used in the very early stages of popular arts and crafts. It is only because I understand and marvel at how simply, coherently and beautifully a ship, weapon, car or wheelbarrow is built that my work is able to please the few remaining rationalists ... unconditionally and resolutely following the functional logic of an article and being unreservedly honest about the materials employed ...

Van de Velde was a socialist and hoped that industrial mass production of his objects might make visual quality available to the broad masses; yet his statements of architectural intent remained within a fairly rarefied circle of patronage. In the Cologne Theatre of 1914, he attempted to create his version of a communal building celebrating widely held social values. But this *Gesamtkunstwerk* (total work of art) was still the property of a cultivated élite.

Art Nouveau did not always remain the aloof creation of an avant-garde. Indeed, the style was quickly popularized in graphic and industrial design, in glassware, furniture, jewellery, and even clothing. The rapid spread of ideas was encouraged by the emergence of periodicals like *The Studio*, which had a great impact on fashion, and by the pioneering commercial attitudes of men like Samuel Bing, who opened a shop for modern art called Salon de l'Art Nouveau on the rue de Provence in Paris in 1895. Bing, and the German art critic Julius Meier-Graefe, had discovered Van de Velde's house at Uccle and invited the artist to design some rooms for the shop. The fashion caught on quickly; and among those influenced were Émile Gallé the glass-maker, and Hector Guimard the architect. In New York, meanwhile, L. C. Tiffany was designing glass with delicate vegetal forms and rich stains of colour. In fact, he had come upon this manner independently, which tended to lend weight to the notion that here at last was a true expression of the underlying spirit of the age. The full triumph of the new style in the public taste was clearly evident at the Paris Exhibition of 1900 and the Turin Exhibition of 1902, in which 'Art Nouveau', 'Jugendstil', or the 'Style Liberty' (such were its various names), was dominant. By the turn of the century, then, Art Nouveau, which may have started in Belgium with a vaguely nationalist agenda, had

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taken on an international character. It was perceived to be a way out of the interminable jumbling of eclectic styles, and a valid reflection of exotic, somewhat escapist, somewhat progressive, *fin-de-siècle* attitudes of mind. This is the way the Italian critic Silvius Paoletti responded to the Turin Exhibition:

> To take the place of pitiless authoritarianism, rigid and regal magnificence, burdensome and undecorated display, we have delicate and intimate refinement, fresh freedom of thought, the subtle enthusiasm for new and continued sensations. All man's activities are more complex, rapid, intense and capture new pleasures, new horizons, new heights. And art has new aspirations, new voices and shines with a very new light.

While one ideal of Art Nouveau was the perfectly crafted and unified interior, the style also revealed its possibilities for much broader public applications. Most notable of these, perhaps, were Hector Guimard's designs for the Paris Métro begun in 1900, in which naturally-inspired forms were used to create arches and furnishings in iron which were then mass-produced from moulds. Like Horta, Guimard had passed through the academy, having been at the Paris École des Beaux-Arts from 1885 to the early 1890s. At the École des Arts Décoratifs from 1882 to 1885, he had already become acquainted with Viollet-le-Duc's Gothic Rationalism, which he had then sought to reinterpret in a highly personal way. In 1898 he wrote that he had 'only applied the theories of Viollet-le-Duc without being fascinated by the

43 Hector Guimard, Métro station, Paris, 1900

44 Hector Guimard, own house and studio, Paris, 1909–10

Middle Ages'. Another key influence was the British Arts and Crafts movement, which he studied while visiting England and Scotland in the 1890s. He also visited Horta, and this provided the essential catalyst.

Guimard began experimenting with the new style in his design of 1894–8 for an exclusive block of flats known as the Castel-Béranger, in rue la Fontaine in the recently developed sixteenth arrondissement. Here the entrance details and ornamental flourishes were somewhat isolated Art Nouveau incidents in an otherwise inconsistent design. Working a decade later at a much smaller scale in his own house and studio nearby, Guimard was able to infuse the whole design with the bulbous and swelling character of a natural growth, and to model brick surfaces and iron details so that they seemed subservient to a single aesthetic impulse. The plan, with its suave links between oval forms and different diagonal axes, suggests that Guimard may have consulted the sophisticated solutions for tight urban sites of eighteenth-century Parisian *hôtels*; indeed, the playfulness and curvilinear tracery of the Rococo may be counted among the possible sources of Art Nouveau ornament.

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In the hands of major talents, Art Nouveau was far more than a change in architectural dress, far more than a new system of decoration. In the best works of Horta, Guimard, and Van de Velde, the very anatomy and spatial character of architecture were fundamentally transformed. Their forms were usually tightly constrained by functional discipline and by a Rationalist tendency to express structure and material. Furthermore, each artist in his own way attempted to embody a social vision and to enhance the institutions for which he built.

Similar points can be made about the Catalan architect Antoni Gaudí, whose extreme originality and idiosyncrasies show him to have been only a loose affiliate of Art Nouveau ideals. Indeed, one has to beware of pushing a historical abstraction too hard: a stylistic phase in architecture is a sort of broad base of shared motifs, modes of expression, and themes, from which a great variety of personal styles may emerge.

Gaudí was born in 1852 and died in 1926. His earliest works date from the 1870s and indicate his reaction against the prevalent Second Empire mode towards the neo-Gothic. He was an avid reader of Ruskin's works and the inspiration of his early designs is clearly medieval, but there emerges early on that sense of the bizarre which was to characterize his highly personal style after the turn of the century. In the Palau Güell of 1885–9 the interiors were transformed into spaces of an almost ecclesiastical character, while the façades were elaborately ornamented with wave-like ironwork preceding Horta's experiments in Brussels by some years. Thus Gaudí's style, like Guimard's, was in part an abstraction of medieval forms. It seemed to elaborate a distinction that Ruskin had made between the evident stylistic traits of Gothic architecture, which varied considerably from region to region and period to period, and the deeper, ordering principles which remained more consistent from place to place over time. The imaginative transformation of these prototypes was motivated by Gaudí's private imagery and by his obsession with finding a truly Catalan 'regional' style. In fact this was conceived locally as a 'national' style, since Catalonia was understood by sectors of the new industrial bourgeoisie to be on the point of reclaiming its ancient culture and language in reaction against the hegemony of Madrid and the

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Castilian language. Gaudí was one of several architects (see Chapter 8) intent upon crystallizing these cultural aspirations. In his case it was a matter of understanding local structural types and construction techniques in brick and ceramic, but also of reacting poetically, not to say mystically, to the hedonistic Mediterranean landscape and vegetation, as well as to the maritime character and traditions of Barcelona.

In 1884, Gaudí was commissioned to continue Francisco del Villar's designs for the Expiatory Church of the Holy Family (the 'Sagrada Familia') on the outskirts of Barcelona. The crypt followed Villar's design, based on thirteenth- and fourteenth-century Gothic prototypes. The lowest visible levels were completed to Gaudí's design by 1893 in a transitional Gothic manner. To then move upwards through the various stages of the termination of the crossing is to be confronted bit by bit with the architect's flowering into one of the most curious and original architects of the past two hundred years. Elements which suggest a vague affinity with Art Nouveau give way finally to a language of utter fantasy, evocative of vegetable stems and dreamlike anatomies. In fact, these surreal forms were not entirely without precedent, since it seems clear that Gaudí (who had worked briefly in North Africa) knew of the mud constructions of the Berbers, with their own inspiration in natural forms, their curious hermetic imagery, and their manifestation of animist beliefs. Sagrada Familia derives part of its presence and significance from the contrast of its geometry with the sharp diagonals and rectangles of the Barcelona street grid established in Ildefons Cerdà's urban plan of 1859, and from the way that its spires pick up the energies of the irregular, hillside topography of the hinterland, transmitting them towards the sea. As a young man Gaudí had worked on the paths and grottoes approaching the sacred site of Montserrat behind Barcelona, a place combining Catalan and Catholic legend, and he remained haunted by the distinctive peaks of this mythical landscape.

The richness of Gaudí's art lies in the reconciliation of the fantastic and the practical, the subjective and the scientific, the spiritual and the material. His forms were never arbitrary, but rooted in structural principles and in an elaborate private world of social and emblematic meanings. The structure of the Sagrada Familia and the designs like that for the crypt of the Chapel of the Colonia Güell (begun in 1898) were based on the optimization of structural forms which led the architect to variations on the parabola. Gaudí was thus much more of a 'Rationalist' than his work would lead one to believe on superficial inspection, and the sections of the church bear comparison not only with those of Gothic cathedrals, but also with some of Viollet-le-Duc's skeletal drawings. But the appellation 'Rationalist' does not do Gaudí justice

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45 Antoni Gaudí, Palau Güell, Barcelona, 1885–9, interior

46 Antoni Gaudí, wire model of the structure of the Chapel of the Colonia Güell, Barcelona, 1898–1900

47 Antoni Gaudí, Expiatory Church of the Holy Family, Barcelona (Sagrada Familia), 1884–present

48 Sagrada Familia, drawing of the nativity façade, based on Rubió's sketch, published in 1906

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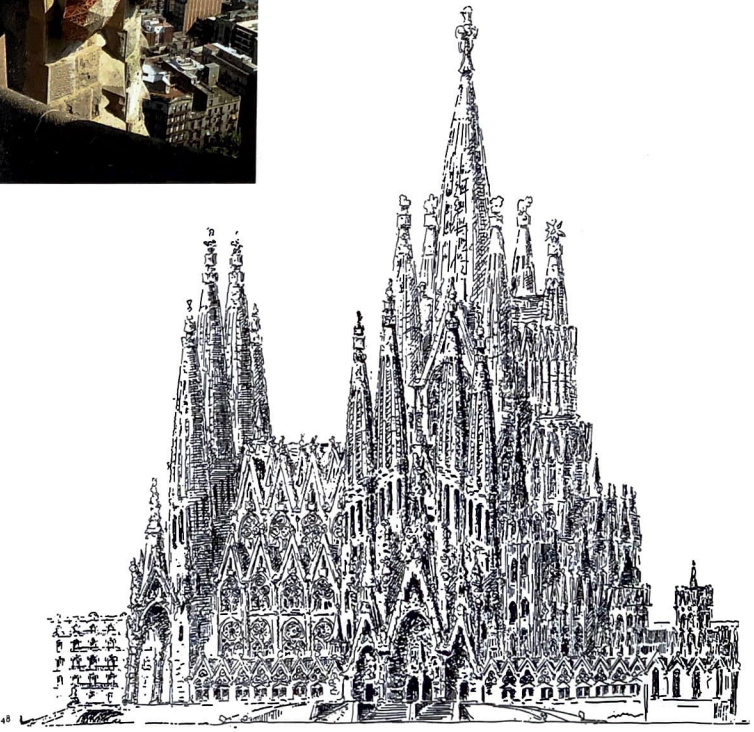

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either, for he was deeply religious and believed that the material qualities of architecture must be the outer manifestation of a spiritual order. He intuited the presence of this order in the structures of nature which he felt to be a direct reflection of the Divine Mind. The 'laws' of structure, then, were not those of a merely materialist physics, but were evidence of the Creator. The parabola, in particular, with its beautiful economy, became an emblem for the sacral.

Thus Gaudí's vocabulary was infused with an elaborate symbolism for which the Gothic revival of his youth had provided a useful, conventional starting-point. His pantheism, like Ruskin's, extended to the smallest mineralogical wonders and to the grandest of natural forces. These features of nature were abstracted and expressed in a vocabulary loaded with metaphor and association. It is little wonder that the Surrealist generation of the 1920s (particularly his fellow Catalan Salvador Dalí) should have felt such an affinity with his work. For in Gaudí at his most bizarre there is a sensation of contact with deep psychic forces and irrational patterns of imaginative thought. His dense calligraphy was capable of carrying several simultaneous meanings, as one may judge from the complex curves in iron of Gaudí's baldachino over the main altar in the Cathedral of Palma, Majorca, which were guided into shape by an internal imagery combining associations with a tent, a ship, and (possibly) a crown of thorns. The 'open book' above this curved and linear armature supporting ship-like

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lamps could also be read as a sail; the baldachino in its entirety as a vessel from the time of the Crusades, an icon of the Church triumphant.

Gaudí's completely personal late style first emerged in the design for the Park Güell, carried out between 1900 and 1914. Beast-like benches embedded with fragments of coloured tile mark off the edges of the stepped terraces offering views over the city. There are nightmarish underground grottoes suggestive of dark clearings in some subterranean forest, and steps which flow like lava. The main terrace is supported by a hypostyle hall of hollow concrete columns with drains running through their cores, while curved buttresses textured with scales suggest the gnarled forms of trees or some natural origin of the Gothic flying buttress. Both the sinuous Park Güell landscape and the encrusted towers of Sagrada Familia give the impression of an undersea world of coral accretions which has been left high and dry when the ocean has subsided.

Gaudí's principal secular works were conceived in parallel with the park, beginning with the Casa Batlló of 1904–7, a remodelling of a block of flats.

49 Antoni Gaudí, Park Güell, Barcelona, 1900–14, undercroft with buttresses

50 Antoni Gaudí, Casa Batlló, Barcelona, 1904–7

51 Antoni Gaudí, Casa Milá, Barcelona, 1905–10

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Here a virtual sport of spotting analogies can be (and has been) played. Thus some critics have emphasized the maritime references of waves, corals, fishbones, and gaping jaws, while others have commented on the dragon-like roof and the possible religious significance of this as an allegory of good and evil. Whether such analogies strike close to Gaudí's intentions may never be known, but they suggest the powerful impact on the imagination of the architect's forms.

In the Casa Milá of 1905–10, the plastic conception of swirling curves was applied not just to the façade, but to the plan and interior spaces as well. The elevation is in constant motion with its deep-cut, overlapping ledges. Once again wave and cliff images come to mind (the building was known locally as '*La Pedrera*' – the quarry), but it is a naturalism achieved by the most sophisticated ornamentation and stone-cutting. The contrived textures of the ledges give the impression that these forms have come about over the years through a process of gradual erosion.

Gaudí's buildings were so bizarre as to be inimitable, which naturally inhibited the immediate propagation of his style in a local tradition. One of the complaints lodged against Art Nouveau in the first decade of this century was that its propositions relied too completely on a subjective approach, and that they were not geared sufficiently to the ideal of designing types for standardized mass production. This criticism has to be taken with some salt, for, as has been shown, both Guimard and Van de Velde were able to mass-produce standardized profiles of some visual complexity. Even some of Gaudí's most complex structural sections could be realized following normal Catalan vaulting techniques using overlapping ceramic tiles. Moreover, Art Nouveau proved itself well suited to repeating print processes in such things as posters, and became a sort of popular style related to consumerism. By the turn of the century it had spread to many provincial centres which contributed their own regional accent. However, there was some resistance. In England, for example, Art Nouveau was regarded with suspicion as a wily and decadent departure from the sober aims of the Arts and Crafts. But in Scotland a style of enormous originality, related to Art Nouveau, was created by another uncategorizable individual,

the Glasgow architect Charles Rennie Mackintosh.

Mackintosh is important at this juncture not only because of the imaginative force of his own designs, particularly the Glasgow School of Art, of 1897–1909, but because his development encapsulated the path beyond Art Nouveau towards a more sober form of expression in which broad dispositions of simple masses and sequences of dynamic spaces were stressed. His style emerged independently of Horta's but from loosely similar sources and concerns, and appeared first in his decoration of Miss Kate Cranston's various 'tearooms' in Glasgow of 1897–8. These designs were linear, abstract and heavily laden with Gaelic symbolism and Celtic reference; it comes as no surprise to discover that the term 'Spook School' was invented to characterize Mackintosh and his circle (including his wife). In 1897 he won the competition to design the new School of Art in Glasgow. The building was to stand on an almost impossibly steep slope, which seemed to suggest that the main façade should be set at the highest part of the site. The functions to be included were several studios, a lecture theatre, a library, a room and private studio for the director. Spaces to display work and to house a permanent collection of casts were also needed.

Mackintosh dealt with these constraints by laying out two tiers of studios along the north side facing Renfrew Street (the high end of the site) with further studios, the anatomy school, the life modelling room, the architecture school, and the design and composition rooms facing east and west. The director's room and studio were placed over the entrance, while the museum was set to the rear of the scheme at an upper level where it could be top lit. The richness of the scheme arose from the juxtaposition and sequence of rooms of different sizes, and the orchestration of different qualities of light; from the clever overlapping down the slope in section; and from the way the stairs, corridors, and display rooms were modelled as if from a continuous volume of space. The School of Art worked with the theme of a transparent lattice of wood or metal slats – a species of luminous cage – which had been set down into a faceted stone armature. Windows, walls, chimneys, steel brackets and other functional elements were handled with an uncompromising directness: there

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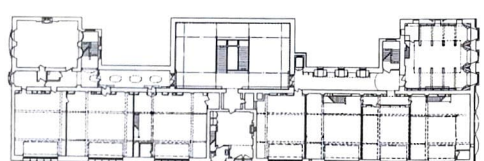

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52 Charles Rennie Mackintosh, Glasgow School of Art, 1897–1909

53 Glasgow School of Art, first-floor plan

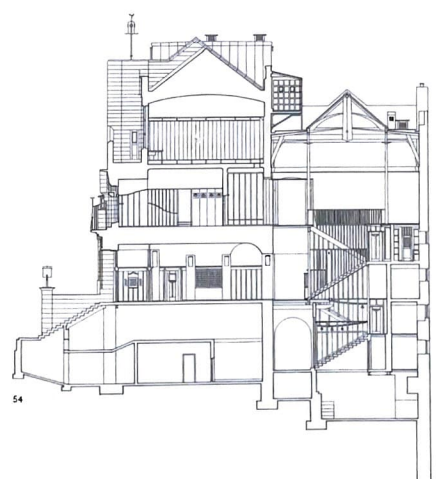
54 Glasgow School of Art, north–south section through entrance hall and museum

55 Glasgow School of Art, interior of library, c. 1908

was a concentration on things in themselves, without distracting rhetoric. Poetry arose from strong juxtapositions, and from a tense interplay between solid and void, mass and plane. The interior movements and structural tensions were sensed in the dynamics of the exteriors. Thus the north elevation was a subtle fusion of symmetry and asymmetry, in which the grand upper windows of the main studios were set into massive, grim masonry forms. The entrance-way was emphasized by a cluster of motifs and an arch, over which the director's study was set in a recess (an arrangement suggesting a schematization of H. H. Richardson's Austin Hall, Harvard University, of 1881). To the sides, the building's flanking walls fell away to the lower portion of the site as large expanses of subtly articulated stone surface, recalling (among other things) the architect's interest in regional farmhouse prototypes and Scottish baronial halls. The ironwork on the exterior, in the railings and in the cleaning brackets on the main windows, was loosely analogous to Art Nouveau in its abstraction of natural motifs but, like the building as a whole, these details spoke less of effete curves and more of a taut, sculptural discipline. The direct handling of glass and metal introduced a frank evocation of industrial technology, not out of place in a shipbuilding city.

These qualities were brought to the fore without distracting fussiness in the library wing of the school, designed around 1908, in which chiselled abstract shapes and groups of austere vertical windows on the outside were supplemented by rectangular wooden brackets in the reading-room interiors. The verticality of the proportions recalls Art Nouveau, but the stern rectangular forms speak of a new direction. It is understandable that Pevsner should have singled out this interior as an early example of the sort of spatial effects which were later to be central to the modern movement, and, in retrospect, there are parallels with the spatial inventions of Frank Lloyd Wright in the same period (chapter 7). Looking back from a distance of more than three-quarters of a century, the British architect Denys Lasdun spoke of 'the brooding mystery of a Japanese temple':

> In the library, there is an extraordinary air of frozen excitement. The lines are dynamic and everywhere the stress is on the manipulation and control of space. The structural form is revealed and emphasized; the timber itself speaks. Posts, brackets, rafters organized within recognizable modules of measurement, speak of timeless space, of a place of assembly which would be appropriate to any age.



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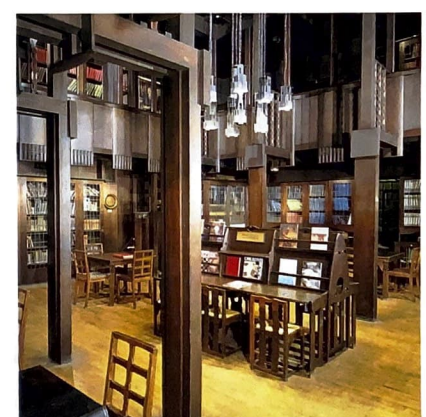

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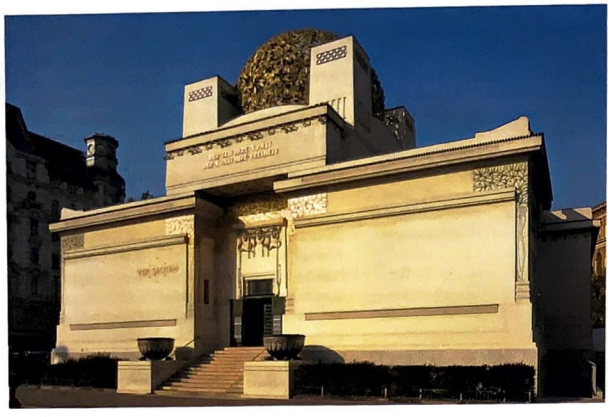

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It is ironic that Mackintosh should have been written off by English critics of his own day as dangerously exotic, since it was precisely his geometrical control and tendency to abstraction which appealed in European artistic centres – partly as a support for their own revulsion at the excesses of Art Nouveau. Mackintosh was less appreciated in London than in Vienna, where publications of his plans and drawings made him known and influential, especially in Secessionist circles around Josef Maria Olbrich. Olbrich and the older Otto Wagner disliked both the pomposities of classical academic design, and the 'new decadence' of Art Nouveau. Indeed, Olbrich's Vienna Secession Exhibition Building of 1897–8 was a somewhat bizarre attempt at formulating an expressive language of pure geometries and massive pylon forms. Decorated on the interiors with paintings by Gustav Klimt, this building was dedicated to the aesthetic cult of the 'Sacred Spring' (*Ver Sacrum*) and was a critical manifesto against the somewhat ponderous, official, imperial cultural monuments created in a grand classical manner in the Ringstrasse a generation earlier. Wagner's Majolica House, a block of flats built between 1898 and 1899, also implied a return to fundamental architectonic values and to strict rectilinear proportions, despite the lingering feeling of vegetal motifs in some of the detailing. In the late 1890s, in an article published in *Dekorative Kunst* (Munich), the German architect August Endell wrote of a 'non-historical' style of pure forms capable of moving the spirit in a manner similar to the rhythms of music.

> They teach us that there can be no new form, that all possibilities have been exhausted in the styles of the past, and that all art lies in an individually modified use of old forms. It even extends to selling the pitiful eclecticism of the last decades as the new style.
>
> To those with understanding, this despondency is simply laughable. For they can clearly see that we are not only at the beginning of a new stylistic phase, but at the same time at the threshold of a completely new Art. An Art with forms which signify nothing, and remind us of nothing, which arouse our souls as deeply and as strongly as music has always been able to do …
>
> This is the power of form upon the mind, a direct, immediate influence without any intermediary stage … one of direct empathy.

In 1895, Otto Wagner published *Moderne Architektur*, in which he spoke of the need for architecture to orientate itself to 'modern life', alluded to the new cultural stimulus to be drawn from the day-to-day experience of the Großstadt (the metropolis), and recommended qualities of simplicity and 'almost military uniformity'. Moreover, he argued that the new style should be a 'realist' one, which seems to have implied a direct expression of the means of construction, an

56 Joseph Maria Olbrich, Secession Exhibition Building, Vienna, 1897–8

57 Otto Wagner, Post Office Savings Bank, Vienna, 1904–6, interior

admiration for modern techniques and materials, and responsiveness to the changing aspirations of society. Wagner's ideas owed more than a little to Semper, but also to the sensation of a new age of industrialism and engineering erupting through the confectionery of earlier Viennese architecture. He insisted that: 'new purposes must give birth to new methods of construction, and by this reasoning to new forms.'

If we follow Wagner from his late nineteenth-century designs to the Vienna Post Office Savings Bank of 1904–6, we enter an entirely different world from that of Art Nouveau, a world in which a nuts and bolts rationality and a stable and dignified order have replaced the dynamic tendrils and curvaceous effects. This was to be a people's institution, a bank for the little man, and Wagner invoked and subverted norms of monumentality in his solution. Compared with the neo-Baroque monuments in the vicinity, the building would have seemed stern and simplified, even if its plan relied upon an essentially classical discipline. Certain of its details, such as the abstracted rustication or the slender metallic columns of the entrance canopy, involved subtle inversions of familiar elements of construction. The façades themselves were covered in thin marble sheets with bolt-heads expressed and dramatized by shiny aluminium caps. In fact these plain surfaces of stone (and the rustication below them) were mortared to a brick wall, the caps having only a temporary function during the fixing. None the less, these bolt-heads underlined that the cladding was merely a veneer, and hinted at the presence of the glass and metal skeleton making up the main banking hall at the heart of the building. Rather like Sullivan, Wagner was concerned not just to 'express' function and structure, but to symbolize them; even to use artifice to convey 'truth'. The banking hall at the heart of the building was bathed in natural light and could be seen at the top of the main stairs the moment one entered. In effect it was a transformation of a prevalent nineteenth-century urban type – the glazed railway shed – into a translucent social metaphor evoking honesty, transparency, lightness, efficiency and availability; all values appropriate to the building's social purpose. The tapered steel supports and curious upstanding ventilating stacks suggested a slight

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machinist rhetoric rather than just an engineering objectivity, but also implied inversions of the usual expectations of load and support. The glass was detailed to supply a milky white, weightless skin diffusing the daylight, while the floor (which had the bank-vaults directly beneath it) was made from translucent glass bricks. The 'modernity' of Wagner's solution relied upon the freshness and luminosity of his institutional interpretation and on his radical reinterpretation of pre-existing norms for public architecture.

Vienna, and a little later Berlin and Paris, were to be among the strongholds of a reaction against Art Nouveau which acquired increasing momentum in the first decade of the twentieth century. This reaction was fed in part by the Arts and Crafts ideals of simplicity and integrity; in part by an abstract conception of classicism as something less to do with the use of the Orders than with a feeling for the 'essential' classical values of symmetry and clarity of proportion; and in part by a sense that the architect must strive to give expression to the values of the modern world through frank and straightforward solutions to architectural problems in which disciplines of function and structure must play an increasing, and attached ornament a decreasing, role.

Apart from Wagner, who was already in his early sixties at the turn of the century, the two chief exponents of a new architecture in Vienna were Josef Hoffmann and Adolf Loos. Hoffmann was a founder of the Wiener Werkstätte in 1903 as a centre of activity in the field of decoration. In his design for the Purkersdorf Convalescent Home (1904–6), he reduced the walls to thin planar surfaces. His greatest opportunity came in 1905 with the commission for a luxurious mansion to be built outside Brussels for a Belgian financier who had lived in Vienna. The Palais Stoclet was to be a sort of suburban palace of the arts in which Adolphe and Suzanne Stoclet would assemble their treasures and entertain the artistic élite of Europe. It had thus to combine the moods of a museum, a luxury residence, and an exemplary setting of modern taste.

58 Josef Hoffmann, Palais Stoclet, Brussels, 1905–11

59 Palais Stoclet, dining room, with mosaics by Gustav Klimt

60 Charles Rennie Mackintosh, House for an Art Lover, 1900, design for a competition sponsored by the German periodical *Zeitschrift für Innendekoration*, and published in 1902

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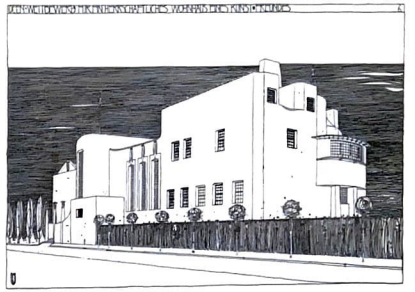
Hoffmann was able to respond to the 'aura' of the programme in a house of immense sophistication, combining devices of formality and informality, characteristics of an honorific and a more humble sort. The rooms were linked en suite in a plan employing ingenious changes of direction and axis, in which such major spaces as the hall, the dining room and the music room (with its little stage) were expressed as protruding volumes in the façades. The overall composition was balanced, but asymmetrical, the main points of emphasis being the fantastic stepped stair-tower with its attached statuary, the bow windows, and the *porte-cochère*. The forms were coated in thin stone-slab veneers detailed with linear mouldings to accentuate their planarity. In the interiors materials were stern, rectilinear and precise, and included polished marbles and rich wood finishes. The influence of Mackintosh is felt in this house (a prototype for the design was clearly the Scot's 'House for an Art Lover' of 1900), but where he would have stressed the rustic and the humble, Hoffmann emphasized the grandiose and the cosmopolitan. The disciplined elegance of the Palais Stoclet is enhanced by the furnishings and by Klimt's splendid mural decorations. As well as echoes from Mackintosh, there are also memories of Olbrich, perhaps even of Schinkel. But the Palais Stoclet is one of those designs where there is little point in listing the sources and influences, as these have been absorbed and restated in a convincing personal style. In its imagery and mood it portrayed an exclusive way of life of a kind which was to be swept away by the devastation of the First World War – a sort of aristocratic bohemianism.



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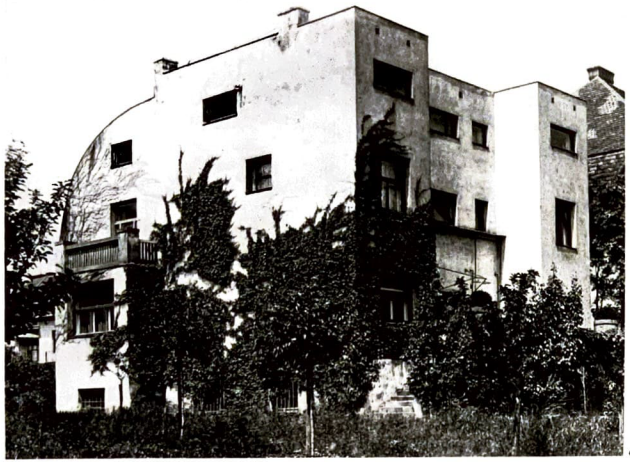
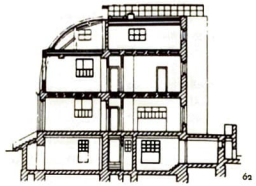
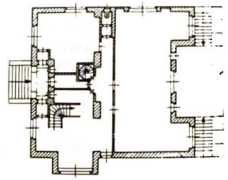
Adolf Loos's move towards a rectilinear and volumetric simplification was even more drastic than Hoffmann's. Loos was little affected by Art Nouveau, in part because he spent the mid-1890s in America (a country he praised highly for its plumbing and its bridges); in part because he seems to have sensed that that movement's reaction against the 'dead forms' of the academy was swinging too far towards the wilful, the personal and the decorative – all of which he felt to be inimical to lasting achievement in art. But Loos brought the perspective too of someone who had reflected on the form of many simple everyday objects, which he contrasted to the pretentious inventions of much self-conscious art. Some of his most penetrating essays are on such things as gentlemen's suits, sportswear, and Michael Thonet's mass-produced wooden chairs. He seems to have felt that these







61 Adolf Loos, Steiner House, Vienna, 1910

62 Steiner House, section

63 Steiner House, plan at entrance level

were the objects which gave evidence of, as it were, an unconscious style. Loos also admired the simplicity and directness of peasant architecture, and even of modern engineering, both of which he compared favourably to the painful stylistic excesses of the architecture and product design created for the Vienna bourgeoisie. It had been Nietzsche's suggestion that modern European man should strip away the mask, and in the Vienna of Freud Loos advocated a removal of conventional disguises to discover the 'honest' being within.

If Loos detested the mass fakery of the false façades clamped on to the apartment buildings of the new arriviste classes of Vienna, he also reviled the cultivated aestheticism of Secessionists like Olbrich, who appeared to him to express the nervous rootlessness of the grand metropolis and its lack of a foundation in common usage. Beyond Loos's acerbic witticisms, there was a serious reflection on the difficulty of evolving a genuine culture on the basis of a mass production which seemed doomed to create nothing but kitsch. In a manner that anticipated Le Corbusier's later use of 'pure', mechanized objects such as steamships and cars to reveal a 'truer' modernism than that produced by architects, Loos singled out railway engines and bicycles for qualities that had little to do with 'personality' or aesthetic taste. He declared: 'To seek beauty only in form and not in ornament is the goal to which all humanity is striving.'

Up to 1910 much of Loos's design effort went into small-scale conversions. In his few house designs of that period he reduced the external vocabulary to rectangular stucco boxes punctured by simple openings, without even the reminiscence of a cornice or a plinth. Usually his interiors were more elaborate, some of them achieving interpenetrations of space (later elaborated as what he called a '*raumplan*'), yet they were still distinguished by an overall rectangular control. Despite his polemics, Loos had recourse to a reductivist ornament (the interior of the Kärntner Bar of 1907 (Fig. 154) even had stripped classical mouldings), but by the Viennese standards of the day this treatment would have seemed restrained, if not minimal. Perhaps the outstanding design of Loos's middle years was the Steiner House in Vienna of 1910, where the external architectural effect relied on the adroit placement of large plate-glass windows in undecorated planar surfaces. Although it was a long way (in meaning as well as form) from this villa, with its 'neo-classical' plan and its strict symmetry, to the interpenetrating planes and dynamic asymmetries of the International Style of the 1920s, the achievement of such a drastic simplicity within a decade and a half of the beginnings of Art Nouveau, and a full decade before Le Corbusier's white, cubic villa designs of the 1920s, is worthy of comment.

In fact, it is by no means certain that Loos's pre-war designs had much influence on the emergence of the modern movement after the First World War. His theories, especially on ornament, were far better known, perhaps because they put into words a number of concurrent but not necessarily connected prejudices, which the later generation was determined should be a unified doctrine. As a polemicist, Loos was brilliant; in an article entitled 'Ornament and Crime' (1908), he inveighed against the very notion of ornament on the grounds that it was evidence of a decadent culture:

> Children are amoral, and – by our standards – so are Papuans. If a Papuan slaughters an enemy and eats him, that doesn't make him a criminal. But if a modern man kills someone and eats him, he must be either a criminal or a degenerate. The Papuans tattoo themselves, decorate their boats, their oars, everything they can get their hands on. But a modern man who tattoos himself is either a criminal or a degenerate. Why, there are prisons where 80 per cent of the convicts are tattooed, and tattooed men who are not in prison are either latent criminals or degenerate aristocrats. When a tattooed man dies at liberty, it simply means that he hasn't had time to commit his crime... What is natural to children and Papuan savages is a symptom of degeneration in modern man.
>
> I have therefore evolved the following maxim, and pronounce it to the world: the evolution of culture marches with the elimination of ornament from useful objects.

Translated into the situation in which Loos found himself, this meant that Art Nouveau, for all its emancipation from academic formulas, had to be seen as yet another superficial and transitory 'style'. A true style for the times would be discovered when ornament was done away with, and essential underlying qualities of form, proportion, clarity and measure were allowed to emerge unadorned. At least this is what Adolf Loos believed, and there was a generation of later architects ready to follow a similar direction in the search for the supposed 'universal style' for modern times.

64 John A. Roebling, Brooklyn Bridge, New York, 1869–83

4

rationalism, the engineering tradition and reinforced concrete

Living architecture is that which faithfully expresses its time. We shall seek it in all domains of construction. We shall choose works that, strictly subordinated to their use and realized by the judicious use of material, attain beauty by the disposition and harmonious proportions of the necessary elements of which they are made up.
Auguste Perret, 1923

While Art Nouveau appeared to break with the bonds of the past, to be a new style, it was soon perceived to be a subjective creation insufficiently rooted in lasting principles and incompletely attuned to the means and needs of an industrial society. In this view even architects like Horta and Guimard, who had approached the heart of the matter of a new architecture, were lumped together with the most facile Art Nouveau decorators. In part the reaction was impelled by vaguely moral yearnings for the stern and unadorned, in part by Rationalist ideas which required a practical justification for formal effects. This was somewhat ironic because, as has been shown, Rationalism inspired some of the more disciplined creations of Art Nouveau.

By 1905, then, the style which had so quickly flowered was already beginning to wither; but after it, things could not be the same again. It opened up a language of abstraction and implied new ways in which nature's lessons could be incorporated into architecture. A tradition of emotive, organic form was founded, which would develop further in the free experimentation of the 'Amsterdam School' around the end of the First World War and in the so-called 'Expressionism' of the 1920s. More important in the shorter term was the reaction *against* Art Nouveau. This took a number of different forms. In Vienna, Hoffmann and Loos suggested that the way forward to a true modern style lay in increasing formal simplification; in Berlin, Peter Behrens resorted to classical principles, which he attempted to restate in a new form responsive to the modern industrial state; in Paris, Auguste Perret (yet another inheritor of Rationalism) sought a formal discipline in the constraints and creative potentials of new constructional systems, especially reinforced concrete, in the belief that this would lead to genuine architectural forms of lasting quality.

This last notion, of course, stemmed from the ideas of Viollet-le-Duc, who had influenced some of the structural inventiveness of Art Nouveau. It has already been suggested that his theories were at times over-mechanical, but they still had an immense impact on those who felt, at the turn of the century, that a language based on 'truth to the programme and truth to the methods of construction' might be the best antidote to academic

revivalism on the one hand and to personal whimsy on the other. Here one must mention the role of the nineteenth-century engineering tradition, which had already demonstrated the possibility of new forms in new materials, and which Viollet-le-Duc had himself singled out in contrast to the 'dead languages' of the architects:

> ... naval architects and mechanical engineers do not, when building a steamship or a locomotive, seek to recall the forms of sailing ships or harnessed stage-coaches of the Louis XIV period. They obey unquestioningly the new principles which are given them and produce their own character and proper style.

One effect of Viollet-le-Duc's opinions was to found a tradition of architectural history in which the role of practicality in great works of the past was overstressed. Thus Auguste Choisy, in his *Histoire de l'architecture* of 1899, spoke of Gothic architecture as 'the triumph of logic in art', whose form was 'governed not by traditional models, but by its function and by its function alone'. This view was reinforced by simple geometrical drawings in which buildings were portrayed as structural diagrams, as if structure and only structure had been the architect's concern (Fig. 68). The implication of the Rationalist position seemed to be: if only modern architects would think as clearly as these predecessors and concentrate on function and structure, then their results would have the same authenticity.

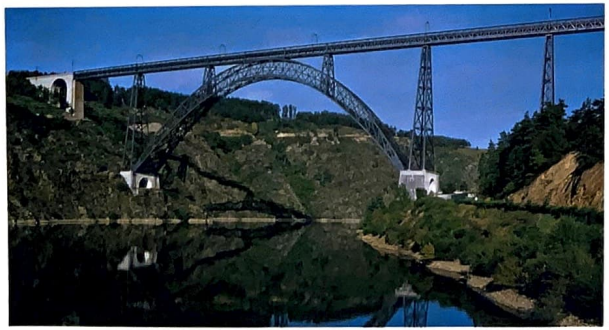
In a sense both Viollet-le-Duc and Choisy were projecting backwards the values of nineteenth-century engineers. The stunning new effects of visual lightness and transparency in buildings like Paxton's Crystal Palace of 1851, or Victor Baltard's market sheds at Les Halles in Paris of 1853, seemed indeed to be traceable to a judicious attention to the demands of programme and structure: but did these buildings in iron, and later utilitarian structures in steel, constitute a new *architecture*? Even those who could admire the structural feats (and the occasional formal elegance) of engineering realized that a certain poetic character of form might be missing. Thus, while the Rationalists and the engineers, each in their different ways, seemed able to emancipate themselves from revivalism, they faced another danger: the proliferation of a bland, materialistic functionalism lacking the quality of a true expressive style.

This problem had already preoccupied some writers and practitioners in the early nineteenth century. In his *Précis des leçons d'architecture données à l'école polytechnique* of 1804–9, J.-N.-L. Durand had advocated a system of design based upon the addition and combination of basic structural and functional elements, resorting time and again to grids of simplified supports laid out on symmetrical plans. In effect this was a desiccated version of classical arrangement with the expressive and metaphysical removed. In the 1820s, the theorist Heinrich Hübsch had discussed the notion of basing form directly on need, while Schinkel, who welcomed the discipline of strict construction, none the less felt that the 'historic and poetic' must be present if architecture, rather than just building, was to result.

Moreover, it is not as if the great nineteenth-century engineers were ignorant of the problem of formal expression in their designs. Considered by any standards, the Pont du Garabit by Eiffel of 1880–4 would have to be judged a sculptural triumph as well as a practical solution to the problem of bridging a ravine. The structural forms were dramatized in visual terms: the dynamics of the arch leaping from one side to the other; the strong horizontal of the upper raft holding the railway line as a virtually independent element flowing in space; the hierarchies of girders embedded in a clear overall order of visual stresses; the transparent lattices and spans through which the sky and the landscape could be seen.

John A. Roebling, the designer of the Brooklyn Bridge in New York of 1869–83, considered that engineering might contribute to a new, democratic culture where usefulness and higher values of form would be united. The Brooklyn Bridge was based upon a suspension principle and combined a gossamer structure of steel wires with two massive stone piers. Diagonal lines complemented the main curved cables and added to both the lateral stability and the visual drama of the design. The Brooklyn Bridge raised engineering to a high poetic plane. Montgomery Schuyler (the same critic who praised the Monadnock Building) spoke of it as 'an aerial bow ... between the busy cities' and as '... a skeletonized structure in which, as in a scientific diagram, we see – even the layman sees – the interplay of forces represented by an abstraction of lines'. For him the Brooklyn Bridge was as 'perfect as an organism of nature ...'

The Chicago architects discussed in Chapter 2 also sought a 'higher synthesis' of technique, material and form in their skyscraper designs. It will be recalled that Sullivan, for example, had attempted to suggest that form should 'follow' from function, but had discovered that a number of arrangements might be equally tenable and that the brute heap of matter which was the tall building could only acquire aesthetic value through an intuitive intervention on the part of the artist. Although Sullivan disclaimed the value of 'rules and other impedimenta', he had in fact discovered that function and structure could not on their own 'generate' an adequate form, without the intervention of highly abstracted historical or natural prototypes. Indeed, Viollet-le-Duc's own clumsy attempts at evolving a system 'true to iron' had been influenced by medieval precedents, and perhaps even by the forms of bones. So history had not dropped out of the picture completely. Quite the contrary, the question in a sense became: which qualities abstracted from tradition might best serve the forms suggested inherently by new construction techniques? At any rate, a query of this sort underlay many of the experiments of the early pioneers of a reinforced-concrete architecture.



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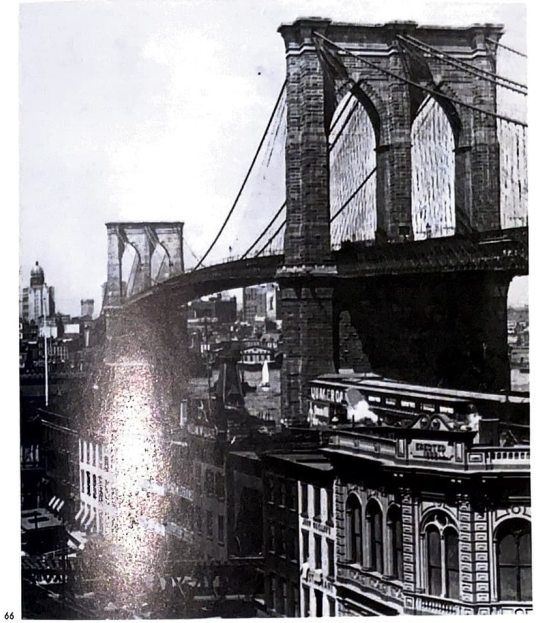
65 Gustave Eiffel, Pont du Garabit, near St-Flour, 1880–4

66 John A. Roebling, Brooklyn Bridge, New York, 1869–83



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Concrete had been employed by Roman and Early Christian architects but had then dropped out of use through most of the Middle Ages and Renaissance. It was not until the second half of the nineteenth century that the material was fully explored again, but usually for mundane purposes where its cheapness, its wide spans and its fireproof character all recommended it. The invention of reinforcing, whereby steel rods were inserted to increase the strength, belonged to the 1870s. Ernest Ransome in America and François Hennebique in France each evolved frame systems employing this principle. These proved to be well-suited to the creation of open-plan work spaces with large windows where fire had previously been a danger. Hennebique's system employed slender vertical posts, thin lateral beams on brackets, and floor slabs. The result was somewhat like a timber frame, which was scarcely surprising since the form-work was generally made from wood. But concrete, of all materials, was one of the most flexible, one of the least determining of form. It relied on the shape of the mould and the shaping intelligence of the designer. Some forms rather than others were certainly more logical in certain situations; but the material did not in and of itself generate a vocabulary.

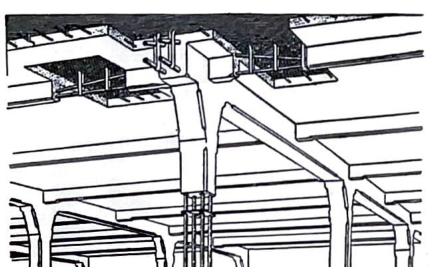
This became all the more obvious when architects in the last few years of the nineteenth century attempted to discover a style based on the material. Where one designer might argue that its malleable character made it natural for Art Nouveau expression, another might emphasize the role of a frame and panel system and claim the value of Gothic antecedents – or even of steel and glass ones. A similar range of positions might be taken with regard to the external expression of the material. Where one architect might regard it as commonplace and in need of covering with tiles or brick veneers, another might claim that it had its own inherent beauty and that it should be exposed.

Among the seminal experiments in France was the church of St-Jean-de-Montmartre, begun in 1894 and completed in 1904, designed by Anatole de Baudot. In fact the church was constructed with reinforced cement, rather than concrete, but the effects of lightness and the breadth of the spans with apparently slender supports were of a kind that either material would have been well suited to achieve. On the exterior relatively little attempt was made at expressing the skeleton, but inside a system was adopted which made clear the distinction between supports and infill panels. The pointed arches and the expression of the ribs suggested medieval prototypes, and it comes as no surprise to discover that Viollet-le-Duc had been De Baudot's mentor. But St-Jean lacks a formal resolution; it is an odd hybrid of medieval and exotic sources, a loosely Art Nouveau accentuation, and entirely novel ideas

67 François Hennebique, trabeated system for reinforced concrete, 1892

68 Auguste Choisy, plate from *Histoire de l'architecture*, 1899, showing Hagia Sophia

69 Anatole de Baudot, St-Jean-de-Montmartre, Paris, 1894–1904, interior



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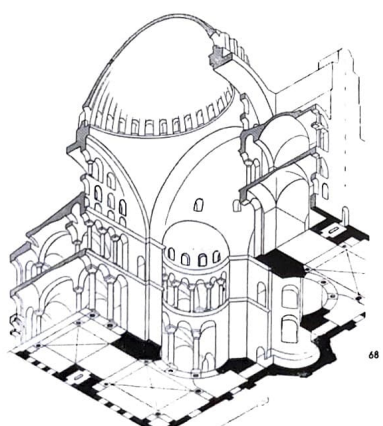

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related to the construction. The structure may be logical, but the visual *expression* of the structure is indecisive. None the less, the church suggested some ways in which the lessons of earlier styles could be applied to a modern situation.

In essence, this was the problem which would preoccupy Auguste Perret as well in the same years. Perret was forty years De Baudot's junior, but was no less influenced by the ideas of Viollet-le-Duc. However, he had also undergone indoctrination in classical principles at the École des Beaux-Arts in the 1890s under the tutelage of Julien Guadet, author of *Éléments et théorie de l'architecture* (1902). The method that Guadet attempted to instil in his students was the opposite of the slavish imitation of precedents that those hostile to the École liked to parody; his lectures were concerned with the classical principles of composition and proportion, and with the analysis of building types. He tried to convey a feeling for essential qualities of classicism, rather than a respect for superficial grammatical usages. A further element of Perret's formation needs to be stressed: both he and his brother Gustave were early trained in the basics of building construction in their father's firm. This blend of practicality, a Rationalist theoretical outlook and a firm, intuitive grasp of fundamental classical principles was to inform Perret's lifelong production.

The apartments designed by the architect at 25 bis rue Franklin, Paris in 1902 were based on the potentials of a trabeated, rectangular concrete-frame construction. The building stands in a row of vertical, rather gaunt, grey stone neighbours, with fine views down towards the Seine and the Eiffel Tower in the distance. Perret maximized these views by making the window openings as large as zoning laws allowed and by the effective device of placing the statutory light-court in the front of his building instead of at the back. The building was polite and well-behaved towards its neighbours, and respected several of their visual conventions, but also announced new departures, especially in the enlarged proportion of windows to supporting masses. The plan conformed to the standard expectations of middle-class occupancy, and placed the salons at the centre of the façade, but the concrete-frame system allowed thin wall partitions, and some saving in space. This potential was most obvious at the ground level where the Perret firm moved its studio, and where the stanchions appeared in free space as premonitions of the *pilotis* so important to the architecture of the 1920s. Perret exploited the setbacks on top of the building, and the flat roofs provided by his constructional system, to create a roof terrace.

What made the rue Franklin flats architecture, instead of just construction, was the way these practical intentions were given a clear, tectonic form. The lowest storey was emphasized as a separate unit, higher than those above it, while the next six storeys were expressed by slight overhangs and a variable placement of window depths within the U-shaped recess. The underlying rectangular frame was not exposed directly, but its presence was

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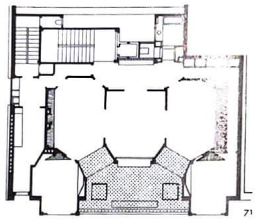
70 Auguste Perret, apartments at 25bis rue Franklin, Paris, 1902

71 Apartments at 25bis rue Franklin, plan of typical apartment

72 Auguste Perret, garage at 51 rue de Ponthieu, Paris, 1905

73 Auguste Perret, Théâtre des Champs-Élysées, Paris, 1911–13, diagram of concrete frame



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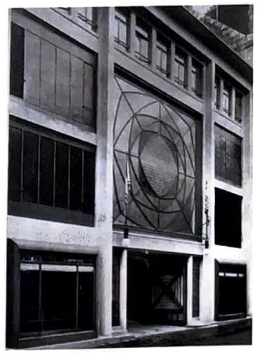
suggested by contrasting colours and textures in the tiles of the façade, while the theme of infill, non-weight-bearing panels, was suggested by recessed, floral-designed ceramic surfaces. At the sixth storey, though, the frame broke free of the wall surfaces, giving some hint of the sort of airy and transparent effects to be pursued in modern architecture a generation later. The result of Perret's careful attention to proportion, detail and interval was a calculated work of great sobriety and repose. The whole was suffused with a serene classicism, yet without the overt use of the classical Orders. The rue Franklin apartments, along with the slightly later library wing of the Glasgow School of Art by Mackintosh, the Palais Stoclet by Hoffmann, the Larkin Building by Wright, the AEG Turbine Factory in Berlin by Behrens, and perhaps a handful of others, must certainly rank as one of the seminal works of the early modern movement. However, part of its strength lay, precisely, in the authoritative way in which it announced the potentials of a new material in a phraseology rooted in tradition.

In 1905, Perret made a further step by leaving the concrete completely exposed (though, admittedly, protected by white paint) in the garage design at 51 rue de Ponthieu. It is possible that he felt freer to do this in a building whose function lay closer to the concrete 'warehouse aesthetic' of Hennebique than did bourgeois apartments. And it may be that in his articulation of the garage façade, Perret was working with second-hand knowledge of Chicago frame buildings. In any case, the result transcends its influences in a clear statement infused with a true personal style. The concrete frame of the interior allowed considerable flexibility in planning to facilitate the circulation and parking of cars. In less sensitive hands this interior organization might well have led to a crude assemblage of rectangular openings and stanchions in the façade. Perret brought order to the design by subtle placement of the window panes to give the right sense of depth, and by organizing the pattern of vertical and horizontal visual stresses – the apparent, not just the actual structure – in a simple rhythm of primary and secondary accents. The armature of the whole composition was defined by the stripped 'pilasters' rising from top to bottom supporting the abstracted 'cornice' at the top.

There can be little doubt that Perret had by this time decided that the 'correct' forms for concrete were rectangular ones, in part because of his aesthetic prejudices, in part because of the simplicity of making rectangular timber form-work from which the concrete was cast in simple standard sections; thus his concrete vocabulary was reminiscent in some ways of wooden-frame buildings of the past. But his father had trained him in the intricacies of stone-cutting and stereotomy, and the mouldings and details of Perret's designs,



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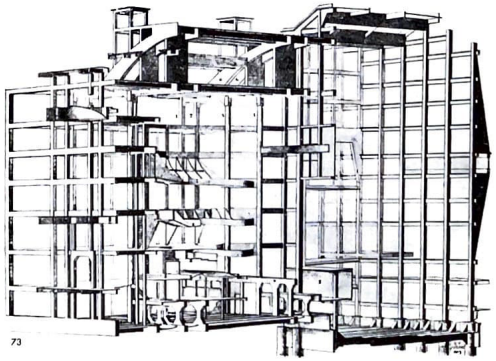

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74 Albert Kahn, Ford Motor Company factory, Highland Park, Michigan, 1909

75 Eugène Freyssinet, airship hangars, Orly, 1916–21, parabola drawn on photograph of unfinished building

76 Freyssinet, airship hangars, Orly, 1916–21

which he could usually justify on extremely practical grounds (e.g. as drip mouldings), seem to be historical relatives of the flat wall and bracket elements observable in the French classical tradition running back to the seventeenth century. It is intriguing to speculate how the Abbé Laugier (the mid-eighteenth-century theorist mentioned in Chapter 1) might have reacted to Perret's work if he could have been brought back to life in the first decade of the twentieth century. One suspects that he would have recognized immediately the intention of restating certain essentials of classicism for new purposes and in new materials. One imagines, too, that he might have respected the sentiments underlying Perret's dictum that 'one must never allow into a building any element destined solely for ornament, but rather turn to ornament all the parts necessary for the support'.

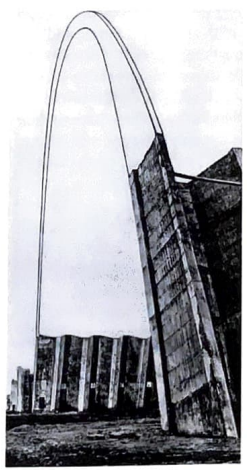
By 1911 the Perret brothers were among the leaders of concrete construction in France. They were approached by the impresario Gabriel Anstuc, who wished to erect a new theatre and hoped that Perret might help to implement a design by Henry van de Velde. This collaboration was short-lived – as might have been expected – and the Champs-Élysées Theatre of 1911–13 was carried out to Perret's design, with façades based on Van de Velde's elevations. Once again Perret demonstrated the depth of his classical allegiances in the use of elements recalling stripped pilasters and cornices. In the interior, the spanning power of concrete was used to minimize interruptions of the view of the stage. The building's concrete frame was almost a work of art in its own right, and was certainly to become a major inspiration to the generation which created the modern movement of the 1920s; the external treatment of the theatre they preferred to forget, as its traditionalism was not in tune with their aims.

In the United States, in parallel with Hennebique's pioneering experiments, the engineer Ernest Ransome and the architect Albert Kahn discovered many applications for the new material in factory, warehouse, and even grain silo design. Cylindrical concrete grain silos were easy and economical to construct, avoided fire problems, and could be taken to great heights, so allowing for high concentration in storage alongside railway lines. They also had an indisputable purity and beauty that was captured in later years by the painters Charles Sheeler and Edward Hopper. They were as much instruments for the industrialization of the countryside as skyscrapers were devices for the industrialization of the city.

Concrete also recommended itself for the design of wide-span factories to accommodate the new techniques of 'Taylorization', whereby all steps of fabrication were submitted to a scientific rationalization for the mass production of goods. Albert Kahn devoted much of his life to the design of car factories, worked closely with Henry Ford, and, by 1908, was already producing his characteristic framed buildings in and around Detroit. He found concrete to be almost ideal in meeting such fundamental requirements as cheapness, standardization, clear lighting, fireproofing, extensive ventilation, and unobstructed, flexible interiors through which the assembly line could be threaded. A characteristic morphology of grid plans and simple rectangular elevations of pleasing proportion resulted. But Kahn never thought of his utilitarian designs as Architecture with a capital 'A'; the same was true of the engineers who designed grain silos; it was the European avant-garde, seeing these objects in photographs, who referred to them as icons of a new, universal language of architecture.

One of the few American architects to grapple with the potentials of the new material was Frank Lloyd Wright. He was certainly attracted to it because of its cheapness and because it could create wide spans, but also because it could be moulded to his spatial ideas. With his 'Arts and Crafts' emphasis on the nature of materials, Wright thought it best to leave the surfaces of concrete bare. One of his early masterpieces, the Unity Temple in Oak Park of 1905–8, was constructed in concrete. This building is best discussed in more detail in the context of Wright's philosophy and evolving vocabulary of abstract form (pp. 127–9 below); here it is enough to say that the building, like Perret's apartments, gave enhanced status to the material, and lent further weight to the impression that the 'correct' forms for concrete were rectangular, stripped, and abstract, although Wright did not, like Perret, rely on the frame.

But rectangular forms were by no means the only ones suitable to concrete, as was well demonstrated by the engineering feats of Eugène Freyssinet in France and Robert Maillart the bridge builder in Switzerland, in the first two decades. Freyssinet's vast airship hangars at Orly (1916–21) were parabolic in section and relied upon pre-stressed members, while Maillart's bridges tended to rest on attenuated curved supports, slabs or slender beams; Maillart's experiments helped to emancipate reinforced concrete from traditional masonry thinking, but were also in conflict with that version of engineering which insists upon calculations at the expense of conceptual and visual economy. His Tavanasa Bridge (1905) over the Verder-Rhine in Switzerland employed a three-hinged arch to allow



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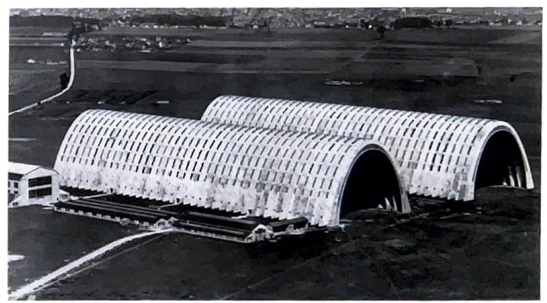

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for expansion and contraction. It was the way in which structural stresses were accentuated directly in the material employed with a complete sense of visual coherence, that raised this rigorous engineering form to the level of structural art. Sharp slab details picked out shadows and provided vectors for the eye. The roadway was expressed as a thin plane with a life independent of the structure actually holding it up. The curves beneath were also dematerialized through careful detailing of rims and extruded ridges. Overall, there was the sense of forces intersecting and counteracting one another in space. Lines and surfaces seemed to hover. Max Berg's Jahrhunderthalle at Breslau, of 1912, also made much of the vast spanning potential of arcuated construction, but revealed an expressionist, dynamic tendency far away from Perret's sobriety, or from Maillart's restraint. This great variation of possible forms for concrete only serves to emphasize that the tendency to think of the rectangular forms of the modern movement as somehow indelibly linked to concrete is an oversimplification. The generation which, for a variety of aesthetic and symbolic reasons, sought effects of thin planarity, overhanging horizontality, and geometrical simplicity, saw its forefathers as being Perret and Wright, while ignoring an equally viable curvilinear tradition.

Among the architects to provide a pedigree for the later rectangular aesthetic was the Frenchman Tony Garnier, who also linked the new material to another development to become crucial in the 1920s: town planning for an industrial society. Garnier was born five years earlier than Perret, in 1869, and also attended Guadet's lectures at the École des Beaux-Arts in the 1890s. In 1899 he won the Prix de Rome with a design for a 'State Banking House' which was an exemplary demonstration of Beaux-Arts planning in the use of primary and secondary axes, absolute symmetry and the separation of circulation from areas served. Ostensibly Garnier was to have spent his time in Rome studying the monuments of antiquity, and making reconstructions of Herculaneum; instead he turned his mind to the design of a modern ideal city known simply as the 'Cité Industrielle'. This project was not published until 1917, by which time the architect had managed to implement some of his ideas in a new quarter on the outskirts of Lyons

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under the socialist patronage of the mayor of the city, Edouard Herriot. The Cité Industrielle was based on the notion of distinct zoning for residential, industrial, transport and recreational areas, and drew together French urbanistic precedents in its use of grandiose axes, English Garden City ideals, and social ideas from the Utopian-socialist tradition. But the houses in the drawings for the Cité Industrielle were far from the Arts and Crafts in their use of flat roofs, their simple cubic geometries, and their use of concrete and standardization. If anything, the style was a sort of stripped 'Grecian', but the minimum reference was made to classical mouldings. The dwellings had simple rectangular windows punched through their surfaces, and in places concrete frames rose clear of the roofs and supported horizontal parasol slabs, lending an air of transparency to the imagery. The central railway station was also constructed from concrete and made dramatic use of cantilevers and horizontal overhangs. Garnier's Cité gave a convincing imagery to the functions of a modern town and lent extra weight to the notion that rectangular cubic forms were the most suitable for reinforced-concrete construction and for standardization. Moreover, there was the further suggestion that sober values of clear geometrical

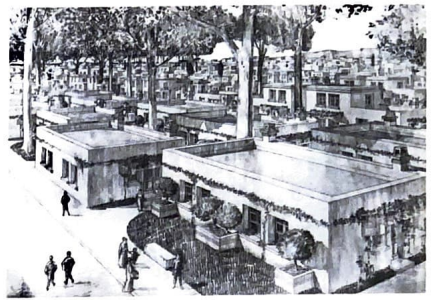
77 Robert Maillart, Tavanasa Bridge, Switzerland, c.1905

78 Tony Garnier, Cité Industrielle, residential quarter, from *Cité Industrielle*, 1917

79 Tony Garnier, Cité Industrielle, railway station, from *Cité Industrielle*, 1917

repetition were the 'correct' ones for an emergent machine-age society.

Among those to be convinced of these patterns of thought, and to adhere to some of the principles behind Perret's vision of a reinforced-concrete architecture, was Charles Edouard Jeanneret, later to become Le Corbusier. So important is this figure to the history to be covered by this book, that it seems best to treat his formation individually (chapter 10). Here it is enough to say that Jeanneret was born in La Chaux-de-Fonds, Switzerland, in 1887; that his early designs reveal a mixture of Art Nouveau and Regionalist influences; that he spent part of his early twenties working in Perret's atelier where he learned the basic lessons of reinforced concrete, and imbibed Viollet-le-Duc's ideas; and that two years later (1910) he worked in the office of Peter Behrens in Berlin, where he absorbed the idea that a new architecture must rest on the idealization of types and norms designed to serve the needs of modern society, while being in harmony with the



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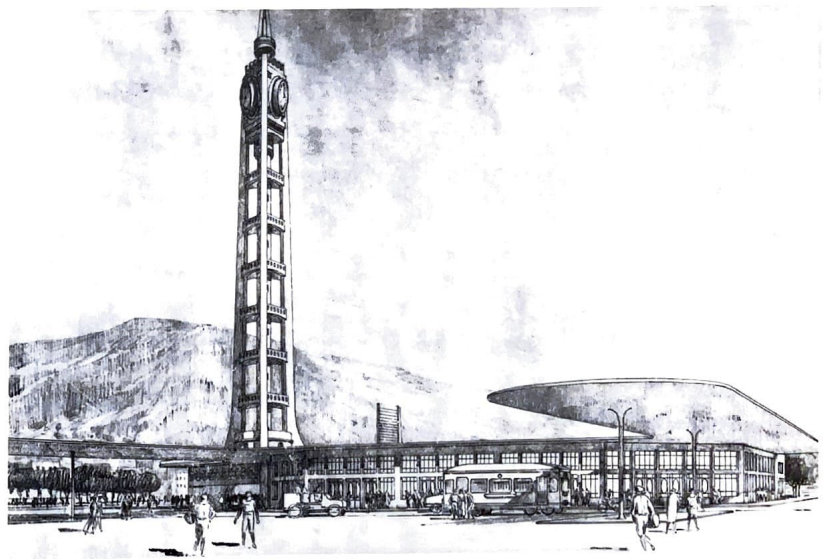

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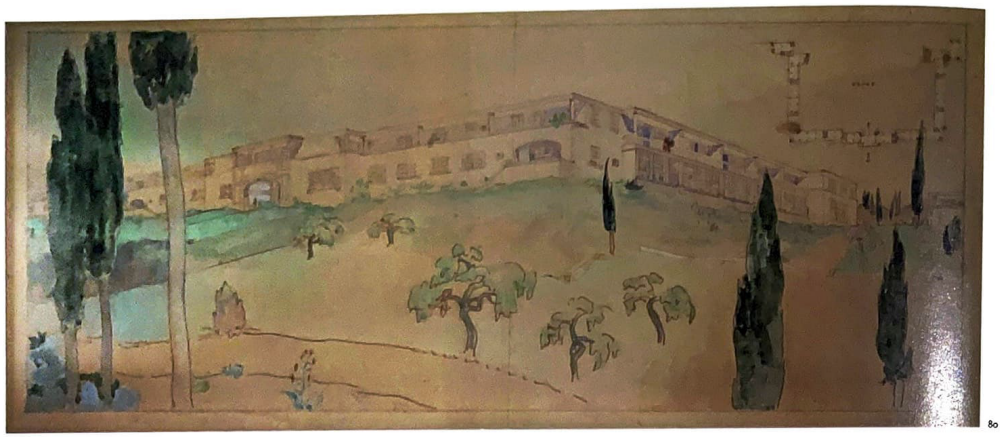


80 Charles Edouard Jeanneret (Le Corbusier), sketch of Dom-ino houses, 1914–15. Print heightened with colour, 18 x 38¼ in (46 x 98 cm). Fondation Le Corbusier, Paris

81 Le Corbusier, Dom-ino skeleton, 1914–15, from the *Oeuvre complète*, vol. 1, 1910–1929

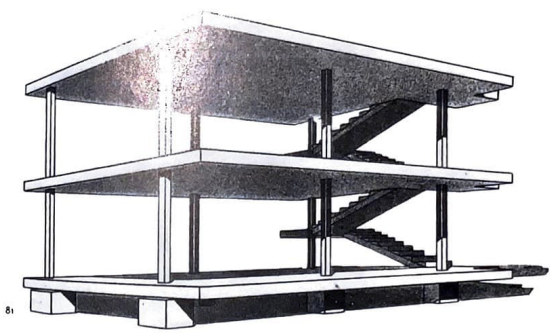
means of mass production. At least this is sufficient to supply a context to his seminal 'Dom-ino' concrete housing system of 1914–15.

This was designed as a housing kit to help in the rapid reconstruction of war-ravaged Flanders. Jeanneret optimistically expected that the war would end quickly and his ideal was to mass-produce a basic set of components, including the necessary moulds, to make a simple, six-point support concrete skeleton with cantilevered slabs. The framework of the dwelling could then be assembled in less than three weeks, and rubble walls made from ruined buildings could be used as an infill. Windows and furnishings, all mass produced, were to be modelled on local precedents, and inserted into the skeleton. The very name 'Dom-ino' implied the Latin word for house (*domus*) and the game 'dominoes' (the plan of a whole suburb did loosely resemble a row of number six dominoes). Intrinsic was the idea that simple, rectangular, mass-producible components could be arranged to make modern dwellings and communities. From the very beginning we can sense the future of Le Corbusier's preoccupation with defining the elements of a new architectural and urbanistic language.

The central generator of the Dom-ino system and of both the architecture *and* the urbanism of the later Le Corbusier was the skeleton itself (designed with the help of Max Dubois). This was a structural unit consisting of three horizontal slabs, smooth below and above, each of the upper two supported on square sectional posts of concrete, the lower level lifted from the ground on squat concrete blocks. In the perspective of this skeleton (which was published only in the 1920s) concrete stairs were shown connecting the levels. It was noticeable that the Dom-ino, by contrast with, say, the system of Hennebique, made no use of brackets or beams. The slabs and posts were entirely clean, and contributed to an entirely pure structural idea. Employing the principle of the cantilever, the slabs, moreover, extended well beyond the line of supports. In fact they were not to be monolithic concrete, but pot-tile, covered over with concrete and reinforced with interior beams of steel.

One advantage of Jeanneret's system would have been its rapid construction, but this was not put to the test. Another was intrinsic and indubitable: it did with concrete what Perret's system had not. It separated out the structural and the screening functions of the wall by removing the fill from the frame. Now the fill was attached to the end of the slabs, with the possibility of its existing as a planar surface hovering in space above a void. As the weight of the building was now borne by the skeleton, the external 'wall' (or other form of cladding) could be arranged without thought for the load on it and without the interruption of the frame. It could become effectively a sort of membrane to be punctured as functional necessities or compositional instincts required. In the drawings for Dom-ino houses glass was placed tantalizingly at the corners in some places, just where a traditional masonry structure would have been structurally most solid.

In the interior the Dom-ino system also allowed new freedoms. Partitions could be positioned as one wished, in or out of line with the grid of supports. Space was saved and a new degree of functional flexibility achieved. Aesthetically the emphasis could now shift from the subtraction of voids from masses, to the modulation of spaces with minimal supports. Parts of the slabs could be removed to create double- or even triple-height volumes. The lower level could be liberated entirely to let public circulation pass through, while the flat top could be used as a terrace. In an embryonic form, the Dom-ino skeleton spelled out certain generating principles – the free plan, the free façade, the flat-roof terrace – that were to be of cardinal importance to Le Corbusier in ensuing years.



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However, this is to look at the Dom-ino skeleton with hindsight, and with the knowledge of the transparent, planar, and lightweight effects of the later works of the modern movement in the 1920s. It is therefore only fair to point out that the Dom-ino houses proposed in 1914–15 were dumpy in visual effect, for all their simplicity of volume, and that their interiors were confined and traditional for all the spatial potential of the structural skeleton. They probably reflected Jeanneret's admiration for the unadorned dwellings of the Mediterranean, with their flat roofs and cubic shapes modelled by light. Indeed, the Dom-ino houses were the first of a number of attempts by the architect at founding a modern, industrialized equivalent to the vernaculars of the past.

But if the Dom-ino ideas anticipated some aspects of the architecture of the 1920s, they also rested firmly in the Rationalist tradition. When Jeanneret worked for Perret in 1908, he had used his first pay-packet to buy Viollet-le-Duc's *Dictionnaire de l'architecture*. In one of the margins, alongside an illustration of a Gothic flying buttress, he referred in a note to Perret's insistence on the structural skeleton: 'grasp the skeleton and you grasp the art.' Equally, the purified diagram of structure represented by the Dom-ino could be seen as the very distillation of the *idea* of load and support: the essence of column, floor and roof expressed in pure, virtually ideal forms. It was like a genotype, an image of origins, out of which a symbolic architecture might be developed. In his own Dom-ino theorem the young man laid the basis for his future architectural and urbanistic systems, but with help from his mentors, past and contemporary. In much the same way, Rationalism and reinforced concrete were two elements, but only two among several, which would eventually coalesce in the 'heroic' period of modern architecture, the 1920s.