

Le Corbusier's carpet projects on the French Coast – the continuous quest towards creating formulae for better place making

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Whereas the merit of Le Corbusier's Unités d'Habitation is still contentious, his contemporaneous unbuilt housing schemes on the French Coast are praised for their sensitivity towards history, climate and their sites, as well as for their formative influence on some other important Post World War II buildings. This article investigates how he explored the dialectic between art and science – always a major concern for him – as well as their relationships to architecture and urbanism.

Key words: Le Corbusier, carpet housing, La Sainte-Baume, Roq-et-Rob

Le Corbusier se tapyt-skemas aan die Franse Kus

Terwyl die meriete van Le Corbusier se Unités d'Habitation steeds omstrede is, word die ongeboorde behuisingskemas van dieselfde tyd aan die Franse Kus geloof vir hulle sensitiwiteit teenoor geskiedenis, klimaat en hul terreine, asook vir hul vormende invloed op ander belangrike geboue na Wêreldoorlog II. Hierdie artikel ondersoek hoe hy die dialektiek tussen kuns en wetenskap – altyd 'n groot oorweging by hom – verken het, asook die verhouding daarvan tot argitektuur en stedelikheid.

Stelwoorde: Le Corbusier, tapytbehuising, La Sainte-Baume, Roq-et-Rob

Le Corbusier (1887-1965) – controversial and creative author, artist, architect and urbanist – was unquestionably one of the most influential figures in the field in the 20th century. An outstanding characteristic of Le Corbusier's career was that he continuously evolved his architecture. From 1917-1928 he pursued Purism – the slick, white machine aesthetic, which in the period 1929-1945 evolved into the so-called International Style. During that time he began exploring a hybrid and rough architecture, often based on vernacular forms, and introduced the *brise-soleil*. From 1946 until his death in 1965 his projects were intermittently characterised by the Mediterranean vernacular (particularly that of North Africa), symbolism and monumentality, and also by what we now call Hi-Tech.

Just as his architecture evolved during his professional life, so did his town-planning. In 1914 he designed an unbuilt, little-known picturesque garden suburb in his home town, La Chaux-de-Fonds in Switzerland. After he moved to Paris in 1917 he became obsessed with improving city forms and soon formulated the four principles for town planning, which he relentlessly pursued throughout his life: (1) the centres of cities must be de-congested, (2) density must be increased, (3) circulation and mobility must be improved, and (4) parks and open spaces must be increased in both number and size (1929: 170).

From 1917-1928 he explored the application of these principles in Baroque-type grids with diagonals, symmetrical on cruciform or linear axes (Contemporary City, 1922; Plan Voisin for Paris, 1925; and the Radiant City, 1930), which were purely diagrammatic proposals. He subsequently abandoned the symmetrical grid and from 1929 to 1945 he designed juxtaposed lattices with different geometries for vehicles and pedestrians, often based on curvilinear, trigonometric and linear forms. After World War II, from 1946-1965, he refined the alternating net with single or multiple superblock clusters, and we now find both high-rise buildings in the park (Unités d'Habitation) as well as compact, low-rise carpet patterns.

Much has been written about Le Corbusier's exploration of the pragmatic *vis-à-vis* the lyrical on the methodological-metaphysical spectrum that is so typical of his work – objectivity at the one end and spirituality at the other. He elicited this focus himself, declaring early on that architecture must not only satisfy needs for “utility, comfort and practical arrangement”, and

suggested that utilitarian demands may be “restrained” in order to achieve “the plastic aim [the architect] was pursuing” (1927: 110-111).

In the very first treatise on architecture in AD 100, Vitruvius (Morgan 1960: 16-17) describes architecture as “the art of building” and notes that buildings must be durable (of good construction and with materials “wisely” selected), convenient (functional and comfortable) and beautiful (in good taste and of pleasing appearance). Nearly 2,000 years later the *Britannica Concise Encyclopaedia* defines architecture as “the art and technique of designing and building, as distinguished from the skills associated with construction”. Tom Bartuska and Gerald Young (1994: 138) propagate an expanded ambit for architecture: “The art and science of designing and building open areas, communities and other artificial constructions or environments, usually with some regard to aesthetic effects”. They explain the word “architecture” as follows:

Arch-i-itecture: art + craft + science + engineering

Most current theories on the nature and scope of architecture agree that there is a fine balance between the art and science of architecture, but in what sense is the term science understood? Roman Verostko (2002) quotes the 14th and 15th century French architect, Jean Mignot, who declared that “art without science amounts to nothing”. He explains that in Latin the term *scientia* “referred broadly to the accumulated knowledge and theory associated with a profession”. I believe the term is ambiguous in the discipline of architecture and in the humanities generally. After all, Freeman Dyson (2006: 17), eminent author and a professor of physics at Princeton, quite adamantly states that “Science is an art form and not a philosophical method”. Perhaps Peter Fawcett (2003: 2) is semantically and procedurally more realistic: “The act of [architectural] designing clearly embraces at its extremes logical analysis on the one hand and profound creative thought on the other, both of which contribute crucially to that central ground of form-making”. Logical analysis is, after all, a fundamental tenet of science.

Bartuska and Young’s more comprehensive definition is aligned with Le Corbusier’s position. He was one of the few practitioners and theoreticians who treated architecture and town-planning in an integrated manner. In fact, he remarks that “the happy towns are those that have an architecture” (1927: 15). He wrote (1947: 13) “Architecture and planning, spirit and heartbeat of an epoch; of nations, and of a civilisation”. Towards the end of his career he would emphasise the “supreme and interdependent rôle” of architecture and town and country planning (1960: 253). Also: “I am an architect and a city planner; *I make plans*” (1964: 180). The word “plan” appears often in English translations of his writings, but as Fawcett (2003: 20) points out, “the three-dimensional organisation” is certainly a better translation, especially since Le Corbusier is known for his propensity for conceptualising and designing everything – from cities to buildings to rooms – in three dimensions.

While the designs of his buildings are still intensely debated, praised by some and condemned by others, his urban plans are generally ignored, even though they are extensions of his architecture. They featured the same art *vis-à-vis* science duality: Maurice Besset (1992: 185), former curator of the Le Corbusier Foundation claims that Le Corbusier applied both *la passion* and pure reasoning to town planning. Two schemes that embrace both architecture and urbanism, and on which consistently favourable comment is expressed, are housing projects on the French Coast: One was at a pilgrimage site called La Sainte-Baume (“Holy Cave”) in Provence, about 17 kilometres inland. The other, called Roq-et-Rob, would have been situated at Cap Martin, approximately 100 km north-west on the Côte d’Azur, also known as the French Riviera. Designed in 1948 and 1949 respectively, they were regrettably never built. The latter was to be situated close to the shore below the small town of Roquebrune where Le Corbusier had a holiday cabin, and where he died while swimming in the sea on 27 August 1965.

References to the designs of these housing projects tend to be quite brief, probably because they were not developed in detail and perhaps because Le Corbusier himself did not publicise the designs very much. However, Roq-et-Rob, especially, is widely recognised as a direct influence on at least two seminal projects: Siedlung Halen in Berne, Switzerland, by Atelier 5 (1961) and Tadao Ando's Rokko Housing Kobe, Japan (1983).

By exploring known, as well as probable, influences and decisions that shaped the two schemes, this article attempts to determine the dialectic between art and science, in both their architecture and urbanism. The images are hauntingly beautiful and have become iconic (figure 1). But did they have the potential to achieve that "fine balance" of both building and settlement scales.

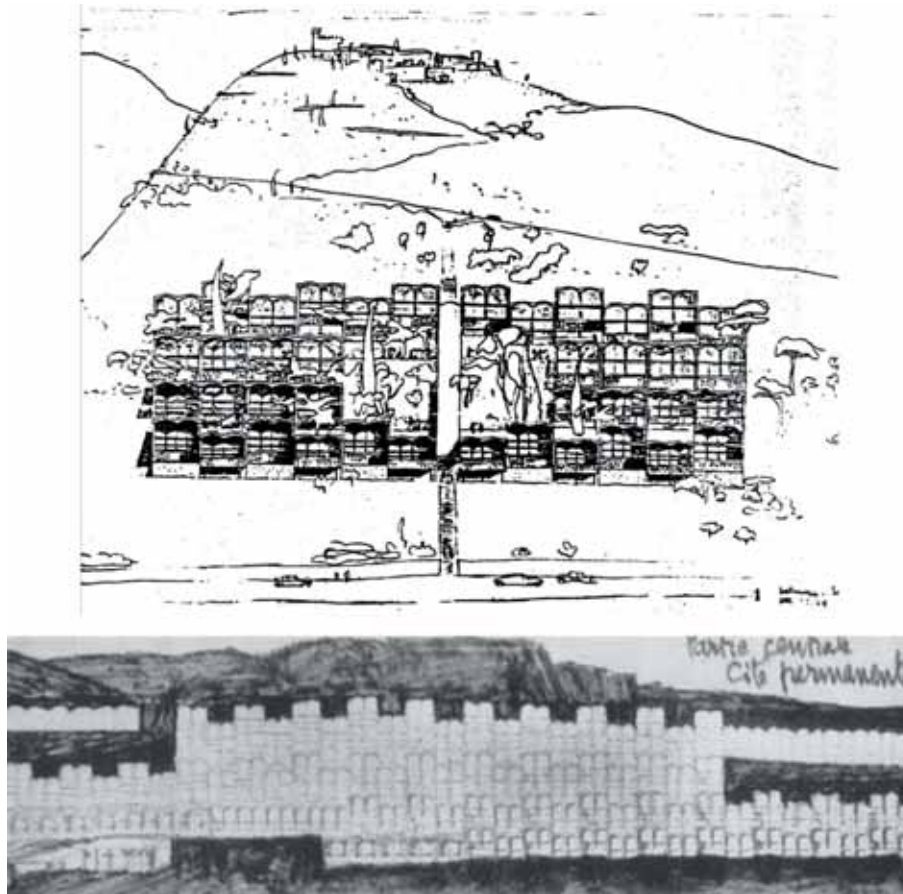


Figure 1

Top: Roq-et-Rob (source: Boesiger et al. 1967: 133).
Bottom: La Sainte-Baume (source: Banham 1966: 93).

An introduction to the projects under study – the vision

For my analysis I decided to first "get a feel" for the projects in an attempt to represent Le Corbusier's vision and work backwards from there. The baseline material comprised plans and sections of the sites as well as my computer drawings of some of the housing units and computer generated isometric views. The very first proposal for Roq-et-Rob was chosen for this analysis since we often find most clarity and innovation in his initial designs.

La Sainte-Baume was planned to consist of a total of 188 units and Roq-et-Rob for 47. Site development drawings show that each of the schemes was assembled from long, thin shapes aggregated into four rows, that both projects are almost totally pedestrian orientated, and

that achieving views and coping with the slopes were obviously quite challenging (figure 2). Whereas Sainte-Baume was asymmetrically organised around a communal courtyard, Roq-et-Rob was primarily symmetrical. The site of the former was infertile and rocky, which perhaps explains why its units sit so lightly on the site, while the latter relies on some cut-and-fill.

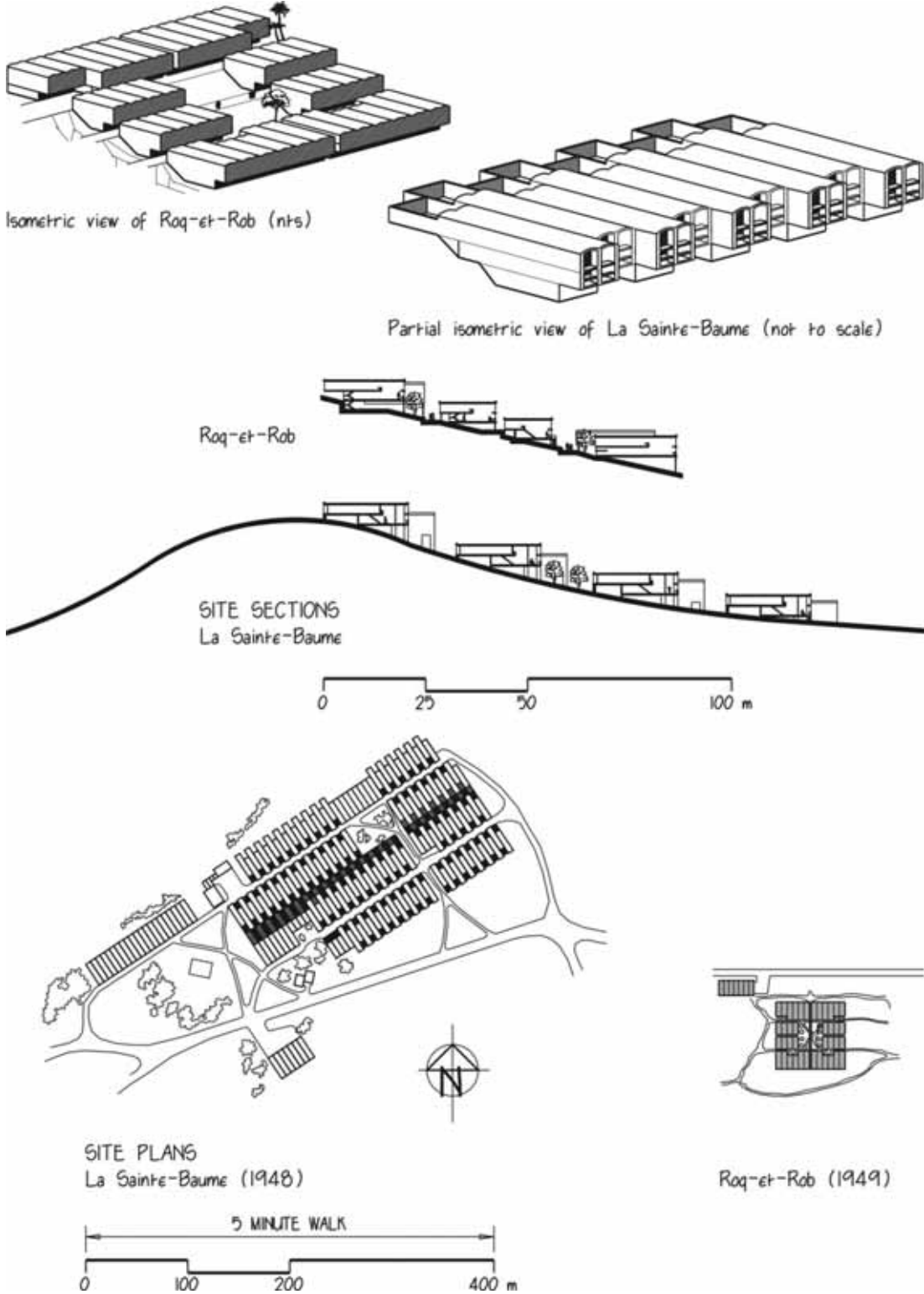


Figure 2
Site development (drawing by the author).

Judging from these drawings it seems as if both schemes use identical unit designs, but the plans and sections show that, while the typologies are essentially the same, interior organisation

and structure differ dramatically (figure 3). La Sainte-Baume constituted an obviously massive structure and enclosure, while Roq-et-Rob consisted of a closely-spaced skeletal metal frame and a thin skin, and its courtyards were internal rather than attached to the rear or front as at La Sainte-Baume. Both included planted barrel vault roofs. It is also clear that the typology is essentially the same as that of the individual units of the Unité d'Habitation. These are the fundamental observations from which the subsequent analyses will proceed.

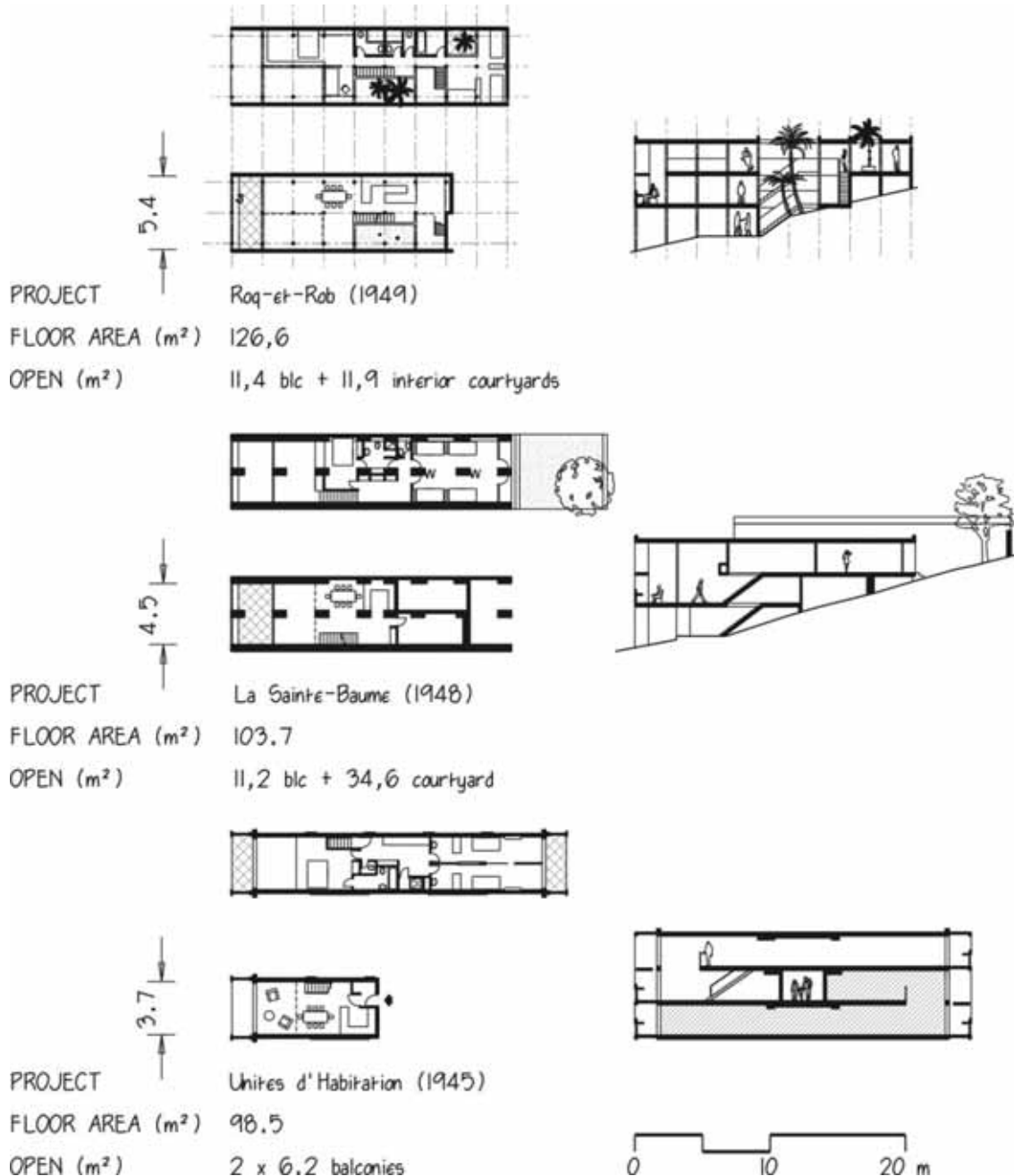


Figure 3

Unit designs compared to that of the Unité d'Habitation (drawing and measurements by the author).

Searching for a concept

From Le Corbusier's drawings one could deduce that the fundamental concept for the Unités was the bottle rack; however, he never explicitly revealed the concept for the designs on the French Coast. To achieve his vision he selected the 2:1 section of the Unités apartments as his basic

dwelling unit, using the variant with the shorter length below to take up the slope, connecting the individual units sideways to form rows, and then spacing four rows close together up the slope to delineate walkways and courtyards between them. The next three sections search for formative ideas that could have shaped the projects.

Peter Rowe (1987: 2-3) identifies three main protocols in architectural design. The first occurs where parameters and constraints are derived mainly from the context; the second, when a small number of “large ideas” inform the design; and the third, is “almost totally dominated by the a priori use of a particular building type as a model”. In each instance, early concepts are identified, the more appropriate ones explored, and the best one developed into a resolved design. He cites Le Corbusier’s Venice Hospital project of 1964 as an example of the first protocol where the city of Venice with its narrow lanes and small courtyards are the “primary themes” (1987: 28). Villa Savoye could be cited as an example of the second protocol where his normative Five Points of a New Architecture dominated the design completely. There can be no question that the Unités d’Habitation are examples of using available models. On the French Coast he applied all three protocols.

Contextual response

The first contextual consideration concerns the sloping sites. La Sainte-Baume has a slope ranging from a “moderate” five degrees at the bottom to a “steep” 18 degrees at the highest point. Roq-et-Rob has a fairly consistent slope of 12 degrees, classified as “strong” by Abbott and Pollit (1980: 50). Both they and Simpson and Purdy (1984: 89) recommend that multi-family housing should have staggered cross sections on steep slopes, calling them “stepped housing” and “cascades” respectively. Le Corbusier was thoroughly familiar with this typology. In 1933 he designed a number of long, stepped apartment buildings on the outskirts of Algiers, named the Durand Apartments (after the client). They were positioned on top of the ridge, but their section was perfectly suited to step down the contours (figure 4). A few years later Alvar Aalto’s stepped housing in Kauttua, Finland (1939) was completed, a Modernist project that was certainly known to Le Corbusier (figure 5).

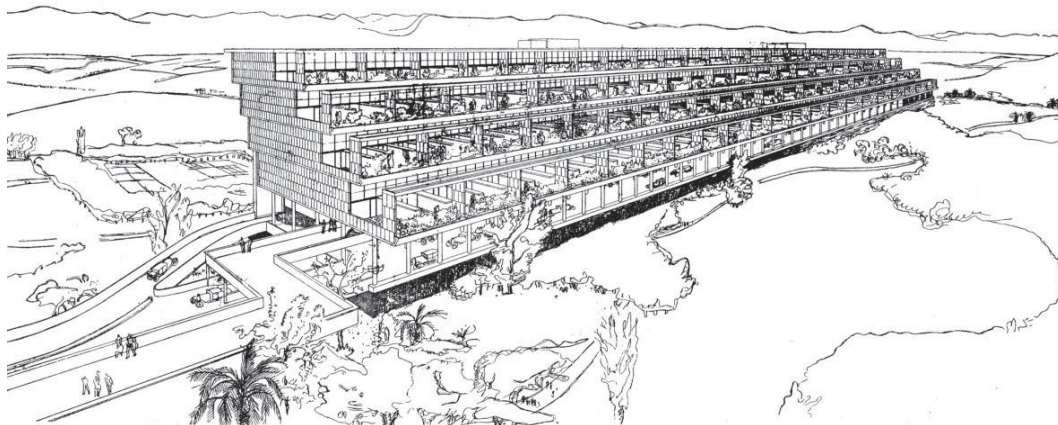


Figure 4
Perspective view of a stepped Durand Apartment building, Algiers, 1933 (Le Corbusier 1964: 294).

Le Corbusier had other ready-made options too. During the latter half of the 1930s his Unité d’Habitation emerged fully-fledged featuring a 2:1 section in yet another proposal for Algiers (figure 6). The columns could have compensated for the slope, but the sketch shows a level earth platform at the base. Surprisingly, an interior sketch showed the arched openings and double volumes that would eventually become prominent features of the schemes under study.

Even more surprising is his caption: “Bringing the home into harmony with the conditions obtaining in North Africa”.

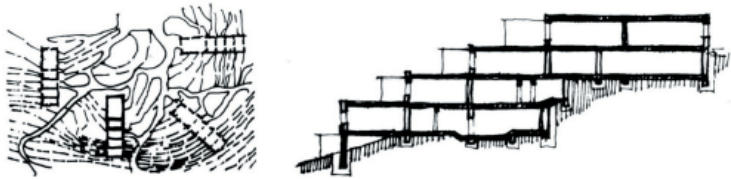


Figure 5
Alvar Aalto’s stepped housing in Kauttua, Finland, 1939
(site plan and section from Abbott and Pollit 1980: 45; photograph from www.eura.fi/matkailu/infobr.htm).

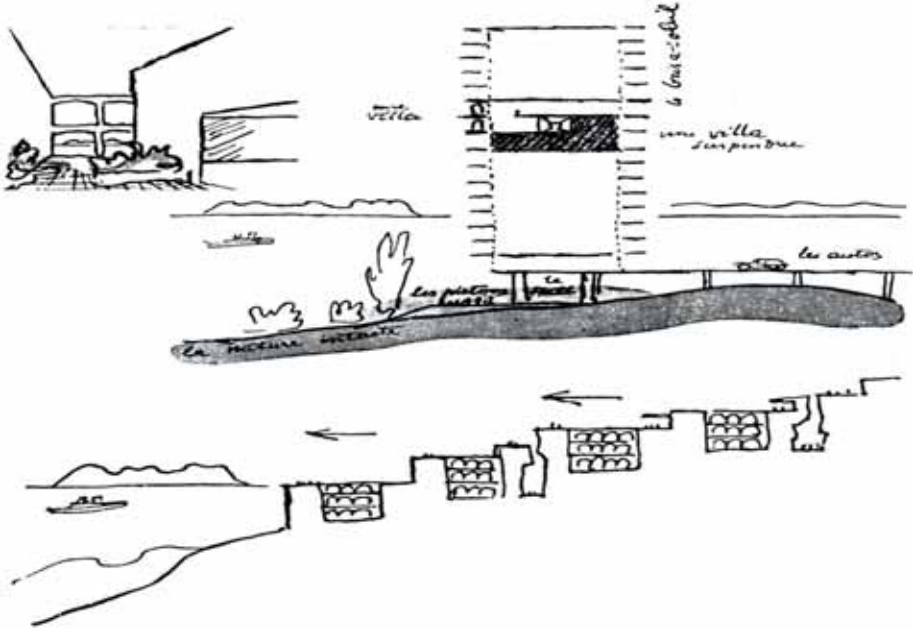


Figure 6
Conceptual section and interior view (Le Corbusier 1971: 126).

The second contextual factor is climate. The Mediterranean climate is characterised by hot dry summers and cold wet winters. The natural vegetation here comprises a variety of shrubs (low bushes), while the typical product crops include citrus, olive and viticulture. Natural forests are rare. The effects of the cold polar wind, called *mistral* in central France, are largely minimised

by building on the south-facing slopes in southern France (Evans 1980: 57), where both sites were situated.

Le Corbusier possessed experience designing for the Mediterranean climate. The first project was Villa Baizeau in Carthage, Tunisia (1928-1929), for which his first design was rejected and a more mundane version was built, but one that opens up to the breeze and as Deborah Gans (2006: 249) states, “began Le Corbusier’s search for a response to climate through form” (figure 7). Although he never visited the site, Le Corbusier himself alluded to the embryonic value of this house. He used it to illustrate his Third Compositional System, noting its influence on the formulation of the *brise-soleil* (1960: 81), a distinctive feature of both French Coast projects, derived via the façade configuration of the Unité d’Habitation in Marseille, just 30 km away from La Sainte-Baume.



Figure 7
Final design for Villa Baizeau, 1929 (source: Risselada 1989: 118).

Also in 1929, Madame de Mandrot, who hosted the first CIAM meeting in her castle, commissioned him to design a holiday house near Toulon in the south of France, situated on a hill, surrounded by vineyards, approximately 1.5 kilometres from the Mediterranean Sea (and coincidentally also about 30 km from La Sainte-Baume). Le Corbusier reasoned, according to William Curtis (1986: 112), that a white cube would have “violated the spirit of the place”, and like other houses in the vicinity he decided to use the local stone. He did this with a stone plinth and some stone walls, and a concrete frame filled in with plastered and painted masonry walls with steel framed windows (figure 8). It responded to the vernacular of a specific landscape and was designed specifically for that place. For the first time there is evidence of a true regionalist approach in contrast to his Purist houses which were “universal” solutions. Climatically, however, the house was not a success, and at one stage the client complained that the house was “uninhabitable because of damp and other problems” (Gans 2006: 123). That must have alerted Le Corbusier to the perils of designing in a coastal environment.

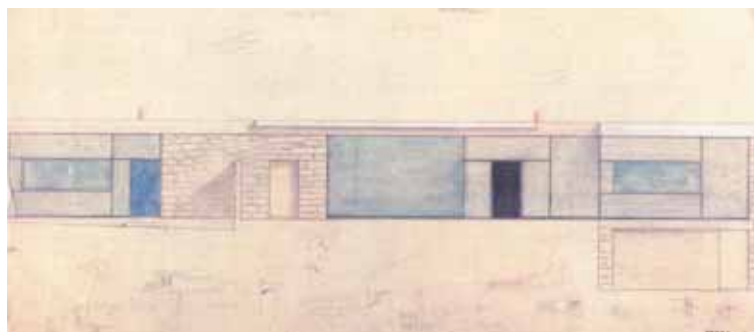


Figure 8
Villa Mandrot, 1929 (source: Graves 1981: 34).

The third contextual consideration was the local built fabric. At both La Sainte-Baume and Cap Martin the local vernacular is clay tiled roofs over stone or plastered masonry walls (figure 9). Le Corbusier would never have considered pitched tiled roofs in any case, but perhaps because of the problems caused by the porous local stone in H el ene de Mandrot's house, he avoided that too. Regarding the prevailing local vernacular tectonics and materiality, his response was therefore somewhat indifferent.



Figure 9
Views of Roquebrune-Cap Martin (source: Google Earth/Roquebrune-Cap Martin).

The fourth contextual response was to the views. At La Sainte-Baume each unit would have enjoyed a view of the entrance to the cave of Mary Magdalene against the mountain ridge called Massif Sainte Baume. The Mediterranean Coast lays some 20 km behind the ridge. At Roq-et-Rob the south-facing slope allowed Le Corbusier to exploit the views of the Mediterranean Sea fully, and a site section revealed that he carefully plotted sight lines to ensure that this was the case. It is clear that at Roq-et-Rob he could place the rows of houses much closer together than at La Sainte-Baume without compromising views. Had he used the same spacing at La Sainte-Baume the two bottom rows would each have obstructed the views from the units behind them; a very pragmatic decision (figure 10).

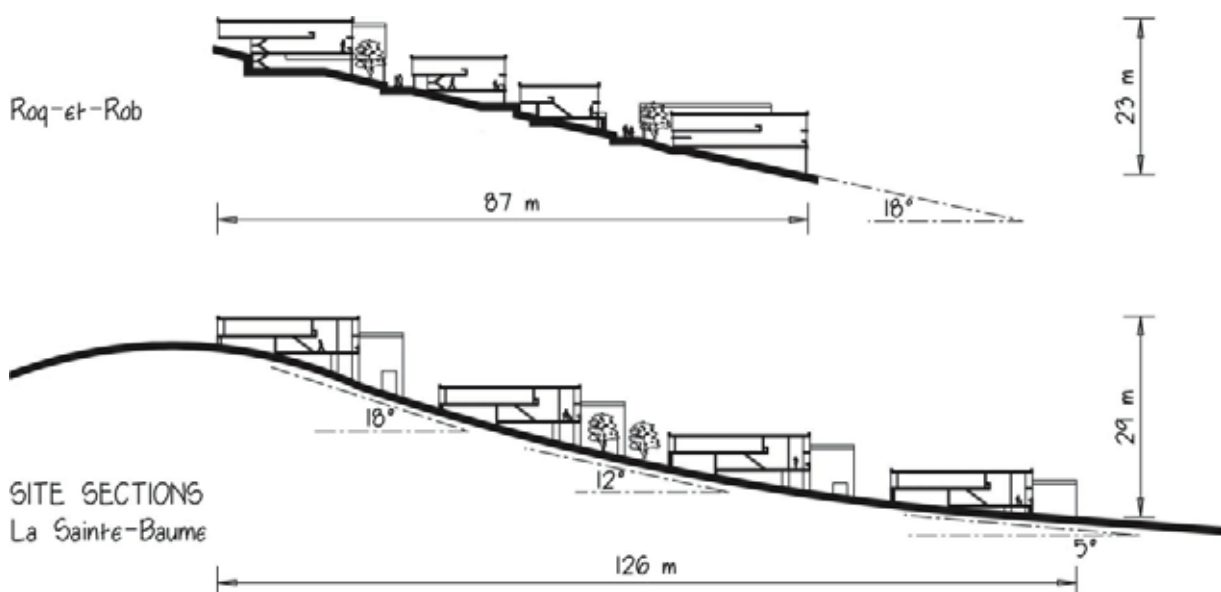


Figure 10
Site sections (drawing and measurements by the author).

Major ideas

The first major idea was the form of urban patterns of vernacular Mediterranean settlement (figure 11). Curtis (1986: 168) writes that “the drawings [of the projects under study] evoked the image of a primeval settlement attached to the hillside”. The imagery was certainly deliberate and there is sufficient information available to be slightly more specific.

From 1929 to 1942 Le Corbusier visited Algeria a number of times and carried out a large number of projects, mainly in Algiers. During that time he visited the valley of M’zab in the Algerian desert (present day Mauritania). Curtis (1986: 115) writes that he declared that “out of simple deference to imperative local conditions a North African architectural style appears ...”. The Arab mashrabiyas and Moroccan brick screens were now translated into *brise-soleil*, and added to the free façade; however, “its regionalism was not so much cultural as climatic”. Le Corbusier clearly became fascinated by the vernacular forms in North Africa, in particular those of the Mzab in present-day Mauritania (figure 12). Curtis (1986: 115-116) comments:

Here he was captivated by the harmony between people, buildings and landscape, as well as by the ingenuity of the vernacular in dealing with local materials and the hot climate. The low houses blended with their natural setting and used shaded courtyards, ventilation holes, thick mud walls and careful orientation to keep out glare and heat.

He realised that through a process of adaptation and tradition, vernacular type-forms were also rigorous and he now searched for ways of “blending the substructures of the vernacular – their principles of organisation – with the rules of his own vocabulary”. More revealing are his comments (quoted in Risselada 1989: 60):

Arab architecture can teach us a great deal. It favours the act of walking; this is the means, by moving from one place to another, with which to experience the articulation of architecture. Here is a principle opposed to that of baroque architecture, whose conception was a theoretically determined centre. I prefer the lessons taught by Arab architecture.

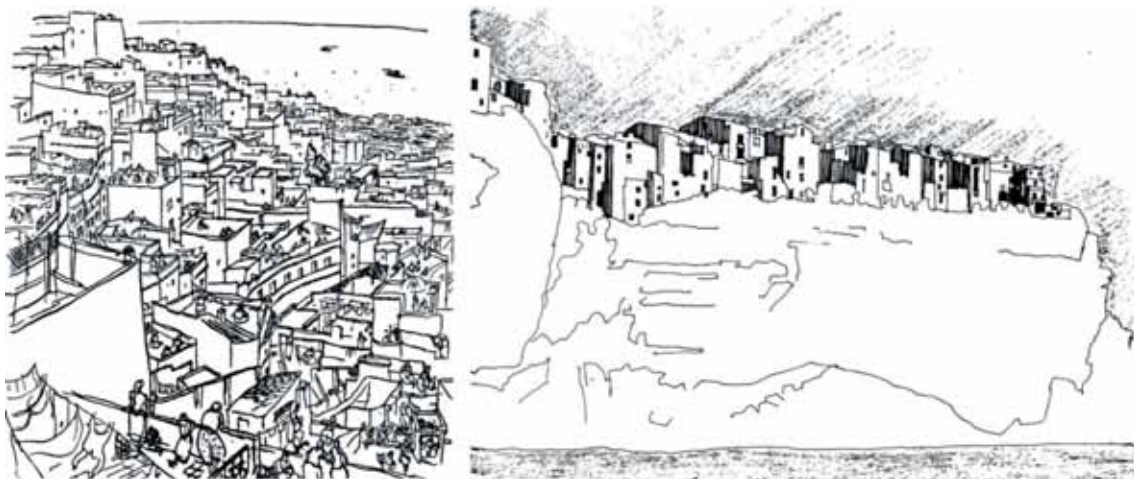


Figure 11

Left: drawing of the Casbah by Brouty (source: Le Corbusier 1964: 233).

Right: clifftop dwellings in Corsica (source: Abbott and Pollit 1980: 11).

Le Corbusier admired not only the M’zab, but also the Casbah, which he described as “a masterpiece of architecture and town-planning” (1947: 102). As with his travels to the sites of antiquity in 1907 and 1911, he again recorded his observations in numerous sketches. Although he certainly experienced historic towns favouring pedestrians in Europe, I believe it was the North African experience that finally convinced him that the total exclusion of cars was a workable solution.

The other dominant pattern is the way the Casbah occupies the land – low, compact, following contours and with narrow alleys defined and shaded by the building fabric. *Looking at city planning* (1971) features a rough section through the historic Casbah showing how the buildings step down to the sea (figure 13). In that publication Le Corbusier (1971: 126) asserts that new planning should, like the historic Casbah, recognise the “constituent elements of the natural setting”, noting that “the city planning of the Arabs is excellent”.

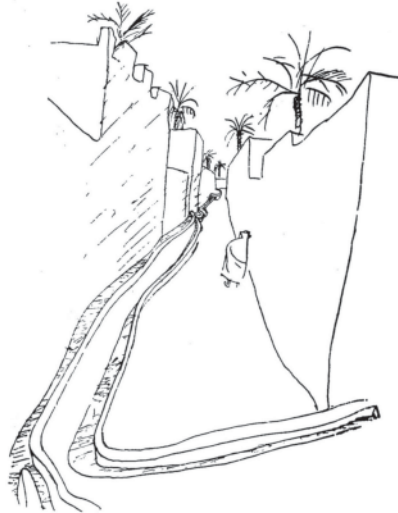


Figure 12
Le Corbusier’s sketch of a quiet lane in the M’zab (Le Corbusier 1964: 232).

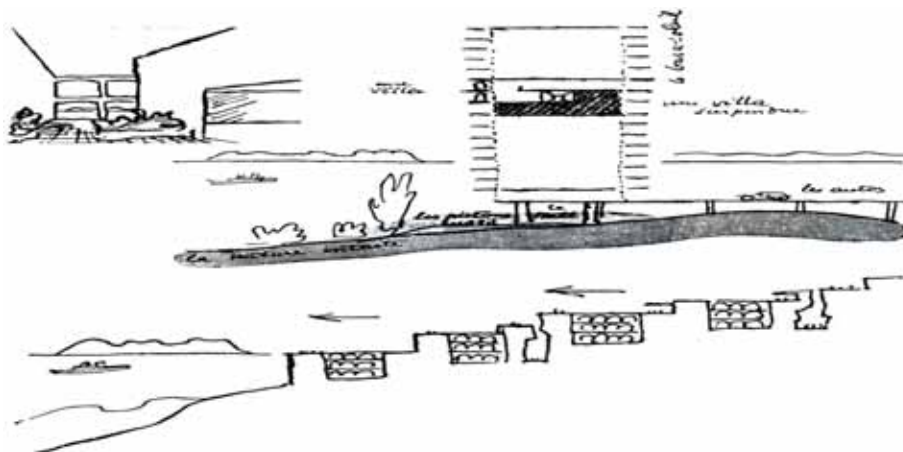


Figure 13
Section through the Algier’s historic Casbah (Le Corbusier 1971: 122).

The second major idea was the recognition of the spiritual female presence. La Sainte-Baume was planned on the site of a pilgrimage centre dedicated to Saint Mary Magdalene – a cave in which she lived for thirty years, according to French Catholic tradition. In 1948 the owner of the property, Edouard Trouin, the famous artist, Fernand Léger, Dominican Father Couturier and Le Corbusier planned an underground basilica. Combined with this invisible architecture would have been a “City of Peace and of Contemplation” (Le Corbusier 1958: 304). Although Le Corbusier was agnostic, he was nonetheless sensitive to religious mysticism and it is quite plausible that he would have wanted to celebrate the female deity. How? In 1923 he described the cuboid form as “masculine” and the parallel Monol vaults as “feminine” (Gans 2006: 207); vaults are the most distinctive tectonic feature defining the dwellings.

The third major idea was the analogy of the cave. Le Corbusier’s early elevations of these projects remind one of a troglodytic town as found in the Mediterranean – caves cut out of

rock to serve as burial places in prehistoric times and as dwellings and refuges in the Middle Ages. There can be no doubt that he intended each unit to be a sanctuary, a place of quiet and tranquillity, and the cave – like the womb – is after all the ultimate, primordial refuge. Since Mary Magdalene’s “holy cave” is a powerful symbol, it is not inconceivable that Le Corbusier extended the idea of “cave” to the design of the settlement. There might have been another, less spiritual association. The buildings in front of and flanking the entrance to the cave are built flat against the cliff face, also creating a troglodytic image, but visible from the site (figure 14).



Figure 14

La Sainte Baume – entrance to the cave of Mary Magdalene (source: Google Earth/Sainte-Baume).

At Roquebrune-Cap Martin, where Roq-et-Rob was located, there are no natural caves, but by the end of the 15th century the Grimaldis (who rule Monaco to this day) had dug tunnels into the rock face so as to house cannons in case of attack from the sea. Their fortress, the Chateau of Roquebrune, also featured spaces with curved ceilings (figure 15), replicated in both Roq-et-Rob and La Sainte-Baume.



Figure 15

Arched ceilings at the Chateau of Roquebrune (source: Google Earth/Roquebrune-Cap Martin).

The closest true troglodytic examples are situated at Corsica, 200 km away. What I find particularly interesting is that Bernard Rudofsky (1964: 146-147) writes that rectangular houses with vaulted roofs are often found near troglodyte dwellings on both the Aegean and Tyrrhenian coasts, areas probably known to Le Corbusier. Furthermore, he explains, from a photograph, the “transition from cliff-face dwelling to half-dug and, eventually to freestanding houses” (figure 16). The Greek west coast is, however, 1,100 km away and Le Corbusier’s perception of regional relevance is, as we know well, somewhat broad.



Figure 16
Rectangular houses with vaulted roofs on the Greek coast (source: Rudofsky 1964: 147).

Myron Goldfinger (1993: 18) suggests that the roofs of La Sainte-Baume were inspired by the Tunisian living-storage ghorfa (figure 17), whereas the “more refined” Roq-et-Rob bears a closer resemblance to the vernacular houses of Santorini, recognising the two different construction systems that Le Corbusier had envisaged. Goldfinger (1993: 158) writes that ghorfas were built by Tunisian tribes who had to abandon their mountain caves and move to valleys where they built the “simple, barrel-vaulted stone structures ... with small, dark, deep interiors that echoed the intimacy and security of their natural cave dwellings”. He (1993: 166) also describes Berber villages south of Tunis “constructed almost entirely from the repetition of a single distinct architectural element – a barrel-vaulted, one-storey, rectangular block”. Thus we find the cave associated with barrel-vaulted rectangular houses on both sides of the Mediterranean, which could have been a major reference for Le Corbusier in his search for an appropriate form, especially considering, as Peter Blake (1960: 123) puts it, “his intuitive sense of tradition and of historical continuity”.

The vaulted house, however, would not automatically have given Le Corbusier the troglodyte effect he seemed to have wanted. Nevertheless, had he combined the typology with that of the megaron it would have done so. A megaron is an oblong structure with an entrance porch (figure 18) that originated in present-day Turkey and became traditional in Greece about

2000 BC. The porch would have given him the depth to emulate the image of a cave from the outside.

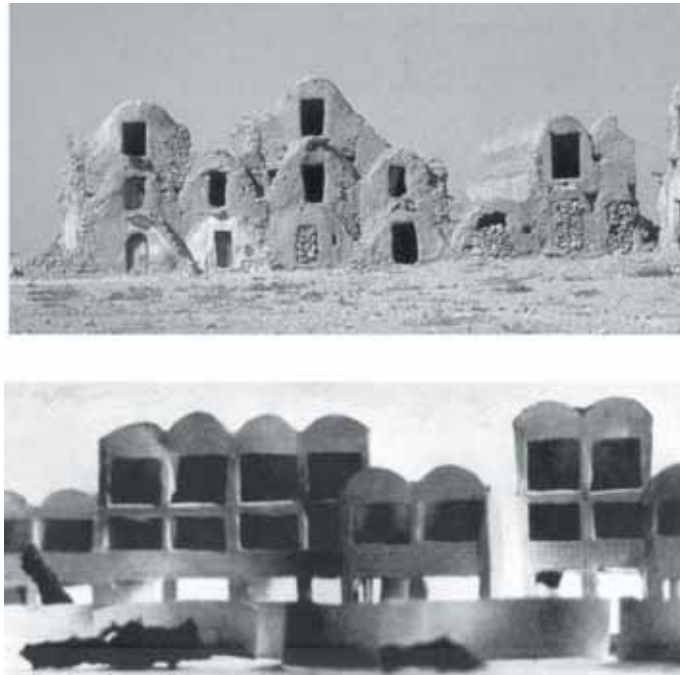


Figure 17

A Sainte-Baume model compared with Tunisian ghorfas (source: Goldfinger 1993: 18, 159).

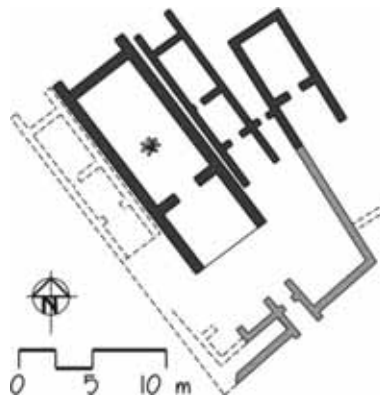


Figure 18

A cluster of Troyan megara from ca 2000 BC (drawing by the author after Robertson 1943: 21).

Proven typologies as models

It is perhaps ironic that Le Corbusier possessed mature and fully-developed patterns in his toolkit with which he could respond to all of the above. Rowe (1991: 122), like many others, recognised that Le Corbusier not only ascribed to a number of “preferred spatial concepts”, but also often employed “formal type as a guiding idea”. He suggests that Le Corbusier used analogy (1991: 31), both from historical precedent and concepts that he had previously developed, as well as “design rules” (1991: 65), while both of these approaches could arguably constitute the application of a priori ideas.

The vaulted roof first appeared in his Monol Housing (1919), consisting of a concrete frame covered with curved, corrugated asbestos sheeting and walls comprising flat asbestos

sheeting filled in with rubble (figure 19). The Weekend House (1935) outside Paris had a slender concrete frame and vault. The roof was grassed and the walls were constructed with undressed stone and glass bricks, a radical departure from his slick, white Purism of the 1920s. Kenneth Frampton (2001: 137), in his usual self-assured manner, calls the Weekend House a “troglodyte dwelling” and is adamant that it derived its form from the “vaulted Mediterranean megaron”.

In 1942 Le Corbusier designed an agricultural estate in Algeria, with stone walls and vaulted roofs in local hollow blocks. This building was planned for views of the Mediterranean Sea to the north and the mountains to the south. Built subsequent to the two projects under review, the celebrated Maisons Jaoul (1954), and the equally iconic Sarabhai House in Ahmedabad, India (1955), both feature unplastered clay bricks and rough concrete, which explains the vaulted profile of the housing units.

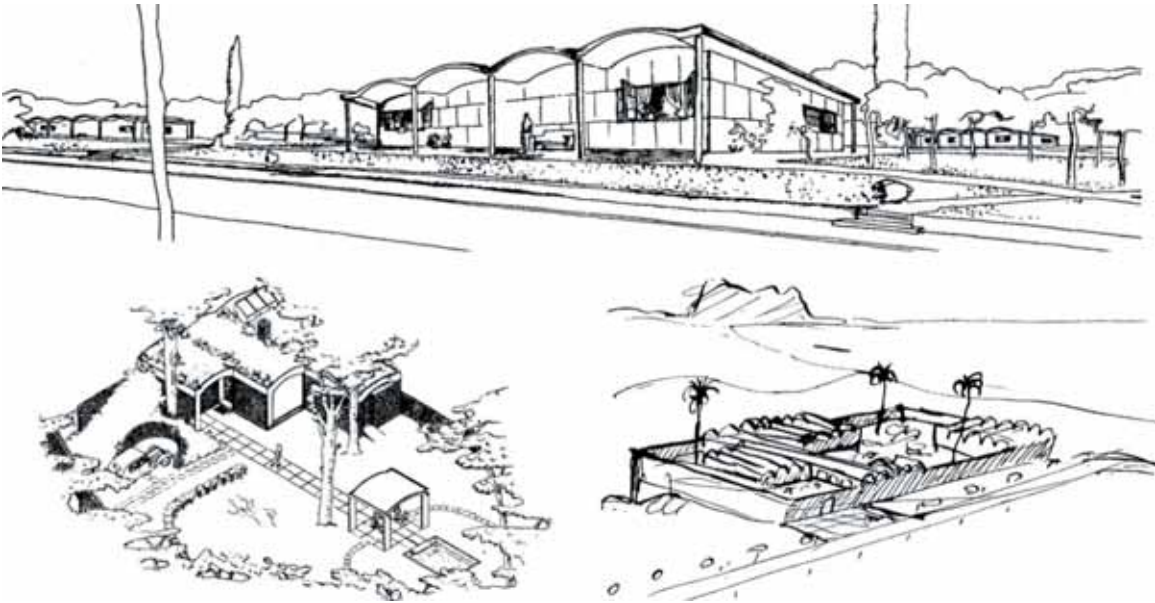


Figure 19
Top: Monol housing, 1919 (Le Corbusier 1927: 242).
Bottom left: Weekend House, 1935 (Corbu’s drawing in Graves 1981: 92).
Bottom right: Agricultural compound in Algeria, 1942 (Le Corbusier 1960: 144).

What about the unit form? The distinctive 2:1 section and configuration first appeared in his 1929 proposal to Edmond Wanner for rental apartments in Genève (figure 20). These were to be accessed by means of a central corridor at every second level, exactly the same concept he would use in his Unités seventeen years later. It was envisaged as a steel framed building with a fully glazed façade, the same construction he applied to the 45-unit Clarté apartment block in Geneva in 1932 for the same client.

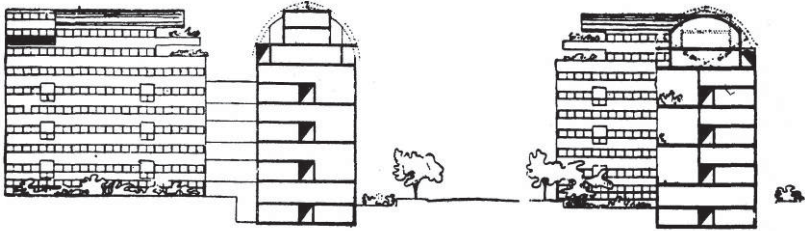


Figure 20
Elevations and sections of the proposed Wanner apartment project for Geneva, 1929 (Corbu’s drawing in Teige 1932: 336).

I assume that the section was quite unique at that time. How did Le Corbusier conceptualise it? He writes that “we arrive quite logically at the plan for South Marseilles [the first Unité d’Habitation]” from the primitive hut and nomad’s tent (1960: 160-161). The leap is certainly an amusing case of oversimplification and post-rationalisation (figure 21), especially since he mostly wrote his theories after designing a project.

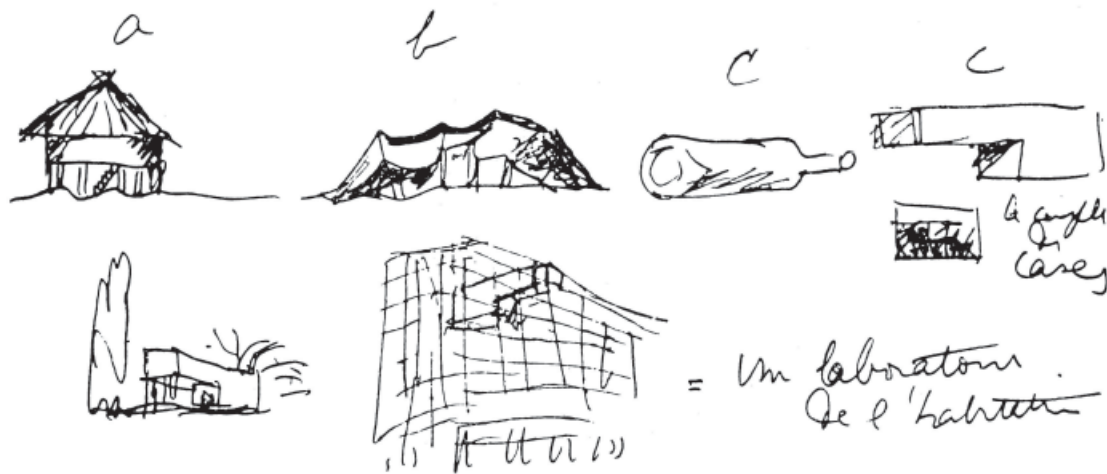


Figure 21
From hut to Unité. Sketch from 1946 (Le Corbusier 1960: 160).

As illustrated in figure 20, he conceptualised the Unité d’Habitation typology many years earlier, and by the early 1940s it was resolved and ready for application (figure 22). For the partly-destroyed Old Port of Marseilles, in 1943 Le Corbusier sketched a proposal for a new residential precinct of 40,000 inhabitants to be housed in a large number of Unités perpendicular to two prominent axes, linked to the Old Port with Boulevard Michelet, along which more Unités would be located (Boesiger et al. 1967: 344-345). Marseille, and Boulevard Michelet, a few years later, would become the setting for the first Unité d’Habitation, which was under construction while the two carpet schemes were being planned.

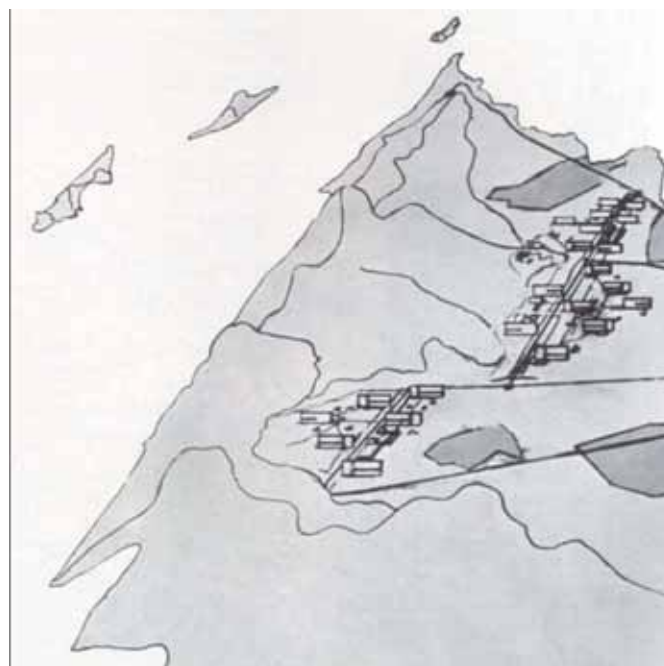


Figure 22
Marseilles-Veyre, 1943 (source : Boesiger et al. 1967: 344).

The third available pattern was the façade. The balconies, balustrades and brise-soleil of individual units were directly derived from those of the Unités, with only vaulted roofs added (figure 23). Interestingly, each unit was roofed by two parallel vaults while their supporting columns divided the balconies below into two, accentuating the verticality of the individual bays.

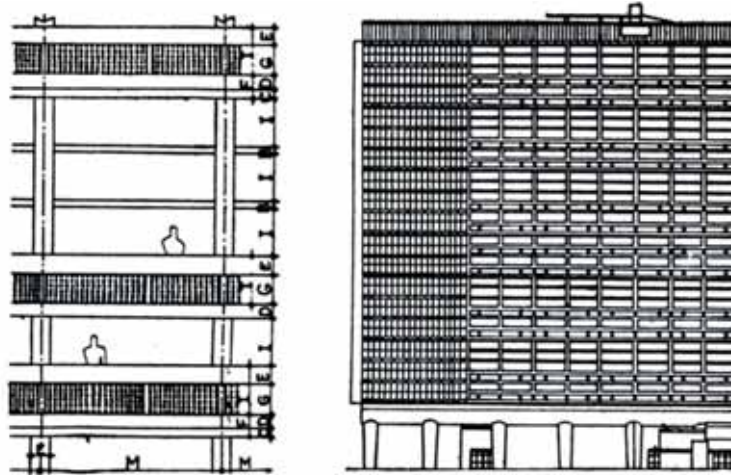


Figure 23

Early studies for the elevations of the Unité d'Habitation (Le Corbusier 1951: 135).

Considering how vigorously he propagated the vertical neighbourhood, as exemplified by the Unités d'Habitation, it is perhaps puzzling that he did not consider it for these projects, especially since, in the 1930s, he envisaged a Unité for a very similar site in Algiers. However, after Villa Savoye (1929), he consistently confused his admirers (and critics) with unexpected and innovative designs. For example, two unexecuted projects of 1939 are both evident of a strong vernacular approach (figure 24). The Les Murondins were conceived as self-built houses with log roofs over rammed earth walls for refugees in France and Belgium (Le Corbusier 1960: 142). The Mesopotamians were intended to be mass-produced terrace housing, inspired by the morphology of traditional houses of present-day Iran (Le Corbusier 1960: 143). Of the latter he added that he “harness[ed] the wisdom of the ancients”.

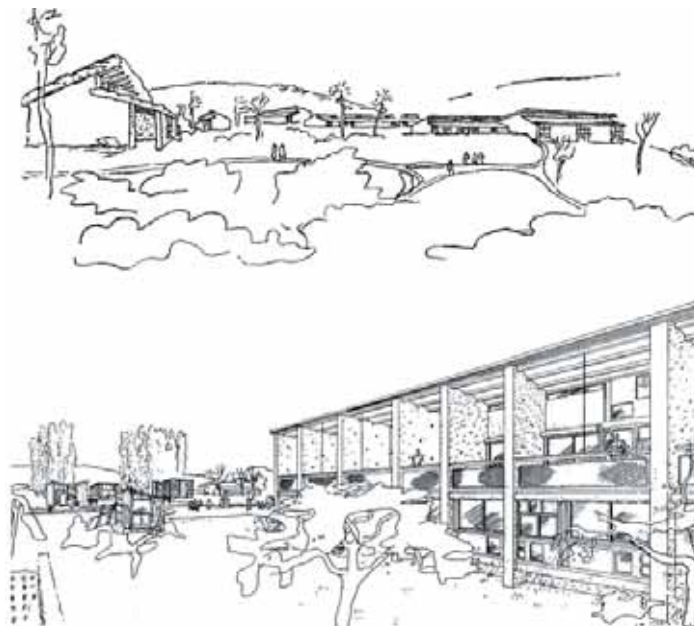


Figure 24

Top: Les Murondins (Le Corbusier 1960: 142). Bottom: Mesopotamians (Le Corbusier 1939: 143).

Site planning – the urban dimension

Curtis (1986: 168) writes that “the idea [behind Roq-et-Rob] was to halt suburban sprawl by increasing density, but in a way which harmonised with the area”. One first thinks of this as a project to formulate a generic response, until realising that large properties adjacent to the sites are being subdivided and that badly planned freestanding houses “in all styles” were proliferating. Boesiger and Girsberger (1967: 132) explain that Le Corbusier studied ancient, coastal hilltop towns and discovered two requirements: A good view is a prerequisite, and buildings must be clustered in order to protect the countryside. They note that the historic houses “are crowded together but all have eyes (windows) towards the infinite horizon”. These principles fundamentally shaped the projects.

Published the year before he designed La Sainte-Baume, his book *Concerning town planning* set out “the doctrine of contemporary architecture” that is intended as “a lawful code of land utilization”. He presented it as an entirely pragmatic five-step urban strategy that is certainly more normative than prescriptive (1947: 115-116): (1) Establish a “sensible” scale for plans based on an hour’s walking (about 4,800-5,000 m); (2) Address requirements for sun, space and green; (3) Determine building coverage; (4) Determine density to reflect use and envisaged character; (5) Determine the perimeter of the town; its urban growth boundary.

Although the first criterion was not relevant, it is clear that he indeed considered the other four very carefully (figure 25). But although both achieve a coverage of about 60 per cent, the former contained open space as the private domain of the household, whereas the latter conceived open space as a communal, semi-public realm. Roq-et-Rob comprised more units per hectare because the houses were on average smaller. The population density was calculated by counting the beds. At, say, 50 units per hectare La Sainte-Baume is a medium-density solution and indeed a viable alternative to suburbia. Roq-et-Rob would have occupied land in a similar manner as a resort.

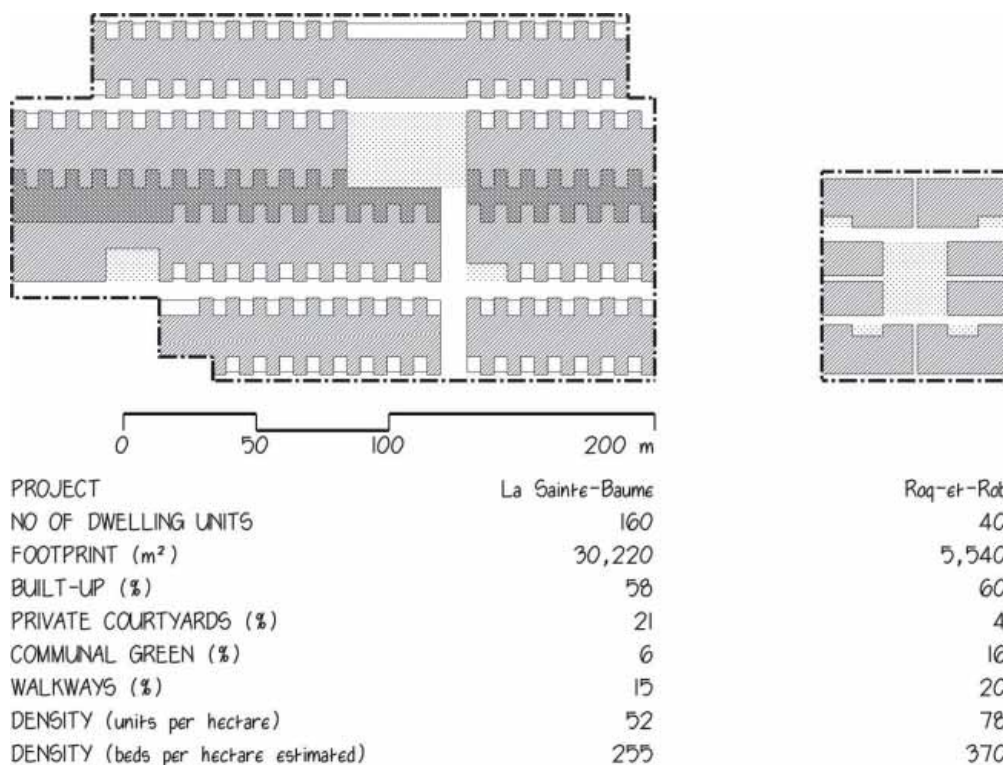


Figure 25
Land-use intensity (drawing and analysis by the author).

The comparative analyses of one hectare fragments below resulted in some significant observations (figure 26). Most surprising (to me) was how closely the land-use pattern and intensity resemble that of an historic North African town. We do not know how deliberate that similarity is. Another important deduction is that Le Corbusier's ground-orientated projects became increasingly denser over time, with coverage increasing from a mere 20 per cent in 1925 to 60 per cent in 1949. The Scottish fishing village depicted below is quite typical of vernacular settlement in Europe and the British Islands where the requirements of carts drawn by horses and mules determined the circulation patterns (and the public realm). A coverage of fifty per cent is nonetheless quite respectable.

The third, and I believe the most important observation, is that with the exception of the designs by Atelier 5 and Ando, subsequent carpet schemes rarely achieved the same density as La Sainte-Baume; for example, the large scheme consisting of 986 courtyard dwellings in Albertslund, outside Copenhagen, that was completed in 1968 and designed by Møller-Jensen and colleagues. The scheme was laid out in a geometric carpet pattern, and as Norbert Schoenauer (2000: 423) writes, this layout possesses a more urban character than, for example, Utzon's parkland schemes. However, because private cars are accommodated throughout the project, the coverage is only about 30 per cent, half that of the pedestrianised French Coast projects.

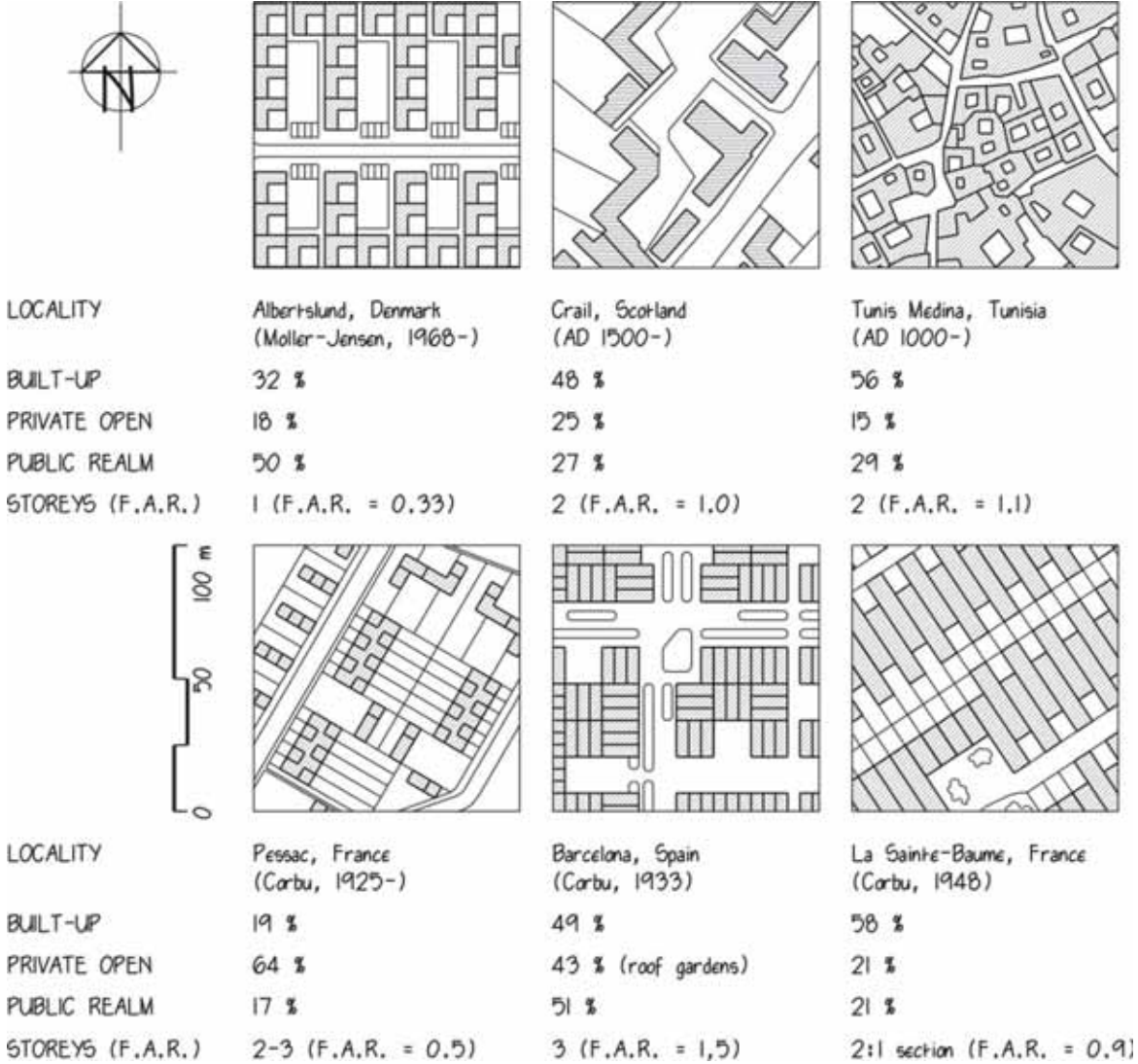
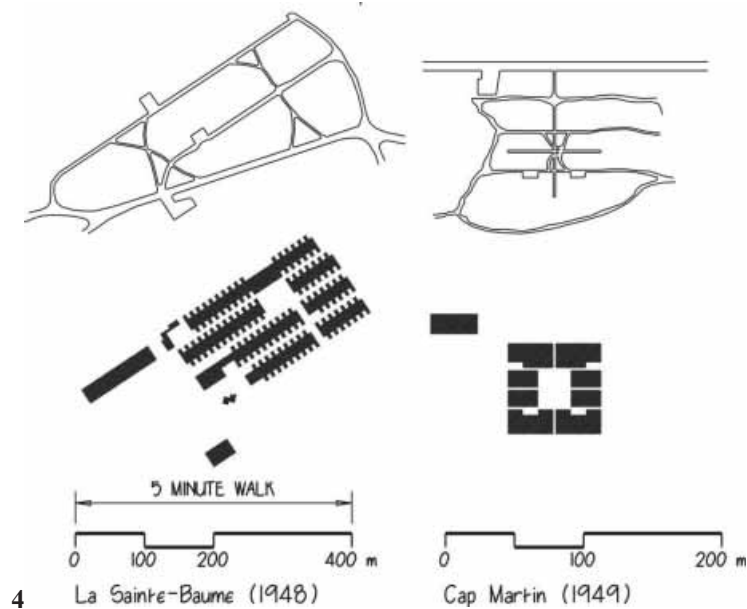


Figure 26
Comparison of land-use intensity (drawing and analysis by the author).

Another feature of the site planning of both projects is that, in contrast to a street grid with perimeter buildings, the figure ground drawings show no obvious relationship to the circulation pattern, in spite of the row units actually defining the pedestrian lanes (figure 27). This is because the perceived formality of the straight lanes is obscured by the informality of the paths connecting them. The units located outside the perimeter of the main blocks spoil the cohesiveness of the layout somewhat, but the main blocks, in particular those of Roq-et-Rob, have a graphic, pictorial quality, quite unlike a typical site plan for multi-family housing.



4 **Figure 27**
Figure ground and external circulation (drawing by the author).

The architecture

It is ironical that Le Corbusier's Unité multi-unit house types were probably not as good as his early designs, particularly those of Pavillon de l'Esprit Nouveau. Why he chose such a deep and narrow module (24.0 x 3.66 m) is simply not known. In hot dry climates, deep sections are a meaningful measure to keep the interior cool, and because of dust, cross-ventilation is not a requirement (Talib 1984: 64). But their climatic advantage on the northern shores of the Mediterranean is debatable. Christopher Alexander (1979: 235) criticises the arrangement and comments on the "terrible glare and discomfort". Charles Jencks (2000: 249) comments gracefully that "the feeling of protection and individuality is so strong that it is comparable to standing in a cave". Curtis (1986: 174) also notes the usual criticism that "the apartments are too narrow, [and] that the approach corridors are too dark". But he adds that "the present inhabitants of the building seem to have surmounted these problems, and are in the building by choice, because they find it a pleasant place to live".

On the French Coast, the long narrow sections were obviously deliberately chosen. Le Corbusier's drawing below (for Rio) could explain his intentions. (In a deep, narrow, darkish interior, the picture window would indeed resemble a back-lighted diorama.)

Le Corbusier (1927: 177) writes that "A plan proceeds from within to without; the exterior is a result of an interior". That was certainly the case regarding his designs on the French Coast. Once he settled on the 2:1 section, he modified the plans and adjusted the form accordingly. His sketches of the interiors are both more plentiful and more detailed than those of the exterior

elevations (figure 29). The drawings below also illustrate the fundamentally different spatial experiences he envisaged – La Sainte-Baume heavy and massive, and Roq-et-Rob light with the structure assuming a filigree quality. The former would also have been much darker inside than the latter with its internal courtyards.

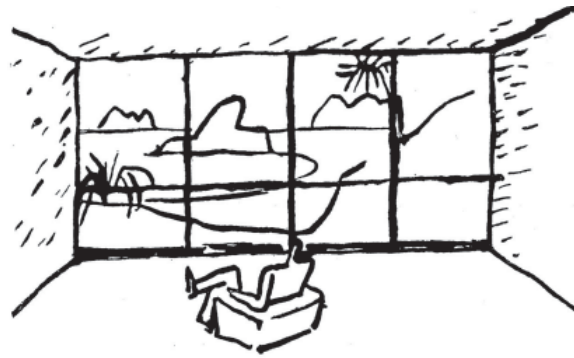


Figure 28

Le Corbusier’s comments: “The whole sea-landscape enters your room” and “the pact with nature has been sealed!” (Le Corbusier and De Pierrefeu 1948: 87).



Figure 29

Left: Interior view of a unit in La Sainte-Baume (source: Banham 1966: 93).
 Right: Roq-et-Rob unit (source: Boesiger and Girsberger 1967: 132).

Le Corbusier always possessed a propensity for narrow-frontage housing units. The table below indicates how he started off with Citrohan’s moderate 1:2.5 length-to-width ratio and proceeded to the much criticised 1:6.8 ratio of the Unités. Subsequently, curiously yet perhaps persuaded by criticism, he progressively reverted back to “fatter” plan forms (table 1).

Table 1
 A comparison of width-to-length ratios (measurements by the author)

| PROJECT | DIMENSIONS in metres | AREA m ² | RATIO width: length |
|---------------------------|----------------------|---------------------|---------------------|
| Citrohan, 1920 | 5.2 x 13.0 | 67.6 | 1:2.5 |
| Barcelona quarter, 1933 | 4.3 x 12.7 | 54.9 | 1:3 |
| Unités d’Habitation, 1947 | 3.7 x 24.0 | 89.0 | 1:6.8 |
| La Sainte-Baume, 1948 | 4.5 x 20.6 | 92.7 | 1:4.5 |
| Roq-et-Rob (long), 1949 | 5.4 x 20.5 | 110.7 | 1:3.8 |
| Roq-et-Rob (short), 1949 | 5.4 x 16.1 | 87.5 | 1:3 |

Referring to the Weekend House, Le Corbusier notes that when a building is wholly made up of a single strong form and no crafting of openings and external features is possible, then: “The designing of such a house demanded extreme care since the elements of construction were the

only architectonic means” (quoted in Frampton 1995: 345). On the French Coast the “elements of construction” were limited to the exceedingly simple 2:1 volume, its screen of the balcony, balustrade and *brise-soleil*, a roof consisting of two adjacent barrel vaults, and some supporting columns in front.

The elevations developed much less vigorously than the site layout, sections and floor plans (figure 30). An early decision was to cover each unit with two parallel vaults. These and their shared supporting columns are strong features of the façades, reducing the perceived width of a unit by half. Was this perhaps an effort to create human scale? And whereas the early elevations were rather amorphous, the elevations below display considerably more modulation. The refined elevation of Roq-et-Rob, especially, shows careful articulation.

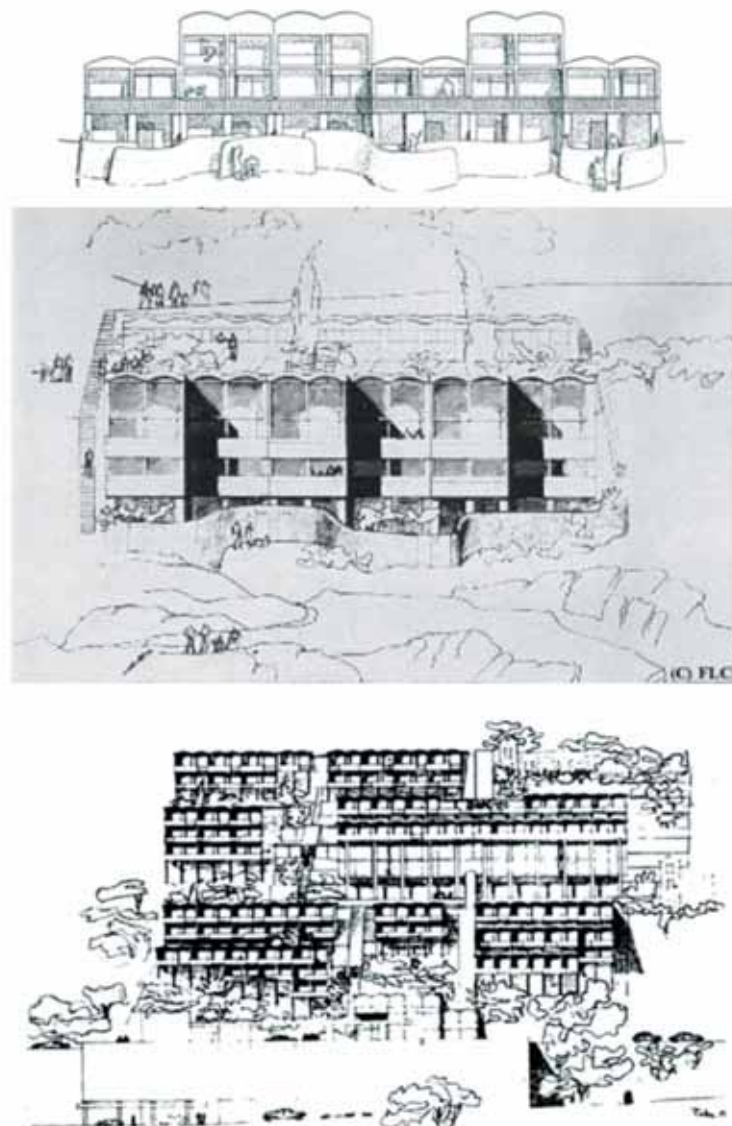


Figure 30

Top: Partial elevation of Sainte-Baume (Le Corbusier and Boesiger 1972: 98).

Middle: Partial elevation of Roq-et-Rob (source: <http://www.fondationlecorbusier>).

Bottom: Refined elevation of Roq-et-Rob (Le Corbusier and Boesiger 1972: 100).

The elements of construction certainly also include texture and colour. The planted roofs are a cue that Le Corbusier not only wanted to merge the buildings with the site – he wanted them to be the landscape, as if pushed up from the land. Both the Weekend House and Maisons Jaoul

– typologically similar to the projects under review – had grass-covered vaulted roofs and walls consisting of rough stone and rough, flush-jointed brickwork respectively. At La Sainte-Baume the rammed earth walls would have been between wooden shuttering. Sections of Roq-et-Rob show a thin skin and we can assume that the metal frame would have been enclosed with split timber poles fixed horizontally, similar to his cottage at Roquebrune, higher up the slope. Le Corbusier never revealed whether these were scientific or artistic ideas.

Le Corbusier’s dialectic between art and science

The reality is considerably more complex than simply reworking the Mediterranean vernacular. To gain a better understanding of his approach to design it is necessary to first consider his working methods. The French Coast projects are two of his great unbuilt carpet schemes – low, contour-hugging structures that cover the landscape like a crust. The others are a residential quarter for workers in Barcelona (1933) and the Venice Hospital (1964). His first carpet layout, however, was the much earlier design of a university quarter in 1925 (figure 31). In a brief description he reveals his method of design (1927: 260-261):

We have to classify, form a type and settle the form of the cell and its elements. Economy. Efficiency. And Architecture? We can always achieve it when the problem is clear.

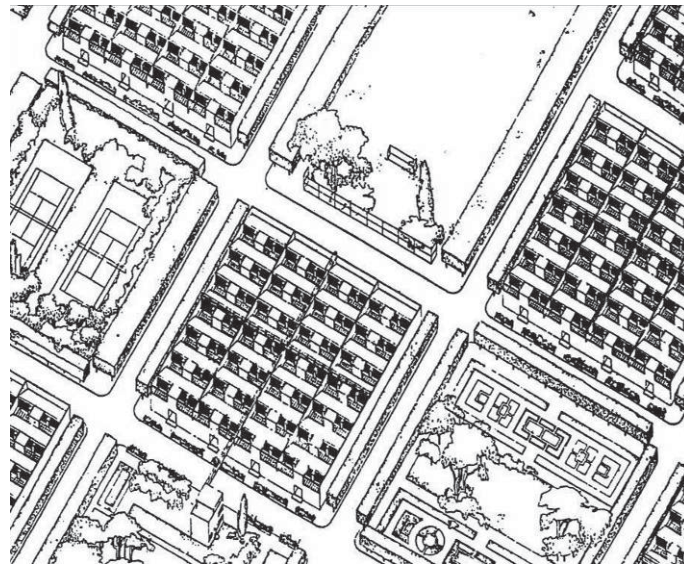


Figure 31
Axonometric view of the University Quarter, 1925 (Le Corbusier 1927: 260).

It is interesting that he considered what is currently popularly called “planning” a rational, exploratory process aimed at solving typological, functional and budgetary issues. “Achieving architecture” seems to be not only the more creative process of modulation and elevational treatment, but also that of determining the construction, a process we tend to associate with practical thinking. His drawings illustrating the two projects under study indicate that he moved into the process of creating “architecture”, but was never afforded the opportunity to fully “achieve” it.

Another pertinent method was his replication of concepts. Geoffrey Baker (1996: 280) comments that “once an idea was absorbed, it was retained, and he never escaped from the stranglehold that his theory imposed on him”. A theoretical approach, however, was not necessarily a handicap; it ensured that a conspectus of ideas – his toolkit – was intermittently tested and refined. The trajectory of the 2:1 unit section from a tentative diagram for the Wanner Apartments (1929) to Roq-et-Rob twenty years later clearly demonstrates that.

The third method was his reinterpretation of historical precedent. There is a perception that he rejected historical precedent; however, that was simply not true, evident in Le Corbusier's writings: "Past history provides us with innumerable and forceful examples. Foresight and control are essential" (1929: 264). Curtis (1986: 228) suggests that "along with nature and geometry, Le Corbusier's other great inspiration was tradition ... [trying] to penetrate to the generating principles". Tzonis and Lafaivre (1985: 7) write: "Le Corbusier plundered history ... in order to grasp, control and transform the given modern reality". Architects and urban planners have learned, from Le Corbusier, that rigorous investigation should underpin design, centred on the proper analysis of the problem. From his sketchbooks and writings we know that he analysed historical precedents in great depth. In fact, he wrote (quoted in Curtis 1986: 36):

The greatness of past inventions should be repeated not through imitation, but through a reiteration of constants, and a search for equivalent magnificence in modern terms.

Although he was an avid reader, unquestionably his travels were the most formative. Le Corbusier travelled to North Italy, Tuscany, Ravenna and Budapest in 1907 and to Prague, Vienna, Budapest, Turkey, Greece and southern Italy in 1911. In Athens he was fascinated by the Acropolis and the monastic establishments in Greece, and in Italy, by the courtyard houses of Pompeii, capturing impressions and surveys in a number of sketchbooks that are still being published (Le Corbusier 2000). He visited Brazil and Argentina for the first time in 1928 and Algeria in 1929; from that point onwards we find more earthy, relaxed, curvilinear and sensuous qualities in both his architecture and town planning, contemporaneous with some celebrated international style projects (Salvation Army Refuge of 1929 and the Swiss Pavilion at the Cité Universitaire of 1930, both in Paris).

The fourth method was painting. Apart from what Baker (1996: 289-290) describes as "an attempt to draw inspiration from phenomena of all kinds and to try (successfully in many cases) to incorporate these into his architecture", Le Corbusier also developed "conceptual strategies" and formal skills by painting every day. Painting was one of his passions that was pure "art" in the strictest sense of the word. His (1960: 219) comments are certainly revealing:

Painting is a bitter struggle, terrifying, pitiless, unseen; a duel between the artist and himself. The struggle goes on inside, hidden on the surface. If the artist tells, he is betraying himself!

This "bitter struggle" is studied by Ora Joubert (1999: 144), who concludes that Le Corbusier's philosophy of first clarifying methodological and metaphysical issues through his paintings, and subsequently applying them to buildings, "sustained him throughout his entire architectural career". Le Corbusier (1927: 16) notes that Larousse defines art as "the application of knowledge to the realization of a conception". Blake (1960: 138) writes that: "To Corbu, the idea of an art without a body of laws is totally irresponsible", adding that "the rule of law is a poetic vision". To help him in his "bitter struggle" he applied "a body of laws" to his paintings – regulating lines (figure 32). Of the painting below, Le Corbusier (1951: 215) writes amusingly that he has been using regulating lines for setting out paintings "for more than thirty years", but adds "as the years go by and the memory begins to falter it is very difficult to rediscover the regulating lines in a work dating ten or thirty years back, unless, by a wise stroke of foresight, the points of reference have been marked"!

Baker (1996: 300) points out that although the vaulted forms of the Jaoul Houses are "unfamiliar and unrecognizable as dwellings", they have a "lyrical sensuality" and "curvilinear rhythm" that are clearly derived from his paintings. This observation is equally valid for the French Coast projects. He is adamant that Le Corbusier used his own paintings and sketches as a source of his symbolism and compositional understanding. Moreover, whereas his Purist buildings are characterised by a precise juxtaposition of primary forms, "the imagery of [his

later work] is more varied and the contrasting forms have a greater range of meaning” (Baker 1996: 309). Even so, his later paintings were still based on regulating lines.

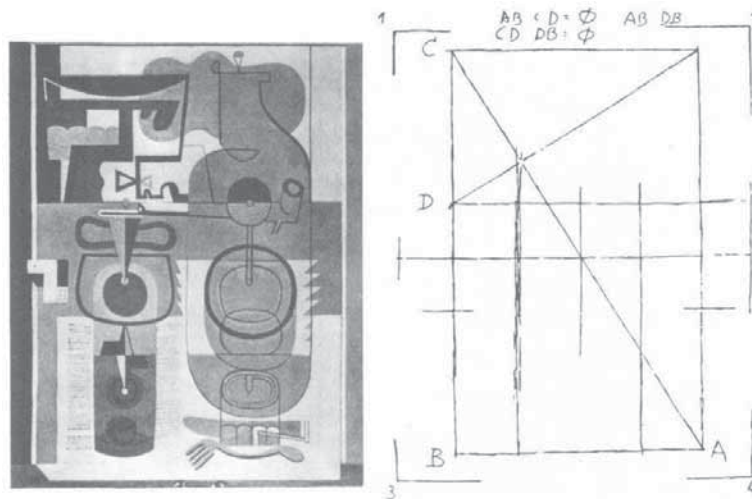


Figure 32
Regulating lines for an undated painting (Le Corbusier 1951: 215).

Le Corbusier considered the same regulating geometries that he applied to his paintings as “one of the means by which architecture achieves that tangible form of mathematics which gives us such a grateful perception of order”. Did he apply the same method to settlement? Indeed. He writes: “What we need is towns laid out in a useful manner whose general mass shall be noble (town-planning)” (1927: 40). In *The Modulor* (1951: 34-35) he is more explicit:

The regulating lines do not bring in any poetic or lyrical ideas; they do not inspire the theme of the work; they are not creative; they merely establish a balance. A matter of plasticity, pure and simple.

He then proceeds to describe the illustration below (figure 33), stating that the “small houses, public buildings, complex architectural groups...make use of the golden section, the place of the right angle, the height of 2.2 m (man with arm upraised)”. Further on, in the same book (1951: 77-78) he reiterates that the façade of a building is perceived in the same format as that of a painting, and can be set out according to the same rules of format, dimension, length, width and angles in a “perfectly, strictly, objective” manner (figure 34). But now he adds that urban entities must be treated differently:

[Consider] a composition combining urbanism and architecture, which sets a group of large buildings in a landscape. The rule is not apparent at first glance, the eye sees nothing absolutely frontally, the buildings rise in tiers one behind the other, and the ground retreats into the distance. Yet the rule will make itself felt, a subjective sensation, and a more or less intellectual one.

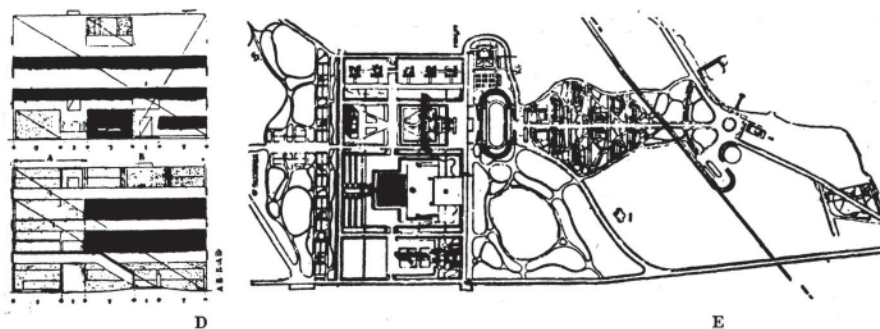


Figure 33
Proportional and dimensional systems applied to both small buildings and complexes (Le Corbusier 1951: 35).

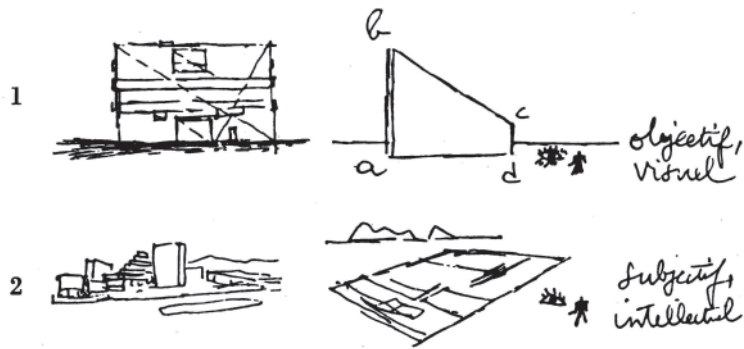


Figure 34
Regulating lines in architecture and urbanism (Le Corbusier 1951: 77).

The quote above might have applied directly to the French Coast projects! These statements were published in French in 1948, exactly the same year he designed La Sainte-Baume and a mere three years before he designed Chandigarh and the three buildings that constitute the Capitol Complex. However, the drawings show no setting-out lines like those on the house façades above – dimensions are wholly based on a proportioning system that he called “the Modulor”. The Modulor was a measuring tool, based on the human body and on mathematics, specifically the rules of the Golden Section and the Fibonacci Series (Le Corbusier 1951: 55).

Within that dimensional and proportioning framework, functional requirements and the need for sun protection, Le Corbusier clearly designed the Palace of the Assembly in a creative, “subjective” mode as mentioned above in order to achieve the monumentality and symbolism which he aimed to achieve (figure 35). Here he worked as a sculptor would have done with soft clay – he carved out huge interior spaces, pushed the truncated hyperbolic shell and asymmetrical pyramid over the assembly halls through the flat roof and added a huge free-standing curved canopy supported on massive blade-like columns to the south-east elevation. These forms all served a very specific purpose, but were intuitively shaped.

The only pre-existing elements from his “toolkit” were the *brise-soleil* screening two elevations and the extensive interior ramp, his *promenade architecturale*, employed so successfully in Villa Savoye (1929). It was, of course, not simply a circulation device, but a means of enhancing the experience of moving through a building. The design was dominated by the “art” of architecture, informed by thoroughly pragmatic considerations. The Chapel of Ronchamp, designed at the same time, took this approach to the extreme. Le Corbusier (1960: 166) noted:

Freedom ... Completely uninhibited architecture. No stipulations except the celebration of the mass ... An important influence, however, was there – the countryside and horizon on all four sides.

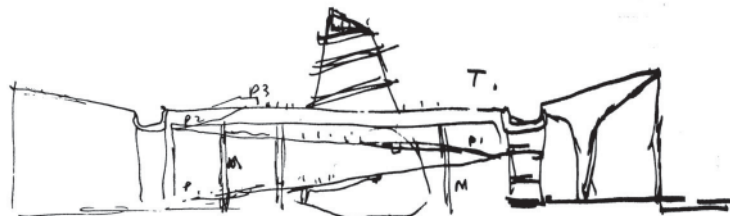


Figure 35
An early section through the Palace of the Assembly, Chandigarh, 1953
 (source: Boesiger and Girsberger 1967: 222).

On the French Coast, however, Le Corbusier did not assume such freedom to shape forms intuitively. As the drawing below clearly shows, he adopted the 2:1 Unité typology and façade

screen as his basic building block, accentuated each unit with two parallel barrel vaults and then assembled the cells into settlements (figure 36). Here the “art” was not in shaping, but in assembling and composing the whole, and in creating the ambience, simplicity and small scale for which he aimed. An analysis of the site plans nevertheless reveals considerable reliance on proportional systems (figure 37). It seems as if La Sainte-Baume relies primarily on the Golden Section, while each half of Roq-et-Rob is delineated by an extension of the Golden Section. This is achieved by setting a right angle on the axis dividing the original square, and then mirroring it on the centre line dividing the project.

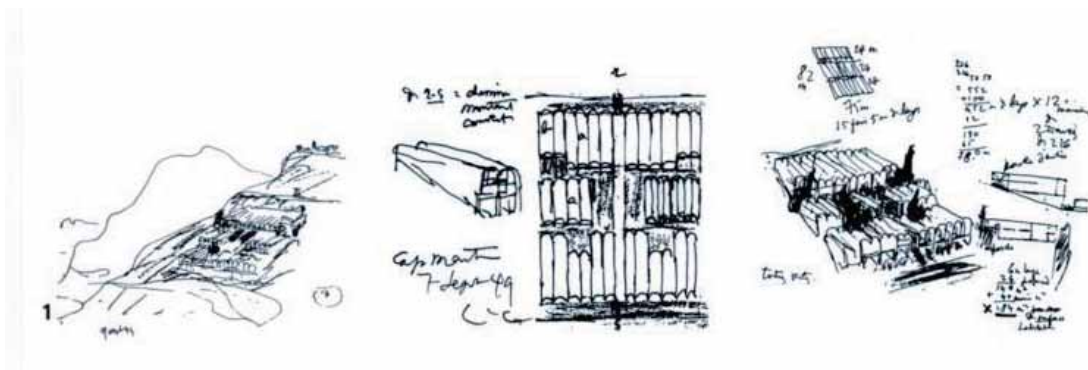


Figure 36
Le Corbusier's early sketches for Roq-et-Rob (Corbusier and Boesiger 1972: 99).

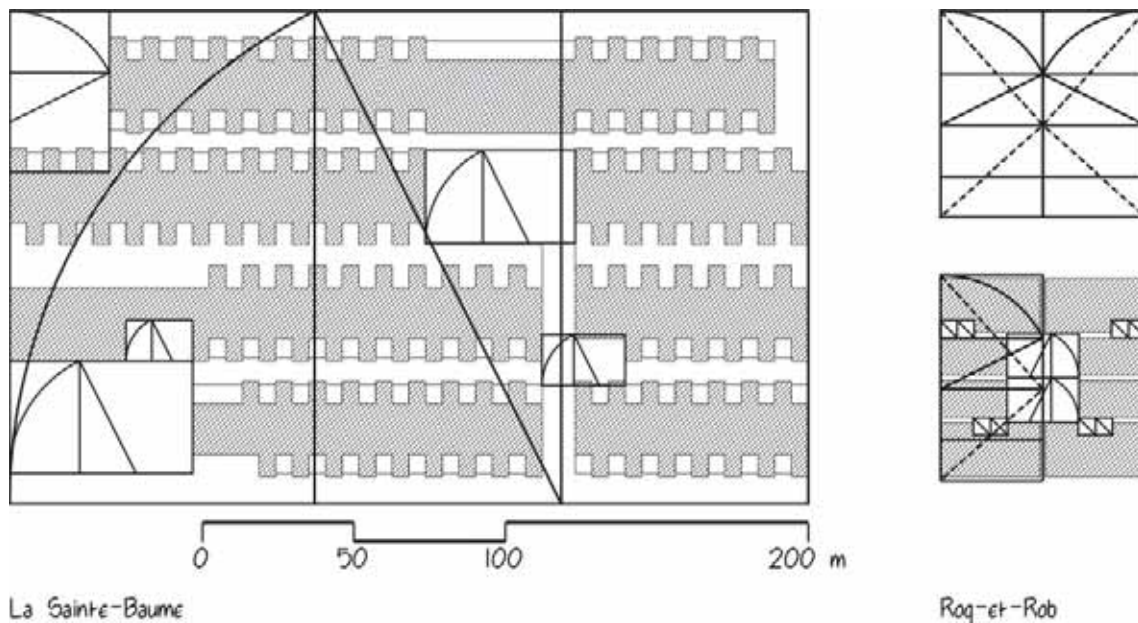


Figure 37
Proportional systems applied to site planning (drawing and analysis by the author).

At La Sainte-Baume the open spaces, most of which are also dimensioned as Golden Sections, seem haphazardly located, but a finer-grained analysis might reveal some geometric relationship. The value of composition on an orthogonal plane is, however, questionable on such sloping sites – in reality the downhill dimensions will obviously be much longer.

There are some intellectually based endeavours that could be labelled “scientific” and which have exerted a profound impact on the design of Roq-et-Rob in particular. These are the Modulor, Le Brevet and possibly also his research into visual perception.

Although Le Corbusier commenced work on a proportioning system that he called “the Modulor” in 1942, it was only after the war that the system was published and extensively applied

(figure 38). In 1948 he published *Modulor* in French, a theory of dimensions and proportions, for which he claims research evolved from primitive huts and nomadic tents (1960: 160-161).

Le Corbusier was obviously immensely proud of this system, writing extensively about it in two books (the English editions were published in 1951 and 1958 respectively). He furnishes a fascinating account of its first application to all aspects of the Unité d’Habitation in Marseilles (1951: 132-153). In the same publication he describes “the full-scale application of mathematics in building: three-dimensional urbanism (on the ground and in space)”, adding that “measures enter into everything: pilotis, highways and roads, swimming pools, buildings, from top to bottom and in every object of the interior, car parks ...” (1951: 168).

He has been frequently criticised for choosing such a tall person (six-foot, 1.8 metres) as his reference, but as he explains: “it is better that a measure should be too large than too small” (1951: 63). Finally, referring to the Unité d’Habitation (1951: 78) he writes that “the systematic application of the harmonious measures of the Modulor creates a unitary *state of aggregation* that may be described as textural”; and: “Having made such a design you feel somewhere near the works of nature which proceed from the inside outwards, uniting, in the three dimensions, all the diversity, all the different intentions in perfect harmony”.

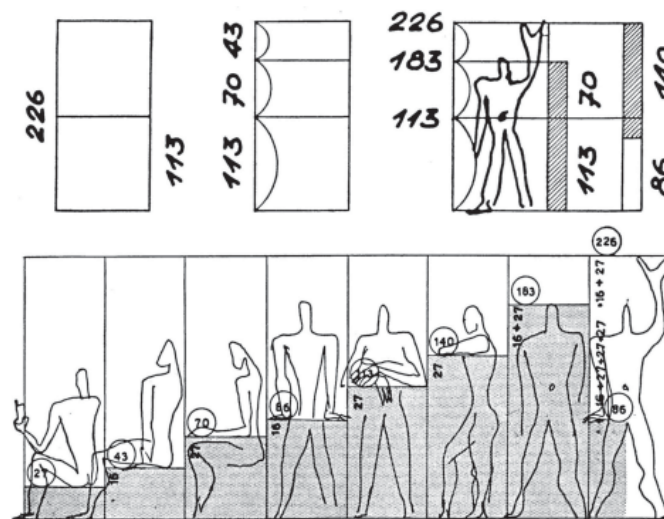


Figure 38
Modulor, 1942-1955 (Le Corbusier 1960: 159).

Abbott and Pollit (1980: 44) aver that the Roq-et-Rob design “involves similar techniques of construction” as those of La Sainte-Baume; but that is not correct. La Sainte-Baume was envisaged as a heavy concrete frame and vaults, with walls filled in with rammed earth. Roq-et-Rob, on the other hand, was planned as a lightweight space frame consisting of short girders of metal angle sections, all welded together (Le Corbusier 1958: 170). Le Corbusier (1958: 168) describes the construction as “an alveolar volume of habitation”, probably referring to the closely packed cellular matrix. The system was patented in 1950 as *Le Brevet 226 x 226 x 226*, after the cubic dimensions derived from his Modulor (Le Corbusier 1951: 168-169). Vaults also consisted of curved and folded sheet metal. In both cases the vaults were covered with turf and planted over.

According to Gans (2006: 166-167), Le Corbusier developed the Le Brevet structural system in collaboration with Jean Prouvé (figure 39). Intended for mass production, the dimensions of the basic cube are based on that of the Modulor man with his arm raised (Le Corbusier 1958: 168-169). He had much praise for Prouvé (1958: 111-112): “everything he touches immediately assumes an elegant plastic form while offering brilliant solutions with regard to strength and manufacture”. In 1964 he again used the system for the Heidi Weber house-museum in Zürich,

but this time the roof comprised an articulated parasol of painted 4 mm sheet metal and exterior walls of porcelain-enamel sheet metal with polystyrene insulation.

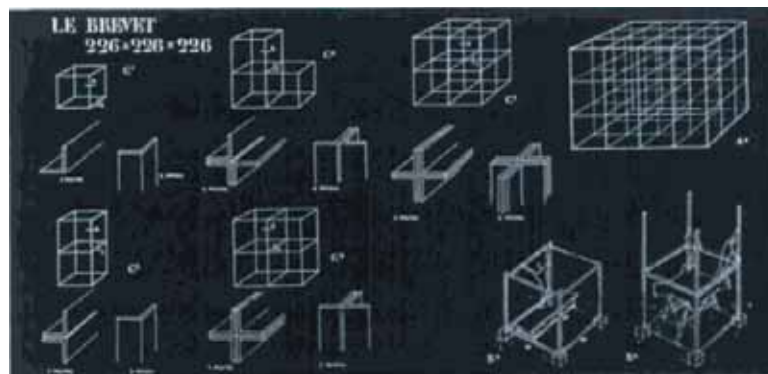


Figure 39
The Le Brevet 226 x 226 x 226 patent (Le Corbusier and Boesiger 1972: 101).

The last issue which is scientifically based is his study of visual perception. Le Corbusier’s sketches attempt to explore “the nature and the quality of the relationship between eye and spirit” (1951: 78-80), again using his “harmonious scale” to explain perspective (figure 40). This relates to observing and experiencing objects in the landscape. Could it be that his cave-like space was intended to create what he calls a “cone of vision”? Certainly, as Frampton (2007: 226) writes, *Maisons Jaoul* was, like *Rob-et-Roq* and the weekend house, “a monumental reinterpretation of a Mediterranean vernacular”. However, it contained framed windows “to be looked at”, unlike the fully glazed south façades of the French Coast projects that were intended “to be looked through”. Why? Because the latter overlooked stunning views that Le Corbusier wanted to optimise, while the former, situated in the suburbs, did not. His contribution to this field is only now being investigated, for example, by Richard Difford in an article entitled “Infinite horizons: Le Corbusier, the Pavillon de l’Esprit Nouveau dioramas and the science of visual distance” recently published in the authoritative *The Journal of Architecture* (June 2009).

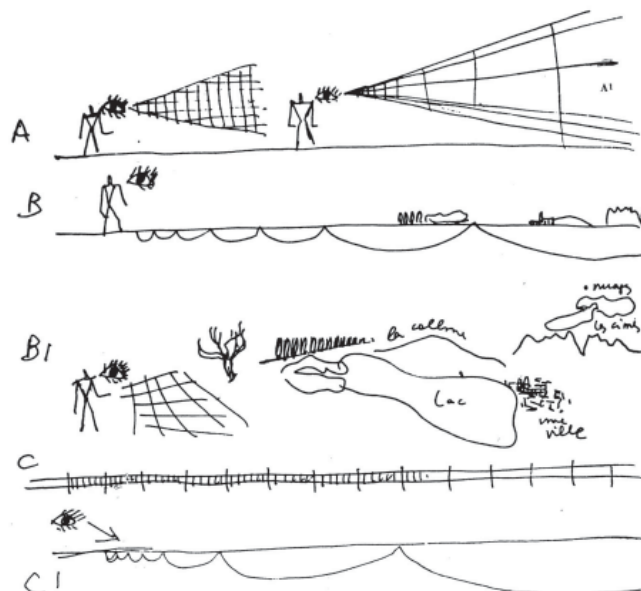


Figure 40
Analysing visual perception (Le Corbusier 1951: 79).

Impacts

In *The city of tomorrow* Le Corbusier (1929: 92) notes two types of city structures. One, “a progressive growth, subject to chance, with resultant characteristics of slow accumulation and gradual rise” and the other, “the construction of a city as the expression of a preconceived and predetermined plan embodying the then known principles of the science”. His city designs were mostly of the latter kind, urban planning based on functionalism and science, an approach continuously attacked by Jane Jacobs and others. Nevertheless, on the French Coast we see a focussed effort to emulate the first, the vernacular approach. What was the impact of these projects? First of all they created great confusion among architects as to where the man who pioneered the International Style, the pre-eminent architecture after World War II, was heading.

The tectonic successor to the French Coast projects was Maison Jaoul, completed in 1956, which as Reyner Banham (1966: 85) claims, became the standard for the New Brutalism with its emphasis on raw and rough exposed, materials and powerful imagery. Although these projects were embryonic archetypes for the New Brutalism, their impacts stretched way beyond just their materiality. Rejecting the mono-functional housing slabs that resulted from the research carried out by CIAM (Congrès Internationaux de l’Architecture Moderne), Banham (1966: 90) describes the “new ideal in architecture and planning” as the cluster, “a close-knit, complicated, often-moving aggregation, but an aggregation with a distinct structure”. He then explains how the Sainte-Baume and Roq-et-Rob concept inspired such cluster development in Britain. At that stage one can clearly see a preference for low-profile architecture and contextualism emerging in architectural discourse.

Curtis (1986: 168) contends that “This was regionalism at its best: combining old and new, responding to climate, site, vegetation views and local precedent”. Jencks (2000: 189) adds: “To put it polemically, Le Corbusier becomes a Post-Modernist before the fact ... building regional and contextual objects that are poems to nature-worship”.

Atelier 5 and Ando certainly applied the typology, but it was Roland Simounet who emulated the imagery. Simounet’s Djenan el-Hasan project in Algeria was planned as temporary accommodation for low-income households displaced by slum clearance (figure 41). He achieved a density of 800 people per hectare with 210 units. According to Zeynep Çelik (1997: 163-164):

The superimposed uniform, vaulted units reinterpreted, rationalized, aestheticized, and synthesized the lessons Simounet had derived from the casbah and the bidonville. The overall image borrowed at the same time from the architecture of Le Corbusier, in particular the 1949 Roq et Rob project in Cap St. Martin – a particularly relevant scheme in the Mediterranean tradition and on a dramatically steep site.



Figure 41
Roland Simounet’s housing project in Algeria, 1959 (source: Zeynep 1997: 164).

I wish to conclude this section by quoting Curtis (1986: 214):

Le Corbusier's detractors have never ceased to bicker about his supposed insensitivity to urban context. But both Venice Hospital and the Roq and Rob scheme (ten years earlier) were based on the reading of underlying typologies in existing towns in terms of both buildings and spaces between. These patterns of adaptation and memory were then translated into standardized modern systems of construction, arranged in a cellular fashion to evoke growth and change, as in the vernacular, or in the patterns of nature. Such preoccupations would be central to Team X in the 1960s, but Le Corbusier beat the younger generation to the mark with a contextualist solution that avoided the other danger of sentimental imitation of old buildings.

Conclusion

It is testimony to Le Corbusier's genius that when faced with a steeply sloping site, he could recognise the appropriateness of the 2:1 section in a totally different topographical context. But he was also a mischievous regionalist. He ignored the local residential vernacular, and guided by the symbolism and imagery of the cave, derived his primary vaulted form from the Greek and North African shores. It was also the North African urban patterns that influenced his use of the land.

Nowhere in this study was any evidence of form, as an artistic creation in the sculptural sense, detected. All decisions seem to be based on a calculated and determined effort to respond pragmatically to an astoundingly wide range of relevant parameters and constraints. The context, the major ideas, and previously developed concepts and typologies gave him a huge choice of practical and proven alternatives. Some critics accuse him of recycling a few fundamental concepts, but what is surprising is not that he had so few options, but rather that he had so many! His peers, Gropius, Van der Rohe, Hilberseimer and others never developed residential urban typologies beyond simple slabs and towers.

The Modulor, Le Brevet and his embryonic thoughts on visual perception probably represent border-line science, but do not fall in the league of "great" scientific discoveries and inventions such as the achievements of Antonio Gaudí (1852-1926, hyperbolic paraboloid), Pier Luigi Nervi (1891-1979, thin concrete shells), Richard Buckminster Fuller (1895-1983, geodesic domes) and Frei Otto (born 1925, tensile structures). Yet, even their approaches were both intuitive and mathematical – they were deeply concerned about the aesthetics of structure and manipulated them to achieve beautiful forms.

The nature of Architectural design in general and the process of inception to the concretisation of concepts and their contextualisation – and specifically their subsequent development into resolved designs – remain a widely discussed but enigmatic process. The result is simply that a discussion of the art and science cannot be neatly packaged – there are too many overlaps and blurred boundaries. Approaching the end of the lengthy study that culminated in this article, I still cannot confidently categorise Le Corbusier's decisions. But what I have learned from these French Coast projects is that good residential design needs to be supported by a vast knowledge base. Appropriate architecture and urbanism can be achieved by recognising the dialectic between science and art – like Le Corbusier.

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