Le Corbusier: The Measurement of Man

Le Corbusier (1887-1965) was a Swiss-born architect, painter and urban planner. He is generally considered as one of the main forces in the development of modernist architecture. UNESCO has designated 17 of his building projects as "world heritage sites," more than any other architect. In the 1940s Le Corbusier developed a system of measurements called the *Modulor* to assist in the fitting buildings to human beings. The first building to be constructed using the *Modulor* was the *Unité d'Habitation*, a striking and innovative residential building in Marseille, begun in 1947 and completed in 1952. In recent years, Le Corbusier has been criticized for his antisemitism and his fascist leanings. These critiques do not detract from the importance of his work but do explain how his buildings sometimes seem inhuman.

Life

Le Corbusier was born as Charles-Édouard Jeanneret in La Chaux-de-Fonds, a Swiss city near the French border that is the center of the country's watch-making industry (Weber, 2008). At the time of Le Corbusier's childhood, the city was prosperous and full of *Art Nouveau* buildings. Le Corbusier studied art, but had no formal training in architecture.

In the early years of the 20^{th} Century, he travelled extensively in Europe visiting the architectural treasures in Austria, Hungary, Bulgaria, Greece, Turkey, Italy, France, Germany and Belgium. He was particularly impressed by the Florence Charterhouse (*Certosa*):

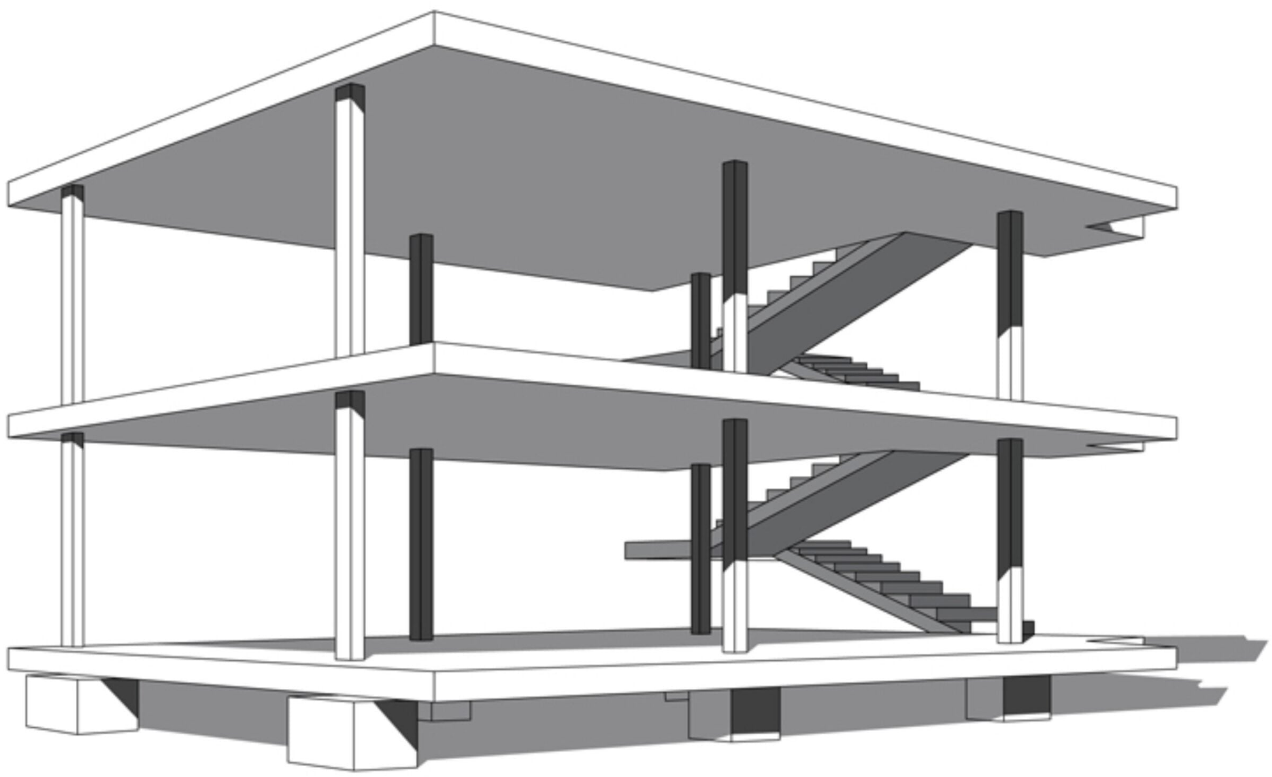
Le Corbusier’s growing passion for urban planning stemmed from his experience there:

> The beginning of these studies. for me, goes back to my visit to the Carthusian monastery of Ema near Florence, in 1907. In the musical landscape of Tuscany I saw a *modern city* crowning a hill. The noblest silhouette in the landscape, an uninterrupted crown of monks’ cells; each cell has a view on the plane, and opens on a lower level on an entirely closed garden. I thought I had never seen such a happy interpretation of a dwelling. The back of each cell opens by a door and a wicket on a circular street. The street is covered by an arcade: the cloister. Through this way the monastery services operate—prayer, visits, food. funerals. This “modern city” dates from the fifteenth century. Its radiant vision has always stayed with me. (Le Corbusier, 1930)

Another formative experience was the 14 months (1908-1910) that he spent in Paris as a draftsman in the offices of

Auguste Perret (1874-1954), a pioneer in the architectural use of reinforced concrete. He also worked briefly in Berlin with Peter Behrens (1868-1940), an innovative industrial designer and architect.

During World War I, Le Corbusier taught in the art school in La Chaux-de-Fonds, and began to design houses for clients in the city, using some to the ideas he had developed in his travels. In 1915 he designed the Dom-Ino House. This was composed of concrete floor-slabs supported by a small number of concrete pillars and with connecting stairs on one side. The concept allowed complete freedom in designing the interior of each floor, and in creating the external walls and windows, since there was no need for load-bearing walls or supporting beams.

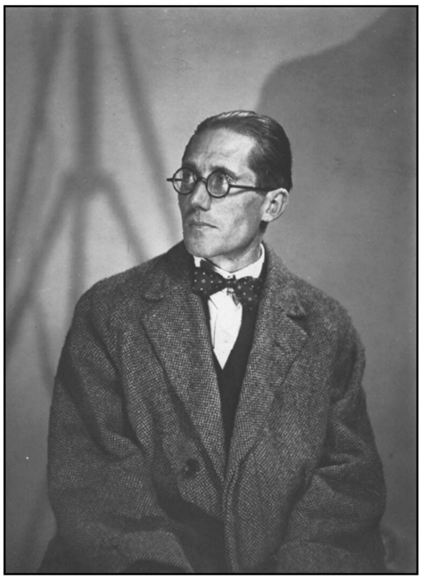
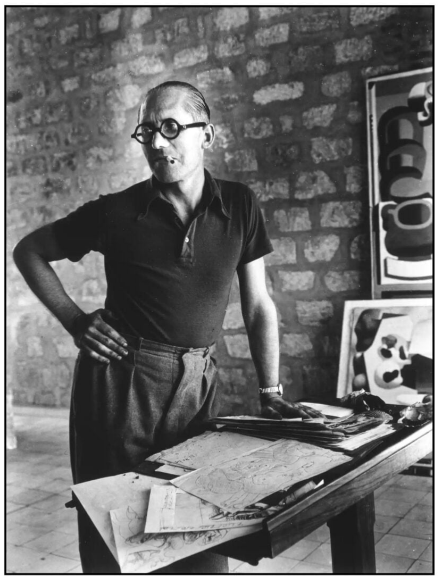


The name combines the Latin *domus* (home) with the name of the pieces used in the game of dominoes. The design could be used by itself in a single house, repeated upwards to form skyscrapers, or duplicated laterally to make row houses.

In 1917 Le Corbusier moved to Paris and opened an architectural practice with his cousin Pierre Jeanneret. He also became intrigued by Cubism, and together with the painter Amédée Ozenfant founded an artistic movement devoted to pure forms and called "Purism." (For some reason they considered Cubism too "romantic.") They published their ideas in the magazine *L'Esprit Nouveau* (1920-1925). To celebrate the sense of the new, Charles-Édouard Jeanneret began to use the name Le Corbusier. This derived from the surname Lecorbesier (itself stemming from an old word for "shoemaker") of one of his Belgian ancestors. Weber (2008, p 178) suggested that the new name also

> endowed its bearer with the ability to have others "courber," or bend to his will. Above all, "Le Corbusier" gave Charles-Édouard Jeanneret the toughness and resiliency he felt he needed.

LeCorbusier became a French citizen in 1930. The following illustration shows some early photographs of Le Corbusier. The first is from 1912, the second is a 1927 portrait by Man Ray and the third is a 1937 photograph by Rogi André:

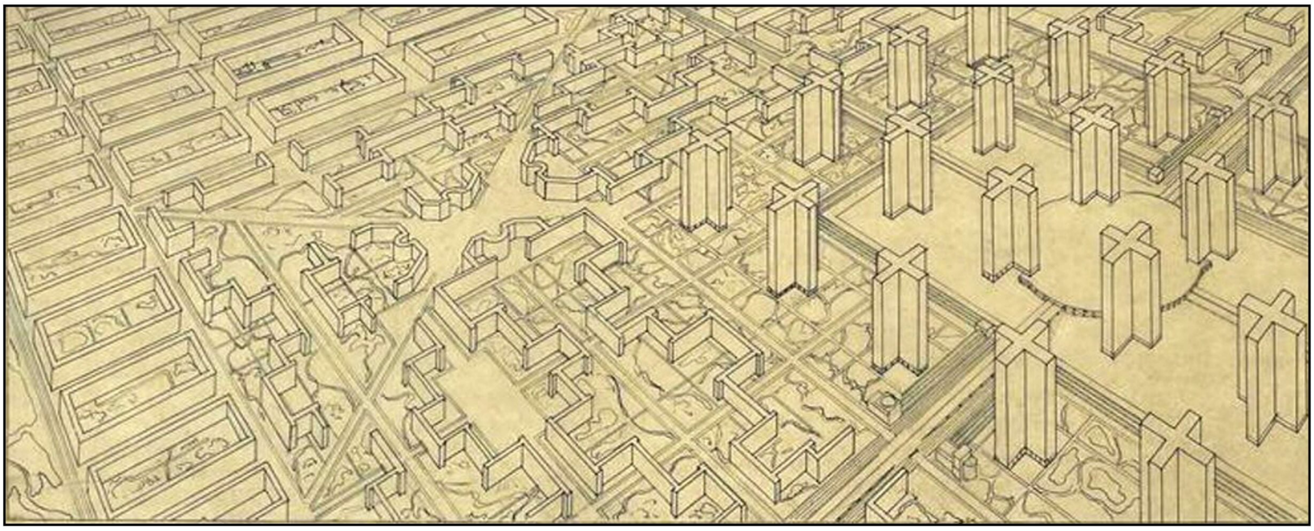




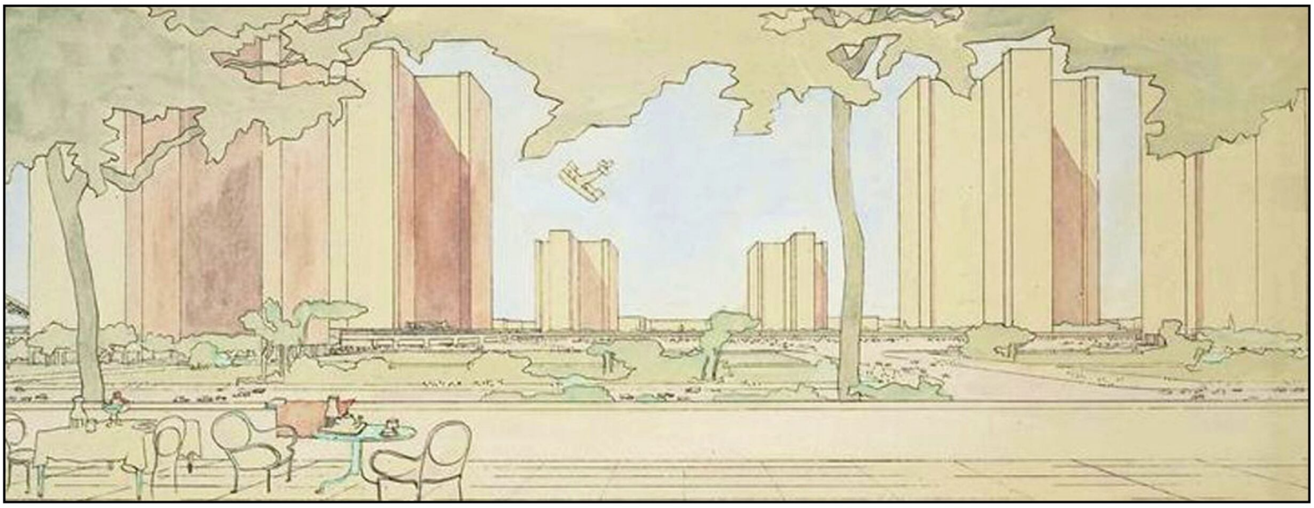
Towards a New Architecture

In the early 1920s Le Corbusier proposed some new principles for modern architecture. His general approach to design and architecture can be summarized in the epigram “A house is a machine for living in” (Le Corbusier, 1923, p 95). An important manifesto, entitled *Les 5 points d’une architecture nouvelle*, went through several different formulations. The 5 principles as ultimately delineated in 1927 can be summarized:

1. *Pilotis* (supporting columns): The ground floor of a building is replaced by a set of concrete supporting columns so that the actual building is raised above the ground
2. *Roof Gardens:* The roof becomes the top floor of the building and can be used for various purposes: pools, exercise areas, gardens.
3. *Floorplan*: The floors are supported by continuations of the *pilotis*. The absence of load-bearing walls then provides complete flexibility in the design of the floorplan.
4. *Horizontal Windows:* Windows no longer need to be part of the building’s support and can be horizontal or vertical as the need arises.
5. *Façade*: Since the building’s exterior does not contribute to its support, the architect can design a façade without restraint. Windows could extend over the whole external surface

In 1925, Le Corbusier made a proposal for the redevelopment of Paris called *Le Plan Voisin* after its sponsor Gabriel Voisin (1880-1973), a pioneering manufacturer of planes and automobiles (Le Corbusier, 1925; Frampton, 2024, Chapter 3). The plan was focused on a commercial central area with 18 cruciform skyscrapers surrounded by parkland. Le Corbusier conceived of these as 200 meters high (about 60 stories). This center was surrounded by self-contained residential blocks of about 10 stories. Each of these blocks would include its own shopping center. The following illustrations show some architectural drawings for the planned city:



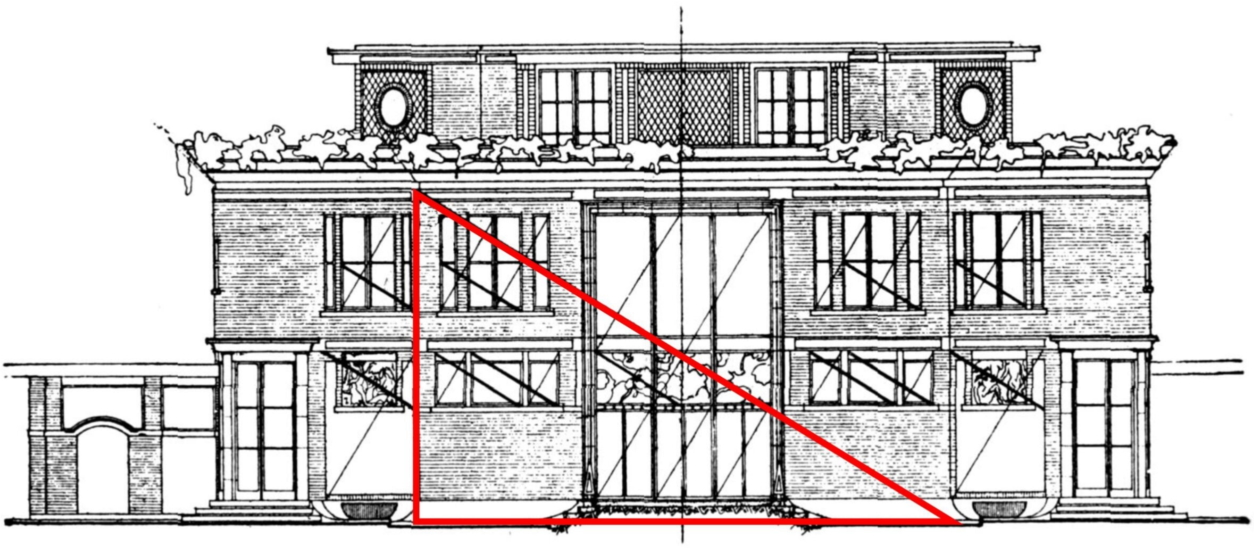


Thankfully Le Corbusier’s plan for Paris was never realized. However, the concept of a commercial city-center composed of skyscrapers surrounded by dormitory regions for those who work in the central towers has become widespread. As pointed out by Jane Jacobs (1961) this leads to the death of the city downtown, which becomes dark and deserted after office hours. As she noted (p 446) “His vision of skyscrapers in the park degenerated in real life into skyscrapers in parking lots.” A major problem with Le Corbusier’s ideas is that they lack the social strength of intersecting city streets: the corners where the inhabitants congregate to shop, eat, drink, meet friends, and people-watch.

Another idea that Le Corbusier pursued in these early years was that of *tracés régulateurs* (regulating lines). His paper describing this concept was initially published in *L'Esprit Nouveau* in 1921 and then reprinted in his book *Vers une Architecture* (1923). Le Corbusier was far from precise about defining a regulating line:

> A regulating line is an assurance against capriciousness …. A satisfaction of a spiritual order which leads to the pursuit of ingenious and harmonious relations. It confers on the work the quality of rhythm. The regulating line brings in this tangible form of mathematics which gives the reassuring perception of order.

In his examples he uses various geometric projections such as the 3-4-5 triangle, and the golden rectangle (with the longer side 1.618 times the shorter). The following illustration shows a hypothetical villa with the main geometric principle, a triangle formed by the sides and diagonal of a golden rectangle, highlighted in red. Various regulating lines parallel and perpendicular to the diagonal can determine the location of the doors and windows.



Le Corbusier apparently did not use the regulating lines in the initial design of his building, but. used them *post hoc* to explain the harmony of his creation (Herz-Fischler, 1984)

The Golden Ratio

One of the geometric principles used in Le Corbusier's early designs was the golden ratio. The importance of this to his later work warrants a brief digression.

At the beginning of the 13th century CE in Pisa, Leonardo Fibonnaci described the mathematics underlying the breeding of rabbits as a sequence of numbers:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55…

Each number represents the sum of the two preceding numbers. In mathematical terms the sequence is defined by

$F_n=F_{n-1}+F_{n-2}$; $F_0=0$; $F_1=1$

Fibonacci had been exposed to the mathematics of the Arab world through his travels with his father, a merchant who traded with Algiers. The Fibonacci sequence was known in the Muslim world, and likely goes back to the ancient Indian mathematics used to analyze Sanskrit poetry (Singh, 1985). Fibonacci's *Liber Abaci* (Book of Calculation) was one of the first books in Europe to use the Arabic numerals and the decimal system.

If we take the ratio between adjacent numbers in the series, we obtain a value that approaches the "golden ratio" of 1.6180. For example, 34/21 is 1.6190, and 55/34 is 1.6176. The golden ratio (also called the "golden section") is commonly represented by the Greek letter phi (ϕ), from Phidias the Greek sculptor and architect who may have used the ratio in his design of the Parthenon (Cook, 1914, p. 420), although this is unlikely (Barr, 1929; Markowsky, 1992). Phi is defined as the ratio of the sum of two quantities to the larger quantity when this ratio is equal to that between the two quantities:

$\phi = a/b = (a+b)/a$

The golden ratio has several intriguing mathematical characteristics. Most importantly, phi (1.6180) is equal to its reciprocal (0.6180) plus 1:

$\phi = 1/\phi + 1$

If we multiply both sides of this equation by ϕ, we can derive the quadratic equation

$\phi^2 - \phi - 1 = 0$

This gives roots

$(1 \pm sqrt (5)) / 2$

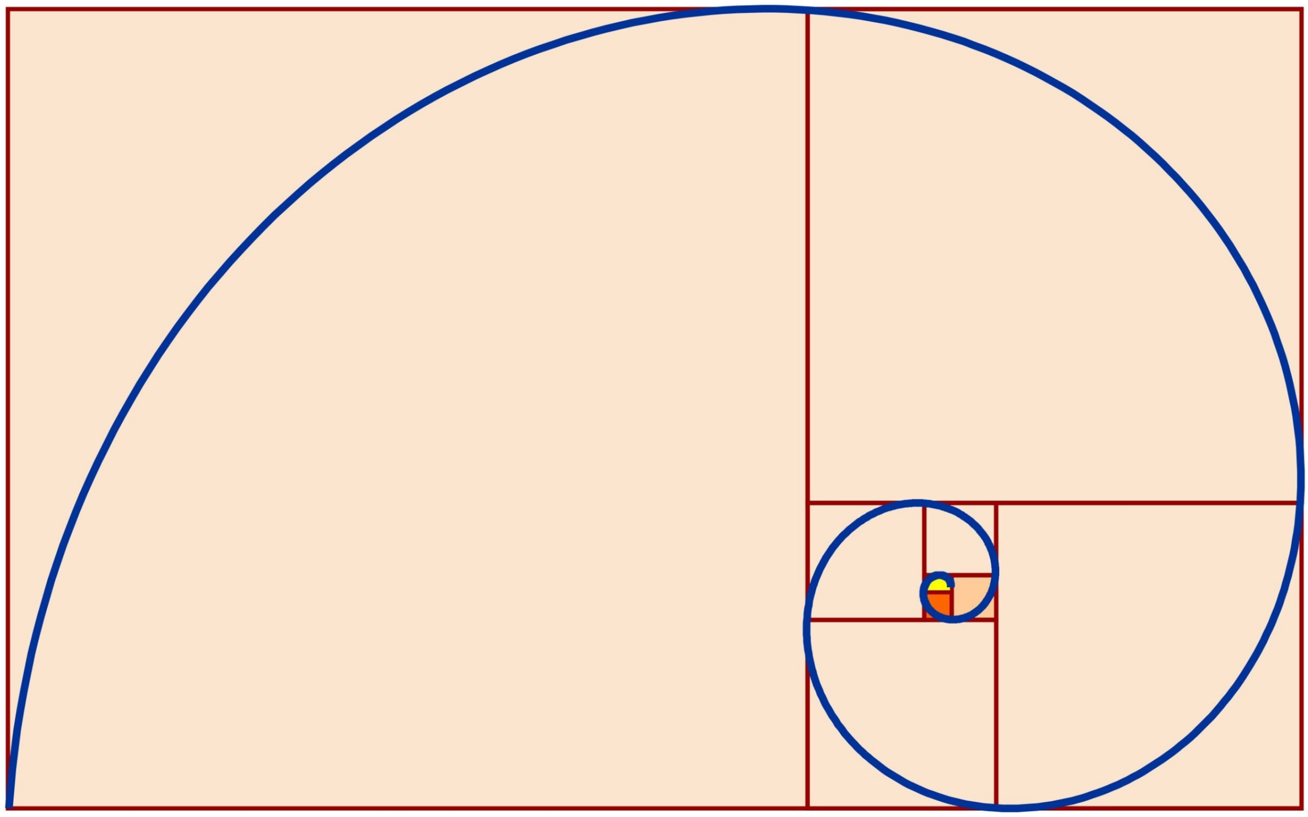
One root is equivalent to ϕ and the other equivalent to -1/ϕ. From these ideas Binet derived a formula to calculate any Fibonacci number without having to compute all the preceding numbers. The Fibonacci number would be the closest integer to that calculated by:

ϕ^n / sqrt (5)

Fibonacci numbers and the golden ratio play important roles in nature by determining, among other things, the locations of leaves on plant stems and the spiral arrangements of pine cones (Cook, 1914: Posamentier, & Lehmann, 2007).

Fibonacci numbers and the golden ratio are used in schemes for tiling surfaces (Grünbaum & Shephard, 1987). Many tiling systems, or tessellations, use regular pentagrams. The diagonal of a regular pentagram is equal to the length of the side multiplied by phi. Penrose tilings (1974) use regular pentagrams and other shapes determined by phi to produce patterns that are quasiperiodic – the parts do not translate from one region to another and cannot be exactly predicted. These tilings may explain how crystals grow and may be a metaphor for how neurons connect — following rules but giving patterns that are not fully explained by them (Penrose, 1989). The recently developed aperiodic one-stone tiling systems (Smith et al 2023) are also derived from pentagrams.

A square added onto the longer side of a golden rectangle will give another golden rectangle and this process can be continued over and over. To produce the diagram on the following page, a tiny yellow golden rectangle has an orange square added to its longer side to form a new golden rectangle. A sand-colored square added to its longer side produces another golden rectangle.



A logarithmic spiral or *spira mirabilis* ("miraculous spiral") is fascinating because its shape remains the same as the radius increases. This spiral is typically computed using polar coordinates and depends on the value of *e*, the base of the natural logarithms. A special logarithmic spiral called the "golden spiral," whose radius decreases by a factor of the golden ratio every quarter turn, can be inscribed within these rectangles. In the golden spiral, four irrational numbers are at play: the golden ratio (ϕ), the square root of five, the base of the natural logarithms (e), and the ubiquitous π.

Why discuss these concepts? In aesthetics we tend to find that a rectangle with sides that follow the golden ratio more pleasing than rectangles that are either longer or more like a square. The golden ratio and Fibonacci numbers have therefore been used extensively in the design of buildings and the layout of paintings (see Chapter 7 in Posamentier, & Lehmann, 2007). As we shall see, the golden ratio was particularly important in Le Corbusier’s later work.

However, we may find evidence for it more often than we should. It is easy to measure two things and find their relationship close to the golden ratio. Some things actually do not fit this famous ratio. The dimensions of paintings considered to be masterpieces cluster around a ratio of 1.34 rather than 1.618 (Olariu, 1999). The preferred sizes for photographs and book pages tend to show side-ratios that are less than phi.

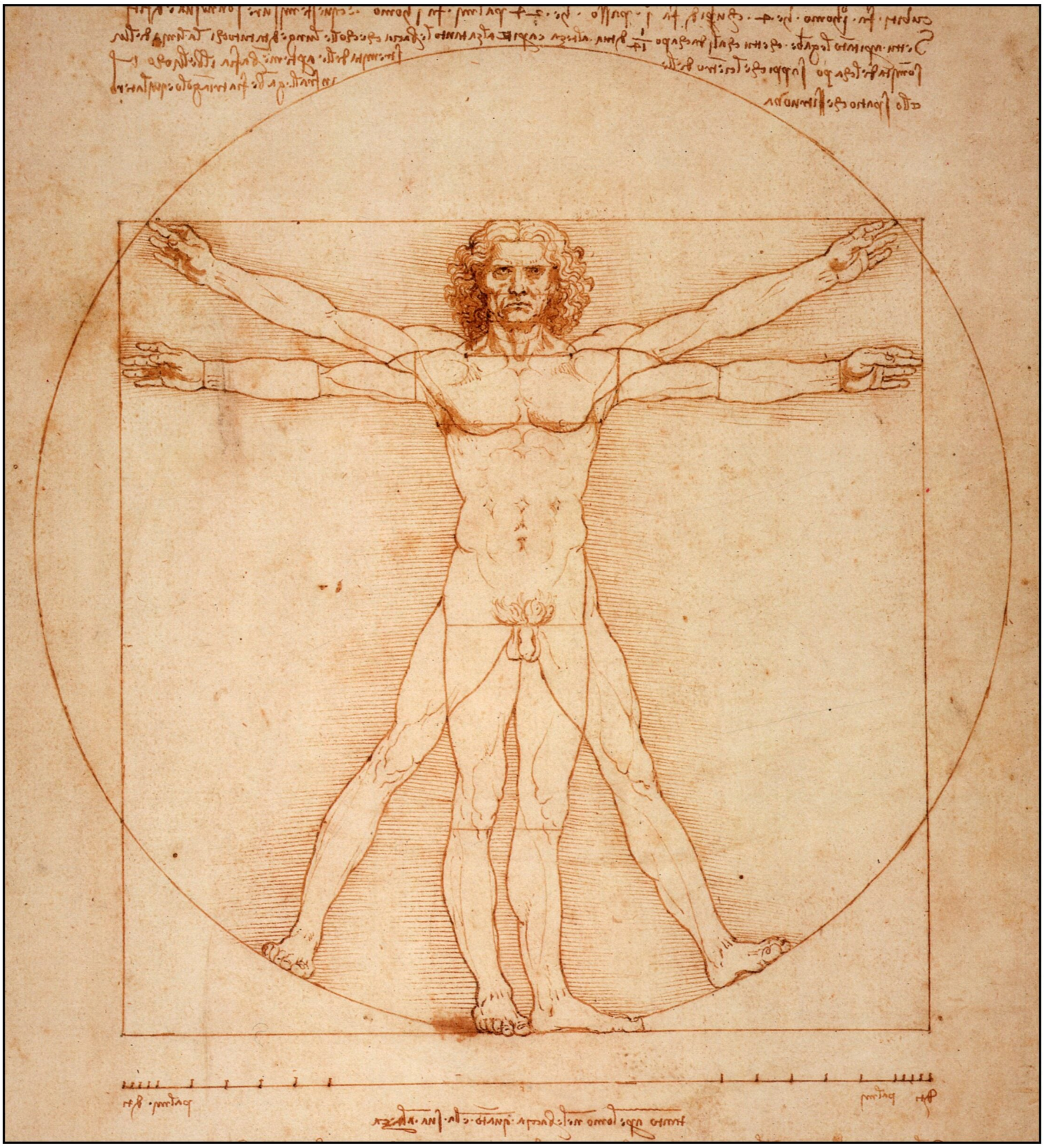
Many claims have been made concerning the geometry of sacred places (Doczi, 1981; Skinner, 2006). Perhaps, the beautiful mathematics underlying their locations and their architecture may reflect the transcendent. Perhaps, not. Much of the work on sacred geometry mixes mathematics with wishful thinking. Although it seems almost blasphemous to say it, God may not have been as enamored of mathematics as his creatures.

The Modulor

Discovering the geometric principles of the human body has long been a goal of artists and architects. Probably the most famous representation of the human form is the drawing of Vitruvian man made by Leonardo da Vinci in 1487. The proportions are based on those reported by the Roman architect

Vitruvius (1st century BCE). His books were re-discovered in the early 15th century and used by Leon Battista Alberti in his own treatise on architecture. The underlying idea of these measurements is

> As man is the image of God and the proportions of his body are produced by divine will, so the proportions in architecture have to embrace and express the cosmic order (Wittkower, 1971, p 101)



Leonardo’s drawing shows a man inscribed within both a square and a circle. This follows from the description in Vitruvius:

> … in the human body the central point is naturally the navel. For if a man be placed flat on his back, with his hands and feet extended, and a pair of compasses centred at his navel, the fingers and toes of his two hands and feet will touch the circumference of a circle described therefrom. And just as the human body yields a circular

> outline, so too a square figure may be found from it. For if we measure the distance from the soles of the feet to the top of the head, and then apply that measure to the outstretched arms, the breadth will be found to be the same as the height, as in the case of plane surfaces which are perfectly square. (Vitruvius, Book III, Chapter 1).

Some of these measurements are not as exact in reality as in representation. The arm-span of a normal human being is on average several centimeters longer than the height (Schott, 1992; Brown et al., 2000). We do not fit exactly into a square.

In Leonardo’s drawing, certain measurements are clearly indicated by lines. For example, the cubit measurement from the elbow to the fingertip is marked off in the vertical to shows that a man’s height is equal to four cubits. The finger-tip to finger-tip distance with arms outstretched also equals four cubits. The width of the shoulders is one cubit. The length of the upper arm is half a cubit.

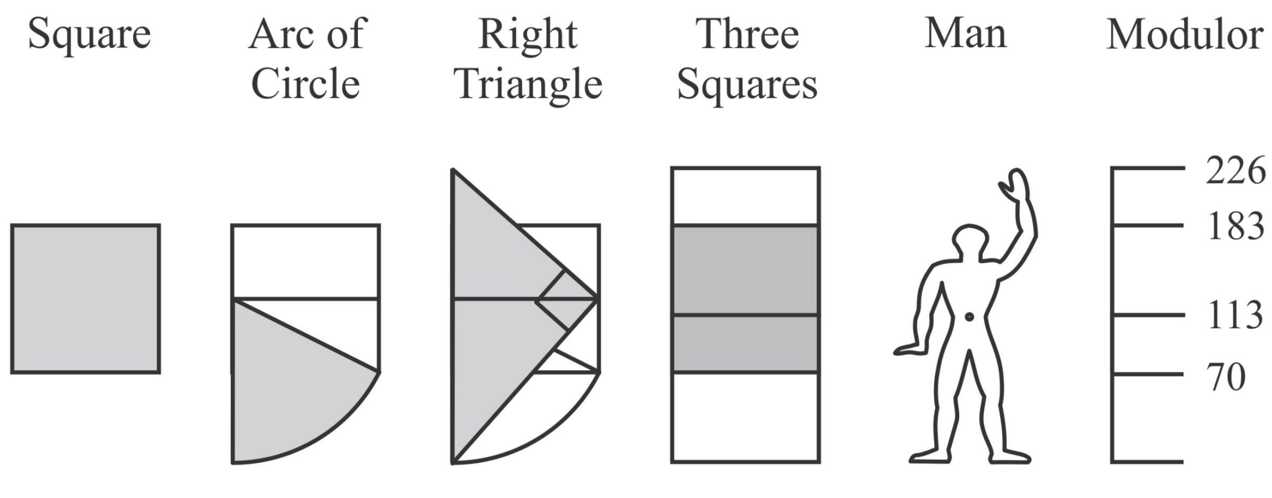
The drawing also shows evidence for the golden ratio ϕ (about 1.618) (Doczi, 1981, p. 93). For example, the height to the top of the head is ϕ times the height to the navel. Similarly, the cubit is ϕ times the distance from elbow to wrist. Most importantly, the side of the square in the drawing is ϕ times the radius of the circle.

The square and the circle are often taken to represent the earth and the heaven. Justifying the one to the other is a problem for both philosophy and geometry. An exact solution to the problem of squaring the circle – geometrically constructing a square with the same area as the circle using straight edge and compass – is impossible. The value of π is not just irrational (cannot be represented by a ratio of integers) but also transcendental (cannot be represented as the root of a polynomial). The square root of 2 is irrational but since it is the root of the equation $x^2-2=0$, it is not transcendental. Both π and e the root of the natural logarithms are transcendental. Several approximate ways to rectify the circle exist (e.g. Dixon, 1991). Some approaches to squaring the circle use the value ϕ, which is easy to represent geometrically (see later). For example, $(6/5)(1+\phi)$ is equal to π with an accuracy of 4 decimal places.

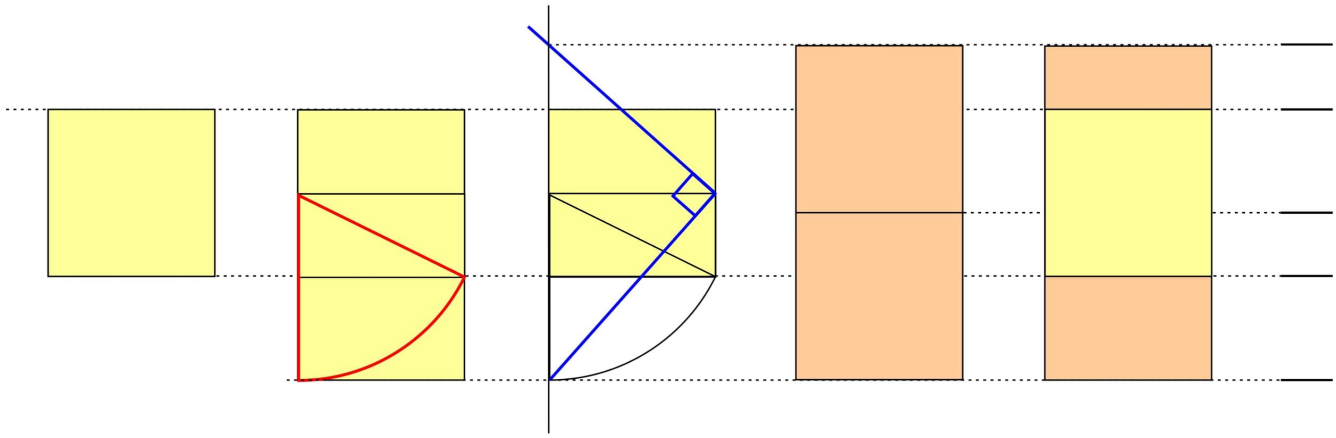
Most of the proportions in the human body involved small whole numbers. Height was equivalent to 4 cubits, 6 feet or 10 hands (wrist to fingertip). This allowed the Renaissance architects to find inspiration in the rules of music (Wittkower, 1971, pp 101-154; Evans, 1995). The Pythagoreans had shown that combining notes with frequencies in the ratio of such small numbers resulted in musical harmony: the octave of 2:1, the perfect fifth of 3:2, the perfect fourth of 4:3, and the major third of 5:4. Alberti proposed that visual harmony could be obtained by using similar ratios. Both architecture and music could then represent the harmony of the universe. Rooms could be designed with sides proportionate to the frequencies of consonant chords. Once the dimensions of the sides were selected the height would be tuned between the others. This could be done using the arithmetic mean $(a+b)/2$), the geometric mean or the harmonious mean $2ab/(a+b)$. When *a* is one half *b* these means are the perfect fifth, augmented fourth, and perfect fourth, respectively. Since the renaissance, Western musical scales have changed to use “equal temperament.” This is based on a constant ratio difference between adjacent notes in a scale rather than determining individual notes by simple Pythagorean ratios of the base note. And architecture no longer uses musical scales to create visual harmony (see Evans, 1995 for review).

Apart from such mystical uses as understanding the music and geometry of God, the proportions of the human body have definite practical applications. Artists use them to facilitate their representations of the human form. Clothiers use anthropometric measurements to design clothes and to determine the range of sizes. Architects use the proportions to determine standard measurements for designing buildings and furniture.

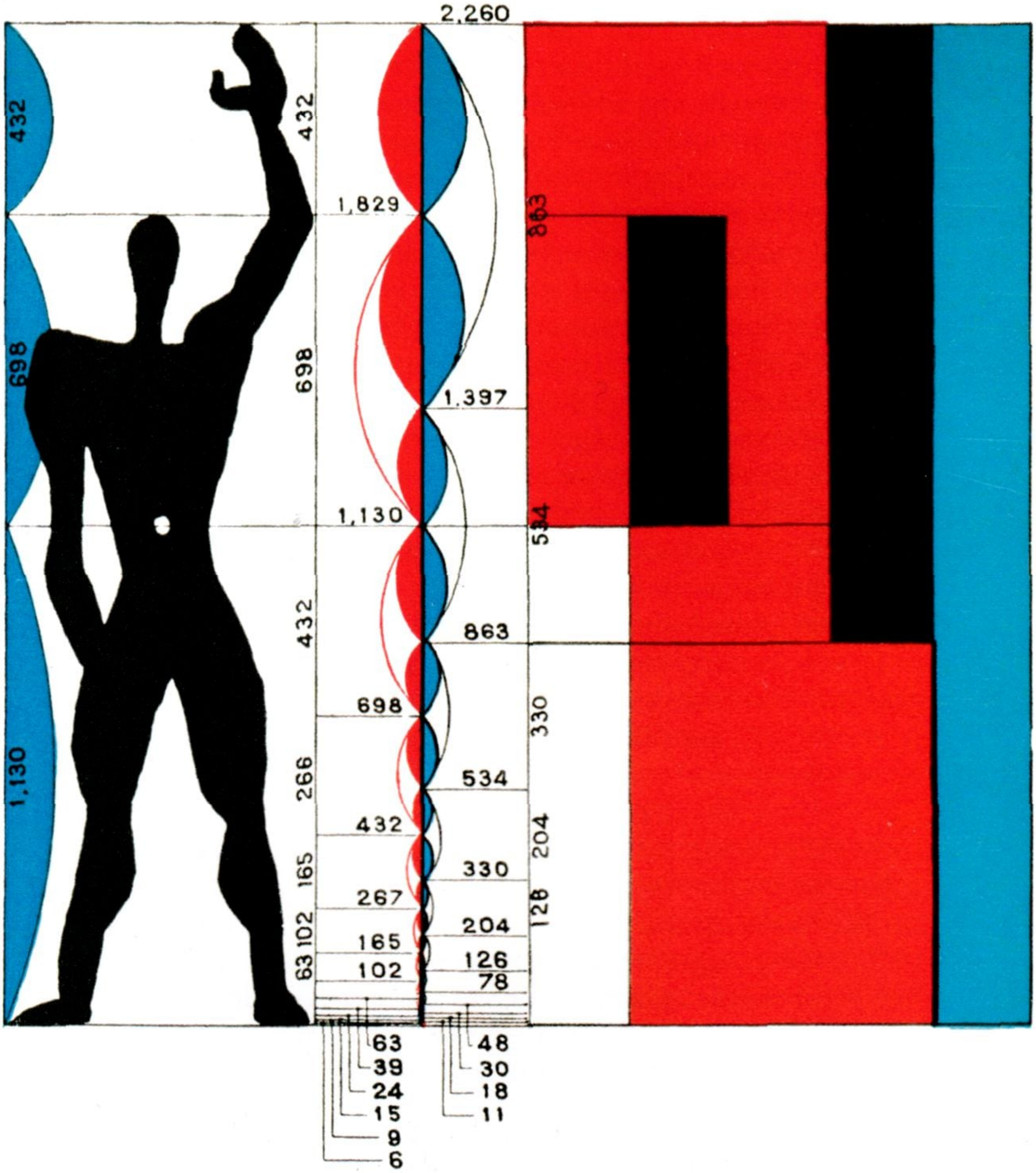
Le Corbusier became fascinated by the proportions of the human form. During the early 1940s, he developed a system called the "modulor." This set of proportions is shown in the following diagram is derived from geometric procedures described by Elisa Maillard and illustrated in *The Modulor* (1950/54, pp 36-45). From the midpoint of the left side of a square the arc of a circle with radius equal to the distance from that point to the opposite corner of the square is drawn to intersect with the extended side of the square. This is the classical way to construct rectangles that show the golden ratio. From the intersection, a right-angled triangle is constructed with its right angle at the midpoint of the right side of the triangle. From the level of the upper apex of this triangle, a square each with sides equal to the initial square is drawn, and another square below that. The original square is then superimposed on the two new squares. The diagram is then "normalized" to fit a man with height about 6 feet (183 cm):



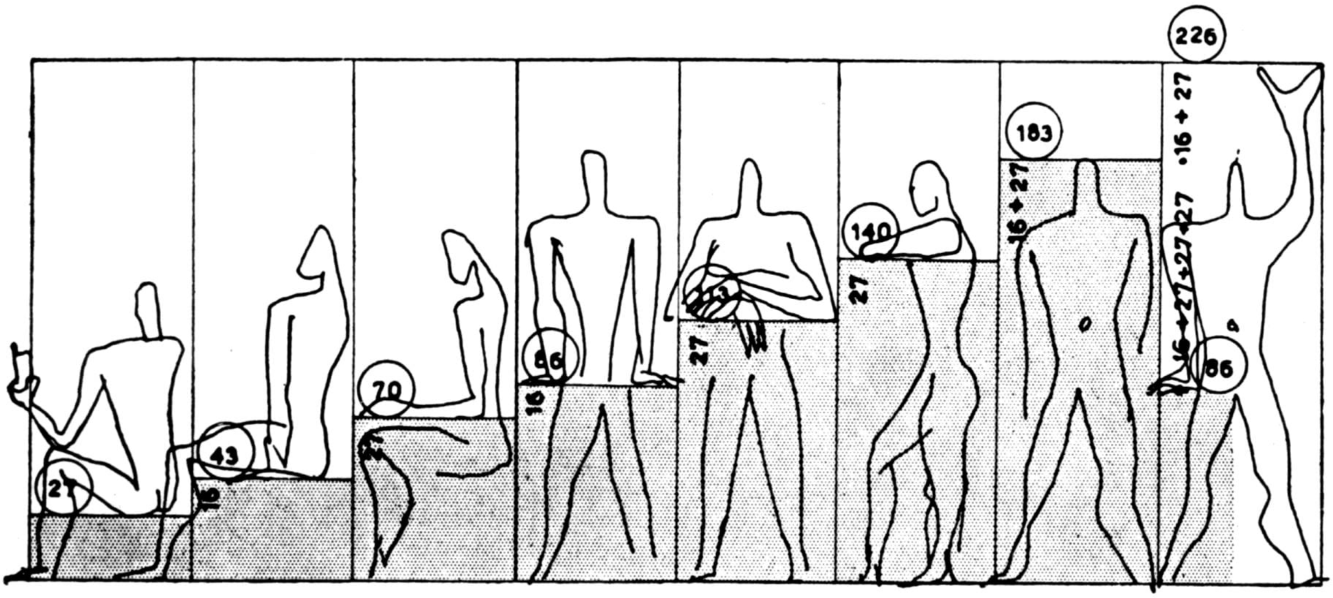
This geometric procedure has been faulted (Rozhkovskaya, 2020). However, I have worked out the steps quite precisely and they do indeed give the modular levels described by Le Corbusier (see also the extensive entry in French Wikipedia):



The diagram below (Le Corbusier, 1952; also in Frampton, 2024, p 175) shows the various measurements of the Modulor system, and a variety of panels (*un jeu de panneaux*) based on the measurements (discussed by Flora, 2023). These could serve as models for doors, windows, tables, shelves etc.



As well as the levels given in the preceding diagrams, we can also take difference measurements, particularly 43 (113-70), 27 (113-2*43) and 16 (2*43-70). The measurements in the *Modulor* system can then give standard measurements for architectural designs. For example, the height of a room should be 226 cm (7.4 feet). Other architectural and design measurements are then derived (Le Corbusier, 1954, Figure 26):

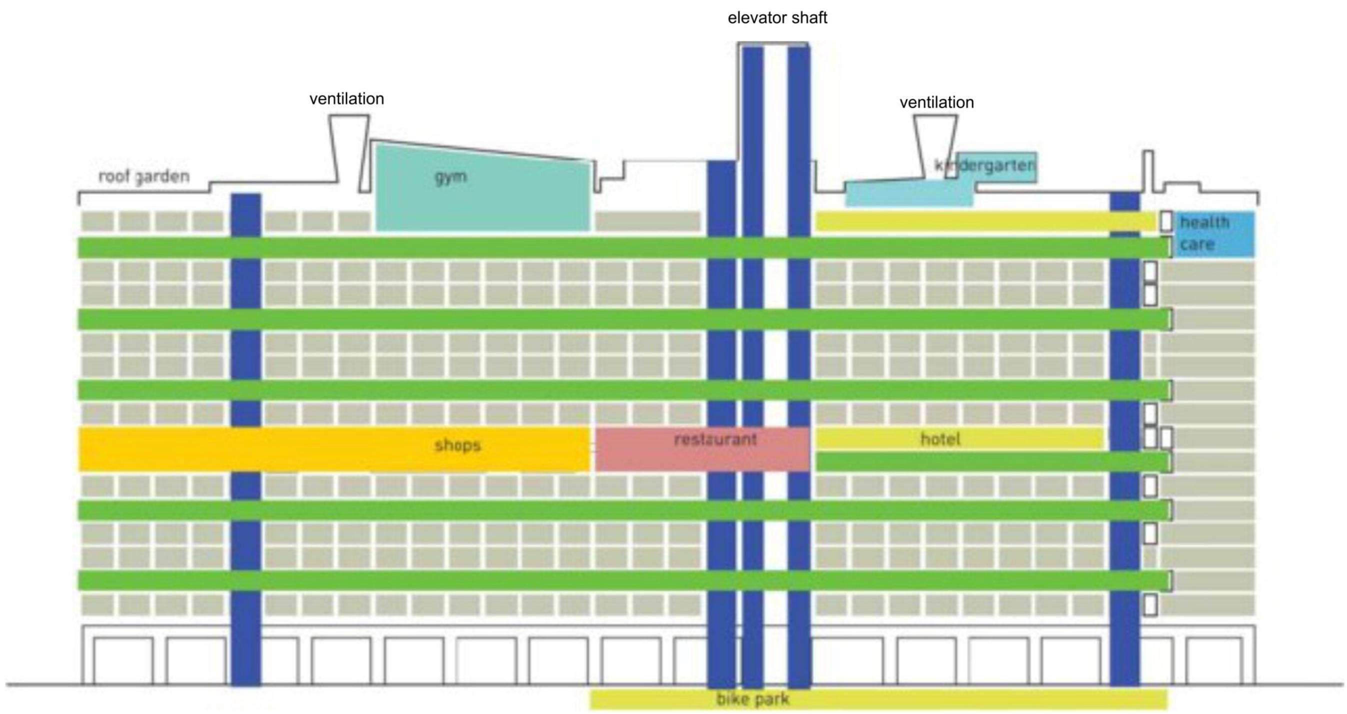


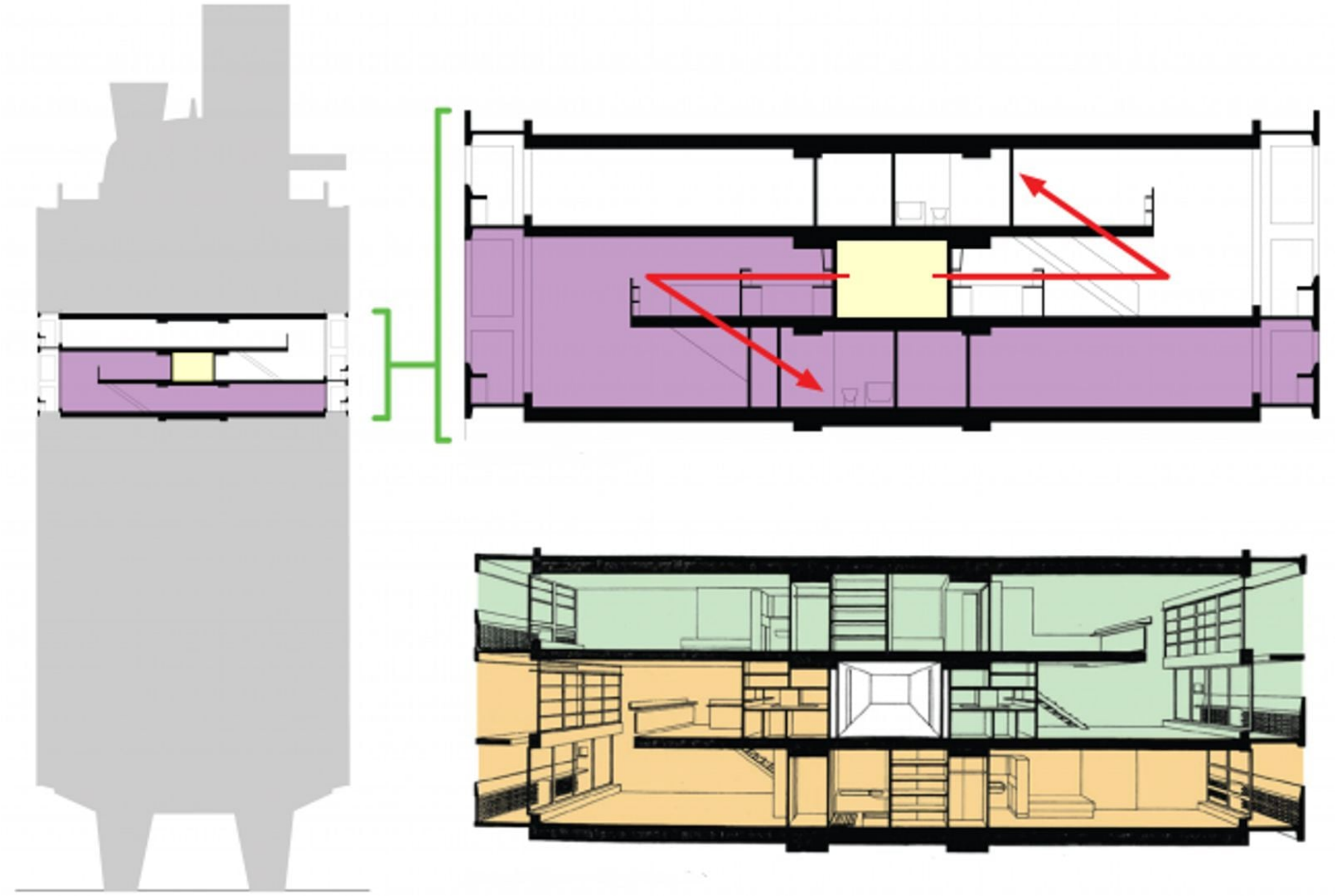
Whether the proportions contained in the Modulor are a reasonable representation of the normal human form is a matter for debate. For example, most North American rooms tend to have a height of about 8 feet (244 cm) – significantly more than the Modular’s 226 cm. Most tables tend to be 30 inches (76 cm) high rather than the Modulor’s 70 cm. The Modulor arbitrarily portrays an idealized male: it does not consider the normal variability of the human form, and it fails to include the female (Tell, 2018).

***Unité d’Habitation*, Marseille**

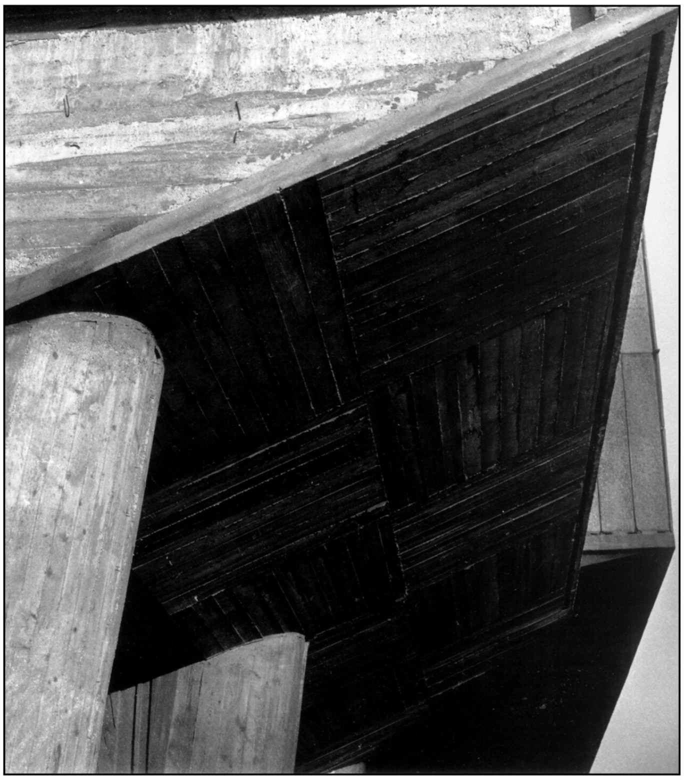
Le Corbusier first used his *Modulor* system in the design of the in the *Unité d’Habitation* Marseille (also known as *Cité Radieuse*) (Sbriglio, 2004; Janson et al, 2007). This large apartment building was built to provide housing for people who had lost their homes during World War II. The building was begun in 1947 and completed in 1952. The whole structure is constructed of rough-cast reinforced concrete, the French name of which, *béton brut* (raw concrete), led to the unfortunate term “brutalist” architecture used to describe later buildings constructed in the same manner (Beanland, 2016)

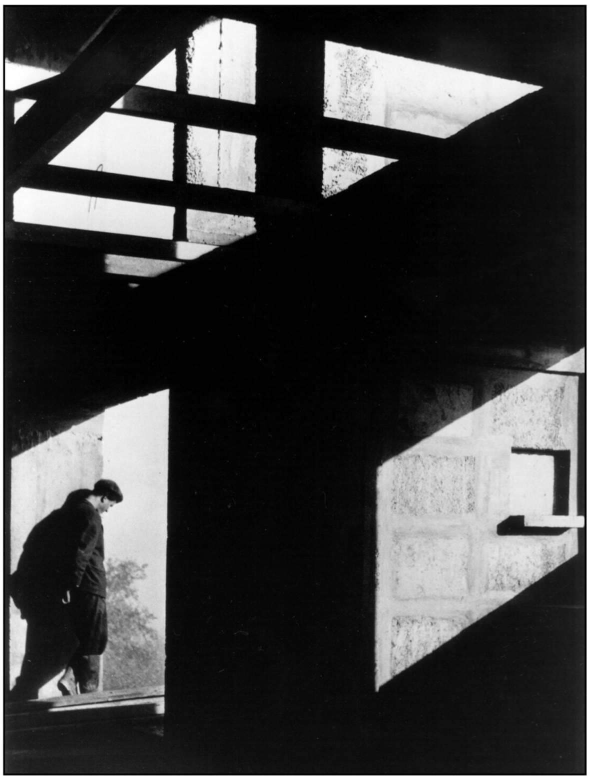
The building is 135 meters long, 24 meters wide, and 56 meters high. The structure is raised off the ground on a set of large pylons (*pilotis*) shaped like inverted cones. There are 330 separate apartments. Most of these (with the exception of those on the southern end of the building) traverse the width of the building. Each of the apartments spans two levels and extends from one side of the building to the other. This means that entrance corridors (internal streets) need only occur on every third floor. The arrangement of the apartments is shown in the following illustrations:





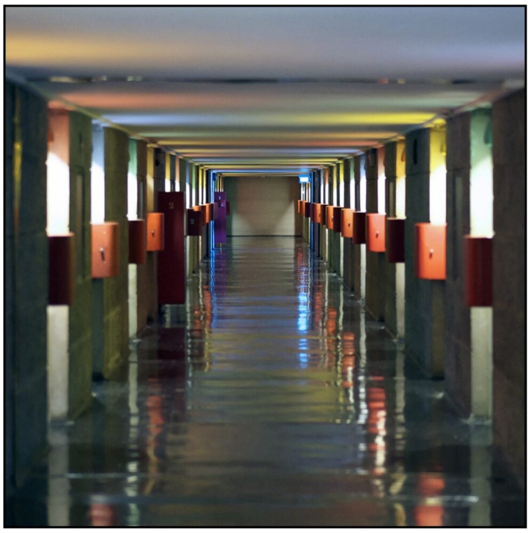
The following illustration shows two photographs taken by Lucien Hervé during the construction of the building. Hervé and Le Corbusier became quite close and Hervé went on to photograph most of Le Corbusier's later buildings (Beer, 2004; Sbriglio, 2011). His austere black-and-white prints clearly delineated the tactile surfaces and the underlying structure of the buildings. The photographs below highlight the rough finish of the *pilotis* and the concrete skeleton of the building:



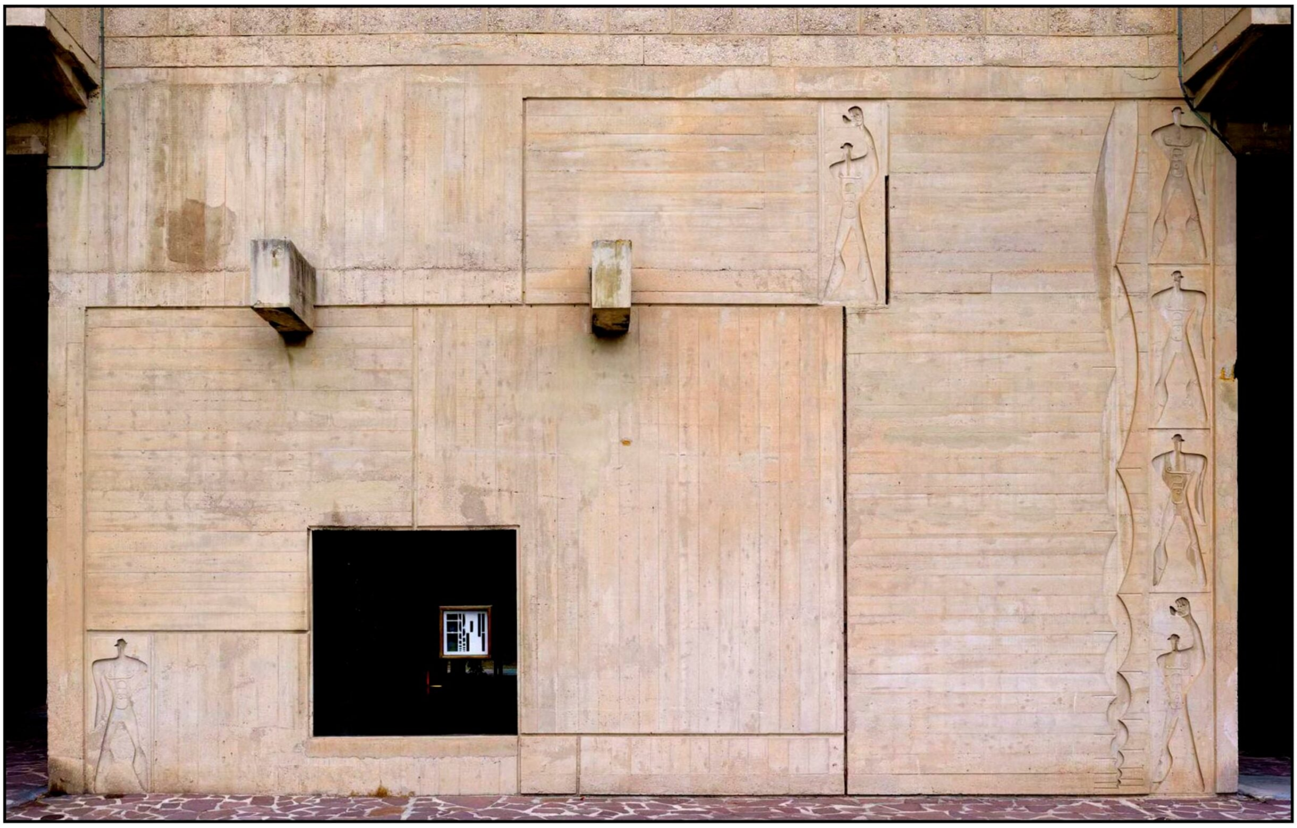


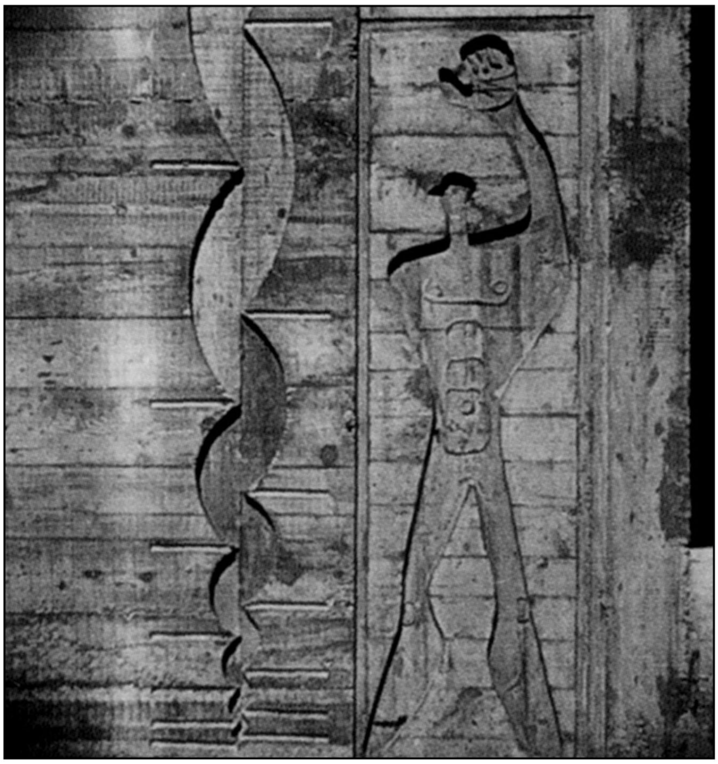
Le Corbusier wished to build a community-dwelling that contained within itself everything needed for everyday life. He was inspired by the utopian idea of a “phalanstery” (a combination of phalanx, military unit, and monastery) proposed by Charles Fourier (1772-1837), and by the Florence Charterhouse that he had visited in his youth (Serenyi, 1967). His idea was to create “a building that is a town” (Janson et al, 2007, p 7). Two floors of the *Unité d’Habitation* are therefore devoted to commerce (stores, hotel, restaurant). The roof was designed for communal use with a meeting-room, paddling-pool, open-air gymnasium, and running-track and to provide stunning views of both the Mediterranean Sea and the inland mountains.

The illustration below shows one of the internal streets, and the two-story commercial street (with the storefront of the bookstore). Below that is a photograph of the rooftop showing the pool, the community meeting room (what was once a kindergarten), the elevator shaft and the inverted cone of one of the ventilation shafts.



Modular ratios determined everything from the overall dimensions of the building to the sizes of cupboards and rooms. Variations of the Le Corbusier logo of the man-with-arm-upraised were cast into the south wall of the building. The illustration below is derived from recent photograph by Cemal Emden. Below that are two photographs by Lucien Hervé taken during construction:





One striking aspect of the Unité d’Habitation is the way that

Le Corbusier designed variations into the regularity. The surface of the building is made visually appealing by the interplay between the concrete *brise-soleils* (sun shades) and the colors of the walls between the balconies. The following photograph by Paul Koslowski (1997) shows the building as viewed from the southwest:

Fitting human beings into modules can make them feel either free or restricted. Variations can take away the rigidity, allowing a sense of community rather than imprisonment. Perhaps the *Modulor* works best if it entails both the setting of standards and their modulation.

Despite his enthusiasm for proportions, Le Corbusier realized that everything must still be subject to aesthetic criteria. The *Modulor* is a springboard not a strait-jacket. And sometimes it may not work:

> …at the very moment when the golden figures and the diagrams

> point to a perfectly orthodox solution I may reply ‘That may be so, but it is not beautiful.’ (1950/54, p. 183)

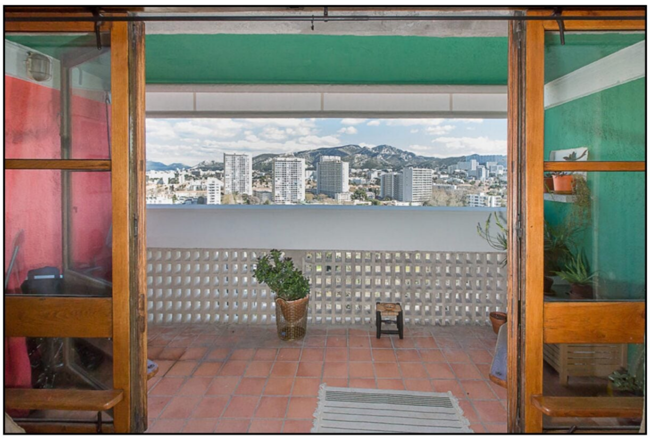
In relation to variation, Le Corbusier states

> I claim for art the right to diversity. I accept on behalf of art the duty of novelty, of the never-seen, the never-conceived. I demand of art the role of the challenger … of play and interplay, play being the very manifestation of the spirit. (p. 220, ellipsis in original)

Apartments were inserted into the building’s skeleton like bottles into a double-sided wine-rack. One apartment had its main floor above the internal street and the other had its main floor below. This entailed two different floor plans:

The living room (4 and 11) is two stories high. The following photographs are from a recent sale:

The main living quarters (on the single-story section of the apartment) are more cramped:

This building is visually striking. However, it did not succeed in what it set out to do (Mumford, 1963; Serenyi, 1967; Janson et al., 2007). Although the living rooms are spacious, the rest of the apartment is very cramped. Originally designed for families, the apartments are more appropriate for single people or couples. The total floor area of the most common apartment layout (illustrated in the previous diagrams) is 98 square meters (1055 square feet). There is little privacy or sound-proofing. The only access to natural light is in the living room and at one end of the small bedrooms. The “interior street” is cold and gloomy (see previous illustration)

The communal shopping street is largely unused: the population of the building is not sufficient to support multiple shops. Ther restaurant (*Le Ventre de l’Architecte,* “Belly of the Architect”), the hotel, and the bookstore are successful mainly because of the tourists who visit the building. The kindergarten is no longer. The following are comments from Serenyi (1967)

> It seems to me that, ideally at least, each apartment of the Marseilles Block is designed for a single human being, living completely alone, while sharing the advantages of a larger collective order. Each apartment, then, must be understood as a bachelor’s quarter and the whole building as a bachelor’s hostel, with communal facilities available to

> the inhabitants at all times. Used by families of various sizes, the building is, at least to a large measure, a failure.

Mumford (1963, p 62) criticized the excessive application of the *Modulor:*

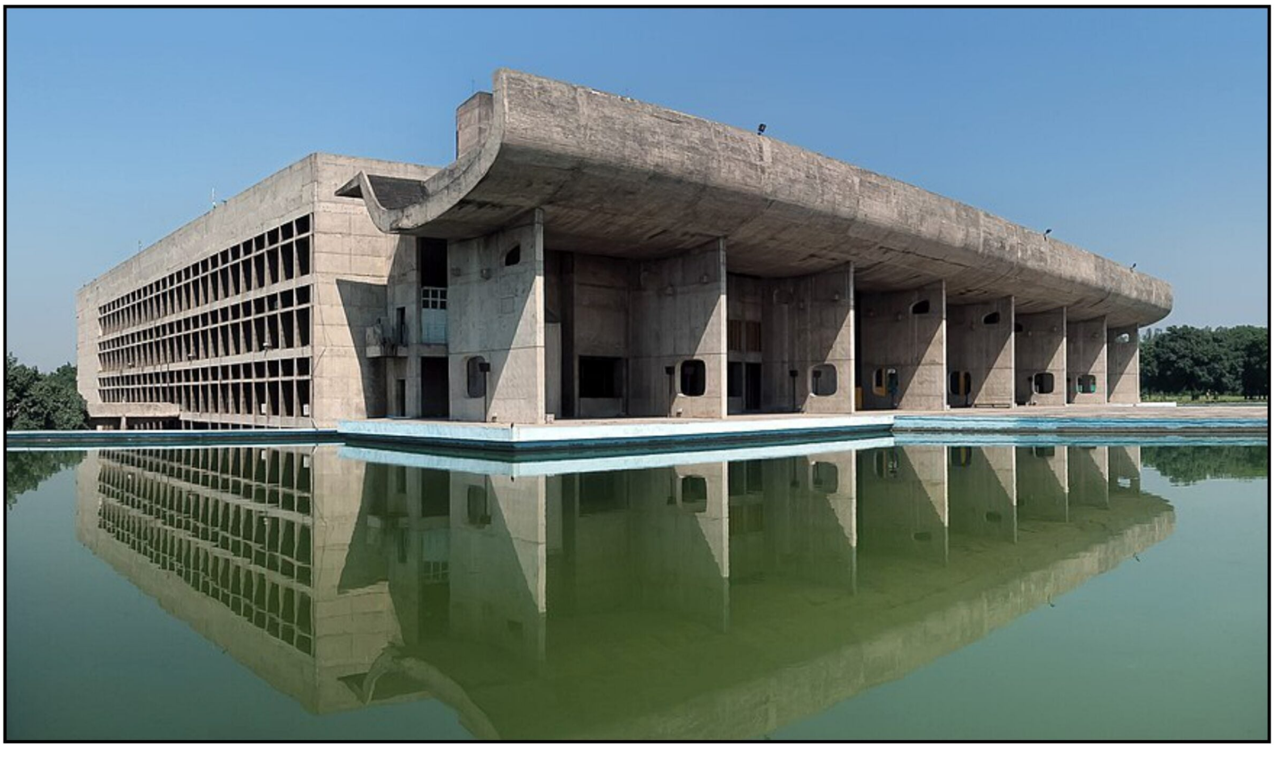
> Like the old Greek innkeeper who chopped off his guests' legs or stretched their frames to fit his beds, the architect of Unity House seeks with violence to accommodate human beings to the inflexible dimensions of his monumental edifice.

The design was duplicated by Le Corbusier in several other locations. The general idea of a city in a building has been followed in many other countries. These have had a varied reception. Many post-war communal housing developments have been considered as brutal as the concrete from which they were constructed. Exposed concrete does not weather as well in the cold, damp North as in the Mediterranean sun.

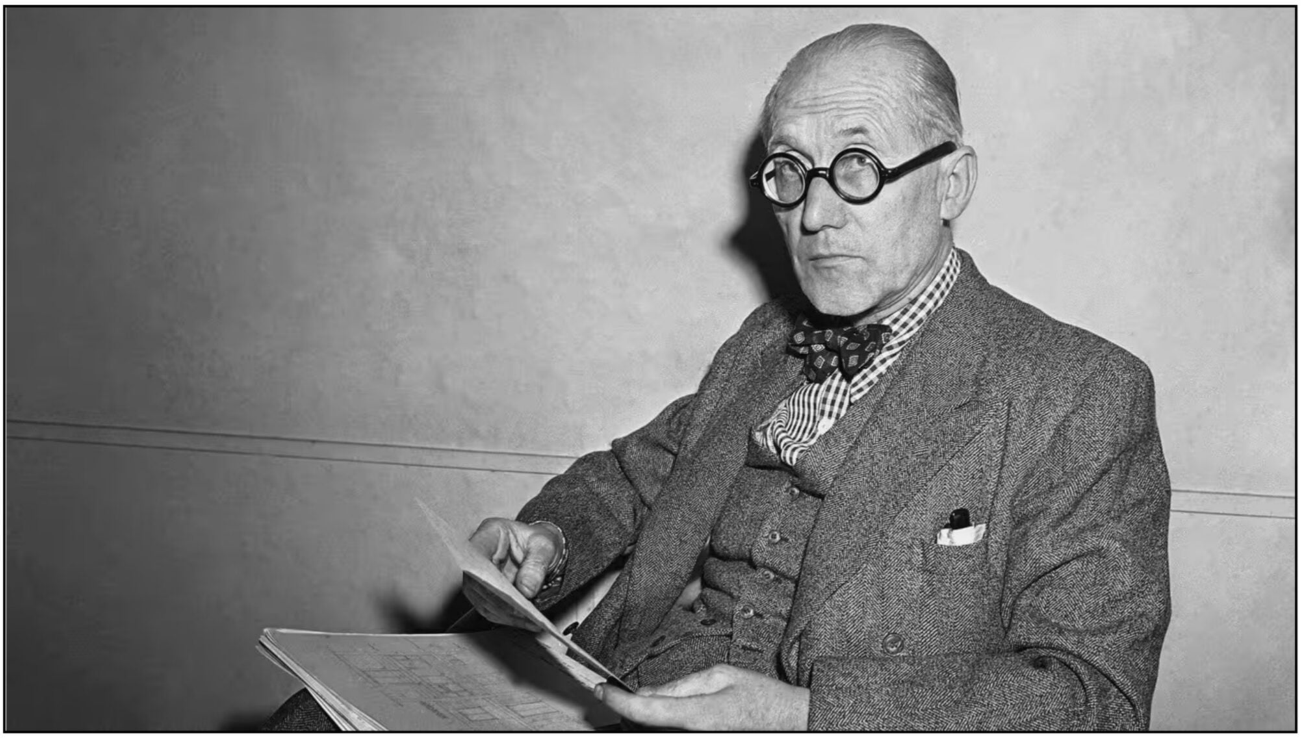
Later Works

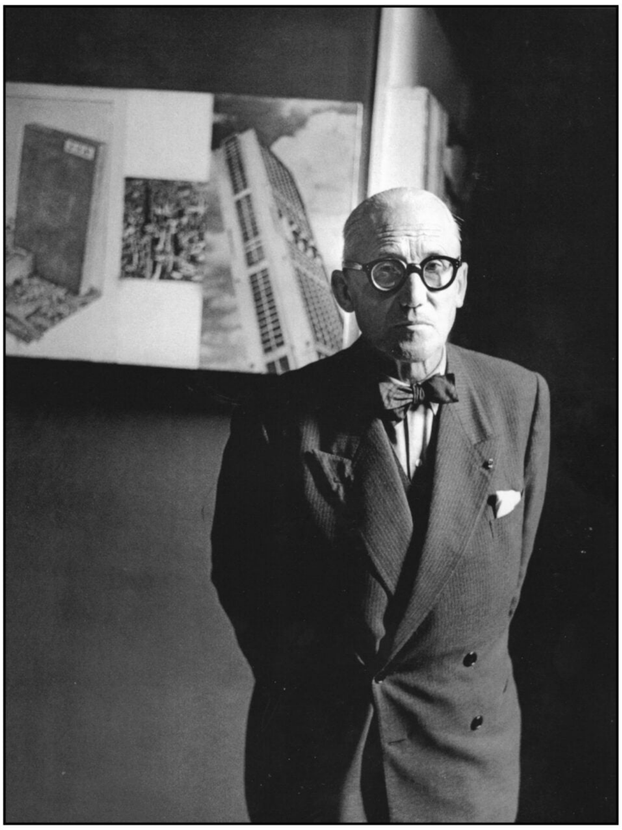
During the last 20 years of his life Le Corbusier was able to realize many of his architectural dreams (Emden, 2017). He continued to use the Modulor as his basic principle of design and concrete as his main structural material. He major ambition was to build self-contained communities. Many other architects imitated his techniques: for example, Oscar Niemeyer, who designed the planned city of Brasilia in Brazil, Mario Pani Darqui, who produced many of the buildings of modern Mexico City.

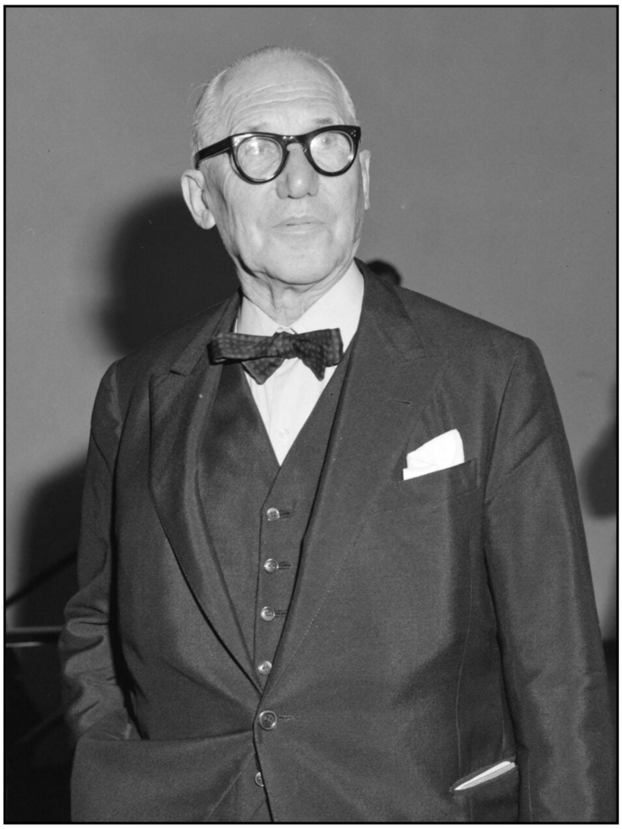
The following illustrations show two of his most famous buildings. The Chapel of Notre-Dame du Haut in Ronchamp, France, was completed in 1955. The National Assembly Building in Chandigarh, India, was completed in 1962.



The following are portraits of Corbusier in the later years of his life. The upper photograph is from 1949; the lower left photograph by Franz Hubmann is from 1955; the lower right by Joop van Bilsen is from 1964.



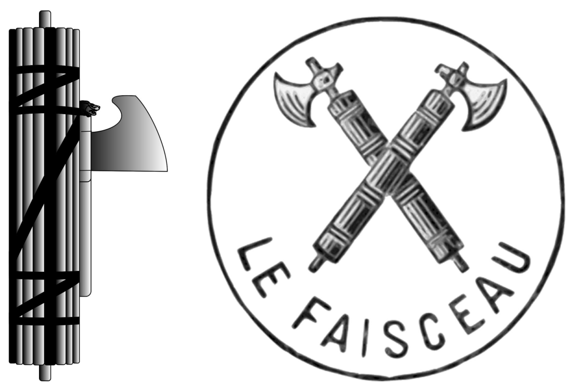




The Measurement of Man

In 2015 a large exhibition on the work of Le Corbusier – *Le Corbusier: mesures de l’homme* – was held to commemorate the 50th anniversary of his death at the Centre Pompidou in Paris (Migayrou & Cinqualbre, 2015): That same year saw the publication of three books questioning his life and ideas, and accusing him of being an antisemite and a fascist (Chaslin, 2015; Perelman, 2015; Xavier de Jarcy, 2015). The authors of these critiques and several other prominent individuals wrote an open letter to the Minister of Culture and Communication, proposing that the French government no longer promote the work of Le Corbusier, but rather educate the public about his antisemitic and fascist leanings. This “Le Corbusier Scandal” persists to this day (Brott, 2017; Xavier de Jarcy & Perelman, 2018).

Le Corbusier was antisemitic (see chapters by Cohen and Fainholz in Badouï, 2020). He did not like Jews and believed that they had contributed to the deterioration of French culture. He wished that they might be transferred to Palestine or to some other non-European country. He worked for the Vichy government though he was not directly involved in that government’s actions against French Jews. The fact that his opinions were very common during his time does not excuse them. However, he did not act on his prejudices.



Le Corbusier participated in the short-lived French fascist party called *Le Faisceau*, founded by Georges Valois (1878-1945) in 1925. The party derived its name from the *Partito Nazionale Fascista* (1921-1943), and used the *fasces* as its symbol. The illustration on the right shows the party logos for the Italian and French parties. Le Corbusier contributed articles about urban development to *Le Faisceau*'s journal *Le Nouveau Siècle* (Antliff, 1997; Brott 2016), Valois praised these ideas: "Le Corbusier's grandiose designs express the profound thought of fascism."

The use of the *Fasces* – a bundle of wooden rods bound together, sometimes including an axe – derives from the Etruscans. It originally symbolized the power of a magistrate to punish offenders (using either the rods or the axe). Over the years, this meaning became conflated with the fable about how people should work together because individual rods could be broken but a bundle of rods could not. In this way the symbol came to combine justice with unity (Brennan, 2022). The general idea of fascism is that the individual citizen must sacrifice his or her desires and act together to fulfil the goals of the leader.

Le Faisceau was not clear about its political goals. Valois proposed a general revolt against bourgeois rule but never really instigated any revolution. The party and its journal ceased to exist in 1928. Valois later switched his allegiance to more left-wing political groups. He was active in *La Résistance* during the Nazi occupation of France, was arrested in 1944, and died of typhus in at the Bergen-Belsen concentration camp in 1945.

Le Corbusier's involvement with this early fascist party does not render him culpable of the terrible things later perpetrated by fascism of Italy and Germany. However, it does indicate his political naïveté, and highlights some real problems with his urban planning and his architecture.

The design of communal housing and the planning of cities is extremely difficult. The architect must provide for many people without sacrificing them as individuals. Many critics have considered Corbusier's ideas about urban planning as lacking the human touch. They seem more appropriate to barracks rather than homes: the building is more important than its inhabitants.. If this is so, we are tending to a fascist style of architecture, where individuals function together as modules in a whole.

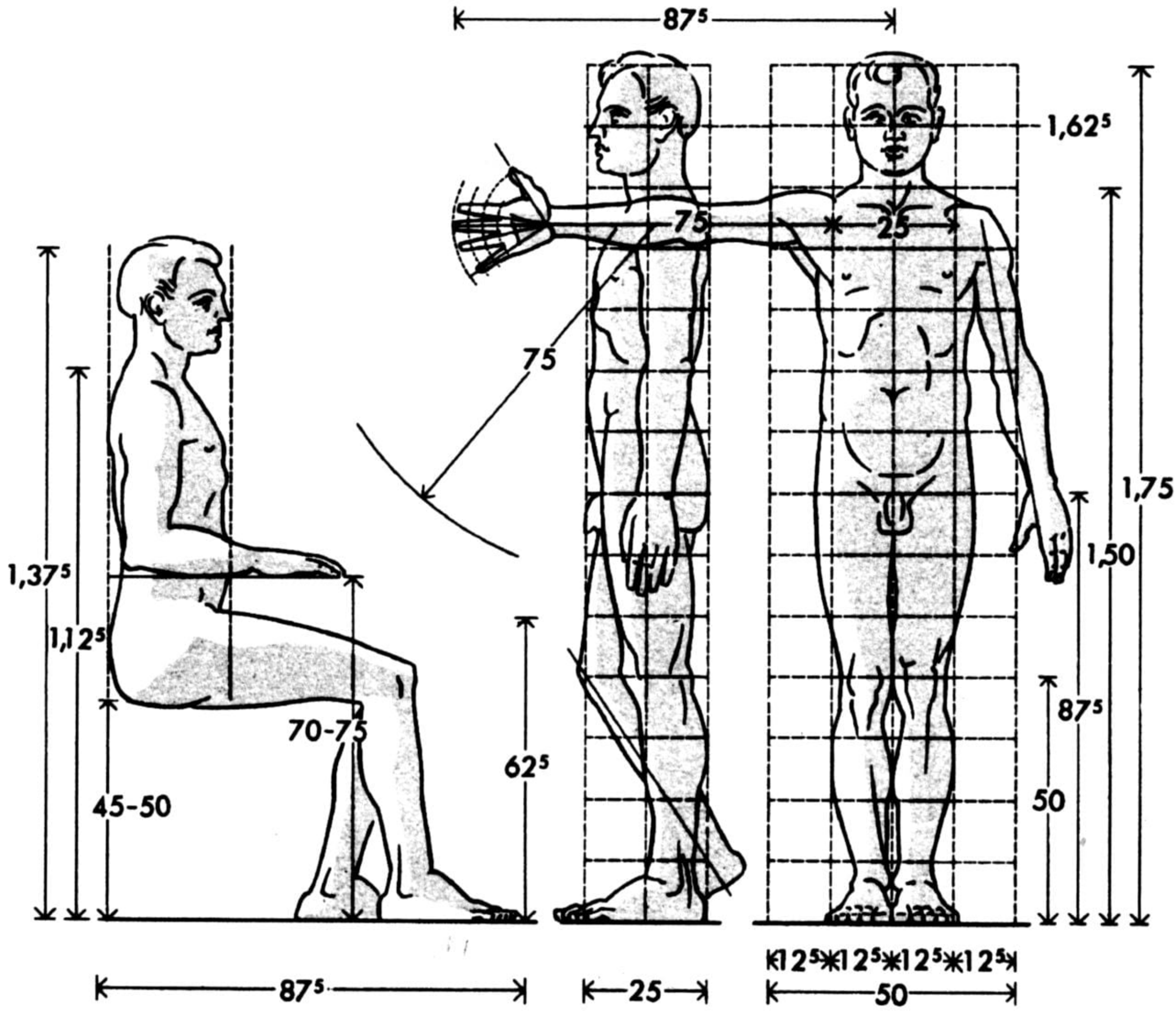
The Marxist philosopher Ernst Bloch (1885-1977) commented on Le Corbusier’s designs for communal housing:

> the real human beings in these houses and cities become normalized termites, or within a “dwelling machine” they become foreign cells, still too organic (1959, translated and reprinted, 1988).

The following is from Perelman (2015, p 70), whose book is titled *Le Corbusier: Une Froid Vision du Monde* (a cold view of the world)

> En tant que totalité concrète structurée, l’oeuvre-système de Le Corbusier est indéfectiblement associée à une visualisation totalitaire de la vie, à une compulsion répétitive de l’idée de machine (humaine, architecturale, urbaine), à l’inquiétant projet d’un urbanisme de la rareté visuelle, au froid alignement de blocs d’édifices standardisés et unidimensionnels.
>
> [As a structured concrete whole, Le Corbusier’s body of work is indelibly associated with a totalitarian view of life, compulsively repeating the idea of the machine (human, architectural, urban), planning cities devoid of visual variation, composed of coldly aligned blocks of standardized, one-dimensional buildings] (my translation)

Standards are important for architecture. They make it possible for architects to fit buildings to human beings. However, they run the danger of removing any individuality from the final structures. Zöllner (2014) has reviewed the history of how we have come up with standard human measurements from Vitruvius to the *Modulor*. He notes that at the same time as Le Corbusier was formulating the *Modulor*, Ernst Neufert (1900-1986) in Germany was promoting a completely different system based on the octameter (12.5 cm, one eighth of a meter):



Neufert’s octameter standards were used throughout Germany and occupied Europe to facilitate the tremendous building program of the Nazi war effort (Vossoughian, 2015). Neufert’s *Architect’s Data,* initially published in 1931, continues to be a sourcebook for architectural standards (2023). Neither the *Modulor* nor the Octameter accurately portrays the average human being let alone properly considers his or her variability,

Epilogue

Art depends on variations. The beautiful combines old and new, similar and different, harmony and dissonance. The architecture of Corbusier is often beautiful. Yet this beauty derives from his aesthetic sense and not from the application of the *Modulor* system.

Buildings must always fit the general size of the human being. Monuments of overwhelming size are common if fascist societies: they exist only to make us feel insignificant. The Basilica of the Valle de los Caidos in Spain is probably the clearest example. Huge and cold, without natural light, this monument to the dead of the Spanish Civil War provides no sense of reconciliation or redemption. Le Corbusier’s buildings do not overwhelm us in this way. However, they do force upon us the arbitrary measurements of the *Modulor.*

Architecture must use proportions that are pleasing to those that use the buildings. “Pleasing” is an aesthetic judgment, one that often depends on what we feel comfortable with. Le Corbusier used a modular approach to designing communal housing. The measurement of man is important but man should not be forced to fit arbitrary measures.

Current developments in architectures have moved away from the modular approach and now stress the individual human context rather than the universal standard (e.g. Alexander, 1979). Each part of the building should be adaptable to what a particular human user will do in that space.

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