

Vernacular Responses to Climate across the European Continent

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Geography/Climate

The European continent has three predominant climates: the oceanic climate that covers a large part of its central territory, characterized by abundant rainfall, temperate winters and cool summers; the Mediterranean climate, on the shores of the Mediterranean Sea, characterized by mild, wet winters, dry, hot summers and variable autumns and springs, regarding both temperature and rainfall; and the continental climate, with scant rainfall and extreme temperatures, and great differences between summer and winter.

The availability of traditional construction materials in each place on the European continent determines the built substance of its vernacular architecture, which – depending also on the climatology, the temperature and the rainfall – determines the configuration of floor plans, with the possible presence of an outdoor 'room' such as a patio; building shape, especially the roof; and the relationship between the interior and exterior space through the existence, dimensions and types of porches, bays, openings and filters in the façade.

Water

The presence of a larger or smaller amount of water, its state and the frequency with which it appears often determine not only the shape of dwellings but also the way in which they are grouped.

Wind

The European continent is traversed by various wind patterns. The westerlies are constant winds that blow from west to east in latitudes of between 30 and 60°; they have a moderate effect on the climate of western European coasts, which are also influenced by the Gulf Stream. They are at their strongest between 40 and 50°, which are known to British sailors as the 'roaring forties.' Besides this forceful current, which circulates at a great height, there are thermally generated local winds created by the difference in temperature between the variable warm and cool zones (day- and night-time breezes between the sea and the land), and those created by dynamic means due to the accumulation of air in a particular spot because of the existence of a mountain chain.

Opposite The hill town of Montilla in Spain's south typifies a response to the warm, temperate environment, with its dense central township surrounded by verdant vineyards and farm housing. Thick building walls are typically rendered in gypsum and punctuated with small openings to protect against strong summer sunlight and cooler temperatures in winter.

Right Alpine huts were devised as a strategy to protect against the roaring gales and scant sunlight that typify northern and central European regions. Logs were a logical building material based on the abundance of timber in the Alps.



Besides their influence on the climate, these winds have also fashioned European vernacular architecture, generating scattered or collective urban solutions and configurations of dwellings. Indeed, the layout of many European rural settlements can still be interpreted as a strategy of sheltering from unwanted strong winds while, conversely, facilitating the circulation of pleasant breezes.

The predominant wind direction in each place also affects the interior layout of that locality's vernacular houses, wherein trial and error has been used to create a horizontal route for currents of air that permits or prevents cross ventilation between the different rooms on each level, and a vertical route in which the staircases or the fireplace location contribute to the dwelling's internal ventilation.² In cold climates, these dwellings customarily have their bedrooms placed at the rear of the interior space in order to ensure greater thermal comfort, whereas in the warmer, Mediterranean zones each room can mediate heat gain through at least one window – although this may look on to an inner courtyard, which also acts as a chimney in the building's cross-ventilation strategy. In both types of dwelling, different types of curtains were generally used. In cold-region dwellings, beds themselves often had a curtained canopy, which could be pulled closed to keep the sleeping place warm. In warm-climate dwellings, internal doors were often replaced by hanging, light curtains or lines of beads that would not stop air from circulating from room to room.

Fire

Fire is present in different ways in vernacular buildings, fulfilling one or more functions and helping to configure the dwelling depending on the climate. In traditional vernacular architecture in warm European climates, fire has been used mainly for cooking and only occasionally in winter for heating, whereas in cold climates, fire has generally been used not only for cooking but also for heating and even for illuminating the rooms during the dark winter nights. The European geographic 'frontier'

regarding the use of fire only for cooking or for cooking and heating lies approximately at latitude 40° N.³ Since the European continent lies in a strip running from latitude 36° N to 70° N, it is clear that only the vernacular architecture of the south of Spain, Italy and Greece – along with the majority of Mediterranean islands – could dispense with fire as a source of heat, while most vernacular European architecture traditionally depended on the presence of fire as a means of heating in order to survive. Furthermore, traditional European vernacular architecture located above 55° N, which implies six or fewer hours of light a day in winter, has especially needed fire for lighting.⁴

The forms that fire takes in vernacular dwellings at different latitudes range from simple, traditional wood or coal fires on which the kitchenware is placed directly, to open ranges, with tripods sitting on the fire, or hanging pots, which at the same time provide heat for the room. In the transition area between latitude 40° N and the zones immediately to the north of it, braziers are quite commonly used not only for portable heating but also as a cooking tool. In central Europe, built-in majolica-tiled stoves are common (the Russian *pechka*, or German *Kachelofen*), and are used for cooking, heating and even lighting.⁵

It is important to point out, too, the presence of the sauna (*Rauchsauna*, *thermae*, *bastu*, *banya* or steam baths) all over the European continent, even since pre-Roman times;⁶ this device was conceived not so much as a heating system as an aid to personal hygiene, and it was usually located in constructions independent from the main dwelling.

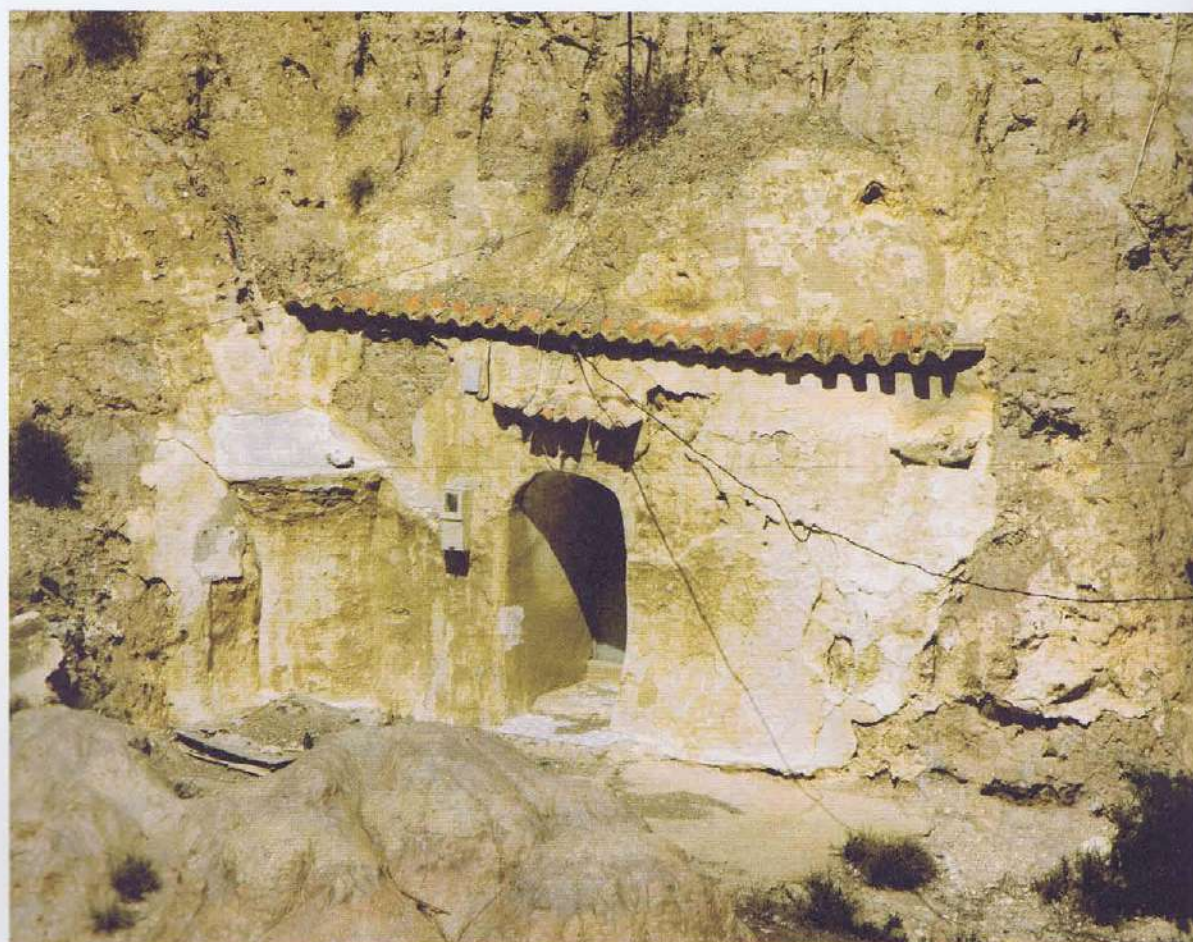
Finally, it is interesting to mention the existence of *glorias*, a traditional vernacular subfloor heating system in the architecture of the north of Castile (Spain), probably developed from the heating mechanisms used in Roman or Arab baths. These, however, are also found in distant lands like Korea (where they are known as *ondol*) or China (*kang*),⁷ where they provide heating for dwellings in cold continental climates where no firewood is available, using straw as their only fuel.

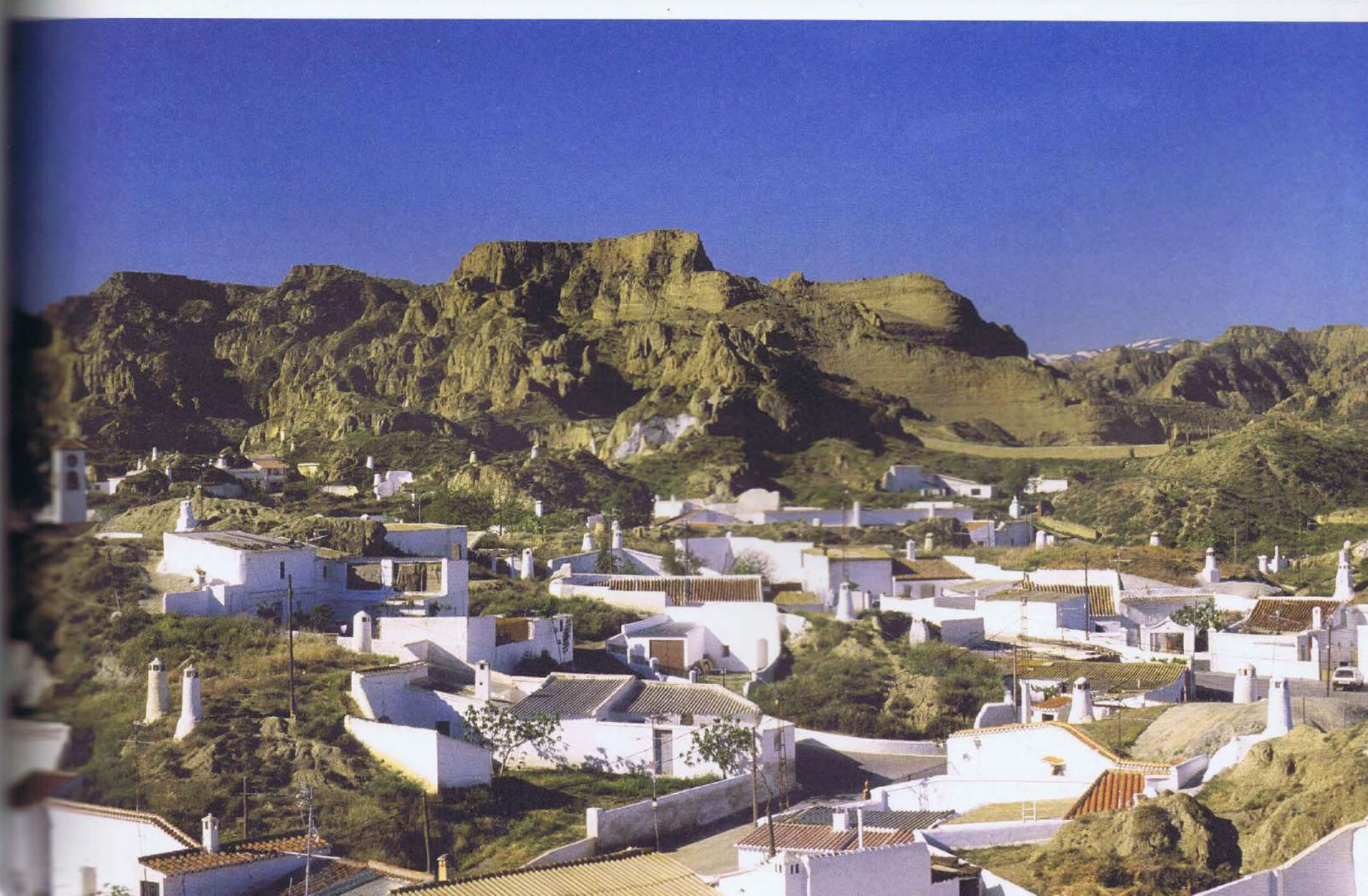
Below left To manage heat gain in warmer Mediterranean zones, rooms often have at least one window that overlooks an inner courtyard, which also acts as a flue in the building's cross-ventilation strategy.

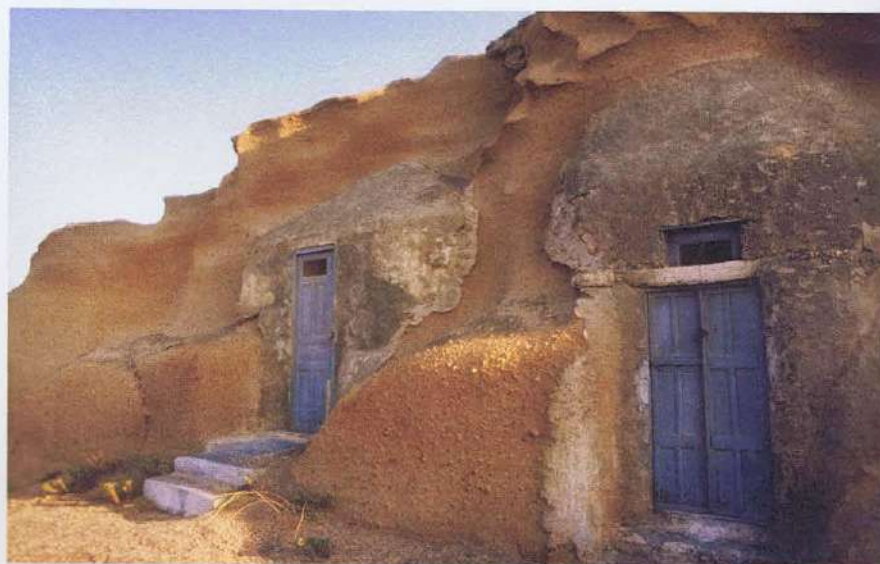
Below right Cave dwellings draw on the inherent properties of the natural surroundings as a means to mediate heat in warm climates. Troglodyte homes provide an immediate respite from high summer temperatures and are to be found all over the Mediterranean region and the Rhône Valley.

Opposite top The form of European vernacular townships and dwellings is often configured in response to the prevailing wind direction. The Spanish village of Riglos nestles below a huge sandstone outcrop – a strategy used by its settlers to protect against strong winds.

Opposite bottom In more temperate European climates, such as the township of Guadix in southern Spain, wind direction also shapes the interior plan of vernacular housing. Frequently, staircases or chimneys are positioned to enable a vertical route with which to evacuate warm internal air.







Sun

The varying degree of sunlight that reaches the different latitudes of the European continent has a great influence on the configuration of its vernacular architecture and especially on buildings' relationships with the exterior. The scant sunlight in the centre and north of Europe – in addition to other conditions, such as the height of the location and its exposure to the wind – has traditionally given rise to very compact vernacular dwellings with bays of limited size, built close to the ground or even embedded in it, in an attempt to minimize the loss of heat from the interior of the house. More frequent sunlight in these places was always very welcome but not to the extent that large bays were inserted, because the loss of heat involved would not be compensated for. The transition between indoors and outdoors in such structures is always rather abrupt: merely through a door – or, at best, though a small hall for robing and disrobing, usually without any intermediate spaces.

The intense sunlight characteristic of the Mediterranean Basin generates a similar exterior compactness in vernacular architecture, with bays perhaps larger but still limited in size – this time in order to prevent too much heat from penetrating indoors. The indoor-outdoor relationship is richer than in northern climes, with a great variety of 'in-between' spaces or places located on the borderline between indoors and outdoors,⁸ and with an abundance of shading and cooling systems.

Such in-between spaces include terraces, porches, raised platforms, pergolas, pavilions, half-open sheds, porticoes and colonnades – in other words, places partially exposed to the open air and partially sheltered by the building. They arise when the threshold of the

building expands and stretches, becoming large enough to create a space that can accommodate living. Patios deserve a special mention as they are to be found all over the Mediterranean area. The tradition of the patio dates back to the distant past, with Greek or Roman houses as prime examples, although they are by no means the oldest. Patios have proved useful in many of this region's buildings, not only to provide light and ventilation but also as an element articulating communication and life within the house.

Shading systems may comprise lattices (fixed or openable), louvred shutters, net curtains, solid timber shutters, roller shutters, Roman blinds, internal or external Venetian blinds, curtains or roller blinds. Blinds can also be used to hang down vertically or at an angle over the handrail of a balcony for the purpose of offering light, shade, breeze and side views and, at the same time, safeguarding privacy from the front.⁹ This warm part of Europe also boasts street-shading strategies to allow people to walk along public thoroughfares protected from the sun, such as generous eaves and cornices running along narrow, winding streets; whitewash finishes that partially avoid the absorption of heat; and street porticoes offering shelter from both the sun and the rain. Other individual shading elements include parasols; awnings or textiles stretching from a street façade to the one opposite; trees with large crowns, or the shade of palms or grapevines and other climbing plants; wooden pergolas; trellised wooden roofs; and canopies intermittently scattered over the streets.¹⁰

In this warm-climate European vernacular, cooling systems have traditionally been used based on height (the presence of tall rooms with draughts passing overhead

Above Differing latitudes across the European continent create varied intensities of sunlight, which directly shape the architectural responses. Characteristically, the strong solar gain in southern regions is reflected in external shading devices such as shutters, curtains, lattices and blinds. Interstitial areas between street façade and interior, such as patios, create sheltered, open areas that extend an individual's living space. These often laid with stone or tiles.



Above Colonnades to the building exterior and to internal courtyards are frequently used in the Mediterranean Basin as a shield from the extreme summer heat that is typical of the region. Other architectural means that provide cool, shaded places to walk typically include porticoes, generous eaves, narrow streets and individual shading elements, such as parasols or pergolas.

in order to favour convection), mass (the use of thick walls with great thermal inertia), air (the promotion of cross ventilation between façades with different thermal gradients due to the different exposure to sunlight or the dissipation of heat in stair wells or chimney flues), and the presence of water and vegetation, which accentuate the effect of the strategies enumerated above. Apart from the overall design, which takes into account the circulation of local winds and the creation of shading systems permeable to wind, other natural cooling systems have been devised in the urban areas of these warm European regions. These include the presence of vegetation, utilizing its capacity to evaporate and hold water in its foliage, and the incorporation of water in the form of fountains, ponds, street wetting, and so on.

Materials and Construction Techniques

As is the case with traditional constructions in the rest of the world, European vernacular architecture is mainly the result of a balanced combination between the dominant climate in each place, the construction materials available in the immediate surroundings – arising partly from the climatic conditions – and the use of space and the system of social relations established in a particular place – again, both partly as a result of climatic conditions. The construction techniques used to build with these materials in each climatic and social context evolved over the centuries, based on old currents of technological transference and a process of trial and error, seeking to adapt in the best possible manner to the physical conditions of each location.

Vernacular architecture is conceived on the basis of taking advantage of the resources available at a

reasonable price considering the functional needs of the building. In places with an abundance of stone, it is natural to use stone for building enclosures, shelters or stepped terraces; it is also a way of clearing fields in order to facilitate ploughing and crop production. In alluvial valleys, earth is commonly used: it is an extraordinarily cheap raw construction material. Where water was scarce, rammed earth was more usual because it requires a water component of only 5 per cent for construction purposes, provided that the appropriate formwork techniques were available. On the other hand, if enough water and straw was available to produce sun-dried bricks during a dry season, adobes were more commonly found. In some areas, the lack of basic means, constant rain or even simply greater urgency led to the construction of cob walls. If timber was available too, mixed solutions were adopted, such as half-timber or post-and-beam structures with a cob or wattle-and-daub filling. Brick manufacture was much more expensive than the aforementioned methods because more fuel was consumed in the process. Brick factories therefore required a certain amount of organization and the coordination of the various crafts involved. They also depended crucially on the level of local economic development, the presence of suitable clay and timber (or scrubland) for the kilns, and the procurement of mortar, which could be made from, among other things, earth, lime or gypsum depending on the availability in the area and the owner's financial means.

Walls

The most common structural systems in Europe are based on loadbearing walls made of stone, brick, earth or timber, bonded variously with earth or lime or gypsum mortars – the last-named also possibly used for interior and exterior rendering. Stone is used throughout the continent, but less frequently north of the Rhine and Danube basins where it alternates with brick (commonly found all over Europe). The presence of stone and brick in these places also permits the erection of pillars, whose use endows interior spaces with greater functionality but simultaneously requires the availability of sizable timber beams to bridge the gap between pillars in order to erect joisted upper floors.

Horizontal log construction – in its three main variants of double-saddle notch log, double 'V' notch log and double square notch log – is limited to places with abundant timber, principally the Alps and the heavily forested areas of eastern and northern Europe. Log houses were exported by European migrants in several waves, beginning in the 17th century, to North America across the Atlantic Ocean, to the North American Pacific Coast across the Bering Strait, to Paraná in Brazil, to Argentinian Patagonia and to Australia.¹³

Earthen walls can be encountered all over Europe, although mainly in plains and alluvial areas. Special mention should be made of those examples located in the Iberian Peninsula, which are found both in monumental and in residential architecture,¹⁴ and in particular in the Pannonian (or Carpathian) Basin of east-central Europe. In the latter case, earthen architecture in more than forty building variants and techniques became very popular

following the 18th-century publication of fire edicts for the vast Austro-Hungarian Empire, which prohibited log houses and favoured earth constructions.¹⁵

Rammed earth walls are to be found mainly in four specific areas of Europe: the Iberian Peninsula, the area comprising southeast France and northwest Italy,¹⁴ the Pannonian Basin, and the Baltic countries. Adobe walls, whose production additionally needs straw and more water than rammed earth walls, were mainly spread over the northern half of the Iberian Peninsula, eastern France, the Padanian Plain (Italy) and the Pannonian Basin. Cob walls are rare, and scattered throughout the continent – mainly in humid areas with plentiful supplies of straw and water.¹⁵

Until the 19th century, half-timbered construction – based on the combination of box-framed walling with either close studding or square panels filled with adobe, cob, wattle and daub, and so on. – was a very widespread and popular traditional construction technique in areas with an oceanic climate, although it could also be found in some parts of the Mediterranean in medieval times. This type of building was exported during the 17th, 18th and 19th centuries by European migrants to the east coast of North America, Brazil and southeast Australia.¹⁶

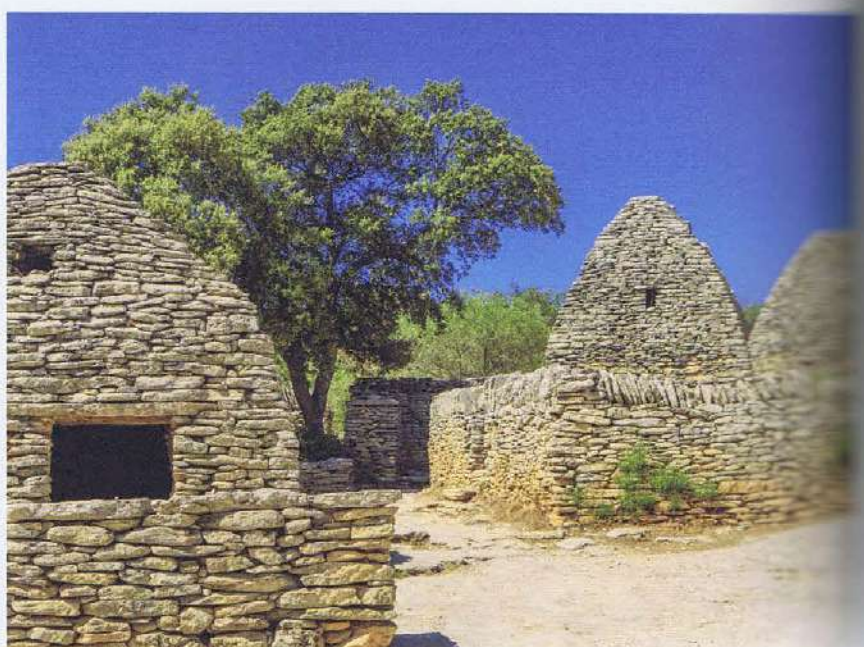
Below Loadbearing stone, brick and earthen walls form the most consistent elements of building construction throughout the European continent. The enduring and fire-resistant qualities of these materials ensured their popular use and eventually superseded other methods, such as half-timbered construction, which declined from the 19th century onward.

Opposite top With stone locally available, this detail of a typical wall in southern Spain illustrates how the building's solid thermal mass, its minimal and shuttered apertures, and its terracotta roof tiles form a carefully considered answer to the need to moderate heat.

Opposite bottom In cooler European regions, such as in northern Germany, more substantial and well-insulated building envelopes have always been necessary. This historic façade in Überlingen, near Lake Constance, shows architectural variation, its timber-framed wall adjacent to solid constructions of render and stone.







Opposite Roofs and interiors of vernacular structures on the continent often draw on timber as a base element. Wood was widely available and typically used to create loadbearing structures. Upon this sturdy framework, timber or stone shingles, or thatch, enclosed the building. Inside, raw floor surfaces were laid with wooden board, flagstone paving, or tiles of ceramic or concrete, all of which provided additional thermal protection.

Floors

Floor and roof structures in European vernacular construction are formed mainly by the use of wooden beams and joists, with bays infilled with whatever materials were freely available in the region. These could be wooden planks, bricks, stone slabs, gypsum or wattle – or a combination of earth with any of the above. Depending on the availability of timber and sawmills in the area, beams and joists could either be simple logs, without bark, or could have sawn, squared profiles. The availability of timber also dictated the infill material, and wooden planks were most commonly used in Europe – especially in relatively forested areas – with wattle being often adopted in wetlands and marshy areas. In drier, rural regions with less sophisticated means, stone slabs were often employed to bridge the (normally short) bay spans that lay between the joists.

In areas with a relatively scant amount of timber and possibly many gypsum deposits, jack-arch (or 'flat-arch') floors with either gypsum-poured or flat tile vaults were developed. These became widespread from the 16th century onwards, along the Mediterranean coast from the south of Spain, with some gaps, to the island of Sicily.¹⁷ At the end of the 18th century, this solution was exported to Britain and other parts of Europe, where it was often put into practice until the early 20th century. It was particularly used in dwellings and industrial plants or warehouses with metal joists and brick vaults, fundamentally because the brick vaults were fireproof – especially if the bottom part of the metal joists was protected or covered to avoid exposure in case of fire.

On this horizontal floor, composed of different materials depending on availability in the vicinity and functionality in each case, it was common to spread a layer of earth, lime mortar or gypsum in order to provide a certain amount of thermal and acoustic insulation between the various floors of the building. In the past, this layer was used directly as the surface of the floor, as in the traditional case of simple tamped earth or earth-and-lime floors found in many parts of central and eastern Europe; *massetti* in northern Italy; and *Anhydritestrich*, or anhydrite flooring, in German-speaking regions of central Europe. Alternatively, a surface of oiled gypsum might be adopted in areas with abundant gypsum deposits, for example in the east of the Iberian Peninsula.¹⁸ In most cases, as soon as the owners of the dwellings could afford them, these raw surfaces were limited exclusively to acting as an insulating layer and were progressively covered with a second layer of floorboards, flagstone paving or ceramic tiles (either earthenware or glazed) in ceramic-producing areas. In the late 19th century, other much more economical options, such as colourful cement tiles, became extremely popular all over Europe.

Roofs

The supporting structure of the roof, formed by timber joists and an upper board to serve as a base for waterproofing, repeats many of the patterns described for floor solutions above – especially those made with wooden boards, stone slabs or wattle. Roofs in buildings with jack-arch floors made use of a range of constructional possibilities, comprised of an upper board made of timber, woven wattle or flat tiles.

Waterproofing techniques for such roof structures depended on availability of materials – employing stone slabs, slate, shingles, in timber-rich log-house areas, or ceramic tiles, which became common in large parts of Europe. Slate roofs are found throughout Europe – in almost all regions of France and Switzerland, in the western half of the British Isles, as well as in parts of Spain, Germany, Greece and eastern Europe. Shingle roofs can currently be found in eastern and central Europe, although they were once widely used in other timber-rich European regions from the Roman era onwards. Ceramic tiles, introduced into Europe also during Roman times, adopted many shapes, ranging from simple, rectangular plain tiles and Dutch S-shaped pantiles to Spanish half-truncated cones.¹⁹ Slates, shingles and clay tiles have also been used occasionally to clad walls, offering extra waterproofing and even (in the case of shingles) enhanced insulation – particularly in areas where walls were exposed to damp, wind and rain.

The traditional thatched roof – historically the region's most popular vernacular solution, used in every European country without exception, with different local species – can still be found in many corners of the continent, although it is not used very frequently nowadays.²⁰ Several types of straw and reeds in bundles, tied or nailed together, are normally applied, either directly to the roof structure or to an intermediate cane mat.

Other structural roofing and waterproofing systems, such as corbelled domes, are mainly associated with Mediterranean dry-stone construction methods, although they can also be found in the British Isles and Iceland. These may be used for isolated farmers' or herdsmen's cabins to shelter their occupants from inclement weather, or may even generate a whole, fascinating village, as in the case of Alberobello (Italy), Village des Bories (Gordes, France) or Cabanes du Breuil (Saint-André-d'Allas, France). A special case of corbelled domes, without any equivalent in Europe and which can only be compared to the beehive structures of Syria,²¹ are the domed huts of Castile, which are made of adobe rather than stone masonry.²²

Another interesting roofing system is provided by the example of excavated architecture, where the terrain itself fulfils waterproofing and run-off functions, examples of which can be found principally all over the Mediterranean region and the Rhône Valley, and which became especially popular in the 19th century with the increase of demographic density in Europe.²³ Most of the underground architecture to be found in these European regions comprised newly excavated caves or, at least, significantly modified natural caves or cavities.²⁴ There are also examples of the remains of semi-subterranean winter dwellings in southeastern Europe and around the Danube Basin, made of timber poles and logs covered with wood, brush and earth.



Finishes

The finishes of vernacular architecture in Europe range from exposed stone or brick to formwork whose finished surface derives from contact with its boarding, to renderings made of diverse materials. There are no set rules regarding the location in Europe of exposed or rendered fabrics, a decision that depends ultimately on a combination of the friability of the material used (for example, an unrendered adobe finish lasts less longer than a brick one) and its exposure to weathering. As is often the case in vernacular architecture, however, there does exist a close relationship between the availability of a specific material in situ and its application in local architecture. Traditionally, three exterior renderings have been used on the European continent: earth, lime mortar and gypsum.

Mud rendering is common in areas where earth is usually used as a construction material – especially to protect adobe, cob, half-timbered and wattle-and-daub fabrics. Rammed-earth building fabrics have a smooth finish because of their formwork, and in principle this resists weathering better than alternatives. There are, however, also cases of mud renderings protecting rammed earth, or even lime-crusted rammed earth that is applied inside the formwork while building. Earth architecture, along with brick or stone masonry fabrics, can also be rendered with lime mortar, which is more expensive than mud – so its adoption often depends on a building owner's financial standing. There are also cases all over the Mediterranean, not necessarily in dry zones, where gypsum has been used historically as the outer rendering of buildings with excellent results.²⁵ This

Above From exposed stone or brick, to rendered or exposed adobe, the materials used to finish structures in Europe are as much dependent on locally available materials as on tried and tested techniques. Mud, gypsum and lime mortar are the three traditional renders that can be traced across this region; to a lesser extent limewash and rammed earth also feature.

Below The extent and manner in which land surrounding a dwelling is used varies immensely throughout Europe owing to the climatic range – from cool northern regions to the intense heat of the south. For the latter, while most rural areas are more dispersed, in towns and cities the population density forces alternative occupation of spaces such as balconies, roofs and the street.

is a specific phenomenon associated with areas rich in gypsum. External gypsum renderings can be found, for instance, in buildings in Sicily (Caltanissetta, Enna, Agrigento and Trapani); in Abruzzo (Gissi, Gessopalena) in Italy;²⁶ in Valencia, Játiva, Cuenca, Teruel and even Madrid in Spain;²⁷ and in the city of Paris and its environs,²⁸ thanks to the fabulous historic quarries of Montmartre.

Finally, despite recently falling into disuse, limewash is another type of finish traditionally present in European vernacular. It can be found in the south of Spain, some parts of the British Isles, Holland, Belgium and the surrounding area, the south of Scandinavia, the Czech Republic and some areas of Poland, among other places.

Building Plan/Form

The space of pertinence of a dwelling,²⁹ understood as the free plot of land surrounding it, varies enormously all over Europe – especially and ultimately due to the climatic conditions mentioned above. This domestic space, originally intended to be used for livestock and crops, is generous in damp climates and much less so in dry climes. People's need to live close to a supply of water became smaller and smaller in urban areas thanks to the progressive densification of buildings and the scarcity of free space. In some cases, it reached its minimum expression as simple balcony, which architectural scholar Gianfranco Caniggia defined as 'what remains of the space of pertinence'.³⁰

The various forms of this space of pertinence are often the arenas in which social events, cultural manifestations or production processes take place. In Mediterranean Europe, the private inner patio, carved out of the volume of the traditional building, is the space of pertinence. In colder and wetter areas of the European climate, the vernacular architecture in rural areas created more open and scattered spaces of pertinence, made up of separate buildings erected around the threshing floor or open spaces used for livestock or crops. This is the case of the English yard, the *corte* of the Veneto region, the Germanic *Bauernhof*, the Finnish *piha* and the Polish *podwórze*.

However, especially in the European Mediterranean countries, the lack of this space of pertinence because of the dense development of rural and urban nuclei was compensated for, in a way, by the appropriation by their inhabitants of the streets as spaces of pertinence, as an exterior extension of the dwelling. So people took chairs and tables outdoors, turning the street into an open-air living room. This catalysed social relationships among city dwellers,³¹ and was a process 'hosted' by the traditional cityscape and architecture, manufactured by neighbouring craftsmen with local materials and created at the human scale of these historical settlements.

