

# The Holistic Approach to Habitat Design

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Just as Holistic Medicine considers the human being as a whole entity and not simply a result of various organs and separated cells, so Holistic Architecture believes that the living space is not the product of many frameworks but a complete system “vibrating” with the people who live in it as well as its environment. A holistic approach to the design of living spaces (Habitat) means design quality and positive surroundings for the end user. This methodology is based on five tenets: Safety, Salubrity, Serenity, Sustainability, Synergy. The objective of this document is to discuss in detail these five points with the aid of two case studies in Tuscany: an ecological house in wood and hemp-lime, in the province of Pisa and a redevelopment of the interior spaces for the new Osteopathic Medicine Center in Florence.

**Keywords:** Holistic Design, Feng Shui Architecture, Holistic Engineering, Eco-friendly architecture

## 1. INTRODUCTION

The main principle behind Holistic Design is the following: everything surrounding us (the external environment and habitat) mirrors our interior world. We can use this connection in order to improve ourselves, beginning with our surroundings and habitat.

This approach, aiming at creating a happy habitat in our home is based on 5 Holistic Design mainstays (see Fig. 1): Safety, Salubrity, Serenity, Sustainability, Synergy.

The first two mainstays concern the protection of human life and the health of people’s habitat.

Safety means the feeling that nothing bad will happen to our family and us. It takes shape through a proper design structure, various systems, and the protection of surfaces and materials.

Regarding Salubrity, it is important to consider the healthiness and comfort of the habitat, as we spend at least 70% of our time indoors. The comfort level is defined by many elements: some of them are physical (temperature, noise, etc.), some chemical and some biological. They can cause many diseases and illnesses when not checked.

However, this is not enough; what really makes the difference is the third mainstay, Serenity. It means harmony in our habitat as a result of the correct balance of shapes, colours, materials and sounds.

This methodological approach which is the basis of Holistic Engineering, matches perfectly with Temporal Design in pursuing a quest for a dynamic and harmonious balance.



Fig. 1. 5 Holistic Design mainstays

The Fourth is Sustainability. We need to minimize the environmental impact and enhance buildings’ performances in the circular economy framework, referring to the whole life cycle of its materials and building processes.

Single expertise and competence are no longer enough to manage intricate and complex issues, so working in Synergy is necessary.

## 2. THE HOLISTIC APPROACH TO HABITAT DESIGN

### 2.1 Safety

Obviously, our main consideration is a secure Habitat. A house is always a protection for those who live there, and the same is true of workplaces and public structures.

Safety means the feeling that nothing bad will happen to our family and us.

Safety is the feeling that nothing serious happens to us and our loved ones, and that's why it comes before anything else. If you consider that the number of victims in household accidents every year is higher than those in the streets, you have a clearer perception of the importance of this point.

Safety in the Habitat is achieved through the appropriate design of structures, plants and materials that have an impact on people's protection (fire risk reduction, etc.).

According to data provided by the ISPELS (Institute of Occupational Health and Safety at Work – Italy) each year about 4.5 million accidents occur in the home, 8,000 of which are mortal. These domestic injuries affect women in 70% of cases compared to 30% of men and is the first cause of death for children. Comparing the number of deaths due to domestic accidents with nearly 2,500 deaths due to car accidents (source: Road Police and Carabinieri, 2010), people die more at home than on the roads. A holistic approach to the majority of engineering themes of living or working space gives security to the people who live or will inhabit this space. The main factors influencing habitat safety are:

- Static and Seismic Safety
- Fire Safety
- Systems Safety
- Surfaces and Protections Safety

## 2.2 Salubrity

Our Habitat affects our health, much more than we can imagine. Each of us spends at least 70% of our time in an indoor environment (home, workplace). The factors affecting the health of the man-house-environment system are of various kinds. [2] [3]

Physical factors:

- Humidity
- Temperature
- Noise
- Electromog Chemical Factors
- Harmful substances
- Mineral fibers
- Heavy metals

Biological factors:

- Mould
- Powders
- Radon gas
- Radioactivity

All of these elements, considered individually or together, determine the Range of comfort and healthiness of the Habitat



Fig. 2. Physical Factors Pathologies



Fig. 3. Chemical Factors Pathologies



Fig. 4. Biological Factors Pathologies

and, if not controlled, over time can cause a number of health problems and very serious illness. (see Figs 2,3,4). The factors listed above for Safety and Health are all measurable with devices that are more or less sophisticated and can be assessed through specific calculation methods. These two pillars for the holistic approach to the design of the Habitat are absolutely necessary but not sufficient to achieve global well-being. In fact, it is possible to come into buildings where the safety and health requirements are perfectly respected but the living space is not pleasant. For example, we might have a cube of reinforced concrete with the utmost structural safety, with plants that perfectly conform to all the health parameters (temperature, humidity, noise, radiation emissions, etc.) which also are under control but the space we live in does not emanate feelings of well-being. This is because there are other factors that affect the feelings that you experience when entering an environment related to our sensory perceptions.

## 2.3 Serenity

It is important that a living space is in harmony with its own environment and that there is a good flow of energy inside the space. Only this can give serenity to people who live in that space. It may also happen that a home, even if designed according to the principles mentioned above, may be suitable for a person or type of person, but not for another. Holistic Engineering allows us to evaluate the living space through interactions with the outside environment and with the people living there. The ancient Chinese tradition of Feng Shui

Architecture, the Vastu Indian tradition, and also the Mediterranean tradition of Geomancy have all studied the art of living in harmony and balance with the environment. The goal of holistic design is to adapt these principles to everyday life to improve the quality of life for people in their home environment, in workplaces and in social settings. Holistic engineering considers the importance of energy in design. Living beings, plants, objects around us are energy sites. This energy, interacting with ours, influences our lives, whether in positive or negative. According to Feng Shui, the ancient art of Wind and Water, this Vital Energy is named Qi, and it manifests itself in three forms (see Fig. 5):

- The Qi of Earth: how the context influences our lives;
- Qi of heaven: how natural cycles affect our dwelling;
- Human Qi: how personality affects our lives.

Since the beginning of time, in Eastern cultures (and not only) Man is placed in the center of this Triad. Each of us is connected on one side to the more physical and terrestrial aspects, and on the other to the Metaphysical ones, and is in turn a generator of energy. In order to create harmony and well-being it is necessary to balance these energy flows. Knowing these forces and learning how to optimize them means learning to increase their energy and improve their well-being.

Earth Qi represents the environment around us. All the natural or artificial elements that characterize the physical environment in which we live strongly influence our lives. Qi of Heaven represents the intangible force of Nature and Cosmos that governs all the life cycles that also marks our everyday life. Just think of the sequences of the seasons, the moon and day / night cycle.

Finally, Human Qi represents the most psychological part of living regardless of context. Just as the environment changes our behavior, so, in turn, personality, in movement and expression, tends to influence the environment. Feng Shui is therefore the art of stimulating and harmonizing these energies. Applying its principles to architecture means to resonate the "Man - Environment - Habitat" system with the laws of nature that regulate its rhythm. Let us first analyze the first of these forms in which Qi manifests itself. From the very beginning, the first necessities of man's survival, such as protection and nourishment, have determined the characterization of living space. The presence of the Mountains, behind, meant protection from enemies, from the cold winds of the North, shelter for the night. Water has always

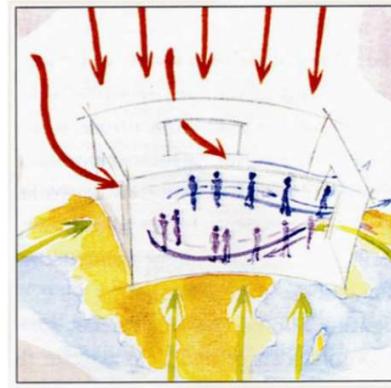


Fig. 5. Three Great Energies [1] (Italian Academy of Feng Shui Architecture)

been an essential source of nutrition, purification and prosperity. We ourselves are made of water! The mountains therefore symbolize protection, as the water, which flows from the mountains themselves, symbolizes movement and expansion. From this duality, harmonious and balanced, Qi is born, the vital energy from which we can benefit. (see Fig. 6) According to Feng Shui, we find these elements in natural or artificial environments. Mountains are natural reliefs, as are hills, woods or valleys, as well as buildings, fence walls and hedges - practically all that resembles static, elevated and solid. Harmonious shapes (sweet and vegetation slopes, harmonious and welcoming shapes) favor our well-being, while aggressive, disharmonious and sharp shapes can generate negative energy. The presence of water is defined by rivers, streams, seas, lakes or ponds, but also roads, pedestrian paths and squares: practically everything that is a vehicle for energy flow and information. Sinuous, constant and soft waters and paths will have a beneficial effect on our habitat, favoring health and well-being in our home and the achievement of our goals in the workplace. On the contrary, impure, contaminated or stagnant water causes Qi blocks and stagnations and consequently has a negative effect on us.

In accordance with the principles of Feng Shui, we can define the phases of holistic design, which are inspired by it, as follows.

- The general features of the property, the context in which it is placed, the position of the main door and the orientation of the facade are analyzed.
- The needs and expectations of the inhabitants are studied and with them, the objectives of the intervention are defined. Analyzing the criticalities of the environment and how to improve the "energy" of the spaces being affected.
- Spatial improvement proposals are created according to the objectives set and the available budget (it is not always

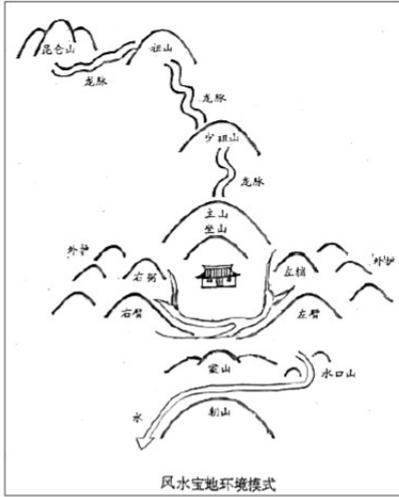


Fig. 6. Mountains and Water. Ideal site representation [1] (Italian Academy of Feng Shui Architecture)

necessary to overturn the building but to merely replace the furnishings and refresh the environment for excellent results).

- The final solution can also be gradual interventions according to specific priorities.

The result will be a pleasant environment, in harmony with those who live in it.

## 2.4 Sustainability

Another fundamental aspect of holistic design is Sustainability. The goal is to provide new tools for a different way to design, to suit man and the environment, to achieve a better future for us and future generations.

The current climatic changes are raising awareness on the importance of minimizing environmental impact and improving building performances. With smart design we can save energy and reduce pollution.

The use of natural, recycled and recyclable materials, the use of renewable energy and passive systems, the utmost utilization of daylight and natural ventilation, are just some of the themes behind good sustainable design, designed to improve comfort and the energy efficiency of structures.

We must try to minimize the environmental impact and improve the performance of buildings and the materials they consist of. Knowing the environmental impact materials during their Life Cycle - LCA - (see Fig.7) is critical to making the right design choices.

## 2.5 Synergy

The holistic approach to design integrates the various parts of the project and its authors as the founding elements of the

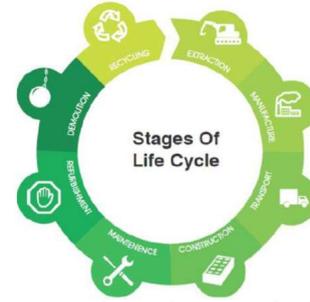


Fig. 7. Life Cycle Assessment [8]



Fig. 8. Synergy

man-habitat-environment system. Technical skills are no longer enough to ensure this bond: as a consequence, new skills are required; the designer is no longer working alone, but working in teams and in Synergy.

This is why every designer must master time management and productivity management in order to reduce stress during work and facilitate harmonious and balanced solutions. In addition to optimizing processes and facilitating shared design procedures, the professional must know how to use the tools of interpersonal communication, personal and professional leadership. (see Fig.8)

## 3. CASE STUDIES

In this chapter we will analyze two projects carried out in Tuscany which follow a holistic approach and apply the 5S method. The first case concerns the creation of a residential building ex novo in wood and hemp-lime while the second discusses the restructuring of the internal spaces for the new CMO, in Florence.

### 3.1 Wood + HempLime House, Tuscany, Italy.

Among the natural materials used in construction, hemp is one of those which show best results. In fact, this plant can be easily cultivated as it has rapid growth, low water consumption

and very rare parasitic attacks. The Canapulo can be extracted from the "Cannabis Sativa" (see Fig. 9), and then shavings can be assembled in pressed blocks or kneaded with lime.

Microscopic air bubbles, in which continuous micro-condensation and micro-evaporation processes occur, block the heat flow through the building envelope and regulate the humidity. Hemp-Lime is a great natural material with good thermal insulation, so that in certain climatic conditions, it is possible to eliminate the heating system by incorporating only a VMC controlled mechanical ventilation system. This allows significant energy savings and a significant reduction in CO2 emissions.

One cubic meter of Natural Beton® 200 absorbs 60 kgs of CO2 from the atmosphere [9]. (see Fig. 10).

Moreover, the combination of the characteristics of vapor permeability of lime and hygroscopicity of hemp, makes this compound a highly breathable material.

This helps maintain appropriate levels of indoor humidity, absorbs excess moisture and releases it when the air is too dry. The habitat will therefore be much healthier (see Fig. 11).

Regarding Acoustic properties, generally, highly porous construction materials have the potential to absorb sound and convert it to heat energy within the material's pores. Recent studies show that hemp-lime concrete, thanks to a high porosity ranging between 70 and 80%, displays good sound absorption when compared to other common building materials. (see Fig. 12)

Un-rendered hemp concrete with hydrated lime and GGBS binder exhibits significant acoustic absorption, with average sound absorption of 40-50% of the normal incident signal, across the tested range of frequencies. [6]

The case in question is found in Tuscany, in the Province of Pisa, where, together with a group of local planners, we are building the first Hemp-lime House with a wooden structure (see Fig. 13, 14, 15).

The goal was to convert the old original project, designed with a traditional construction typology with a reinforced concrete structure and brick walls, into a more sustainable building. Along with a pool of professionals and entrepreneurs, we believe that the future of construction is based on these new construction methodologies, aimed at respecting the environment and people's health.

This is a two-storey mansard + attic with an FSC wooden support structure and awnings, and roof insulation made of



Fig. 9. Cannabis Sativa and Canapulo



Fig. 10. Co2 Emissions comparison

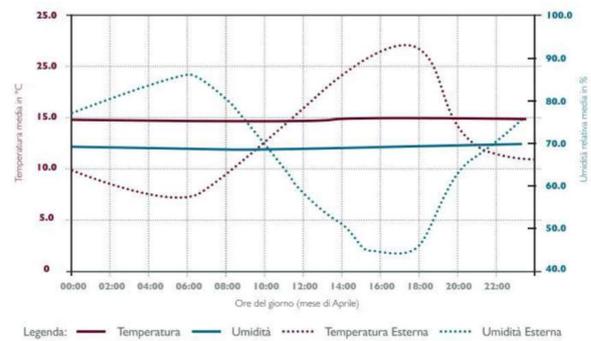


Fig. 11. Indoor/Outdoor Temperature and Relative Humidity [9]

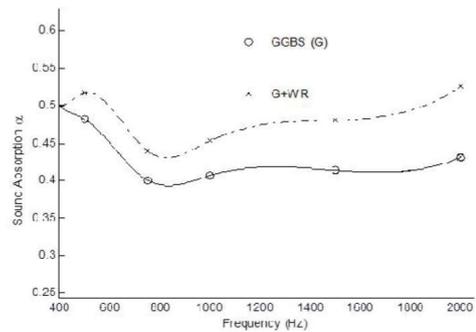


Fig. 12. Characteristic sound absorption curves for hemp concrete [6]

Natural Beton® 200 [9] (lime and hemp conglomerate) 36 cm thick with a 12.5 mm. Fiberglass interior Fermacell projection screen.

The external finish is made of natural lime-stone plaster 1.5 cm thick and water repellent treatment with silicates. The Casaclima Gold Nature Certification Request is also being evaluated.



Fig. 13. Wooden structure



Fig. 14. External view



Fig. 15. Hemp Insulation

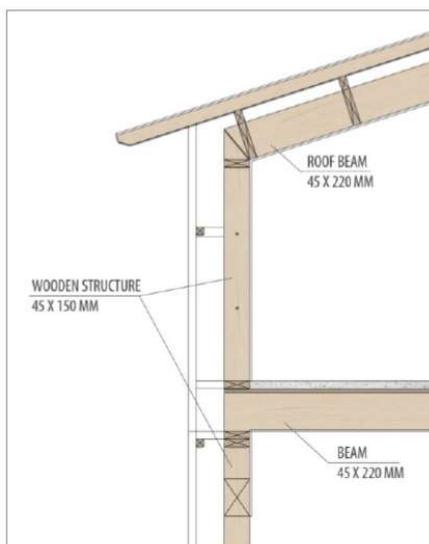


Fig. 16. Wooden structure. Vertical Section

### 3.1.1 Safety and flexibility

A wooden structure is a natural structure that is designed according to the anti-seismic rules and guarantees maximum security for the people living in this house. So much so, that in L'Aquila after the seismic events of 2009, the new buildings were made of wood.

It is a lighter and certainly more 'flexible' material under any seismic episodes. The wooden structure consists of a grid of uprights of 45 x 150 mm and beams of 45 x 220 mm (see Fig. 16).

### 3.1.2 Salubrity

The hemp and lime lining ensure a breathability that cannot be achieved with traditional materials. This gives salubrity to the premises because the house breathes and does not form condensation and moisture inside. The spaces are therefore more healthy and comfortable.

### 3.1.3 Thermal comfort

The thermal insulation obtained with a wall of 36 cm in hemp and lime makes the heating system no longer necessary.

(Thermal conductivity 0,053W/mK; Density 200 kg/m<sup>3</sup>).

An excellent thermal inertia allows you to have hot and cool summer nights without the need to use heating or cooling systems. The end result is a pleasant environment for the people who live there.

### 3.1.4 Ecology and Environment

Not only does it not pollute, but the house of wood, hemp and lime is also able to capture CO<sub>2</sub> from the environment by improving the air quality.

In addition, this construction is completely recyclable, meaning that all its parts can be reused in case of demolition, avoiding expensive disposal operations.

Hemp is an annual plant with very high biomass production and strong absorption of CO<sub>2</sub> from the atmosphere. The amount of CO<sub>2</sub> captured and sequestered during the life cycle of the plant is higher than that emitted during the life cycle of the material.

It is also a totally recyclable and reusable material once crushed and re-mixed with water and lime. If disposed of, it decomposes naturally, being free of toxic substances. (see Fig. 17)

### 3.1.5 Economic saving

A comparison between the original project (construction of traditional type) and the project made of hemp and lime

Condizioni di Sistema	MATERIE PRIME	PRODUZIONE FORNITORI	PACKAGING E DISTRIBUZIONE	PRODUZIONE EQUILIBRIUM	UTILIZZO DEL PRODOTTO	DISMISSIONE
CS1: Materiali estratti dalla crosta terrestre	Yellow	Orange	Light Green	Dark Green	Dark Green	Light Green
CS2: Accumulo sostanze prodotte dall'uomo	Light Green	Red	Light Green	Dark Green	Dark Green	Dark Green
CS3: Degrado della natura	Yellow	Orange	Orange	Dark Green	Dark Green	Dark Green
CS1: Bisogni fondamentali delle persone	Light Green	Orange	Light Green	Dark Green	Dark Green	Dark Green

Fig. 17. SLCA matrix, Equilibrium 2012. [9]

revealed an effective and substantial reduction of costs, both in the construction phase and the user one. In particular:

- The use of a dry and modular construction technology reduces construction time from 18 months (given the statistical average recorded in the construction of a similar building but with traditional technology) to 6 months (the wooden structures were completed in about a month).
- The use of natural, breathable materials, a correct thermal insulation, fixtures and systems with high energy performance also allow the passage from class C (of the original design) to a Class A +.

These aspects lead to massive savings over time and make the investment cost-effective. This is why building a hemp and lime wood house means building a happy habitat:

- The wooden structure guarantees maximum seismic safety;
- Lime cannabis guarantees well-being and comfort and therefore health for people;
- The use of natural materials gives serenity to the environment and the people who live there.

### 3.2 CMO, Osteopathic medicine center, Florence, Italy

The Osteopathic Medicine Center in Florence was designed according to the Principles of Feng Shui Architecture and Eco-friendly architecture.

The main goal of the new environments project was to create a harmonious space for the care and listening to people, aimed at achieving well-being and psychophysical health.

#### 3.2.1 Safety

Structural Safety: following a static analysis of existing reinforced concrete structures, no structural adjustment was necessary. The works covered by the redevelopment of the interiors were also of a non-structural nature and did not compromise the existing structures

Systems Safety: we revised all the plants (electric, hydrothermal), making them compliant with current regulations.

Fire Safety: Although the type of business carried out does not have any particular legal obligations because we are at low risk of fire, we have chosen solutions comprising materials with high fire resistance. The fire exit routes also take into account large number emergencies. Surface Safety: we have chosen an R9 slippery class floor replacing the old smooth marble floor. (see Fig.18).

#### 3.2.2 Salubrity

Temperature: We replaced all the windows with superior performance double-glazed windows.

Noise: among the priorities there was a need to acoustically insulate the various rooms of the Center due to the variety of activities that take place there and the need to maintain a certain degree of privacy (medical practices, common room, waiting room).

In order to improve the internal acoustic comfort compared to the existing situation, two types of interventions have been planned:

- the partition walls between the various rooms of the Center were made of plasterboard (10 cm thick) with interposed insulation layer of 60 mm in mineral wool, having a density of 40 kg / mc and a sound isolation of 46 decibels (compared to an average value of about 38 decibels for the pre-existing plasterboard walls without insulation);
- for the walls adjacent to the other property, a second wall was built with double plasterboard slabs and internal mineral fiber insulation (thickness 50 mm and density 20 kg/mc), leading to a reduction of 57 dB (RL, w, R), as shown by the laboratory's certifications;
- materials: We preferred the use of certified materials with the most stringent DIBt certifications, AgBB for VOC and ISO 9001, ISO 14001 and IMO emissions.

#### 3.2.3 Serenity

In order to allow energy to flow in a positive way, sinuous and harmonious paths have been favoured. (see Fig.19).

Simple furnishings and space management in line with ergonomics and comfort.

Avoiding congested and saturated spaces.

Organic shapes for both furniture and interior spaces that avoid sharp edges and 'aggressions'.



Fig. 18. Main Room



Fig. 19. The Light Path



Fig. 20. Lobby

Warmth and warm colors also give a feeling of tranquility, concentration and harmony, and facilitate the serenity of the operators and the process of healing.

A balance of Five Feng Shui Elements: Fire, Earth, Metal, Water and Wood.

Let us see, for example, the location of the various elements in the entrance (see Fig.20)

Fire: Red element in plants, Vinyl flooring;

Earth: Yellow in the curtains. Ivory colored walls;

Metal: Gold colour lettering;

Water: Corridor curvilinear direction. Sinuous shapes of furniture and walls;

Wood: Wooden fixtures and furnishings. Floor perception.

## 4. CONCLUSIONS

The purpose of this paper was to present the basic aspects of Holistic Design: from sustainable design to safe, healthy and serene living and work spaces, pursuing as a goal the psychophysical health and well-being of those who inhabit them, to the perception that they have of the environment and the atmosphere around them.

In fact, the design of a Habitat cannot ignore the surrounding environment, two parts of the same entity. Just as the environment, the landscape, affect the people who live in it and belong to it, so man interacts with the surrounding landscape and changes it. In the Renaissance, the site and the surrounding environment were already taken into account for the construction of new buildings.

The holistic approach, though innovative and contemporary, draws its origins from the tenets of classical architecture. Starting from these principles and integrating new technology and evaluation techniques, along with the principles of Feng Shui Architecture revisited in a contemporary and western key, and eco-friendly architecture, as well as communication and leadership techniques, the holistic approach represents the future of design. Every design choice can determine the achievement of wellness for the environment and for ourselves and now more than ever we need sensitivity, awareness and a greater attention to these complex issues.

This is why individual professionalism is no longer sufficient, but a broader, more articulate, holistic view is needed at different levels of intervention.

Rather than considering the simple sum of single skills, the holistic approach goes further and represents the simplification of complex systems by putting together technical-scientific aspects with management aspects, aimed at the "building" of well-being.

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