Marco Frascari

Light, Six-Sided, Paradoxical Fight

Built structures and their architectural representations are places where geometry, mathematics and construction discover their common nature, that is, the capability of human imagination to merge architectural objects with the telling of enjoyable tales. In this paper Marco Frascari takes aim at the forces that have shaped a system of critical thoughts on how to fight gravity with a happy architecture based on light structures combined with the dilettante's approaches to hexagonal design, interweaving the thoughts of Alberti, Kahn and Le Ricolais with those of master storytellers Calvino and Rebelais.

Introduction

Built structures and their architectural representations are places where geometry, mathematics and construction discover their common nature, that is, the capability of human imagination to merge architectural objects with the telling of enjoyable tales. To be truthful to its intention, the exact title of this present tale should be as idiosyncratic and lengthy as the Greek-Latin unfolding of the title marking the extraordinary rebus-opus conceived by Francesco Colonna: *Hypnerotomachia Polifili ubi humana omnia non nisi somnium essa docet atque obiter plurima scitu sane quam digne commemorat* [1499]. However, the quasi-short title of this present essay, "A Light, Six-Sided, Paradoxical Fight", is sufficient to take aim at the forces that have shaped a system of critical thoughts on how to fight gravity with a happy architecture based on light structures combined with the dilettante's approaches to hexagonal design. Within an allegorical garden of hanging paradoxes, the labyrinthine path of this account begins with Italo Calvino's critical evaluation of lightness and a biased version of the myth of Perseus. Next, Johannes Kepler's curious essay on snowflakes becomes the springboard for an examination of hexagonal geometry. Finally, the geometry embodied in the marvelous steel models devised by a French structural engineer, Robert Le Ricolais (1894-1977), is probed to find out their design roots following the clues given by a couple featherweight tales of the past French hexagonal architecture tracing their origins in Francesco Colonna's narration of Polifilo's dream.

Calvino's Lightness

In a sequence of lectures, Italo Calvino forecasts "lightness" as the first of six categories of human thought that arise as preliminary theoretical conditions for the present millennium.[1] In his six memos for architecture—a transmutation of Calvino's considerations into an architectural hexad—Vittorio Gregotti cautions us that an intellectual analysis of architectural lightness might be rather arbitrary and inappropriate,

since lightness is a real physical state within the realm of construction and structures [Gregotti 1988]. He argues that considering lightness "strictly from the point of view of architecture" is a sufficient condition to unfold the theoretical importance of Calvino's prediction. Consequently, the lightness criterion may open a way for making use of a critical approach within the realm of the "architectural project". Since structural reflections and architectural thoughts echo along a path of affinity and similitude, it is possible to undertake this approach because of architecture's innate nature as an analogical referent for the verbalization of many theoretical structures.

Many theoreticians and professors of architecture, such as John Rajchman [1994] who is following the lead of Calvino explicitly, have announced that lightness is an irrepressible impulse, a concept at the heart of the discipline of architecture. Unfortunately, within the present condition of the discipline, philistine professors and professionals are not capable of envisioning weightless and happy architecture anymore. The prevailing commonplace—a theoretical doxa—is that constructions are increasingly becoming lighter. However, it is just an illusion of lightness since buildings present heavy and distressing inenarrable tales. Consequently a gentle image of architecture, an idealized tale of joyfully, lightly-conceived architectural bodies and images, is no longer the paradoxical motor of successful and delightful structures.

The essence of the paradox of lightness is in the precise and determined transformation of large complicated wholes through the discreet—almost silent—manipulation of strategic unexpected details, sophisticated elements and detectable joints in the construction of wonder. In the Prologue of his treatise, Leon Battista Alberti stresses the importance of structural elements in architecture. In characterizing the responsibilities of the architect, he states that the architect is an individual

... who by sure and wonderful reason and method, knows both how to devise thorough his own mind and energy and to realize by construction, whatever can be most beautifully fitted out for the noble needs of man by the movements of weights and joining and massing of bodies [Alberti 1988:3].

The realization of architecture in "wonderful reason and method" indicates "wonder" as the origin of architectural structures. A common turn of phrase gives us the clue: I wonder how such a light structure can hold such a heavy weight. The idea of lightness as a virtue grows out of the recognition of wonder as a tectonic ambiguous condition that puts man at the mercy of things; we wonder about things, not ourselves [Verhoeven 1972:30]. Wonder gives things their meaning, showing them to be significant. It is a step nearer to the recognition that things have an infinite meaning and that this meaning is attributable to the things themselves, rather than to our human interest [Verhoeven 1972:30]. Wonder is central to any intellectual and design search, since wonder is a state of desire. Wonder is human desire at its beginning. An almost erotic search for knowledge, for Louis Isidor Kahn,

Wonder is the forerunner of all knowing. ...
Wonder is the primer. It primes knowing [Kahn 1986:218].

Wonder solves aporiae such as the lifting of a heavy load with a small force; in other words, the transformations of something heavy into something light. The lever is a wonderful machine that solves this aporia by moving heavy weights, joining and massing ponderous bodies and other petrifying tasks.

Connecting expressions of contemporary experiences with the past of the world, the application of the criterion of lightness makes it possible to understand how intellectual edification dwells in properly built edifices. Accordingly, an evaluation of the role and properties of lightness becomes an elemental measure in the imagining of building structures. A substantial understanding of the paradoxical nature of light structures can be derived from Calvino's demonstration of lightness as a positive and productive faculty of human thinking. As Calvino points out, the entire world is turning into stone, a slow petrifaction, more and less advanced depending on people and places but one that spared no aspect of life as if no one could escape the inexorable stare of Medusa [Calvino 1988:4].

The petrifying gaze of Medusa, one of the three Gorgons, has always been a prevailing force within the realm of architecture. Wood structures have always been transmogrified into weighty stone, as took place in Greek temples, Nero's Rome and the Venetian *Urbis Renovatio*. In the case of wood architecture changed in stone architecture, the transformation of light materials into heavy materials does not change the nature of the structure; it simply overturns its original delightful nature. The philistine idea behind these transformations is the indirect recognition of lightness as a sinful condition.

Distant sisters of the Gorgons, the Graiae are the ponderous and severe mirror-like representation of the frivolous and delightful Graces. Ancient girls born with white hair and as wrinkled as the skin that forms over milk, the Graiae told Perseus the secret location of Medusa after the Greek hero had stolen the shared eye that they used to look at the world. Having located Medusa, Perseus carefully beheads the monster, avoiding her petrifying gaze by looking at the reflected image in the mirror-like surface of his polished shield. The myth ends with the presentation of the head to Athena, who has the skilful Ephestus mount it at the center of her aegis (therefore known as Gorgoneion). The structure of Perseus's myth reveals, on the one hand, the essential role played by mirror images in dealing with the philosophical opposition between weight and lightness and, on the other hand, the negative role performed by a shared point of view—the single eye, representing opinions or beliefs, i.e., a *doxa*.

In a platitudinous world, lightness is regarded as an appalling defect rather than a terrific quality. Within the philosophical opposition of weight and lightness, weight is a positive force since it deals with the gravity of human life, whereas, lightness is a negative force since it has to do with happy human urges for light heartedness and beautification, frivolous expressions to be repressed. Speciously, lightness has always been judged as a major defect in architecture. During our childhood, we are told the story of the three little piglets that built three small houses. Two of them were extremely light hearted and merrily happy, but squandered fruitful time by playing their musical instruments. The

outcome was that they hastily built their houses using light materials and structures, which did not oppose any challenge to the fury of the bad wolf. The third, a wise and cheerless old piglet—the sad Graia of this children story—built a heavy brick house, which saved him as well as the other two from the hungry wolf. Thereafter they lived 'sadly,' within a weighty house.

Le Ricolais and Lightness

Sometimes academic research is captive of weighty disciplinary approaches. Nevertheless, Le Ricolais's paradoxical approach to solving the problems of structures results from a hedonistic and joyful approach to the study to of lightness (Figure 1).[2]

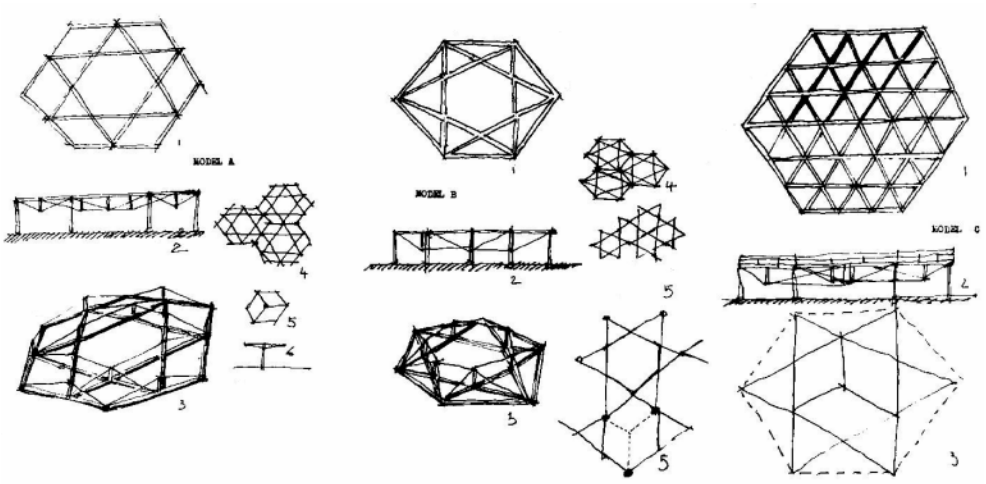

Fig. 1. Drawings by the author of Trihex and Starhex Hexagonal Flooring steel models made by the students of Robert Le Ricolais at the university of Pennsylvania

In answering a structural Philistine about what constitutes proper and serious research, Le Ricolais stated that the ultimate goal for light structures is "zero weight, infinite span" [Le Ricolais 1973a: 81] and that what is generally called a light structure is anything but light:

Look how wrong some thinking can be: it was a great mistake, which I realized many years later, to say that the art of building is to build with match-sticks, that if you want to build light structures you must use light members because if you use light members a group of light members will be light. It took me quite a long time to see that it was just the opposite: it's the art of making a light structure with big heavy members. A paradox [Le Ricolais 1973b: 84].

The same paradoxical notion is embodied in a brief aphorism uttered by Paul Valery: "one should be light like a bird, and not like a feather" [quoted by Calvino 1988:16]. A lighthearted method, a Penelope's tapestry of ideas incompatible with commercial concerns, the way of structural design advocated by Le Ricolais (1973a: 83) is based on

three major paradoxes. The first one is the definition of engineering as a field of expertise, of knowing "how and where to put holes" [Le Ricolais 1973a: 88].[3] The second and the third paradoxes re-code the metaphysical nature of structural research by stating what seem two illogical goals: one is to make "to make a stiff hollow rope" [Le Ricolais 1973a: 96]; the other is to be responsive to the rule of the fight:

The rule of the game for trusses is to fight bending, or to substitute bending with tension and compression, which is exactly what the king post and queen post do ...[that is] the paradox of columns suspended in the air [Le Ricolais 1973b: 109].

The result of the application of these three ideas to structural doxa makes architecture a delightful representation of lightness.

I'm fantastically hedonist ... it's not all the desire to be sensational ... I think we have to be satisfied with little things ... some little analogies which are infantile enough to keep me going for quite a while. These analogies may be pure fancy, may be very stupid things, but sometimes they illustrate in an amusing way things that are very difficult to comprehend [Le Ricolais 1973b: 83].

Three steel models of floors designed by Le Ricolais deal with a positive perception of lightness. They originated within an interest for hexagonal structures and for a French bias for the hexagon as formative principle. France is often called "the Hexagon" because of its six-sided shape and children in France learn to draw the map of their country bounded by the Channel, the Atlantic, the Pyrenees, the Mediterranean, the Alps and the Rhine through first constructing a hexagon.

If we consider these models as three-dimensional tales, they can be compared to Ludovico Ariosto's playfully and delightfully maze-like plot of the *Orlando Furioso*, one of Calvino's favorite sagas. In this masterpiece of late chivalric literature, Ariosto plays many tales at once. The story is a narration of many familiar tales, which constantly interlace with each other. The major and minor characters of these chivalric tales meet in the knots of the narrative rhizome. In addition, it is quite common that the principal characters—the Queens, the Kings or the Heroes—of a canonized fable or legend leave their own tale and go on in another one in a search for sacred things or for a vanished delightful age. The same intricate search for lightness is in Le Ricolais's structural models. Many structural tales are conveyed through the steel models produced by his students in the metal shop on the fourth floor of the Graduate School of Fine Arts at the University of Pennsylvania. The models are the evocative knots of these exchanges of characters. In these structural configurations, the king posts and the queen posts meet the hexagonal characters of the grid, Trihex and Starhex, and undergird the force of the Solomon Seal. These models go beyond their direct relationship with a successful distribution of loads. They are Epicurean and hedonistic investigations within the lightness of hexagonal structures and the delight of architecture.

Two of the models can be graphically illustrated as a Solomon Seal inscribed in a hexagon, and they are an expressive celebration of the paradox of "columns suspended in

the air" mentioned in the quote from Le Ricolais cited above [Le Ricolais 1973b: 109]. The third model is an expression of the paradox of making light structures with big heavy members. In the first one of the Solomonic models, the posts in the middle support the six vertices generated by the two interlocking triangles and king posts are used for the sides of the interior hexagon of the Solomon seal; queen posts are used for the sides of the generating triangles. In the second model, only interlaced queen posts are utilized and the sides of the hexagon are plain beams. The third model is the expression of the meeting point between two kinds of triangular grid devised by Le Ricolais, the Trihex and the Starhex. In this model, the grid of the Trihex takes care of compression whereas Starhex deals with tension (Figures 2-4).

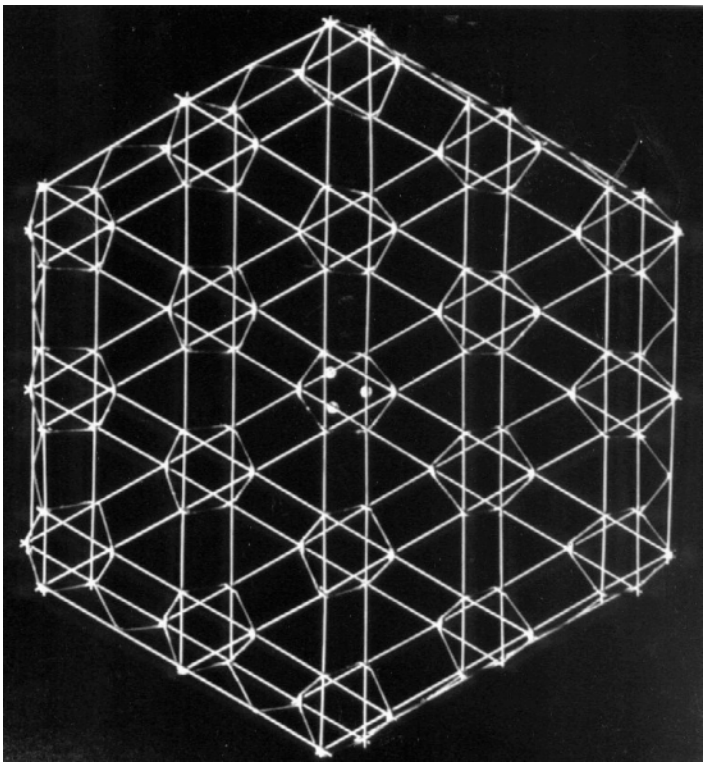

Fig. 2. Robert Le Ricolais, Hexacore steel model Architectural Archive of the University of Pennsylvania

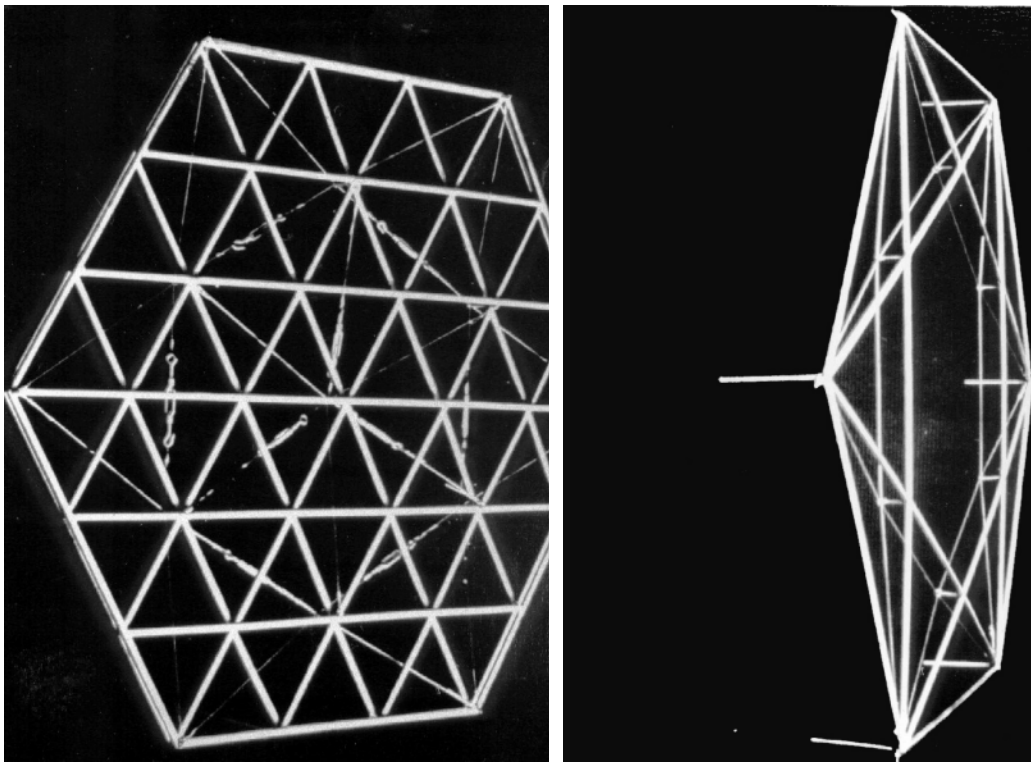

Fig. 3 (left). Robert Le Ricolais, Trihex steel model
Fig. 4 (right). Robert Le Ricolais, Starhex Hexacore steel model. Architectural Archive of the University of Pennsylvania

Kepler and Hexagons

Citing Cavalcanti and Dante, Calvino examines the human fascination with the falling of snow on windless days. This interest produces fruitful meditations on abstractions like lightness (Calvino 1988:13). In a short and delightful essay written as a New Year present for his august patron, Johannes Kepler tries to answer the question: why are snowflakes hexagonal? The answer is short and enigmatic: because they are a "suspended abstraction."

With remarkable clarity Kepler considers several explanations, nevertheless he is not persuaded by any of them, as they do not respond to the crucial question of his inquiry, how does a visible form originate? Kepler's conjecture is that visual forms arise from a facultas formatrix (formative capacity), a ubiquitous force that pervades and shapes everything. Kepler's key challenge is to explain why there are six sides. In other words, why does a three-directional geometrical symmetry play such an important role in the world of structure? On a plane, space can be filled up with identical polygons in only three ways: 1) by clusters of six triangles, 2) by clusters of four squares and 3) by clusters

of three hexagons. The hexagonal cluster is the most economical in terms of both labor and materials and Kepler performs one of the most beautiful analyses of honeycombs to prove it.

The Search for Structure

Kepler's essay is a great work of scientific poetry dissipating the conventional view of the world solidity and leading to a purposeful perception of all that which is minute, light and mobile. Le Ricolais reaches the same conclusion through his study of soap bubbles and radiolarians. Le Ricolais's approach to natural structural clues, like Kepler's method, is not an inflexible process but rather strives to benefit from demonstrative power of wonder:

I no longer believe, as I once did, in beauty, in the harmony of nature. Those are ready-made formulas, impregnated with that pious naturalism of the eighteenth century; I believe much more in the bizarre, in the sign, in curses [Le Ricolais 1973b: 111].

Le Ricolais sees science as "a long series of riddles more or less absurd" [1973b: 117]. In this scientific theatre of the absurd, "it is in the monstrous things that the truths most quickly come to light" [1973b: 117]. The imagining of structures takes place within this theatre of the absurd.

Things themselves are lying, and so are their images, says the Chinese proverb ... They intersect: invisible photons make the death visible. It is really just a matter of 'arrangement'. Physics with electrons, Poetry with words, everywhere, wild energies are at hand so to speak, ready to break loose. No doubt in most cases our perceptions are obtuse and to discover these arrangements, something or someone has to remove the veil [Le Ricolais 1973b: 111].

Calvino points out that the process of removing of the veil is achieved through indirect vision as in a mirror,

to cut off Medusa's head without being turned to stone, Perseus ... fixes his gaze upon what can be revealed only by indirect vision, an image caught in a mirror ... a lesson in the method to follow when writing [Calvino 1988:4].

Le Ricolais follows an analogous process in his image method. Le Ricolais uses the "image method" as the essential tactic of "indirect vision," to demonstrate his structural exercises. The method is based on the use of Euler's equation for polygons. The Euler formula for two-dimensional figures is:

$$P\text{-}E\text{+}C\text{=}1$$

(where P is the number of polygons, E the number of edges and C the number of joints). The equation is then modified by a hex-operator [*] and E becomes a constant and P and C mutually permuted. This "image method" is the "polished shield" used by Le Ricolais to approach the petrifying task of devising structures. For instance, the Euler formula for Perihex, one of the hexagonal grids devised by Le Ricolais, is:

P_+=12, E_+=24 and C_+=13.

The image or dual of it is Starhex, another of the Le Ricolais's hexagonally shaped grids:

P^*=13, E^*=24 and C^*=12.

P_+=12 P^*=13, E_+=24 * E^*=24 C_+=13 C^*=12

This application of Le Ricolais's image method is based on a topological inversion yielding to a graphical representation of the stresses. The resulting topological chiasm is not merely a verification method; but also becomes its generative method. Metaphorically speaking, the Perihex, a Medusa-like weighty grid, is eradicated through the mirror of the hex-operator in such a way that "forces of an abstract nature can be substituted for concrete and ponderous materials [Le Ricolais 1973a: 98] and the Starhex is generated similarly to Pegasus, the flying horse generated by the blood of Medusa.

The development of Le Ricolais's work on the hexagonal floors follows the same course of the growth of a simple hexagonal configuration. The story of his work can be easily traced by using the hexagonal growth diagrams sketched on the back of the minutes of a Graduate School of Fine Arts faculty meeting held in 1966. The first step is a radial configuration, i.e. the hex-operator of Le Ricolais's interpretation of the Euler equation. The second step [Le Ricolais 1953] is a topological chiasm where the Hexaflex floor system is mirrored in the Hexacore system. In the Hexaflex system the supporting columns are located at the periphery, whereas in the Hexacore—as the naming devised by Le Ricolais for the system suggests—the columns are located at the center of the hexagon. The Hexaflex system is mainly based on the use of the king post arranged in a hexagonal symmetry.

Myths, Memories and the French Order

Le Ricolais's interpretation of hexagonal growth belongs to myth and as Calvino states:

...any interpretation impoverishes the myth and suffocates it. With myths, one should not be in a hurry. It is better to let them settle into memory, to stop and dwell on every detail, to reflect on them without losing touch with their language of images [Calvino 1988:4].

The myth of structural lightness and hexagonal symmetry looms in the images elaborated by Ribart de Chamoust [1783] to illustrate a strange "tale" entitled *L'Ordre Francois trouvé dans la nature* (*The French Order Found Within Nature*). In this delightful scientific tale offered to the king of France at the end of the eighteenth century, Ribart de Chamoust tells how he found the fourth order, the French or Gallic Order, during a leisurely stroll in a grove. The view of particular grouping of three trees gave him the idea for the design of the order. In keeping with the Vitruvian tradition of an anthropomorphic interpretation of the order (Doric = man, Ionic = woman, Corinthian = young maid), Ribart de Chamoust saw the three Graces in the French

Order's triplet of columns. Applying comparative mythology, he then transformed the Classical Graces in three Celtic goddesses, Urd, Werandi and Sculde, who are respectively personifications of the French qualities of Magnamité, Affabilité and Générosité. This mythological thinking is further raised in a temple dedicated to Sainte Sophie or Heavenly Wisdom; the use of the triple-columns order as germinating cell is the design essence of the temple.

At the beginning of fifth section of his treatise/tale, in revealing the peculiar characteristics of the French Order, Ribart de Chamoust claims that it is *le plus lèger*, the lightest. Looking at the illustrations one may discover very strict formal analogies between Ribart de Chamoust's French Order and Le Ricolais's light structures. Products of French myths and memories; both are monuments to an imagining of architectural structure by a development of repetitive elements based on a germinal cell.

It seems that in the search for structures two opposed attitudes are possible: to start with a 'block' and work by the means of excision or, on the contrary, to start with a germinal cell in order to arrive at definitive form by means of addition, as in some arrangement of repetitive elements [Le Ricolais 1973a: 101].

Dwelling on the details of Ribart de Chamoust's design one can see how the poetic geometry of Le Ricolais's hexagonal floors is also embodied in the architecture of Sainte Sophie. Ribart's Plate XVI shows the hexagonal plan of the temple results from the interlacing of two systems of hexagonal geometry: Le Ricolais's Hexaflex and Hexacore systems. The section of the structure resting on top of the Sanctuary of the temple is based on two interlocking Solomon Seals and the parterre used for the garden is a landscaped version of Le Ricolais's Starhex conceptual diagram.

Plate IX of L'Ordre Francois trouvé dans la nature presents a canonical representation of the Orders found in nature. However, Ribart de Chamoust adds a fourth icon to the three traditional representations of the origin of the orders. A representation of the traditional icons of the natural references of the Ionic and the Corinthian orders is in the foreground of the illustration, and, the icons of the Doric and the French orders are located on the left side of the engraving. Both the Doric and the French orders originate in a tree from which the foliage has been removed and the cut branches topped by a square tablet. The difference between the two orders is that in the Doric, the tree is cut before the forking, whereas in the French order the cut is just a little above a tripartite fork, generating a spatial joint. This spatial joint looks exactly like many of the joints devised by Le Ricolais to connect the heavy members of his light structures.

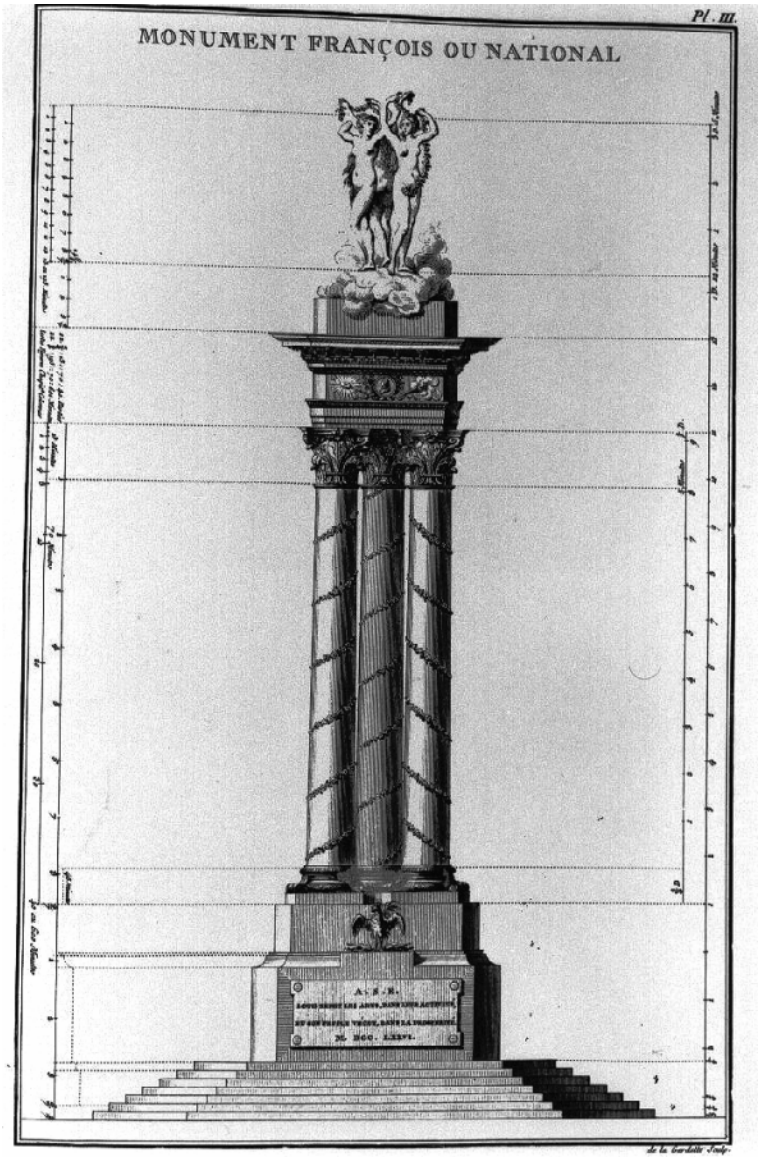

Fig. 5. Ribart de Chamoust, Plate III, the French order triad of columns topped with the Druid goddesses

Rabelais's Abbey of Theleme

In their perfect form, the three columns that make up the French order are represented as free-standing with a statue on top (Figure 5). Located at the center of Sante Sophie, the configuration symbolizes the three Graces or Druidic goddesses embodied in the three trees that gave the idea of the French order to Ribart de Chamoust.[4] The story of this delightful image of the three Graces began in the Veneto with the plates devised to illustrate Francesco Colonna's *Hypnerotomachia Polifili*. Written in a language mélange and implicitly related to architecture, this erotically oneiric book had a very strong influence on French architectural thinking directly and indirectly through the architecture of the Abbey of Theleme conceived by Francois Rabelais, in his *Gargantua and Pantagruel* [1962] (Figure 6 and Figure 7).

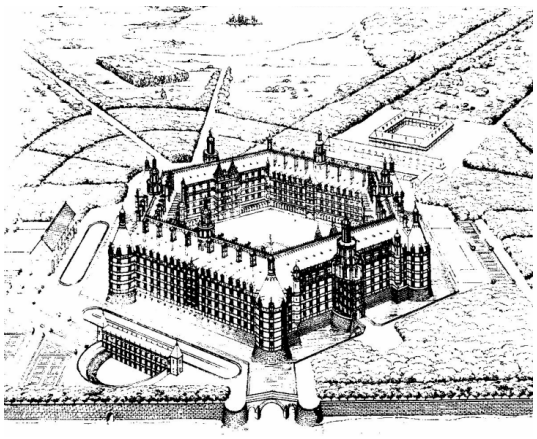

Fig. 6. A reconstruction of Rabelais's Abbey of Theleme

In the Abbey, an overt copy of Colonna's three Graces is at the center of the main hexagonal courtyard becoming the structural and mythological focus of the building. Located on the north bank of the Loire, in a fertile setting, this exceptional Abbey is the place where lightness is sovereign, as the inscription on the main gate states:

Grace, honor, praise and light
Are here our sole delight
Of them we make our song
Our limb are sound and strong
This blessing fills us quite
Grace, honor, praise and light
[Rabelais 1962:154].

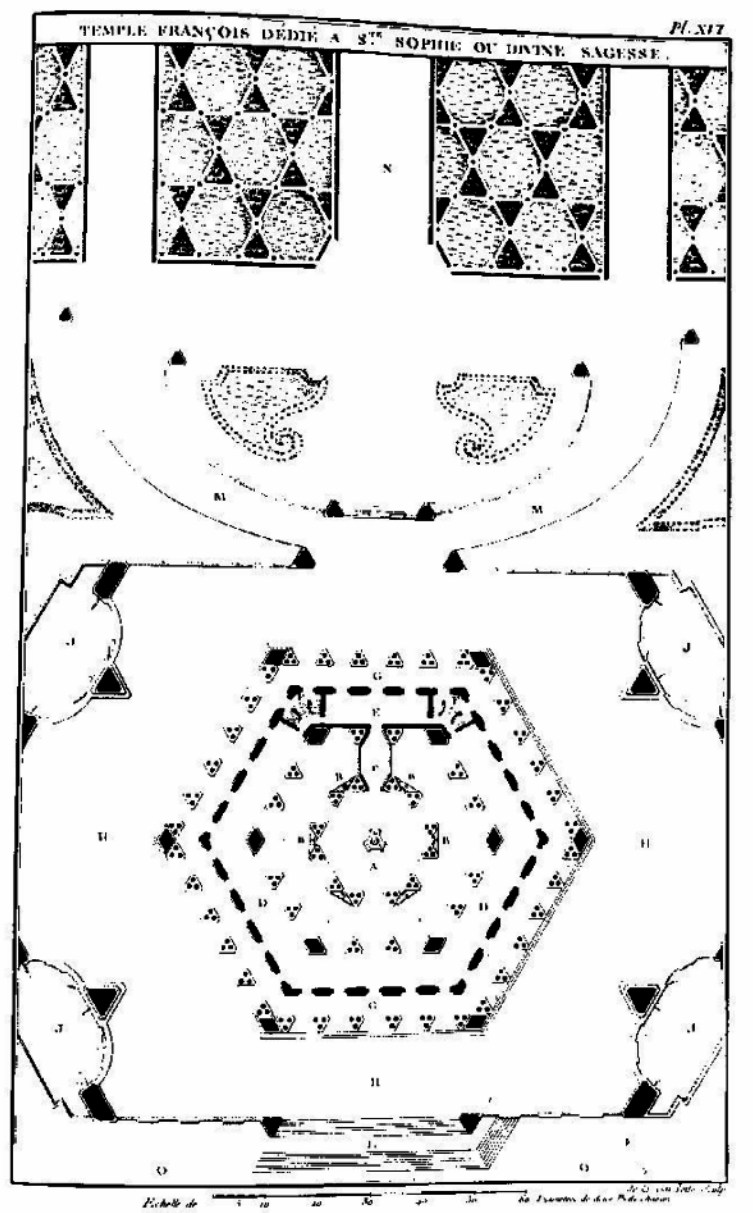

Fig. 7. Ribart de Chamoust, Plate XVI, Plan of the temple dedicated to Sainte Sophie or Divine Wisdom, Plate IX of *L'Ordre Francois trouvé dans la nature*

Theleme houses an elite group of talented "monks" and "nuns" in the bloom of youth and beauty. Within the walls of the abbey, life is light and beata, but it is also a stronghold of civility.[5] The motto of Theleme is *fay ce que vouldras* [Rabelais 1962:152] and within this paradoxical abbey, epicurean pleasures and hedonistic thinking are supreme rulers:

If some man or woman said, "Let us drink," they all drank, if he or she said, "let us play," they all played; if it was "Let us go and amuse ourselves in the fields, everyone went there" [Rabelais: 1962:155].

In the middle of the first courtyard was a magnificent fountain of fine alabaster, on top of which were the three Graces with horns of abundance, spouting water from their breast, mouth, ears, eyes, and other physical orifices [Rabelais: 1962:153]. This fountain is the main symbol for the lighthearted life of the abbey. This is a copy of the fountain put in the center of the Temple of Venus Phyzoica described by Colonna in his *Hypnerotomachia*. In Rabelais's account, the materials are less precious and the corporeal expression is stronger, but the trinity of goddesses symbolizes the same concept.[6] The stoics believed that the three Ladies symbolized liberality; the Renaissance Epicureans, who believed in pleasure as knowledge, also asserted the same idea by stating that knowledge could be based on voluptas. Marsilio Ficino, the Florentine Neoplatonist, equated voluptas with voluntas as a way of achieving knowledge. The same hedonism is the rationale for Le Ricolais's satisfaction in a thoughtful lightness as a kernel for his academic research.

The hexagonal plan of Theleme has circular towers located at each angle. The towers are sixty yards in diameter and spaced at intervals of three hundred and twelve yards (312; 3+1+2=6). The edifice is six stories high and it contains 9332 apartments (9332; 9-3=6 3x2=6 3+3=6; 9 is the mirror image of 6). Each one composed of an inner chamber, a closet, a wardrobe and a chapel. In the abbey, there are also six libraries for six different languages. Halfway between each tower, there are winding stairways with twelve steps between each landing; they are six toises wide and the marble tread is three inches thick. Six is the dominant number in the abbey. Philo calls six a terrestrial number (seven is the first heavenly one); six is male and female (a multiplication between the odd three and the even two) and a symbol for mating and fertility. Francesco Giorgi, in his *De Harmonia Mundi* suggests that the number six is attuned to beginnings and marriages, because of the six days of Creation, a beginning, when all the things were coupled.[7] In numerology, six is then the most powerful number for achieving knowledge; it is the same in Le Ricolais's hexagonal growth where topological chiasms are "suspended abstraction". Martianus Capella designates six as the number of Venus (De Civ.Dei 11.30.241.). Six is Kepler's *facultas formatrix* (formative capacity), or in other words, the numeric tally of Venus Phyzoica.

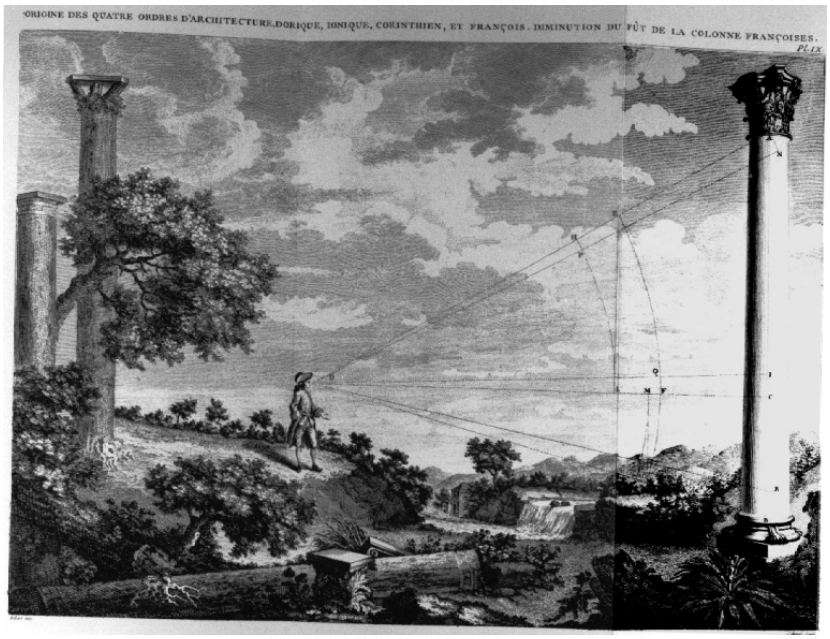

Fig. 8. Ribart de Chamoust, The discovery of the orders in Nature. Plate IX of *L'Ordre Francois trouvé dans la nature*

Conclusion

It is indispensable to reaffirm the importance of telling tales in the making of architecture. A structurally ambiguous condition, such as lightness raises questions that give meanings other than that of a shared perception to architecture. An assessment of the real task of lightness becomes a fundamental criterion in the imagining of building structures since it can translate the power of human thoughts in a physical realization. Lightness becomes a real condition in architectural construction, which then becomes a poetic dimension of any human endeavor. These thoughts/objects echo along the path of affinities and resemblances, connecting the expression of contemporary experience with the past of the world, and demonstrating that intellectual edification takes place in the act of dwelling in building. The kernel of the discipline of architecture is in the imagination of the architect or better is in the training and the sustenance of the oculus imagination is the real professional eye of the architect. The imaginative eye is the crucial clinical eye for who is interested in telling the story of the physiognomy, physiology, pathology, anatomy of structures and their representations stemmed between the physical and metaphysical possibilities since "representation is just the weaving of thoughts into images" [Bloom, 1996:113] (Figure 8).

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Notes

1. One of the world's best "scientific" storytellers, Italo Calvino died on the eve of his departure for Harvard, where he was to deliver the 1985-86 Charles Eliot Norton Lectures. The title chosen by Calvino for the lectures was Six Memos for the Next Millennium and the memos are entitled: [1] Lightness, [2] Quickness, [3] Exactitude, [4] Visibility, [5] Multiplicity, and [6] Consistency. Five lectures of this hexad were written at the time of Calvino's death; the sixth, Consistency, was not yet done.

2. French architect and engineer, active in the U.S. Le Ricolais was born in 1894 at La Roche sur Yon. His university studies in math and physics were curtailed by World War I in which he was wounded and decorated but he was to go on in teaching and research anyway. As a practicing engineer (as well as a painter and poet), in 1935 he introduced the concept of corrugated stress skins to the building industry and was awarded the Medal of the French Society of Civil Engineers. Then in 1940, his work on three-dimensional network systems introduced many architects to the concept of "space frames." After years of research, many patents and the 1962 Grand Prix of the Cercle d'Études Architecturales he was well established as the "father of space structures". In 1951, at 57, he came to America to conduct "experiments in structure" workshops at Illinois-Urbana, North Carolina, Harvard, Penn and Michigan.

3. *Mais si, au lieu de raisonner avec les pleins, on raisonnait avec les trous, la vérité apparaissait. La science des structures consiste donc à faire des trous.*

4. For an identification of trees and goddesses see Hersey (1988:11-15).

5. In the inscription on the entry of Theleme is also stated "Here find civility / Among your host will reign, / All worthy gentleman". For discussions of the meaning of 'civility', see Greene (1970:50-53).

6. For the influence of Francesco Colonna on Rabelais, see Greene (1970) and Weiberg (1972).

7. For a discussion of the numerology used by Rabelais see Weiberg (1972:123).

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About the Author

Born under the shadow of the dome of Alberti's Sant'Andrea In Mantua (Italy) Marco Frascari achieved a Dottore in Architettura at the *verum IpsUm fActVm* (Istituto Universitario di Architettura di Venezia), in 1969. He began his professional career as architect in Verona and at the same time taught at IUAV. Later he moved to the States and he earned a Mater of Science in Architecture at the University of Cincinnati and a PhD in architecture at the University of Pennsylvania. He has taught in several institutions and presently is G.T.Ward Professor in Architecture at Washington Alexandria Architectural Center of Virginia Tech. He has extensively written on topics of architectural theory, representation and tectonics. Since he graduated from Venice, he has always run a small architectural practice. He strongly believes that architectural theory and the resulting buildings should make life happy (*vita beata*).