

**Natural Light in Architectural Space**

by

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(Abstract)

Light in nature is a unique element affecting man completely. The nature of daylight as well as its meanings are examined, to show that both stages decisively determine the application of light within architecture and, moreover, that man still remains capable of controlling that which affects him and generates meanings for him.

Unveiling the unconscious, conscious, and applied relations between man and light as inseparable stages, demonstrates how the human can achieve unification with architecture by virtue of light.

Light and man meet in space. It is architectural space that provides the only control over natural light and allows light to act upon man in striking perfection. Consequently, inquiring into light will improve the definition of architectural space. Beyond being a mere three-dimensional void or simply the object of imaginations, concepts, intentions, etc., architectural space becomes a new dimension.

# Acknowledgements

All quotations from books written in foreign languages have been translated by the author unless references are made to American/English sources within the footnotes.

I wish to express my gratitude to all those on both sides of the Atlantic, who helped with comments and criticism where needed; especially, in overcoming the obstacles in a language other than my native German. Because a list of people to whom I owe might pass over someone important, I prefer to leave this message universal.

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# Preface

This thesis deals solely with light in architecture which is emanated from natural sources; i.e., the sun and, in some cases, the moon. The essence of my work may be simply described as this: I have set light in a position where it can become a spatial element for unifying man and his architecture. Consequently, since architecture is a human achievement, and the only one that controls and directs natural light, the following treatise will reveal that man will be able to cause this (re-)unification once he is aware that a spatial understanding of light entails a different understanding of architectural space.

Are we in need of reshaping our conception of space and, if so, why did I choose light for this purpose?

First of all, space in architecture has mostly been considered as a kind of vacuum. Various discussions have lead us to believe that, in a broader sense, space contains material elements and living beings, but that in a narrower sense it is spread out between manifold components. Space has been explained as a matter of distances, of proportions, of

possibilities, and of freedom. Thus, these descriptions of vacuousness offer no more than a haphazard picture; they depict structures, sequences (conservative approach) or perceptions, imaginations, meanings, expectations, concepts, or behavioral patterns (progressive approach). Because I am unable to perceive space as merely a *void* but rather as something which has a constantly fluctuating impact on me, I have undertaken this investigation.

Second, natural light is vital for space, for its architecture, and for man. Moreover, man is inconceivable without light; as is architectural space. But light is more than essential; it also has distinct characteristics which make a widened contemplation of space possible: (a) light reveals phenomena, (b) manifests itself as energy, and last and perhaps most important, (c) natural light is capable of being transcendental.

In other words, light as it appears in nature<sup>1</sup>, -and it has to be natural because of its vitality-, affects matter, influences the living sphere psychophysically, and has a strong impact on man's mind and concepts. Natural light is such a unique element that it is superior to all other perceptions and radiant energies.

There is no longer any doubt that light is an enormously powerful factor in unifying the human being with his architecture, since both are enveloped in space/energy. It is astonishing for how long topics of intellectual discussions have been confused: details have been considered more important than unity; the result is that space and its boundaries have been juxtaposed, or that humans are suspected of having created numerous parameters of space.

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<sup>1</sup> In this work light is called "natural" when it is provided by nature and not by artificial sources; "daylight" is part of this "natural light"

What is the proper approach for casting light on this confusion? It is not the analytical approach of science, although this is tempting because we are used to it. Scientific analysis is an attempt to better understand an entity by dissecting it into parts--an attempt that becomes questionable when one uses a particular component for the point of departure, leaving us with bits and pieces left over after the analytical process. Therefore, I have decided to extract certain results, to assemble -rather than disassemble- them, regarding the idea of a unifying space. Gathering, extracting, assembling, integrating, and unifying is the approach chosen for the present work.

Consequently, this work examines the basic nature of light, its physical and therefore measurable characteristics, its effect on the environment as well as on human beings and their spatial orientation. From a religious and symbolical understanding it investigates the meaning of light in its conscious relation to man. The study then approaches natural light as a visual and applicable phenomenon, how it creates different outward manifestations for the sculptures of architecture and how it changes, and becomes changed, through building materials. The reader will be able to follow the concept of natural light from its penetration into the buildings to its internal suffusion to its appearance throughout the inside. Finally, physics, meanings, and the application of light merge into a new understanding of architectural space and a psychophysical energy created by the sun. The energetic space is a medium with an overwhelming influence on human beings and their neverending attempts to project themselves onto nature, creating place, shelter, and therefore architecture.

Lastly, I want to make clear that the scope of this work does not include charts or tables for examining a lighting-engineering problem. Nor does it attempt to write a history of light, or to develop certain recipes for design solutions. It embraces a comprehensive

understanding of the phenomenon of light with all its energetic implications for man.  
Where this thesis ends, architectural design begins.

*Washington, October, 1986*

Carsten Roth

# Introduction

Natural light is vital for architecture and even more so for the human being. It is in architectural space where both meet. Light must be related to man and vice versa, and space must be associated with both. This thesis begins with the correlation between *light*, *space*, and *man*.

In theory, we are quite familiar with architectural *space*; concepts have already reached philosophical levels, because they are based on various constituent definitions. This is the advantage -and the problem -of space as it relates to construction. Discussing light as interrelated with space presumes a basic understanding of the various contemporary arguments about space. In the consideration of space in architecture, two main lines may be distinguished:

The first starts from the *spatial boundaries* set up by construction mediums--an approximation defined by the *mathematical device* of three-dimensional space. This minimal definition distinguishes only between the cubical "space of the body" and the "space

between things.” In the course of time this notion has been widened and modified. Nevertheless, its mathematical-geometrical roots cannot be denied.

The second approach commences from the opposite starting point. Instead of crafting architectural space around things and their particular relations, the human being becomes the focal point. *Man* as a subject -influenced by his own personality, by other people, by material objects, and other external stimuli- is the new focal point for spatial investigations. The individual *subjectively perceives* his environment, makes up his *own* mind, and acts thereupon.

These two approaches are simply described as two dichotomous poles. Attempts have been made to bridge both positions. The whole purpose of the meanings and symbols is to relate the human being and matter; the latter is given certain meanings which then become attached to authentic things and to phenomena.

Thus the problem: man and space are not linked together; only man and his spatial boundaries are. This situation is like an island encompassed by a river and connected with its opposite banks through various bridges. Hence, architectural space, as it has been defined thus far, is still something in limbo. It is the definition of this chasm which this thesis addresses.

In contrast, *light* as applied in architectural space has not yet achieved a constituent definition similar to that of space. To formulate a comparable definition for light, the present considerations start with the following premise: Light is only comprehensible in relation to man. The following three chapters discuss three different layers of such a relation, with each succeeding chapter depicting a more advanced stage:

(I) Light as a pure element in nature, connected with man in an *unconscious* relation. Light is the active subject and man the affected object.

(II) Light as a genuine element in mind and thought, revealing a *conscious* stage, where man begins to relate actively to light. Light conversely becomes the object of his thoughts and conceptions of the world;

(III) Light as a modified element in architecture, involved in a complexly organized *applied* relation. On this rung man tries to achieve the totality of being unified with space; he uses the only discipline among the fine and plastic arts capable of modifying natural light: architecture.

In summary, the third category is the most advanced stage. Here, man combines his experience of light with his concepts about it; as an architect he applies natural light as an object, which then becomes transformed to a medium different in its influence upon man. Light achieves a new integrity through modification.

# CHAPTER I



Figure 1. Transmitted Energy: Jefferson National Expansion Memorial, St. Louis MO.



Figure 2. Pathways of Light: Mosque of Ibn Touloun, Cairo, Egypt.

# The Nature of Daylight

In the past man has always wanted to be integrated in his architecture, to be one with it. Yet, modern man is losing an understanding of the holistic existence of man-house-universe or microcosmos-architecture-macrocosmos. It is the intrinsic virtue of such a unity to provide both shelter for man and a place for him in the universe. Nevertheless, in order for humans to establish the perfect place for themselves, they have to understand the living being within his environment as well as the universe.

What does “to understand” mean? For modern man understanding is based on facts imbedded in systems. Living without facts is tantamount to getting lost in intuitions, feelings, and instincts. But, unfortunately, gathering facts never constitutes a whole nor does the assembling of parts ever result in more than a sum of elementary particles. “Numbers, formulae, laws *mean* nothing and *are* nothing. They must have a body, and only a living mankind -projecting its livingness into them and through them, expressing itself by them, inwardly making them its own- can endow them with that.”<sup>2</sup> If the present work begins with facts and laws, it is only because the resulting discussion will “project

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<sup>2</sup> Oswald Spengler, *The Decline of the West* (New York: Alfred A. Knopf, 1928), p. 382.

livingness into them.” Natural light has been chosen as one way of revealing the spirit of a holistic existence. Nonetheless, light is only one example, though an essential one, and the thoughts presented here should be extended as soon and as often as possible.

Since every understanding is based on a body of preliminaries, this chapter deals with the nature of daylight, examining the physical characteristics of light and its effect on sentient beings, man’s visual perception, and spatial orientation.

## The Physical Characteristics of Light

Light is part of the cosmos, a world that has to be understood dynamically, where all parts correspond with each other. As paleontologist Teilhard de Chardin has observed: “*Every mass is modified by its velocity. Every body radiates. Every movement is veiled in immobility when sufficiently slowed down.*”<sup>3</sup> This means that if the world is regarded too closely in time, it appears static and unchanging. Because the paleontologist is used to investigating a subject over a long period of time, he is well qualified to discuss the “universal stuff” from his broad temporal point of view. Some of his observations may serve as introductions to an understanding of the physics of light.

Teilhard de Chardin departs from a constantly transforming world -a progressing evolution- where the mineral world of “most solid rocks” and stones continually changes its mineral constitution. Behind all transformations is an energetic cosmos, where “energy is the measure of that which passes from one atom to another in the course of their

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<sup>3</sup> Pierre Teilhard de Chardin, *The Phenomenon of Man*, with an Introduction by Sir Julian Huxley (New York: Harper & Bros. Publ., 1959), p. 55.

transformation. A unifying power, expression of structure.”<sup>4</sup> “From the aspect of energy, renewed by radioactive phenomena, material corpuscles may now be treated as transient reservoirs of concentrated power. Though never found in a state of purity, but always more or less corpuscular (even in light) energy nowadays represents for science the most primitive form of the universal stuff.”<sup>5</sup> Here energy is described in materialistic terms (*including light!*) by introducing potential power to matter. Without intending to write about the physical characteristics of daylight, Teilhard de Chardin later concludes “...When it became too weak to escape in incandescence, the free energy of the new-born earth was compensated by the power of reacting on itself in a work of synthesis...”<sup>6</sup> -a sharp-sighted statement, where light is only a different stage of matter once both are considered emerging from energy.

Thus, energy is the all-embracing category for matter and *nonmatter*, where the latter may simply be described as a presence of various kinds of radiation: thermal radiation and nuclear radiation, both types made up of various specific radiation. Since architecture, when humanly and artistically considered, depends on conscious and unconscious *sensation* and human reaction, only thermal radiation remains of special interest at this point. Its components must now be distinguished as heat, light, and radio waves.<sup>7</sup>

Not all of these electromagnetic waves are of equal interest for an investigation of light and space. In my examination of the *emptiness* detected between spatial boundaries and humans, light emerges as the prime phenomenon for several reasons:

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<sup>4</sup> Ibid., p. 42.

<sup>5</sup> Ibid.

<sup>6</sup> Ibid., p. 70.

<sup>7</sup> David M. Gates, *Energy Exchange in the Biosphere* (New York: Harper & Row, 1962), p. 60.

- (1) Light is most appropriate for an understanding of universal totality including human totality, based on energy.
- (2) Though influenced by sun spots, flares, and the course of the sun, magnetic fields of the ground and the air are neglected in this study, because their effects on human life and architecture is insignificant.
- (3) Radio waves, finally, are excluded to allow depth in the field of light.

Light itself is considered to be energy, "radiation capable of causing visual sensation directly."<sup>8</sup> Both the electromagnetic theory and Planck's quantum theory define light as a flow of energy, a special form of radiant energy in general. When a flash of light is seen, five to eight photons enter the eye and reach the retina. The photon is the elementary quantum of radiant energy.<sup>9</sup>

Every organic and inorganic substance in our world is exposed to this visible form of energy except those shielded by impervious materials. If materials or living beings are exposed to light rays, they are energetically affected. Moreover, they are in the supply of energy: this means, they themselves take an active part in the energetic process and begin to transform space. The sunlight we perceive is to be thought of as white light. Only when it meets matter for the first time does it becomes altered. Certain portions are absorbed and are changed to heat. The rest is reflected, refracted, or filtered and then affects the cosmos as colored light.

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<sup>8</sup> W.R. Stevens, *Building Physics: Lighting* (Oxford: Pergamon, 1969), p. 27.

<sup>9</sup> Ibid.

Light and heat are almost solely generated by the sun--“the source of most of the energy derived by the planet earth.”<sup>10</sup> This fact immediately reveals the polarity with which this thesis has to deal: disembodied light, as it spreads out in a medium and as a medium, can only be understood through the phenomenon of the fiery body of the sun. There is no discussion of light without considering the sun and vice versa. The consequences are complex: inquiring into light leads to the sun, but investigating the sun requires one to probe into electromagnetic waves different from light as a visible sensation. This means a spectrum of comparatively short wavelengths, the so-called microwaves, which are an important factor influencing life on earth and, thus, human architecture, according to Endroes, Ott, and others. Microwave radiation has an “imperceptible impact on the inner mechanism of the living organism.”<sup>11</sup>

Remembering the exclusion of invisible radiation, objections might rise at this moment, whether it is not too far-fetched to discuss microwave radiation in a treatise on light and architecture. Two considerations will dispel these objections:

(1) the radiation in question is mainly dependent on solar activity. It is the sun “playing a decisive part in the cosmic occurrence”<sup>12</sup> of microwaves although they are emitted by various other sources as well, such as outer space (as background radiation), the Earth (through radioactive decay of molecules), a number of planets (including the moon and Saturn), etc.<sup>13</sup> True comprehension of the relation between space and light can only be achieved as long as major impacts from the sun are taken into consideration. Evidently,

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<sup>10</sup> Gates, *Energy Exchange in the Biosphere*, p. 47.

<sup>11</sup> Robert Endroes, *Die Strahlung der Erde und ihre Wirkung auf das Leben* (Remscheid: Paffrath, 1980), p. 22--a work which is still in need of a broad scholarly discussion.

<sup>12</sup> *Ibid.*, p. 41.

<sup>13</sup> *Ibid.*, p. 15, 17.

since radiation of microwaves is dependent on the sun, it is "affected by the course of the day and by the length of path through the atmosphere according to the position of the sun even by clear weather, namely through the proportion of oxygen molecules and hydrogen molecules. Under an overcast sky it does not directly reach us at all, but indirectly through radiation controlled by particles of water."<sup>14</sup> Moreover, Endroes points out the importance of the sun winds, sun spots, and flares which cause spontaneous radiation within the microwave spectrum: "...and by such torchlike eruptions of the sun a multiple intensified emission of highly energetical particles comes immediately into existence."<sup>15</sup>

(2) Without regard to human sensitivity, the facts just explained would be of little interest in this thesis. Living beings are indeed sensitive to these radiations. The reason why it appears to be relatively difficult to prove this assertion to 20th century man lies in the fact that we are highly alienated from our environment. The pace of life has changed, transportation around the globe has rapidly accelerated in this century, metropolises have grown monstrously, the way of building has changed, and with it the choice of building materials. All these circumstances cause partial or total loss of necessary sensitivity.

Why is this sensitivity necessary? Endroes points out that microwaves differ from other wavelengths in so far as they are capable of penetrating "practically all matter"<sup>16</sup> due to the fact that their photons' mass is almost zero within the far, short-wavelengths. Because of this ability, microwaves gain major importance in all vital processes, since low

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<sup>14</sup> Ibid., p. 41.

<sup>15</sup> Ibid., p. 41.

<sup>16</sup> Ibid., p. 40.

energies possess an “affinity to the biophysical processes in organic tissues.”<sup>17</sup> Some negative effects of low-level radiation, if disturbed, have recently been marked. For example, “lower academic achievement among schoolchildren, rising levels of stress, the general increase of crime and violence, and widespread use of drugs.”<sup>18</sup>

Compared with most humans in modern western civilization, many individuals of former times and other cultures were more sensitive to microwave energy. Observing a Chinese geomancer, an ancient European dowser, or merely a member of a “knowing” caste, it is evident that they were aware of resulting disturbances in the radiating environment--and, thus, aware of disadvantages for human life.<sup>19</sup>

In summary, radiation has to be understood as part of energy because the latter includes both matter and radiation in a materialistic sense. A discussion of light leads to satisfying results only if it is seen in the twofold phenomenon of the visible spectrum of radiation and the sun. Yet, considering the sun means acknowledging microwave radiation in addition to light and heat.

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<sup>17</sup> Ibid., p. 17.

<sup>18</sup> John Ott, “The ‘Light’ Side of Health,” *The Mother Earth News*, January/February 1986, p. 21; the arguments refer to *artificial* background radiation emitted by electronic devices.

<sup>19</sup> Among others, Endroes claims to have proven these evidences, since his findings show correlations between intensities of microwaves, a gridlike structure causing polarized emanations from the ground, and, more importantly, subterranean springs. He observes that in former times humans tried to avoid settling and living above these hidden springs and intersections of grid structures. Endroes, *Die Strahlung der Erde und ihre Wirkung auf das Leben*, p. 18.

## Effects of Daylight on Sentient Beings

Man can not be indifferent to the phenomena that affect him. The occurrence of natural light is neither three-dimensional, nor changeable. Once energetic phenomena are established, a human can only get in motion within them. By changing his position he can alter their influence on him. Because of their unconscious nature, these influences need to be understood before light can be discussed as being transcendent and applicable to architecture. Considering the environment of plants and animals first, is less an approach towards architectural biology than it is the study of those particular beings of the biosphere that are not controlled by consciousness. Animals, in contrast to man, have little reason to act against natural factors.

The radiation field of the microwave spectrum, for instance, has an inevitable influence on animals. Endroes points out, that socially organized animals such as bees and ants select terrain for their dwellings that reveals a certain ground radiation. Furthermore, animals' traces, when observed in nature, follow strips with specific radiation of the ground which are, so to speak, "illuminated" for them even at night. In stables, or at biologically inconvenient places, domestic animals might refuse to produce offspring.<sup>20</sup>

Looking at the visible spectrum of radiation sheds more light on its various effects upon animals. Animals show abnormal development and unusual behavior if they are not exposed to the full-spectrum range of natural light. Under artificial light, with a spectrum restricted to certain wavelengths, some animals develop smaller gonads, or their sexual

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<sup>20</sup> Endroes, *Die Strahlung der Erde und ihre Wirkung auf das Leben*, p. 62.

maturation is retarded;<sup>21</sup> they may give birth to either males or females, grow tumors, show up with “excessive calcium deposits in the heart tissue,” or develop a “strong tendency toward irritable, aggressive, and cannibalistic behavior,” and so forth.<sup>22</sup> The animals’ natural migratory rhythm might be changed; that is, birds are likely to alter aim and direction of their migration, if the seasonal turn of natural lighting conditions becomes disturbed.

In the previous paragraph, microwave radiation together with the visible radiation of light was defined as part of a much broader energetic spectrum emitted by the sun. Beyond visible rays this spectrum decisively affects the biosphere, a complex “boundary layer, near the surface, subjected to the diurnal changes of the heat flow, where large numbers of organisms spend their entire lives.”<sup>23</sup>

According to Gates, the interaction between organisms and their environment is significantly determined by a flow of energy, which has to be distinguished in sunlight and thermal radiation, and further, in conduction, evaporation, and convection; all either providing net energy for the organism or subtracting energy from it. In contrast to the previous use of the term, here Gates conceives of thermal radiation simply as “long-wave infrared thermal radiation.”<sup>24</sup> This infrared radiation gains importance in two ways:

(1) “Almost never will the thermal radiation stream, downward or upward, contribute less energy over a twenty-four hour period to the horizontal surface than will the solar

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<sup>21</sup> F. Hollwich, *The Influence of Ocular Light Perception on Metabolism in Man and in Animal* (New York: Springer, 1979), p. 69.

<sup>22</sup> Ott, *The Mother Earth News*, p. 18.

<sup>23</sup> Gates, *Energy Exchange in the Biosphere*, p. 12.

<sup>24</sup> *Ibid.*, p. 30.

radiation. The solar energy is of course important because it irradiates plants with the wavelength of importance to photosynthesis and furthermore contributes energy to all of the dynamic and life-giving processes on the planet earth. But if the thermal radiation from the ground and atmosphere were not present, then life on this planet would not be possible either, for during the nighttime everything would get desperately cold.”<sup>25</sup>

(2) Yet, the mere existence of thermal radiation would not contribute much to the process of life on Earth, if it were not linked with a very special characteristic of space within the Earth’s atmosphere. Thus, space comes into slight conflict with previous academic discussion, because it is neither discussed in terms of the *hardware*, in other words, the layout of spatial boundaries, nor in terms of human *behavior*. What is meant here shall be called the *software*, a medium that fills the sky above the ground with more than just a “complete transparent gas.”<sup>26</sup> In this medium water vapor and carbon dioxide, which, as Gates states, “produce the critical control on the radiation exchange between the earth, the sun and outer space, which mollifies the climate of the surface to give the biosphere tolerable temperature limits.”<sup>27</sup>

This environment furnishes the living space for all living creatures on the surface of the Earth, an environment determined not only by solar radiation and microwave radiation, but to a great extent by thermal radiation. Gates explains that animals take part in the energy exchange mainly through radiating, convecting, or evaporating.<sup>28</sup> He is, therefore,

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<sup>25</sup> Ibid.

<sup>26</sup> Ibid., p. 37.

<sup>27</sup> Ibid., p. 16. The very same constitution of space enables Endroes even to photograph the microwave radiation from the ground: “*Die Wassermolekuele in den Wassertropfen der Nebelschicht werden in gleicher Weise angeregt wie die Molekuele der Bodenmineralien.*” Endroes, *Die Strahlung der Erde und ihre Wirkung auf das Leben*, p. 112.

<sup>28</sup> Gates, *Energy Exchange in the Biosphere*, pp. 41.

classifying them by these activities. Because of their constitution, some animals begin to orient themselves within the environment. According to Gates, these animals try to avoid unnecessary heat load not simply by seeking shade but by taking advantage of the so-called *cold spot* in the sky, orienting themselves to the north; hence, they emit more radiation than they receive.

Summing up the relevant effects of daylight on sentient beings leads to the knowledge of microwaves as a perceptible radiation and important part of a radiating environment. The spectrum of such an environment is only acceptable for the health of living beings if it remains as undisturbed as possible. Moreover, a natural environment with full-spectrum daylight includes seasonal changes and, thus, a time factor, which sometimes induces movements in space (migration, etc.). Perhaps most remarkable is the fact that life on earth is impossible without space being filled with a mollifying medium. Beyond the recognition of *energy* as something material, *space* must also be seen as having a comparable material constitution.

## **Visual and Energetical Perception of Man**

Every organism, including the human being, is subject to the sun's influence. As daylight and the biosphere reveal, man is interwoven with and dependent on this background. The result is an all-embracing adaptation of man to the influence of natural light. So far, the environment has been explained, as that into life is born and as a cause of some of living beings' subconscious, involuntary and instinctive reactions. Now, at the threshold of consciousness a device comes into existence, which in its perfection amalgamates man, light, and space into one unity: "The eye may be said to owe its existence to light,

which calls forth, as it were, a sense akin to itself; the eye in short is formed with reference to light, to be fit for the action of light; the inner light juxtaposes the outer light."<sup>29</sup> Goethe, the German poet, found those congenial words for the ingenious marriage between man and light. In regard to space, Helmholtz states: "No other sense can be compared with the eye in this respect."<sup>30</sup> Yet, if we link Goethe's formulation with Helmholtz' statement the oneness is unveiled. The totality of man's presence on earth then rises beyond doubt. Teilhard de Chardin becomes excited when he exclaims: "Seeing. We might say that the whole of life lies in that verb--if not in end, at least in essence."<sup>31</sup> And even the philosopher Otto Bollnow does not merely rely on his own words when quoting Merleau Ponty: "... that the eye inhabits the being like man dwells in his house."<sup>32</sup>

To explain the phenomenon of the eye beyond philosophy and poetry, it is advantageous to join the ophthalmologist Hollwich establishing a working hypothesis: "The eye is seen to be involved in two different processes; the visual pathway is distinguished into an *energetic portion* and an *optic portion*."<sup>33</sup> "The eye fulfills a double function here: owing to the 'optic portion' of the visual pathway it receives light for the purpose of

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<sup>29</sup> Ruprecht Matthaei, *Goethe's Color Theory* (New York: van Nostrand, 1971), p. 73; the German original goes: "*Das Auge hat sein Dasein dem Licht zu danken. Aus gleichgueltigen tierischen Huelfsorganen ruft sich das Licht ein Organ hervor, das seinesgleichen werde, und so bildet sich das Auge am Lichte fuers Licht, damit das innere Licht dem aeusseren entgegentrete.*"

<sup>30</sup> Richard M. Warren and Roslyn P. Warren, *Helmholtz on Perception: its Physiology and Development* (New York: Wiley, 1968), p. 108.

<sup>31</sup> Teilhard de Chardin, *The Phenomenon of Man*, p. 31.

<sup>32</sup> Otto Friedrich Bollnow, *Mensch und Raum* (Stuttgart: W. Kohlhammer, 1963), p. 280.

<sup>33</sup> Hollwich, *The Influence of Ocular Light Perception on Metabolism in Man and in Animal*, p. 3.

visual perception and owing to that pathway's 'energetic portion' it transmits light for the purpose of stimulating the autonomic regulatory centers."<sup>34</sup>

In the *optic portion*, the basic function of the eye is to provide a lens system -pupil, iris, and ciliary muscle- to project a reverse image of the outside world on a concave spherical surface, the retina, with its millions of light-sensitive receptor cells. These cells dissipate the light-rays into electric impulses, which are transmitted by a nerve system to the brain, a mental storage room able to interpret the signals by comparing them with known and accumulated messages. But beyond the fact of the eye being connected with the brain and providing "some eighty percent of all our sense impressions,"<sup>35</sup> visual sensation provides a number of clues to perceiving space beyond the spatial impression mediated in the duplication of the eye apparatus. At a distance beyond 200 feet the stereoscopic effect, as a result of the binocular vision, is useless. Therefore, linear perspective, shape or size of familiar objects, aerial perspective as the coloration of distant objects (haze), and head movement gain more importance.<sup>36</sup>

All human abilities of perceiving and conceiving space become developed gradually during childhood. Shortly after birth there is hardly more than "seeing patches of light."<sup>37</sup> The rise of consciousness is, to a large extent, equivalent with progress in vision, both throughout the history of the evolution<sup>38</sup> and during the growth of the individual.

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<sup>34</sup> Ibid., p. 9.

<sup>35</sup> Walter Koehler and Wassili Luckhard, *Lighting in Architecture* (New York: Reinhold, 1959), p. 140.

<sup>36</sup> M.H. Pirenne, *Vision and the Eye* (London: Chapman Hall, 1967), p. 185.

<sup>37</sup> Jean Piaget and Baerbel Inhelder, *The Child's Conception of Space* (London: Routledge & Kegan Paul, 1967), p. 6.

<sup>38</sup> Teilhard de Chardin, *The Phenomenon of Man*, p. 31.

In any case, "to see" is not "only to touch more accurately," as Louis Kahn, who was otherwise extremely sensitive to light, unfortunately stated.<sup>39</sup> Just touching can hardly succeed in perceiving the totality of the world, because there is no simultaneousness involved. Touching is always sequential, but seeing is simultaneous. Thus, vision is the ability to perceive proportions. Every perception of proportions, for example, is a matter of existence at the same time.

As far as the optic portion is concerned, all the preceding thoughts describe more or less well-known phenomena; so well-known, in fact, that many scholars dealing with the spatial environment or with light have not gone beyond them. However, an all too-often underestimated reality is the *energetic portion*: the whole human and animal organism is stimulated and regulated by light. If the eye were regarded only as an optical apparatus that is connected to the brain, it would be difficult to explain how the many biological functions are influenced by light.

The history of living creatures reveals the evolution of the transmission of photoperception. A prehistoric organ, at the beginning of the evolution, transmitted heat, light, and vibrations to the body of the living being in order to provoke reactions to danger, to reproduction, etc. In the evolutionary process this original organ had been transformed into the pineal gland.<sup>40</sup> In comparison with lower vertebrates, the highly evolved mammal of today shows that its pineal gland no longer has a sensory task, but its eye has developed into an organ that now transmits light to the vegetative nerve system. More precisely, light enters the eye and causes neural impulses that affect the

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<sup>39</sup> John Lobell, *Between Silence and Light* (Boston: Shambala, 1979), p. 8.

<sup>40</sup> Hollwich, op. cit., p. 12, states more particularly: "Reptiles show the highest development of the pineal gland as a sensory organ. In their case it has an incomplete ocular structure that contains a miniature cornea, lens, and cornical retina with nerve fibers emanating from it."

pineal gland to produce a hormone, "which -once released into the bloodstream- travels to and affects the gonads and the pituitary, adrenal, and thyroid glands."<sup>41</sup>

Although this description is very much in biological terms, it explains precisely the fact that the energetic pathway is a highly neglected phenomenon which does not connect the retina with the brain but with the hypophysis or pituitary gland.<sup>42</sup> "The eye uses light not only as a medium of vision: light entering the eye regulates and stimulates numerous autonomic, i.e., unconscious metabolic and hormonal processes such as sugar balance, water balance, blood count, sexual function, and much more."<sup>43</sup> To demonstrate the relevance of these theories, much research on animals and human beings has been undertaken. Examinations of blind people, in particular, have shown that being cut off from light lowers all metabolic and hormonal activities, causes a neuroendocrine deficit, and influences speed of growth.<sup>44</sup> On the other hand, case studies with blind people, and especially those who had been suffering from a cataract and then recovered after surgery, show that sunlight creates a rhythmic fluctuation inside the human body equivalent to the circadian rhythm in the outer world.<sup>45</sup> The consciousness of this rhythm has been progressively disappearing since Edison invented the light bulb.

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<sup>41</sup> Ibid., p. 13.

<sup>42</sup> Ibid., p. 9, Fig. 10.

<sup>43</sup> Ibid., p. 95.

<sup>44</sup> Hollwich, op. cit., p. 19, explains further: "On the basis of observations of 694 blind children in Karl Marx-Stadt, Liebe and Keller (1965) found that blind children are more frequently retarded than children with normal vision in regard to speed of growth and to intellectual development. Those who became blind early (in the first year of life) were considerably more affected than those who became blind later (after the first year)."

<sup>45</sup> Ibid., p. 48, "...it was the sunrise and not the act of awakening which was followed by a fall in eosinophil count, independently of the rhythm of physical activity. ...the earlier the sun rose, the earlier the fall in the number of eosinophils occurred."

At this point it needs to be briefly explained why this treatise is dedicated solely to natural light. At first it was stated that light must be natural -existing in nature- because of its vitality; that, of course, needs further explication. The question has to be answered whether incandescent or fluorescent light can provide conditions comparable with sunlight.

First, according to Hollwich, there is a substantial difference in the spectrum of both the natural and the artificial light sources: whereas sunlight has a continuous level of different wavelengths, there are two enormously distinguished peaks in the artificial spectrum. One result is that stress is reached under artificial light at levels where complications never occur in sunlight.<sup>46</sup>

Second, man has not only “adapted completely to natural daylight, but for his biological regulatory mechanism to work properly, continuous variations in the amounts of stimulation are necessary to sustain its power to function.”<sup>47</sup>

Louis Kahn has found his own poetical words to further explain these highly medical circumstances: “So light, this great maker of presences, can never be ... brought forth by the single moment in light which the electric bulb has. And natural light has all the moods of the time of the day, the seasons of the year, [which] year for year and day for day are different from the day preceding.”<sup>48</sup>

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<sup>46</sup> Ibid., p. 90.

<sup>47</sup> Ibid., p. 91.

<sup>48</sup> Louis I. Kahn, ed. Nell E. Johnson, *Light is the Theme* (Fort Worth, Tex.: Kimbell Art Museum Publ., 1975), p. 18.

The thrust of this chapter is that humans, like animals, are highly adjusted to their energetic environment. Specifically, the visible spectrum of natural light has been important to man -his eye establishing a double link between his organism and the outside world. The human eye serves the needs for both visual perception- including the comprehension of space- and the unconscious regulation of man's organism. By now, it is impossible to imagine man being involved with his environment -unconsciously, consciously, or practically- without energy acting upon him.

## **The Effect of Daylight on Spatial Orientation**

"Architecture encompasses the art of guiding the motion of the human being. The body's movement through the articulation of space, the eye's movement through both the articulation of space and the disposition of light"<sup>49</sup> are two of the most desirable achievements in architecture. The physical composition of light, its acting upon living beings, and the function of the human eye, leads to full significance only when man begins to orientate himself. Orientation is the prior condition for conscious movement that entails the changing of places and spaces with all their implications on human life.

Orientation implies that man already has a certain notion of space. What exactly is the spatial notion upon which man bases his decisions, and to what extent is it dependent on light? We still can read in today's architectural journals', that "light does not make space and it does not make architecture. Walls, and floors, and ceilings, and windows, and doors, and columns, and pediments and so on and so on do these things." In con-

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<sup>49</sup> Fritz Schumacher, "Das Bauliche Gestalten," *Handbuch der Architektur*, vol. IV/1 (Leipzig: J. M. Gebhardt's, 1926), p. 32.

sequence this would mean that space, once defined by these elements, is everywhere the same, even outside the atmosphere, or in parts shaded from the sun. This raises the question: is orientation also determined by these elements?

The intricate relations between light, orientation, and space make it impossible to easily oppose statements such as the one cited above. Bollnow approaches the problem from his linguistic and phenomenological education. He defines the spatial term *narrow* as that which “restrains the development of life,” and *wide* as which “opens a sufficient realm of development.”<sup>50</sup> He establishes his ideas with a treatise about falling asleep, darkness, and awakening. According to the energetic nature of light, it is no surprise when he equates falling asleep with the renunciation of activity: “The abandonment of activity means at the same time the suspension of the mind’s reflexion.”<sup>51</sup> “Darkness is the absence of light and hence the absence of possibilities for reasonable action in the world.”<sup>52</sup>

But fading light is not only a matter of disappearing energy and vanishing human activity. Space not only contracts around us: “Our eye does not have the visible as a boundary anymore, but the invisible becomes its prison: homogeneous, immediate, indifferent, compact.”<sup>53</sup>

Does this not remind us at once of a description related to three-dimensional space, mathematical, homogeneous, immediate, indifferent, compact, and missing any relation

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<sup>50</sup> Bollnow, *Mensch und Raum*, p. 229.

<sup>51</sup> Ibid., p. 184.

<sup>52</sup> Ibid., p. 224.

<sup>53</sup> Bollnow, op. cit., p. 185, quotes Claudel.

to human existence? Every three-dimensional space is a dark space, whereas illumination creates the energetic space. The real space, existing as an ordered environment on earth, develops every morning anew. Bollnow, partially citing Marcel Proust, describes human awakening: "For a final fixation the brightness of the day is required. Only the full daylight, 'as with a stroke of chalk across a blackboard, its first white correcting ray,' assembles the roughly ordered at its definitely correct place: 'the dwelling place, which I had built up for myself in the darkness...; put to flight by that pale sign traced above my window curtains by the uplifted forefinger of the day.'" <sup>54</sup>

Bollnow spares no pains to come close to the real character of space. But he fails to a certain extent since he approaches space as "a to the *subject* [italics mine] related intentional space."<sup>55</sup> Although sometimes having slight doubts about the intentional space, then describing space as a medium, something "quasi-materialistic,"<sup>56</sup> nevertheless, at one point he explains: "The hodological space describes the system of ways whereupon I can reach single locations in space. In that manner it is comparable with a net, made up of lines of *force* [italics mine], which stream through this space. But also in the physical sense the lines of force are indeed related to charges or substances, which they emanate from."<sup>57</sup>

What are Bollnow's findings about orientation and where do they need to be extended? The first parameter of space is a previous notion of space, whose dependence on light

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<sup>54</sup> Bollnow, *Mensch und Raum*, p. 182; Bollnow's citations from a German translation of Proust are substituted here with quotes from Marcel Proust, *Swann's Way* (Franklin Center, Pa.: Franklin Library, 1980), p. 245.

<sup>55</sup> Ibid., p. 272.

<sup>56</sup> Ibid., p. 274.

<sup>57</sup> Ibid., p. 203.

has already been explained. A second parameter is the human eye, an organ which has been discussed according to its optical pathway and the influence of light on the metabolism of man. Yet, it would be insufficient for the human being only to have a notion of space, without theoretical access to that space. According to Feldenkrais, there is no perception without the body being adjusted to space, or, more precisely, to the gravity of the earth. Without adjustment "all signals from the outside world are blurred, distorted, and meaningless;"<sup>58</sup> moreover, consciousness is impossible. Not being able to use the eyes, man would be unable to compare the perceived vertical and horizontal positions with the real ones. After being adjusted to the gravity of the Earth, the spatial movement of the body needs to be initiated and coordinated. Interest in this connection has to concentrate on the activity of certain muscles. "All perception and sensation take place on a background of muscular activity."<sup>59</sup>

Further exploration leads to the knowledge that the movement of the eyes organizes the whole movement of the body. "The muscles of the eyes and the neck have a decisive influence on the manner in which the neck muscles contract. It is sufficient to recall climbing up or down stairs when the eyes did not see the floor at the end of the stairs to realize how great a part the eyes play in directing the muscles of the body."<sup>60</sup> Taking this relation between eye muscles and neck muscles into account, light again becomes a major influence on the human body. "Soon the eyes begin to follow the light, the head

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<sup>58</sup> M. Feldenkrais, *Body and Mature Behavior* (New York: Int. Univ., 1973), p. 81.

<sup>59</sup> Ibid., p. 79. With regard to the eye muscle some phenomena are worth noting. "Compression of the eyeball slows down the heart, with some people, by up to fifty beats per minute." Ibid., p. 19.

<sup>60</sup> M. Feldenkrais, *Awareness through Movement* (New York: Harper Row, 1977), p. 148.

turning to assist the eyes."<sup>61</sup> Once the head begins to turn, the whole trunk is affected, and so on.

Movement can only be thought of as being caused by energy. How compulsory the energetic influence on man's mobility is, shows that "energy not converted into movement, turns into heat within the system and causes changes that will require repair before the system can operate efficiently again."<sup>62</sup> Here energy means concerning living cells, the "restoration of potential energy." Above all it must be kept in mind, that body movement and eye movement are mutually dependent on each other, and neither of them gains priority over the other. It is what Piaget calls the "total sensory-motor schema," hence, negating all considerations of movement or perception undertaken in isolation.<sup>63</sup>

In summary, orientation is the prior condition for spatial experiences. Orientation begins with a notion about space; this notion develops along with light penetrating space. Where space is still dark, it may be called three-dimensional; every other condition depends on energy with all its implications. From energy emerges radiation and matter, both understood in a material sense. Light as a specific radiation leads to the sun, the latter inducing the consideration of various other radiation, which is dependent on the sun. Life on earth becomes affected especially by light, the visible spectrum of all radiation, which regulates man's organism, enables perception and consequently orientation, causes muscular activity and thus movement. These numerous effects presuppose a suitable condition of space -a space filled with a medium in a material sense.

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<sup>61</sup> Feldenkrais, *Body and Mature Behavior*, p. 113.

<sup>62</sup> Feldenkrais, *Awareness through Movement*, p. 58.

<sup>63</sup> Piaget and Inhelder, *The Child's Conception of Space*, p. 14.

The first stage of man's relation to light has been revealed as an unconscious and complex one. Yet, since light can only be comprehended in the twofold existence of the sun and its rays, this visible form of radiation must be considered on the conscious level as well.

## CHAPTER II



Figure 3. Dilated Zone: Arches National Park, Utah.



Figure 4. Energy in Material Space: Thunderstorms in Arches National Park, Utah.

## Daylight and its Meaning for Man

Man has no independent identity. Born to listen and to speak, he takes shape through communication. Yet, man is capable of communicating only on the basis of borrowed terms. Indirectly establishing the prime foundation for an identity of the human species, it is *nature* that through its eloquence enables human self-definition. The communicative process between nature and the human species can be described in terms of *self-explanation* by nature, and *interpretation* by man. Nature, however, grants the freedom of interpretation to man as part of this very same nature. Therefore, all cores, legends, and myths passed from man to man and from generation to generation -through culture, conversations, or ethics- are traceable back to an origin in nature.

Consequently, this chapter deals, first, with the self-explanation of nature in regard to the sun and its light, discussing orientation in natural space, the latter's relation to light, and how the medium that unifies both light and space reveals itself. Shadows and time are then analyzed. Finally, assembling all these revelations of nature evokes their meanings for man which become interpreted within various religions. Paradigmatically, a number of religious ideas about light in respect to space will be introduced to show the

light's--and, thus, the space's-- capability of being transcendental. This necessarily leads to the significance of symbols, especially where they express the sun, the light, or related themes. Again, despite the goal of comprehending light in its totality, it is just *one* example of how nature reveals itself, becomes explained and symbolized.

## Daylight and Nature

Natural space is the reason and the prototype for architecture; moreover, it lays the foundation for the deepest meanings of human life, for the environment, and hence for existence.

Somewhat in isolation, the previous chapter dealt with natural light, its characteristics and effects on man and the biosphere. This is reasonable as long as light is seen in its unconscious relation to human beings. If light, now, is raised into man's *consciousness*, the next and more advanced stage in his experience of light, it is then nature providing the necessary context for man to develop his consciousness, which almost at the same time becomes assured through meaningful and symbolical associations.

However, before meanings and systems can be installed, man must learn to "read" nature, which in the beginning of consciousness reveals itself as nothing more than a maze. To overcome this maze, man has to *oriente* himself therein. Recall from the previous chapter, that illumination enables a notion of space, hence, entailing orientation, the latter being dependent on the coordination of the eye-muscles that determine the body movement. The opening and using of the eyes leads to adjustment to the earth and to knowledge about the true verticality and horizontality. But so far, the discussion has been related only to the question of *how* the human body is related to the ground. Now,

being able to change places, man wants to know *where* he is and *wither* he shall move. Orientation conquers nature.

Here, again, and surely not for the last time, the twofold existence of light and sun must be noted. The preceding discussion of the “how” was solely related to the illuminated space, whereas the “where” in the nature leads to the sun’s body and its movement. I. Kant explains: “To orientate oneself, in the literal sense of the word, means: in respect to a given region of the heavens (one of the four compass points), to find the other ones, that is, the point where the sun rises. If I know that it is around noon, then I know how to find South, West, North, and East.”<sup>64</sup>

The superimposing of two imaginary axes upon the earth according to the path of the sun becomes man’s first ordering principle in the maze of nature where the same celestial sun likewise establishes a vertical order; this is explained when Norberg-Schulz quotes Kaestner: “Even one who, long ago, has lost his belief in heaven and hell cannot switch the words up and down” and immediately concludes: “In ‘our world’ the highest light still stands at the zenith.”<sup>65</sup>

Orientation in nature is based on intellectual concepts, especially in its foreign parts where there is no longer any possibility of remembering pre-known units. With the help of the celestial bodies, man’s unconscious orientation advances into the imagination of a structured cosmos. Thus, he begins to prevent himself from getting lost as well as from feeling lost in the midst of the far-reaching unknown. Bollnow reveals that “the word

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<sup>64</sup> Bollnow, *Mensch und Raum*, p. 63, quotes Kant.

<sup>65</sup> Christian Norberg-Schulz, “Vom Bild der Kirche,” *Rudolf Schwarz, Emil Steffann--Ueber die Rueckfuehrung der Architektur auf die Philosophie*, ed. Ottokar Uhl (Karlsruhe: By the Author, 1985): 22.

'to orient' comes from 'Orient,' the quarter of the sunrise," and suddenly it is apparent that one of the greatest achievements of human orientation is to give names even to the unseen, to the alien (e.g., "Orient").

Orientation is largely linked to the sun. This is all the more important since nature undergoes constant variations, due to geographical characteristics, changing lighting conditions, and above all due to its existence. "Why is nature always beautiful, and beautiful everywhere? And meaningful everywhere? And eloquent! And with marble and plaster, why do they need such a special light? Isn't it because nature is in continual movement, continually created afresh, and marble, the most lively material, is always dead matter? It can only be saved from its lifelessness by the magic wand of lighting."<sup>66</sup> It is the same fascination with nature and light, here described by Goethe, that led the Chinese to their highly sophisticated garden and landscape design where they felt little need of architecturally directing natural light but transformed it through *natural* elements.

Besides daily and seasonal changes of light -a topic discussed later- various types of landscapes offer different lighting characteristics. In the following, the ever-changing physical or biospheric settings are not the main theme but rather the *differential light*, since to a great extent architecture has to be seen as a reaction to this environmental archetype. Without considering spatial implications, we may recall Norberg-Schulz, who very sensitively distinguishes four characteristic types on the northern hemisphere (mainly referring to Europe): between the two adversaries, the *Nordic landscape* and the

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<sup>66</sup> Goethe, *Goethe on Art*, ed. and trans. John Gage (Berkeley and Los Angeles: University of California Press, 1980), p. 17.

*desert*, he places the *Central-European* landscape and the *southern type*; all of which he relates to their individual skies:

"In the desert the complexities of our concrete life-world are reduced to a few, simple phenomena: The infinite extension of the monotonous barren ground; the immense, embracing vault of the sky ... the burning sun which gives almost shadowless light; ... Sunset and sunrise connect day and night without transitional effects of light."<sup>67</sup>

"On the plains of Northern Europe, instead, the sky is usually 'low' and 'flat'...<sup>68</sup> and is ... continually modified by clouds.<sup>69</sup> Even on cloudless days its colour is relatively pale, and the feeling of being under an embracing dome is usually absent. The sun is relatively low and creates a varied play of spots of light and shadow, with clouds and vegetation acting as enriching 'filters'. Many variations are however possible according to the local surface relief and the quality of the light. In areas which are not too distant from the coast, the atmospheric conditions are continuously changing and light becomes a lively and strongly poetic element."

"In a country like Holland, where the ground is flat and subdivided in small spaces, light remains a local and intimate value. In Northern France, instead, the landscape opens up and the extended sky becomes a comprehensive 'stage' for the continuously changing quality of light. A 'light-world' is experienced, which evidently inspired the luminous walls of the Gothic cathedrals and the impressionistic paintings of Monet."

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<sup>67</sup> Christian Norberg-Schulz, *Genius Loci* (New York: Rizzoli, 1980), p. 45.

<sup>68</sup> *Ibid.*, p. 40.

<sup>69</sup> *Ibid.*, p. 42.

"In Southern Europe these poetic qualities of light are mostly absent: the strong and warm sun 'fills the space' and brings out the plastic qualities of natural forms and 'things.'<sup>70</sup> ... a strong and evenly distributed light and a transparent air which give the forms a maximum of sculptural presence. ... The environment thus consists of palpable 'things' which stand out (ek-sist) in light. The classic landscape receives light without losing its concrete presence."<sup>71</sup>

In summary, the previous observations describe the interaction between light and various landscapes according to the latter's location on earth. As important as these different manifestations are, they hardly have spatial consequences besides revealing a distinct perception of the vault of the sky. Different degrees of latitude have mainly been described in *atmospheric* and *cosmic* terms (perceived "height" of the sky) so far.

But additionally, in every one of the landscapes described above, light is able to *change* the actual space.<sup>72</sup> Bollnow, the linguist, should be noted here, and how analytically he set light and nature into a spatial relation: "Space in its earliest linguistic meaning is the clearing (*Lichtung*) through uprooting within a woodland as a place for human settlement. Thus, 'space' originally meant 'hollow space.' "<sup>73</sup>

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<sup>70</sup> Ibid., p. 40.

<sup>71</sup> Ibid., p. 45.

<sup>72</sup> *Landscape*, as distinguished from *nature*, is used in the present work only for the "hardware," that is, without the specific lighting conditions which are included in the term "nature."

<sup>73</sup> Bollnow, *Mensch und Raum*, p. 37; original German text: "Raum in seiner fruehsten sprachlichen Bedeutung ist die durch Rodung im Wald geschaffene Lichtung als Platz menschlicher Siedlung. Der Raum ist also urspruenglich Hohlraum."

Yet, it seems that Bollnow fell one step short here. The English "clearing," from Latin *clarus* (clear, bright),<sup>74</sup> is derived almost as directly as the German *Lichtung* from *auslichten* and *Licht* (light). Thus, as straight forward as it was said earlier that mathematical space is dark, it may now be stated that natural space in its first consequence is *illuminated space*.

Notwithstanding the slight dissent with Bollnow's earlier conclusion, his later and very sensitive analyses of the differences between day and darkness, achieved by comparing their spatial qualities, still deserve our attention. His *night-space* is not just a non-space, having simply disappeared in darkness; rather it possesses a different and specific quality: the experience of this dark space especially calls to mind how *day-space* is determined by seeing, where the day enables a "clear and visible space."<sup>75</sup>

Notable in this connection is how Bollnow refuses throughout his analysis of *Mensch und Raum* (Man and Space) to talk only about "artificially isolated partial space" while repeatedly emphasizing the relevance of the "experienced space as a whole."<sup>76</sup> Thus, he sensitizes his mind for transitions and changes such as dawn and twilight, both either introducing or dismissing the two cardinal spatial phenomena: *horizon* and *perspective*. "Horizon and perspective only exist in a visible world.... But if you can no longer see, then horizon and perspective disappear. For that the human being does not need to be completely blind. Every evening at twilight the visibility of things in space disappears. And, nevertheless, we remain in space."<sup>77</sup> But *why* and *how* do we still remain in space?

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<sup>74</sup> Webster's Ninth New Collegiate Dictionary, 1985 ed., s.v. "clear."

<sup>75</sup> Bollnow, *Mensch und Raum*, p. 214.

<sup>76</sup> Ibid., p. 215.

<sup>77</sup> Ibid., p. 214.

Simply explaining it with darkness "safely enclosing (*bergend umfangend*)"<sup>78</sup> the human is insufficient. Rather, some other spatial functions of light deserve close attention in nature.

Around the turn of the millennium, patronized by the Fatimid Kalif al-Hakim, the Arabian scientist and scholar Ibn al-Haytham (also called Alhazen) wrote a number of works on optics which in the following centuries became most influential on the research of European scientists such as Roger Bacon, John Pecham, and Witelo.<sup>79</sup> Endowed with knowledge, based on a variety of scientific writings,<sup>80</sup> Ibn al-Haytham carefully observes in his treatise "On Light" a certain behavior of light in natural space. For an understanding of his observations it is necessary to know that he only talks of natural *bodies*; thus, he distinguishes between *transparent* and *impervious* bodies. Three different qualities of the former are described: "the first of these is the air; the second, water and transparent liquids, like the white of an egg and the transparent layers in the eye, and whatever is similar to these; and the third, the transparent minerals, such as glass, crystal and the transparent precious stones."<sup>81</sup>

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<sup>78</sup> Ibid.

<sup>79</sup> Ibn al-Haytham (Alhazen), "Abhandlung ueber das Licht von Ibn al-Haitam," transl. J. Baarmann, *Zeitschrift der Deutschen Morgenlaendischen Gesellschaft*, vol. 38 (Wiesbaden: Kommissionsverlag F. Steiner, 1882): 195/196; Alhazen and Witelo, *Opticae Thesaurus--Alhazeni Arabis libri septem, nuncprimum editi. Eiusdem liber de crepusculis et nubium ascensionibus. Item Vitellonis Thuringopolini libri X.*, with an Introduction to the Reprint Edition by David C. Lindberg (New York and London: Johnson Reprint Corp., 1972), p. V.

<sup>80</sup> Alhazen and Witelo, *Opticae Thesaurus*, p. XIV: "(1) Aristotle's description of light..., (2) Neoplatonic views..., (3) the opinions of Galen and others..., (4) the atomists..., and (5) Euklid and Ptolemy."

<sup>81</sup> The English translation (from Baarmann's German) used in this thesis is available in Thomas H. Shastid, "History of Ophthalmology," in *The American Encyclopedia and Dictionary of Ophthalmology*, ed. Casey A. Wood, vol. 11 (Chicago: Cleveland Press, 1917), p. 8709

In the very ancient and sometimes obscure quarrel among philosophers, metaphysicists, and scientist about the constitution of space, Ibn al-Haytham makes the following contemplation of space in nature: after having become aware of the air *growing luminous* he concludes, "in all transparent bodies, however, beneath the sky, there is something of opaqueness; for there proceeds from each one of them, when the sunlight streams upon it, a second light, such as proceeds from opaque bodies when the sunlight streams on them; only that the second light which proceeds from the transparent bodies, is weaker."<sup>12</sup>

"That from the air a second light proceeds, is obvious from the case of morning light. The surface of the earth is illuminated in the morning before the sun arises, and the sense perception beholds the surface of the earth brighter than that it was in the night, although, in the morning, the sun, before it becomes visible to the eye, does not stand opposite the earth."

"This air, now, stands opposite the solar body, and between it and the sun is nothing which can hinder: this air grows luminous in the morning, and the light which is in it is perceived by the senses."<sup>13</sup>

What is the essence of Ibn al-Haytham's observations? Most importantly he discovers a material medium enriching an otherwise empty space. It is this "something of opaqueness" that sets natural space as a function of light. The Arabian scholar had observed practically the same medium whose existence was proved by Gates through his scientific research on the effects of the biosphere on animals (see chapter I). There is no

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<sup>12</sup> Ibid.

<sup>13</sup> Ibid., p. 8710.

reason to underestimate the fact that Ibn al-Haytham was able to discover a Phenomenon through *observation*: something that is subject to visual perception is always capable of becoming applied *artistically* (see chapter III). Besides, space is oriented not only through man's intellectual concepts but by way of its own constitution. Since space is set in relation to light by virtue of its medium, it is built up *in the east* as the day follows the night.

A better understanding of the spatial consequences resulting from these findings is obtained in the contemplation of both color and fog:

- (1) Space becomes determined by *color*. This is observed, for example, in an increasingly bluish appearance of further and further distant objects, mixed with an augmenting portion of white due to haze.
- (2) Space is constantly expanding and contracting, according to the saturation of opaqueness which peaks in the experience of dense *fog*. Throughout fog, again, the intensity of light also intensifies the momentary spatial situation as can easily be experienced during a ride in a car using low and high beams.

At this point two witnesses may be quoted observing the psychological consequences of space filled with fog; H. Hesse's description of loneliness: "Strange to walk in the fog! Lonely is every bush and stone, no tree sees the other, everything is alone...."<sup>24</sup> Bollnow, on the other hand, fights consumption and a sense of danger, carefully distinguishing between the fog of the darkness and fog under glaring light: "Yet, this fog rising from the dusk and disappearing in the darkness has an entirely different character than the one flooded by the full, bright light. It is not so much the feeling of an undermining nothingness which in a way sucks at the human being, so that he believes he ought to

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<sup>24</sup> Norberg-Schulz, *Genius Loci*, p. 21, quotes H. Hesse.

fall into the void, but on the contrary something, as it were, assuming materialness and something threatening to rush upon him."<sup>85</sup>

Nothing demonstrates so clearly the being of space on earth in its dependence on light as these previous two descriptions. Hence it is all the more incomprehensible when Bollnow, despite his careful observations, later raises the question: "But how can the infinitely open space prevent fading away of the human consciousness. For the acoustical phenomenon walls were required which reflected the sound and without them it [the sound] would disappear in infinity. If this, now, becomes transferred to space as a whole, so follows, that space has an effect as if it possesses walls, that man can feel safe in it like in an enclosed space."<sup>86</sup>

Bollnow does not reach the point here where space becomes a *function* of light, which would have entailed the consideration of the non-diaphanous portion of natural space as energetically effected with all the physiological and psychological consequences. So, we can only agree with him when he states that "the space belongs to man like his body ... we are our space,"<sup>87</sup> but we disagree when he considers especially the *night-space* as being a medium that, as it were, lies upon the skin as a tangible medium.<sup>88</sup> Space as a parameter of light entails the opposite: it is an intensifying experiential medium, proportional to the increase of light.

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<sup>85</sup> Bollnow, *Mensch und Raum*, p. 222.

<sup>86</sup> Ibid., p. 303.

<sup>87</sup> Ibid., p. 303.

<sup>88</sup> Ibid., p. 305.

Besides this one major factor--the *something of opaqueness*--establishing certain spatial experiences, we are still in need of turning our eyes upon another important element: *shadow*. Its absence will result in the insufficient ability to judge scales and distances: "and since there was no shadow, hence there was no judgement about the size of the things."<sup>89</sup> If the material elements in a landscape cast shadows, perception will be facilitated; usually elements will be easier to distinguish and, therefore, reveal more spaciousness despite the fact that the horizon appears closer to one's own standpoint. The latter fact may even be enhanced by a very clear atmosphere providing an extremely intimate scale.

This provokes the interesting question: "Why does man hike?"<sup>90</sup> It is both the landscape being so vital and *spatial when casting shadows* and the sunlight becoming irresistibly tempting when unifying itself with *space as a medium*. Some people, when asked to explain their appreciation of sunny days, adduce neither liberation from narrowness--generally provided by nature anyhow--nor the comfortable warmth. Such days simply make people more mobile. Space becomes so much more accessible that it begs to be conquered.

Space, on the other hand, is not homogeneous once it is understood as light being unified with a medium. Parts of the space become activated according to the light's actual prevailing intensities subdividing the medium. Sunbeams or indirectly irradiating light bring about more or less distinct boundaries -boundaries that might be seen on bodily surfaces such as walls, when bright areas lie next to gloomy ones. Ergo, light has the

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<sup>89</sup> A. Stifter, on snow within bright light, quoted in Bollnow, *Mensch und Raum*, p. 221.

<sup>90</sup> Bollnow, *Mensch und Raum*, p. 116.

property of being an *image* revealing a certain part of the heterogeneous space. Light is the *out-cast* or *out-line* of an energetically distinguished partial volume.

Space is *more* than a matter of "*how* is the ground on which we walk, *how* is the sky above our heads, or in general; *how* are the boundaries...."<sup>91</sup> Grounds, boundaries, etc. have to be comprehended as a kind of canvas for images of the light's diverse conditions, with the latter being revelations of differentiated volumes of space. Light is more than an ever-changing painting of boundaries, as Norberg-Schulz tends to understand the subject.

In the beginning of the present chapter we inquired into the roll of the sun in ordering the chaos--carving out space by providing orientation. At this point, *time* deserves a brief discussion. Supported by the moon and other celestial bodies, the sun, with its light *in toto*, generates a daily and a more or less seasonal rhythm in addition to the previously mentioned orientation. Hence space receives its *historical* dimension. How closely the human physiology is adapted to this temporal factor has already been shown; to illustrate the way man's *thinking* is governed by it, Luetzeler refers to the Greeks who, as he remarks, "know a word for 'year', which means light-march (*Zykabas*)."<sup>92</sup>

Time is directly related to movement: the rotation of the earth organizes man's life into small units, of days intersected by nights, whereas the earth on its way around the sun underlines our understanding of a cosmic eternity.

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<sup>91</sup> Norberg-Schulz, *Genius Loci*, p. 14.

<sup>92</sup> Quoted in Schnell, "Christliche Lichtsymbolik in den einzelnen Kunstepochen," *das muenster* (1978, Heft 1), p. 34, where Luetzeler translates *Zykabas* into German with *Lichtgang*.

Time also has its twofold quality. Modern man has become aware of a second layer of temporality: *duration*.<sup>93</sup> Within the cosmic rhythm, organic and inorganic matter slowly develop. Despite the seemingly never-ending rhythm, nothing ever stays the same. Teilhard de Chardin labels it with the term "space time," explaining "... that everything that up to then we regarded and treated as points in our cosmological construction became instantaneous sections of indefinite temporal fibres."<sup>94</sup>

Summarizing the role light plays in nature discloses the second facet energy unveils: by virtue of light emitted by the sun it is visible radiation that both regulates the human organism and rises into man's consciousness. Light acts on two stages; first, it affects, unconsciously, the same (human) body that then becomes mentally aware of the light's presence, though this mental awareness conceives worldly concepts rather than analyzing bodily functions. That is, unconscious reception and conscious comprehension circle about two different centers, only partially including commonalities.

The presence of daylight in nature brings about orientation in nature and the distinguished lighting conditions of different regions, man's dependence on the illuminated space (cf., linguistic analyses) and "something of opaqueness" in the air, fog as well as shadow, and, finally, images of the dissected space on surfaces. At the beginning of consciousness, man relies on the presence of the sun, and throughout its path around the earth he structures the chaos he was born into. Two axes with four extreme points--East, South, West and North--unravel the maze, and the zenith of the sun informs about up and down, heaven and hell. No matter what a particular landscape looks like in detail, the distinguished lighting conditions always tell us whether we are close to one of the

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<sup>93</sup> Ibid., p. 218.

<sup>94</sup> Ibid., p. 47.

poles or near the equator. This is the nature of illuminated space, which is contrary to mathematical space with its three dimensions, yet practically without any possibility of orientation. Natural space has been observed as filled with "something of opaqueness" that is capable of "growing luminous." The presence of this material medium raises spatiality beyond doubt as nothing empty; space is receptive to colors, and various densities of haze and fog let it contract and expand. Such space is the opposite of night-space, which is almost mathematical in its being. Illuminated space activates its parts and achieves distinguished intensities divided by more or less distinct boundaries; energetically intensified, it outlines itself by way of images perceptible on all that is material. Thus, by means of the above, natural space becomes lucid to the mind, too, as a function of light.

## **The Meaning of Daylight in Religion**

Ignorance is not the opposite of fanaticism. Instead, one can think of both as being the same, with each only carrying a converse sign -plus or minus. Each of them walling up the access to a rich and complex mode of being that for millennia was never questioned. It was religion which endowed mankind with a cosmos; with unity, meaning, symbols, and architecture. Religion nearly determined everything: from the way of ruling countries to ecclesiastical and political ceremonies; from the artist's work to scientific hypotheses; how country life and cities were organized; how the world was conceived; and, last but not least, the way architectural space was formed. In ancient days religion and philosophy were transitional; the philosopher believed in God or gods and the monk

often developed rather scientific concepts. "Every human being is made up at once of his conscious activity and his irrational experiences."<sup>95</sup>

But, as absurd as it would be to skip an investigation of religious meanings in a treatise on light, it would be ridiculous to limit the present work solely to a religious statement. In other words, to quote D. H. Lawrence, "When ... I learnt from Euclid that: 'The whole is greater than the part,' I immediately knew that that solved the problem of allegory for me. A man is more than a Christian...."<sup>96</sup> Yet, this presupposes knowledge of that which has to be overcome; i.e., to comprehend the whole one has to know about religions. For this thesis that means inquiring into some religious attitudes about sun and light.

Twentieth century man rarely lives religiously anymore. His mode of being on earth is *existential*, the proper philosophy being called *existentialism*. Today, with Heidegger, we still live between earth and sky: "But 'on earth' already means 'under the sky.'"<sup>97</sup> Yet his sky "is the vaulting path of the sun, the course of the changing moon, the glitter of the stars, the year's season, the light and dusk of day, the gloom and glow of night, the clemency and inclemency of the weather, the drifting clouds and blue depth of the

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<sup>95</sup> Mircea Eliade, *The Sacred and the Profane. The Nature of Religion* (San Diego, New York, London: Harcourt Brace Jovanovich Publs., 1959), p. 209.

<sup>96</sup> D. H. Lawrence, *Apocalypse* (New York: Viking Press, 1980; original copyright: The Estate of David Herbert Lawrence, 1931), p. 4.

<sup>97</sup> Christian Norberg-Schulz, *Genius Loci*, p. 10, includes quotations from Heidegger. Norberg-Schulz closely follows Heidegger when setting up his "2-zone-model" with *up* and *down*: "The earth is always the bearing, dark ground, the rock and the organic life; the heaven was always the entire differentness of the light, the azure and the quarters of the heaven." (Christian Norberg-Schulz, *Vom Bild der Kirche*, p. 25)--a statement opposed by H. Muck (cf., "Theoriemodelle zur vorausgegangenen Diskussion," *Rudolf Schwarz, Emil Steffann--Ueber die Rueckfuehrung der Architektur auf die Philosophie*, p. 71.), who refers to a "3-zone-model" as the historical model, where not man but the Earth is the section between "up" and "down."

ether....”<sup>98</sup> Rich in its phenomena, this sky, nevertheless, reveals what Sedlmayr once called “Loss of the Center”--a vault which leaves man behind, frightened because of being “thrown” into the world, as the existentialists have said. Space in this profane world is a “hostile and haunted medium” where man “lacks something essential in his relation to space.”<sup>99</sup>

Instead of being thrown into a chaos, which in the most sacred conceptions is equivalent with disorder and darkness, *religious man* conceives himself as living in the totality of a cosmos being organized and filled with power.<sup>100</sup> It is worth noting that he neither lives *between* things, *on* earth, or *under* the sky, but *in* the cosmos.<sup>101</sup> Herein, “beginning at a certain stage of culture, man conceives of himself as a microcosm.”<sup>102</sup> After all that has been said in the first chapter, it should be possible to understand that these human conceptions were experienced as something *real*.

Yet, these realities differ from modern man’s natural phenomena to a large extent. Here lies the reason why this section needs so much attention. Essential for religious man is the view that “by manifesting the sacred, any object becomes *something else*, yet it continues to remain *itself*, for it continues to participate in its surrounding cosmic

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<sup>98</sup> Norberg-Schulz, *op. cit.*, p. 10, quotes Heidegger.

<sup>99</sup> Bollnow, *Mensch und Raum*, p. 275, about existentialism as exemplified through Heidegger.

<sup>100</sup> Eliade, *The Sacred and the Profane. The Nature of Religion*, p. 44.

<sup>101</sup> *Ibid.*, p. 12.

<sup>102</sup> *Ibid.*, p. 165.

milieu,"<sup>103</sup> where the sacred becomes tantamount to "power, efficacy, source of life and fecundity."<sup>104</sup>

From here the religious reality develops various micro-macro correspondences dissolving the equal status of spatial spheres and the quarters of the heaven.

It is worthwhile to note that, since modern man is threatened by angst, death, and senselessness and unable to perceive more than a limited number of phenomena, light bears, for him, the capability of leading to various transcendences of space once it is endowed with meanings. In this connection it is necessary to keep in mind what has been said about the light's influence on human physiology and how light reveals, differentiates, and orders natural phenomena (see the section about "the nature of daylight"). But, so far *light in nature* has been no more than a guide post to help man oriente himself in natural space. *Light in mind*, however, as in religious conceptions, functions both to structure natural space *and* to affect man. Only when both the structuring component and the physiological component are synthesized, can the various religions achieve *meaning*. Only then can meaningful places exist in meaningful space.

This, now, becomes the prior condition for *transcendence*. Though some religions tend to focus more on transcendence of the individual, certain other add the transcendence of space. Because a treatise on light and space should not pass over spatial transcendence, several of the major religions will be compared, according to their solar and luminous epiphanies, to illustrate where transcendence therein effects the *spatial being in the world*.

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<sup>103</sup> Ibid., p. 12.

<sup>104</sup> Ibid., p. 28.

In all religions there are certain *myths* to inform us about primordial beginnings. From different hostile environments such as desserts, death, marine monsters, dragons, from the midst of chaos and darkness, man is believed to have been conceived into life. Most tales of the beginning are transitions from one to another constitution to define the axioms for the various micro-macro correspondences.

Often these creation myths are related to light or reveal homologies between man's eyes and the celestial bodies. "According to Taoist philosophy," as Siren records, "man is a microcosm, corresponding to heaven; as heaven has the sun and the moon, so man has his two eyes."<sup>105</sup> Consequently, Laotzu poetically demands:

"Harmonize with its light,

Sympathize with its dustiness.

This is the way of natural unity." (Chap. 56)

Another Chinese creation myth recounts: "The origin of the world lay in a primordial egg which hatched a god who lived eighteen thousand years. Then he died. His head split and became the sun and the moon...."<sup>106</sup> The Bible states: "Then God said, 'Let there be light'; and there was light."<sup>107</sup> Moreover, the God of the Bible exemplifies the duality between light and the celestial bodies again when He skips two complete days before

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<sup>105</sup> Oswald Siren, *The Imperial Palaces of Peking*, (Paris--Brussels: van Oest, 1879; reprint 1926), p. 25.

<sup>106</sup> Maggie Keswick, *The Chinese Garden--History, Art & Architecture* (London: Academy Edition, 1978), p. 29.

<sup>107</sup> *Holy Bible--The New King James Version* (Nashville, Camden, New York: Thomas Nelson Publs., 1979), Gen. 1:3; Hugo Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 21; Franz Joseph Doelger, *Sol Salutis* (Muenster: Aschendorffsche Verlagsbuchhandlung, 1925; reprint ed., Muenster 1972), p. 158.

He “made two great lights: the greater light to rule the day, and the lesser light to rule the night. He made the stars also.”<sup>108</sup>

These examples show that, for many peoples, in various religions, luminous epiphanies occupied outstanding ranks influencing whole cultures for thousands of years. So it is no surprise that one and a half centuries ago Goethe confessed to Eckermann: “If I am asked whether it is in my nature to revere the sun, I again say--certainly! For he is likewise a manifestation of the highest Being, and indeed the most powerful that we children of earth are allowed to behold. I adore in him the light and the productive power of God; by which we all live, move, and have our being -we, and all the plants and animals with us.”<sup>109</sup> Here, Goethe delivers an excellent example of how the twofold presence of sun and light is needed to transcend the visible world. In his statements the sun becomes “the *mightiest* to be perceived” and “a revelation of the *Almighty*,” it is important that, for him, both are no longer separable, since they exist at the same time! Because of his personal education, his cultural history, and his own thinking, Goethe transcends the “mightiest” towards the “Almighty”: *transcendence* as an imagination of the mind uplifting phenomena from the perceptible world together with simultaneously losing the capability to comprehend the act of transcendence.

In the following, a number of existing as well as faded religions and sects will be investigated with regard to their awareness and integration of light’s physiological aspects and where they continue to approach spatial transcendence. Nonetheless, it is beyond of the

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<sup>108</sup> *Holy Bible--The New King James Version*, Gen. 1:16; Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 21.

<sup>109</sup> Karl Kerényi, “Vater Helios,” *Eranos-Jahrbuch*, vol. 10 (Zurich: Rhein-Verlag, 1943), p. 83, quotes Goethe; the English translation used here is taken from Johann Peter Eckermann, *Conversations with Goethe*, transl. John Oxenford, ed. J. K. Moorehead (London: J. M. Dent & Sons LTD, 1930; reprint 1971), p. 422.

scope of this work to render a comparative study of world religions. The following brief survey of a number of those religions, rather, will address the extent to which they react upon light's effect on the human body and how space, especially in Christianity, is experienced in relation to light.

The complex *Indian* religions and philosophies acknowledge first and foremost the general importance of light as the creator of life. In some cases light even becomes equal with life. This equation, which is not only typical for Indian transcendence (as has been seen with Goethe and will be seen in Christianity), immediately enables us to comprehend light in spatial terms both *ad infinitum* (shining "beyond this sky, beyond all things, in the highest worlds beyond which there are none higher") and *ad infinitesimal* ("The same light that shines within a man."<sup>110</sup>)

With the knowledge from the first chapter about light's various influences on human physiology, there should be little surprise now, when "consciousness of the identity between the interior light and the super-cosmic light is accompanied by ... well-known phenomena: a rise in the temperature of the body..."<sup>111</sup> Another reference to transcendence and human physiology is found in Hinduism with the *atman* (the innermost essence of an individual, the Self). This becomes identical "with the entity that is to be found at the heart of man, in the form of 'a light [the highest light] in the heart.'

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<sup>110</sup> Mircea Eliade, *Myths, Rites, Symbols*, ed. Wendell C. Beane and William G. Doty (New York: Harper, 1975), p. 329, quotes from the *Chandogya Upanishad*, III, 13, 7.

<sup>111</sup> Eliade, *op. cit.*, quotes from *ibid.*, III, 13, 8.

<sup>112</sup> Mircea Eliade, *Myths, Rites, Symbols*, p. 329.

In the Buddhistic branch of *Mahayana* philosophy one faces a slightly different equation of light and space; infinite distances become less emphasized, but light stands for the absolute negative volume of the *universal void*. Bearing in mind what has been stated about the spatial qualities of light in “daylight and nature”, this “negative” light of the universal void is the converse of our observations of nature: “ ‘clear,’ ‘pure,’ that is to say not only without spot or shadow, but also colorless, and without qualities ... free of all attributes, of all differentiation.”<sup>113</sup> In some cases Indian religions even go so far as to imagine radiant beings after the world has been dissolved.<sup>114</sup>

The *Hellenistic* and *Roman* world of gods probably reveals the most outstanding dissimilarities among the Mediterranean and the Near Eastern religions compared with Far Eastern preoccupation with transcendence: a whole convention of Gods, climbing up and down an hierarchical rank-list, sometimes even changing their “vocation.” Where they constitute the world, they offer Greek and Roman citizens, and noncitizens, the unity of three zones: sky, earth, and underground. The first mentioned is reigned by *Helios*, the sun-god, life-bestowing and archetype for numerous emperors. The latter, *Hades*, “reads in homeric language still *A-ides* and means the invisible being and the invisible-maker, exactly corresponding to the opposite characteristic feature of *Helios*, the visible being and visible-maker.”<sup>115</sup> Among Greek and Romans sunlight was thought

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<sup>113</sup> Ibid., p. 330.

<sup>114</sup> Ibid., p. 332.

<sup>115</sup> Kerenyi, *Vater Helios*, p. 91.

of as a "symbol of birth" (Plutarch),<sup>116</sup> Helios and Hades were experienced as a unity of the "one providing and withdrawing sight and life."<sup>117</sup>

Nevertheless, we still have to underscore the fact that both the Hellenistic culture and especially the pragmatical Roman culture concentrated on and involved far more the *sun's body* as an incarnation of a goddess than the Christians or the previously cited Indians ever did. From the major turning point in the Roman celebration of gods -the Augustan secular-festival in 17 B.C.- until Constantine, the Roman emperors were increasingly "portrayed ... wearing the sun-crown, ... a very conscious parallel between the imperial World-Ruler and the Helios-Kosmokrator...."<sup>118</sup>

It is hardly necessary to call attention to the fact that the *imperium romanum*, as a superpower unequaled throughout the Mediterranean, had to be, and was, extremely syncretic to absorb and control the wide spectrum of peoples (and religious cults!) within its empire. Among the various sects with more or less impact on Roman culture there were quite a number with distinct solar or luminous deifications. Some of these sects' myths, rites, and ways to make this medium transcendent should be briefly listed here, under the aspect of light being an energetic medium.

Among those sects it was *Mithraism* that had a great influence on Roman religion. During its late phase and before Mithraism succumbed to the growing church, it was a competitive rival for early Christianity. In this sect Mithras is the Guiding-Light God.

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<sup>116</sup> Hugo Rahner, "Das Christliche Mysterium von Sonne und Mond", *Eranos-Jahrbuch*, vol. 10 (Zürich: Rhein-Verlag, 1943), p. 354.

<sup>117</sup> Kerényi, *Vater Helios*, p. 92.

<sup>118</sup> E. Baldwin Smith, *Architectural Symbolism of Imperial Rome and the Middle Ages* (Princeton: Princeton University Press, 1956), p. 57.

A description of the God's being states that it is almost as if the air were "growing luminous." "The light-nature of the God becomes intensified to the extreme. Now, He is the God of the Light which comes up upon Mount hara *before* the sun."<sup>119</sup> The greeting of the God almost waxes a physiological salutation: W. Wili calls it "taking spiritual breaths."<sup>120</sup> It again becomes evident that physiological aspects of light in Mithraism have notable importance as in numerous other religions.

For the *Mandean*, baptism took place in the "light-stream, in the Light-Jordan." In the *Corpus Hermeticum* an ancient mystical prayer seeks the inner light and commands its presence: "The universe in us (or: our whole being) save life! (or make alive!)-let there be light, Pneuma-God!"<sup>121</sup> Furthermore, discussing the ascension of the soul according to these cited writings, M. Pulver explains how unification with the world is to be thought of: "At the next stage the sensory functions of the body return to their origins by becoming parts again and by unifying themselves with the energies, that is to say either with the mental activities which the universe possesses -thought of as a huge human being, or with the energies of the elements."<sup>122</sup> Obviously, the senses are conceived of here as a link between mental and elemental energies on a preliminary stage before unification. By mentally extending his physical experiences, ancient man demonstrated that he was *aware* of nature's affect on him. The energetic universe is even a thinking universe; and indeed, though we might not be willing to accept this, the final unification

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<sup>119</sup> Walter Wili, "Die Roemischen Sonnengottheiten und Mithras," *Eranos-Jahrbuch*, vol. 10 (Zurich: Rhein-Verlag, 1943), p. 148, quotes E. Wuest in Paula-Wissowa XV, 1932, p. 2132.

<sup>120</sup> Ibid., p. 160.

<sup>121</sup> Max Pulver, "Die Lichterfahrung im Johannes-Evangelium, im Corpus Hermeticum, in der Gnosis und in der Ostkirche," *Eranos-Jahrbuch*, vol. 10 (Zurich: Rhein-Verlag, 1943), p. 257, (C.H.: XIII, 19).

<sup>122</sup> Ibid., p.266.

of bodily senses with elemental energies strongly reminds us of the physiological reactions to light as we examined them in the previous chapter.

Lastly, *Manicheism* shall be mentioned briefly as a Gnostic sect "melting together Buddhistic, Parsic, Gnostic, and Christian elements in its rule of the eternal light-empire."<sup>123</sup>

This short discourse into a few light-oriented religions becomes reasonable the moment Christian thoughts and experiences are introduced to the present topic. When, for example, Augustine, as a former follower of Manicheism mentions the Manichean custom of turning oneself to the sun (and the moon) while praying,<sup>124</sup> then we become aware of a rite with similarities to be found in numerous other religions. Often the exchange of essential ideas took place with the help of symbols. "The fact that architectural symbolism was always intuitive at the popular level, and for that reason dependent upon traditional forms and customary ideas, helps to explain why Christian churchman took over, both consciously and unconsciously, so much from the past and, often with very little change in the meanings, made use of pagan symbolism, imperial forms, and palace conventions to present in convincing terms the spiritual beliefs and heavenly rewards of the new faith."<sup>125</sup> Thus, amidst those various myths, creeds, cults, and rites broached above, the new Christian movement is not a message just spoken into the void. In a treatise on light this amounts to the question, how the renewal of symbols, images, thoughts, and myths in Christianity affect the role of either (or both) the sun or its light;

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<sup>123</sup> Paul Schmitt, "Sol Invictus," *Eranos-Jahrbuch*. vol. 10 (Zurich: Rhein-Verlag, 1943), p. 224.

<sup>124</sup> Ibid., p. 236.

<sup>125</sup> Smith, *Architectural Symbolism of Imperial Rome and the Middle Ages*, p. 6.

how the transformation of their symbolical meaning reacts "in the depth of the psyche;"<sup>126</sup> and how the reasoning of space through light leads to transcendence.

Constantine was the first political power to support Christianity, though not always clearly distinguishing between Mithraism and the Christians' God. Nevertheless, it is "consistent with Constantine's early interest in Apollo and his policy of associating himself with the Invincible Sun in the Hope that both pagans and Christians might be united in an imperial cult."<sup>127</sup>

Certain similarities between the pre-Christian and the early Christian religions have recently been cited by scholars. In the beginning of *John* (1:1) we read: "In Him [the Word] was life, and the life was the light of men. And the light shines in the darkness, and the darkness did not comprehend it;"<sup>128</sup> Later he quotes Jesus "I am the light of the world" (*John*, 8:12)<sup>129</sup> who subsequently urges, "Walk while you have the light, lest darkness overtake you."<sup>130</sup> When Jesus equalizes light and life (*John*, 8:12), it finally becomes obvious how similar to other religions are Christian teachings in regard to basic cosmic understanding. Along with M. Pulver, God and life, light and the "word" become one- "thus, for man was, or perhaps still is, life the same as light."<sup>131</sup> Later, the author

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<sup>126</sup> Mircea Eliade, *Images and Symbols* (New York: Search, 1969), p. 160, quotes Fr. Beirnaert.

<sup>127</sup> Smith, *Architectural Symbolism of Imperial Rome and the Middle Ages*, p. 46.

<sup>128</sup> *Holy Bible--The New King James Version*, *John* 12:35; Pulver, *Die Lichterfahrung im Johannes-Evangelium, im Corpus Hermeticum, in der Gnosis und in der Ostkirche*, p. 253; Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 25.

<sup>129</sup> Rahner, *Das Christliche Mysterium von Sonne und Mond*, p. 344.

<sup>130</sup> *Holy Bible, The New King James Version*, *John*, 12:35; Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 21.

<sup>131</sup> Pulver, *Die Lichterfahrung im Johannes-Evangelium, im Corpus Hermeticum, in der Gnosis und in der Ostkirche*, p. 255.

relates the introduction in *John* to hermetic forms, then in comparison to Chinese thinking interpreting: "Here the light is alluded to in its emotional function; as an internal event of becoming light, and as psychic merit of existence, after having become light. Light as path in the same sense that the Tao is path."<sup>132</sup>

In addition, Christianity made, and makes, certain noteworthy adjustments to physical and physiological evidences. In the first chapter, man, the microcosmos, was considered to be the mirrored result of the macrocosmos, upon which he reacts with various physiological settings. The energetic medium, acting through radiation on man, could be made capable: via the *energetic portion* the human *inhales* light for the purpose of a variety of bodily functions, more generally spoken, for growth, health, or just for simple life. Christianity addresses, *in its own way*, quite a number of the issues that have just been summarized. The church father and patriarch of Constantinople *Chrysostom*, for example, states in a striking analogy: "The sun of justice now emits its rays within our flesh and shines into our souls,"<sup>133</sup> an experience similar to M. Pulver's explications about the *Corpus Hermeticum* where "man as microcosmos is essentially Body of Light such as the world as macrocosmos is essentially Body of God."<sup>134</sup> Similarly, according to *Pseudo Witelo*--and here one may say, in perfect accordance to what has been said about physiology in the first chapter--"light is the principle of movement and of life within all living."<sup>135</sup> All these equations of life with either light or other phenomena are the key to

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<sup>132</sup> Ibid., p. 256.

<sup>133</sup> Rahner, *Das Christliche Mysterium von Sonne und Mond*, p. 379.

<sup>134</sup> Pulver, *Die Lichterfahrung im Johannes-Evangelium, im Corpus Hermeticum, in der Gnosis und in der Ostkirche*, p. 264.

<sup>135</sup> Clemens Baeumker, "Witelo, ein Philosoph und Naturforscher des 13. Jahrhunderts," Clemens Baeumker, Georg Freih. von Hertling, *Beitraege zur Geschichte der Philosophie und Theologie des Mittelalters*, vol. III/2 (Muenster: Aschendorffsche Buchhandlung, 1908), p. 452.

transcendence in numerous religions, being a lively *experience* and not a mere intellectual whim. To know this will improve all further understanding of the transcendence of space in particular.

Eliade points out, that as opposed to the profane existential world, nature is more than a matter of scientific investigations and that the space nature forms is not homogeneous for religious man. It shows "interruptions, breaks in it, some parts of space are qualitatively different from others."<sup>136</sup> With Eliade, there are two modes of being in the world: the sacred and the profane (though Bollnow carefully remarks that the secular world is not simply homogeneous.<sup>137</sup>).

Since there is a very unusual conception of space in scholastic metaphysics today, it is all the more necessary to discuss whether the Christian God is set either as equal to the sun, thus, in danger of developing towards pantheism, or as equal to light. Perhaps still another possibility exists. The difficulty of this enterprise lies in three facts: (1) the importance, as Eliade remarks, "to differentiate between the subjective light and the phenomenon of light objectively perceived by other people;" (2) that "in the Indian, Iranian and Christian traditions the two categories of experience are lumped together;"<sup>138</sup> and (3) that medieval thoughts and writings are highly influenced by two different Greek philosophical schools of thinking: the school of *Plato* and that of *Aristotle*. Because we shall later discuss the scholastic concepts of space in the writings of Pseudo Witelon, we will concentrate mainly on the Platonic branch.

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<sup>136</sup> Eliade, *The Sacred and the Profane. The Nature of Religion*, p. 20.

<sup>137</sup> Bollnow, *Mensch und Raum*, p. 141.

<sup>138</sup> Eliade, *Myths, Rites, Symbols*, p. 337.

Baeumker points out, that many neo-Platonic thoughts are based on some of Plato's thoughts in his *Politeia*, where Plato considered two equations analogous: (1) in the realm of the *intelligibility*, the idea of the Good is imagined as the deity, (2) in the realm of the *visibility*, the sun as the deity's offspring stands for the Good of the visible world.<sup>139</sup>

Upon this analogy, *Plotin*, representative of neo-Platonism, derives his idea of emanation: enhancing Plato's idea, he abstracts light from the body of the sun and consequently perceives the former as potency without mass. For him, *light* is primary, not the sun. Imagining that light is not emanation in the sense of substance but of power, he deduces what Baeumker calls a theoretical model born in phantasy,<sup>140</sup> where the primary being is the core encompassed by three circles of light, first circle: the *nus*; second circle: the soul of the world; and third circle (no independent light circle due to lack in sufficient self-generated light), p. the sensuous world.<sup>141</sup>

Upon this model, the scholastic Greek philosopher *Proclus* teaches that the sun impregnates this world, according to its capacity for absorbing, with the light of that supra-celestial world.<sup>142</sup> Later, Augustine relativized some of those neo-Platonic ideas and stated: "Christ is not named Light the same way he is called Corner Stone, rather the former stands in the true sense, the latter in the figurative sense."<sup>143</sup>

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<sup>139</sup> Baeumker, *Witelo, ein Philosoph und Naturforscher des 13. Jahrhunderts*, p. 361.

<sup>140</sup> *Ibid.*, p. 368.

<sup>141</sup> *Ibid.*

<sup>142</sup> *Ibid.*, p. 370.

<sup>143</sup> Baeumker, *op. cit.*, p. 374, quotes Augustine.

From here a direct connection leads to Bonaventure. Dwelling on Augustinian concepts and, hence, on Platonic thinking, light had two characteristics for him: (1) "Light as *lumen* is a sensuous quality;"<sup>144</sup> (2) it is also an active power, emitted by radiating bodies, prompting Bonaventure to generate a "dynamic ontology," as Baeumker calls it; "this active power does not become visible; nonetheless, it proves its reality through its efficacies in nature. After all, as philosophers, such as Avicenna say the sky still acts by means of its light, right down to the depths of the Earth where throughout this influence the minerals are said to be generated."<sup>145</sup>

It might seem that a such deep-seated survey of ancient philosophy and medieval scholasticism should stay outside the field of this investigation. Nevertheless, it has to be confirmed that those concepts--like every idea whether philosophical, scientific, or religious in principle--decisively determine the kind and quality of space, its transcendence, and hence architecture. For modern man it is an intricate problem to succeed in a full understanding of Christian space becoming transcendent. He has to place himself not only in a medieval century, but in a system of metaphysical ideas alien to his own thinking. Today's spatial concepts, based on systems of coordinates, or relying on psychological theories and studies (e.g., "intentional space"), need merely to be called to mind to demonstrate how much even humans of today are caught up in con-

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<sup>144</sup> Ibid., p. 374.

<sup>145</sup> Ibid., p. 404; Hans Sedlmayr, "Das Licht in seinen kuenstlerischen Manifestationen," *Studium Generale*, vol. XIII (Berlin, 1960; Reprint 1978), p. 37. When considering the bodily light as never existing without matter, "even not there where, in this sense, it is called pure," (Baeumker, *Witelo, ein Philosoph und Naturforscher des 13. Jahrhunderts*, p. 397.) Bonaventure provoked a major opponent, *Thomas Aquinas*, to turn up with a fundamental criticism. With the latter as being based on the Stagirite, the whole difference between Aristotelian and Platonic thinking reveals itself when he denies that the sun emits light as substantial form, rather that light is "within the sun, as within the air an accident, namely a quality." (Ibid., p. 418.) Thomas Aquinas regarded the notion "light" as a metaphor, that means, the common does not exist in the notion but in the "manifestation." Thus, he relates light to the theory of cognition instead of understanding it metaphysically or ontologically. (Ibid., p.415.)

temporary models of thoughts determining every notion of space. The previous discussion of metaphysical ideas in Christianity is necessary to elucidate some basic concepts for transcendence of space.

What, after all, are the main ideas of space in early and medieval Christianity? Two topics shall be introduced in the following: (1) the *oriented* space and (2) the *spheric* space. The latter will be explained along with the space-concept of Pseudo Witelo.

(1) *Orientation* has already been dealt with twice, the second time in the beginning of this chapter, with the conclusion that a chaotic archetype of the world needs to be structured. To achieve this, the sun's rising, zenith, and setting are used to set up four imaginary quarters of the heavens. What has not been said so far is the fact, that these quarters are not equally entitled, rather each one is associated with certain meanings.

In pre-Christian and contemporaneous religions and sects, the *sun* as an effulgent body attracted believers of various religions as well as sects, and the entitling of the heaven's quarters was still subordinate to the meaning the sun itself exacted. More in the sense of "body movement follows eye-movement"<sup>146</sup> the worshipers united themselves with the cosmos through their bodies' movement by following the sun's path throughout the day; here "the spinning of the worshipers is an imitation of the world's revolving" (Plutarch).

<sup>147</sup> For example, Augustine notes that the Manicheans like the Indian *Aszets* and like the sunflower "joined in prayer in the full circular course of the sun."<sup>148</sup>

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<sup>146</sup> The "spatial orientation" from Chapter I becomes relativized here in so far as it is never solely dependent upon perception meant as seeing "patches of light;" it also depends on the specific meaning an object carries for the observer.

<sup>147</sup> Doelger, Franz Joseph. *Sol Salutis* (Muenster: Aschendorffsche Verlagsbuchhandlung, 1972; first publ. 1925), p. 57.

<sup>148</sup> *Ibid.*, p. 29.

But as soon as the *light* gains more significance than the sun's body, producing a primary metaphor similar to Christianity, meanings also become imposed on the four ends of the two imaginary axes. The world is everything else but homogeneous. For Christians, orientation begins with *Genesis* 2:8: "The Lord God planted a garden eastward in Eden;" thus, the Christian *Lactantius* clothes the consequences in the following words: "... light belongs to the orient, but within light lies the reason for life, so darkness is death and destruction."<sup>149</sup>

The studying of some early and medieval writings reveals another spatial aspect: the orient as the outstanding quarter of the heavens where space *begins*. Augustine, for instance, reasons: "We turn, when standing for praying, towards East whence the sky rises;"<sup>150</sup> and *Honorius Augustodienensis* similarly explains: "... because the vault of the sky (*corpus coeli*) and the light of the day rise in the east."<sup>151</sup> How strikingly those Christian authorities describe this spatial quality: space originates in the Orient. When monks prepare for praying before dawn, this also expresses *that they are waiting towards space!*

(2) *Spheres* make up the second spatial concept in Christianity to be introduced here. The spatiality of bodies is comprehended in an extremely different way from that which modern man is used to. "The preservation of the cosmic order and the spatiality of bodies in space is established through light being emitted from the deity."<sup>152</sup> The space-concept of Pseudo Witelo, which shall serve as an example here, is a metaphysical, ontological idea deduced from neo-Platonic writings. A neo-Platonic scholastic, such as

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<sup>149</sup> Rahner, *Das Christliche Mysterium von Sonne und Mond*, p. 345, quotes Lactantius.

<sup>150</sup> Doelger, *Sol Salutis*, p.245.

<sup>151</sup> Ibid., p. 257.

<sup>152</sup> Baumecker, *Witelo, ein Philosoph und Naturforscher des 13. Jahrhunderts*, p. 358.

Plotinus, thinks of sensuous light as light arising from spiritual light. His cosmos is built up from differently qualified spheres of light constituting a hierarchy where God influences man by degrees of light-spheres and, through them, gains access to God. Dionysius the Pseudo-Areopagite explains: "Everything, even a stone or a piece of wood which we contemplate, gives us light to ascend to the creator again."<sup>153</sup>

Pseudo Witelo's concept has more than a mere Platonic origin. According to Baeumker, it departs from Aristotelian thinking where space as a relative place is encompassed by the absolute space of the remotest skies.<sup>154</sup> Without penetrating too far into this specific concept, one idea may be worth mentioning; namely, that his model generates two functions of space: "to *contain* (*continere*) and to *preserve* (*conservare*)."<sup>155</sup>

In the context of this thesis it is only necessary to realize, that both functions can be assumed because Pseudo Witelo thought of light as the nature of space. Very important in his concept is the idea that space is able to contain *and* to influence that which it contains, thus preserving it. Dissociating those terms from medieval writings may be helpful in comprehending how those two functions--*continere* and *conservare*--become prior conditions to transcending space. Instead of simply interpreting Pseudo Witelo, the first chapter is called to mind with its reference to light as an energetic, spatial medium. This medium has a constitution that has earlier been called "software" (oxygen mole-

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<sup>153</sup> Ibid., p. 381; cf., Erwin Panofsky, ed. and transl., *Abbot Suger on the Abbey Church of St.-Denis and its Art Treasures* (Princeton: Princeton University Press, 1946), p.18.

<sup>154</sup> Ibid., p. 438.

<sup>155</sup> Ibid., p. 441. Baeumker criticizes that there is no reason given for these two functions. Later, he speaks of those concepts of space as appearing somewhat strange to us and, finally, that they must have been thought of as resulting in the assumption of space as being a motionless, inseparable, and immaterial body.

cules and hydrogen molecules--water vapor and carbon dioxide) or "something of opaqueness" (cf., Ibn al-Haytham).

This particular constitution is the prerequisite now that space has become capable of generating both qualities: On one hand, the medium fills space in a material sense; throughout its nature it is able to spatially encase matter and living beings; on the other hand, this very same medium receives irradiating light and conveys it to all things and living beings it encloses. Since life depends on light, it is space that acquires the property of also preserving what it contains. Because space is not empty, it is enabled to create an entity together with light. This impregnated, powerful, and affecting space is subject to become crafted and, moreover, it empowers man to exceed the spatial-temporal-sensuous world in an act of transcendence.

In summary, religious concepts about light generate their meaningful existence in the human world. By means of myths, occurrences observed in nature become interpreted. According to light, religions acknowledge two aspects: (1) its physiological effects on the living world, and (2) the structuring capability of light enabling orientation within the chaos.

Light is a relatively abstract phenomenon. It gains power over man's thinking only through the equation of light and life, derived from the perception of the physiological aspects. Furthermore, light is capable of losing some of its abstract character when various concepts of space reveal the material nature of light. Although some religions and sects are strongly related to pure light (e.g., Indian religions) or the sun's body (e.g., some Mediterranean cults) it is Christianity that has most strongly influenced occidental development in its concepts of spatiality. By means of those concepts, light becomes tangible and experiential; thereby forming an entity with space. Being object to the mind,

yet still subject to the human body, light reaches a new dimension- it is shapeable and it is a premise for transcending the spatial-temporal-sensuous world.

## The Symbolic Nature of Daylight

Often transcendence is likely to fail to exceed the world in a true sense, either mirroring the sensuous world or generating an image of the world purely born in mind. Therefore, symbols have been invented to preclude such failure. A symbol depends on both human experiences with a reality provided by nature and the resulting interpretations on various levels. Symbols are real *and* capable of carrying a meaning, of being “pregnant with messages.”<sup>156</sup> The process of existential transition often starts with a concrete symbol. “It is through symbols that the world becomes transparent, is able to show the transcendent.”<sup>157</sup>

It was religion first which established symbols as a meaningful part in life. W. Wili describes this complexity in his essay on Mithraism, a sect which reached the extreme of symbolism; it is the “power of the religious symbol, to distill spiritual substance from its historical culture medium and still cogently indicate it.”<sup>158</sup> Hence the Light-God Mithras assembles a vast variety of symbols such as the *white* garment, the *golden* garland;<sup>159</sup> he is thousand-eared and *ten thousand-eyed* and always *wakeful*.<sup>160</sup> He himself, placed be-

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<sup>156</sup> Eliade, *The Sacred and the Profane. The Nature of Religion*, p. 130.

<sup>157</sup> Ibid., p. 130.

<sup>158</sup> Wili, *Die Roemischen Sonnengottheiten und Mithras*, p. 162.

<sup>159</sup> Ibid., p. 160.

<sup>160</sup> Ibid., p. 149.

tween *torch-bearers*, represents the *full light* at noon, and killing the bull is a rite for exuberant *fertility*, multifarious symbols, no longer so powerful, which show the general complexity of symbolism. According to Wili, a symbol requires interpretation on three levels: (1) as a religious symbol itself, (2) within its historical striation and contamination, and lastly (3) as a prime indicator of spiritual experience.<sup>161</sup>

Both symbol and sign have to be comprehended merely as *significants* (i.e., “signifiers” or “that which signifies”), which, in the process of *signification*, attach meanings to the “things they signify.”<sup>162</sup> That means, symbols on one hand and signified things on the other hand are not necessarily identical in the sense that one particular thing always carries the same meaning. Yet signs, as opposed to symbols, bear only one meaning established through either convention, association, or experience and are more or less easily subject to change. Whereas symbols are multivalent, sometimes representing even contradictory meanings; “history does not radically modify the structure of an immanent symbolism. History continually adds new meanings to it, but does not destroy the structure of the symbol.”<sup>163</sup> Yet, under all the ambivalent meanings a transhistorical kernel of truth is built up and slowly reinforced, so “different ‘histories’ can intercommunicate” and art objects are “still comparable upon the plane of imagery and symbolism.”<sup>164</sup>

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<sup>161</sup> Ibid., p. 155.

<sup>162</sup> Piaget and Inhelder, *The Child's Conception of Space*, p. 17.

<sup>163</sup> Eliade, *Images and Symbols*, p. 161; cf. with diagram in Muck, “Theoriemodelle zur vorausgegangenen Diskussion,” *Raumkonzepte bei Schwarz und Steffann*, p. 76.

<sup>164</sup> Eliade, *Images and Symbols*, pp. 173.

An example is Goethe's statement that *reflective thinking* has to distinguish between *sense* and *sign*.<sup>165</sup> He did not mention symbolism, since it remains on a subconscious level. Consequently, this means that human communication existed *before* language, forming a subconscious expression in its own way. Countenance may serve as an illustration here, about which Goethe stated that therein "is exactly that, what we just said, day-to-day presence: a simple sensuously perceptible event, at the same time becoming a conveyor of a meaning; indeed this meaning already is its being, for without it [the event] it would not have taken place. ...a block has nothing to veil, because it has nothing to say."<sup>166</sup> Eliade further explains that "a symbol speaks to the whole human being and not only to the intelligence."<sup>167</sup> Thus, he regarded symbolic thinking as "consubstantial with human existence."<sup>168</sup>

It is this statement of Eliade's that fully justifies the consideration of symbols in a treatise on light and space. If a symbol speaks to the whole human being, then light does so, too, by means of radiation physiologically affecting man. Furthermore, if a symbol communicates with human intelligence, then so does light. By virtue of both the sun's body and the material constitution of space visualizing radiation, light becomes an object "which is signified" in a symbolic process. Light in unity with space achieves consubstantiality with human existence. Therewith both symbols and light have an important characteristic in common (consubstantiality ...). Hence, light is capable of being more than an ordinary symbol; it is a sort of supersymbol or *arch-symbol*.

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<sup>165</sup> Johann Wolfgang von Goethe, "Naturwissenschaftliche Schriften I," *Goethes Werke Bd. XIII* (Hamburg: Wegner, 1966), p. 553.

<sup>166</sup> *Ibid.*, p. 552.

<sup>167</sup> Eliade, *The Sacred and the Profane. The Nature of Religion*, p. 129.

<sup>168</sup> Eliade, *Images and Symbols*, p. 12.

As such an *arch-symbol* light represents existential qualities. Generally, in Greek thinking Helios becomes the embodiment of *life* and for Plutarch light was the beginning, a symbol of *birth*.<sup>169</sup> Similarly related to light, Christians in fourth-century Jerusalem staged an immeasurable flood of light when assembling an enormous amount of candlesticks behind and in front of the cross.<sup>170</sup> This was a fabulous custom: to express life through light where, far from being mere “light objects,” candles virtually enlivened dead matter, the cross, with the flaring of candle-light. Besides symbolizing life, birth, etc., light also includes the abstract and not immediately deductible virtues of *wisdom*, *spirit*, *knowledge*--a more spiritual way of comprehending the world.

It has been explained elsewhere that in this world man is seeking for accommodation and is desiring a “cosmic house,” i.e., totality, unity, shelter, and above all, a place. The prerequisites of place are both self-explanation and interpretation which together bring the symbol to life. But occasionally it may happen that the world hesitates with self-explanations; it offers no immediate hint where to establish a place. Eliade notes: “When no sign manifests itself it is *provoked*. For example, a sort of *evocation* is performed with the help of animals; it is they who *show* what place is fit to receive the sanctuary of the village.”<sup>171</sup> With the previous discussion of how animals react to various sorts of radiation it becomes evident that man sometimes decides to settle in accordance with the energetic quality of a particular place. Quite different from haphazard decisions the sign, represented by an animal, is converted into a symbol which is embodied within the architectural statement.

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<sup>169</sup> Rahner, *Das Christliche Mysterium von Sonne und Mond*, p. 354.

<sup>170</sup> Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 32.

<sup>171</sup> Eliade, *The Sacred and the Profane. The Nature of Religion*, p. 27.

With or without the help of animals, architecture has always been derived from human explanation of the cosmos, in conformity with the world's self-explanation. Thus, Norberg-Schulz states that a building "does not depict anything, but visualizes the world."<sup>172</sup> The desire to "share ... [the] qualities of perfection and performance" of "the heavenly prototype"<sup>173</sup> causes man to create symbols and to embody them in his architecture. Hence, the present treatise on light has to acknowledge a great number of various light-symbols invented for, interwoven with, and experienced through contemporary art of building.

E. B. Smith has assembled a variety of examples to prove that architecture sometimes was indeed regarded as "the radiant house of the sun" (Justinian's *divina palatia patris*);<sup>174</sup> or that gateway motifs symbolize celestial and cosmic power with gateways showing "the sun of heaven rising gloriously over the entrance,"<sup>175</sup> with the Greeks seeing in the "Gate of the Sun ... a resplendid portal separating heaven and earth,"<sup>176</sup> and so on.

Yet, symbolism was not only limited to figurative craftsmanship. Materials, such as *gold*, could also express symbolic intentions. Without forestalling the later discussion of building materials, gold can be mentioned here as being appointed to the sun,<sup>177</sup>

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<sup>172</sup> Norberg-Schulz, *Vom Bild der Kirche*, p. 21.

<sup>173</sup> W. R. Lethaby, *Architecture, Nature & Magic* (London: Gerald Duckworth & Co., 1956), p. 30.

<sup>174</sup> Smith, *Architectural Symbolism of Imperial Rome and the Middle Ages*, p. 54.

<sup>175</sup> Ibid., p. 46.

<sup>176</sup> Ibid., p. 13.

<sup>177</sup> Schmitt, *Sol Invictus*, p. 221.

concretizing "Divine Light,"<sup>178</sup> and impressively recalling "the other symbols of the culture, Alchemy and Kabbala, the Philosopher's Stone, the Holy Scriptures, the Arabesque, the inner form of the tales of the 'Thousand and One Nights.' "<sup>179</sup> Gold, together with precious stones, could transcend a gate like the *Porta Incluta* into a "place of supernatural illumination,"<sup>180</sup> and shining doors could radiate "like the Sun-God at midday."<sup>181</sup> Similarly, *silver* was used in the baroque to transcend the sculpture of a lamp into an "eucharistic and apocalyptic sign as 'light of the Light.' "<sup>182</sup>

In summary, symbols have to be acknowledged in their indispensable role as a link between worldly reality and meaningful imagination in human life. Because symbolism addresses both the sensuous world and the imaginative mind, it is able to unite man's everyday-life with his desire to leave this world behind. Especially in the realm of symbols, light achieves the rung of a supersymbol because of the many similarities among both the nature of symbols and the nature of light. Thus, in space, light influences man psychologically, structures his mind, and addresses his consciousness prior to reflection. This light not only dominates the human body and thinking, it also guides the human psyche. Therefore, light should not merely be understood as developing the human ego anew every morning, rather a bright sky also changes the "inner constitution of the human being. It [the bright sky] unlocks him, it turns him to the outside...,"<sup>183</sup> and the

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<sup>178</sup> Norberg-Schulz, *Genius Loci*, p. 32.

<sup>179</sup> Spengler, *The Decline of the West*, p. 248.

<sup>180</sup> Smith, *Architectural Symbolism of Imperial Rome and the Middle Ages*, pp. 49.

<sup>181</sup> Ibid., p. 12.

<sup>182</sup> Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 43.

<sup>183</sup> Bollnow, *Mensch und Raum*, p. 238.

world of an optimist is "rosy or ... cloudless, that means in any case ... shining, luminous, or bright."<sup>184</sup>

In the long run, the discussion of "daylight and its meaning for man"--from light observed in nature throughout its interpretation in religious thinking, to its translation into symbolic form and symbolic language--has demonstrated that light as an object of conceptions has reached a stage where it is no longer a mere object, but reacts back upon man's conceptions.

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<sup>184</sup> Ibid., p. 239

## CHAPTER III



Figure 5. Revelation on a Palpable Surface: Gipsotheca Canoviana, Possagno, Italy.

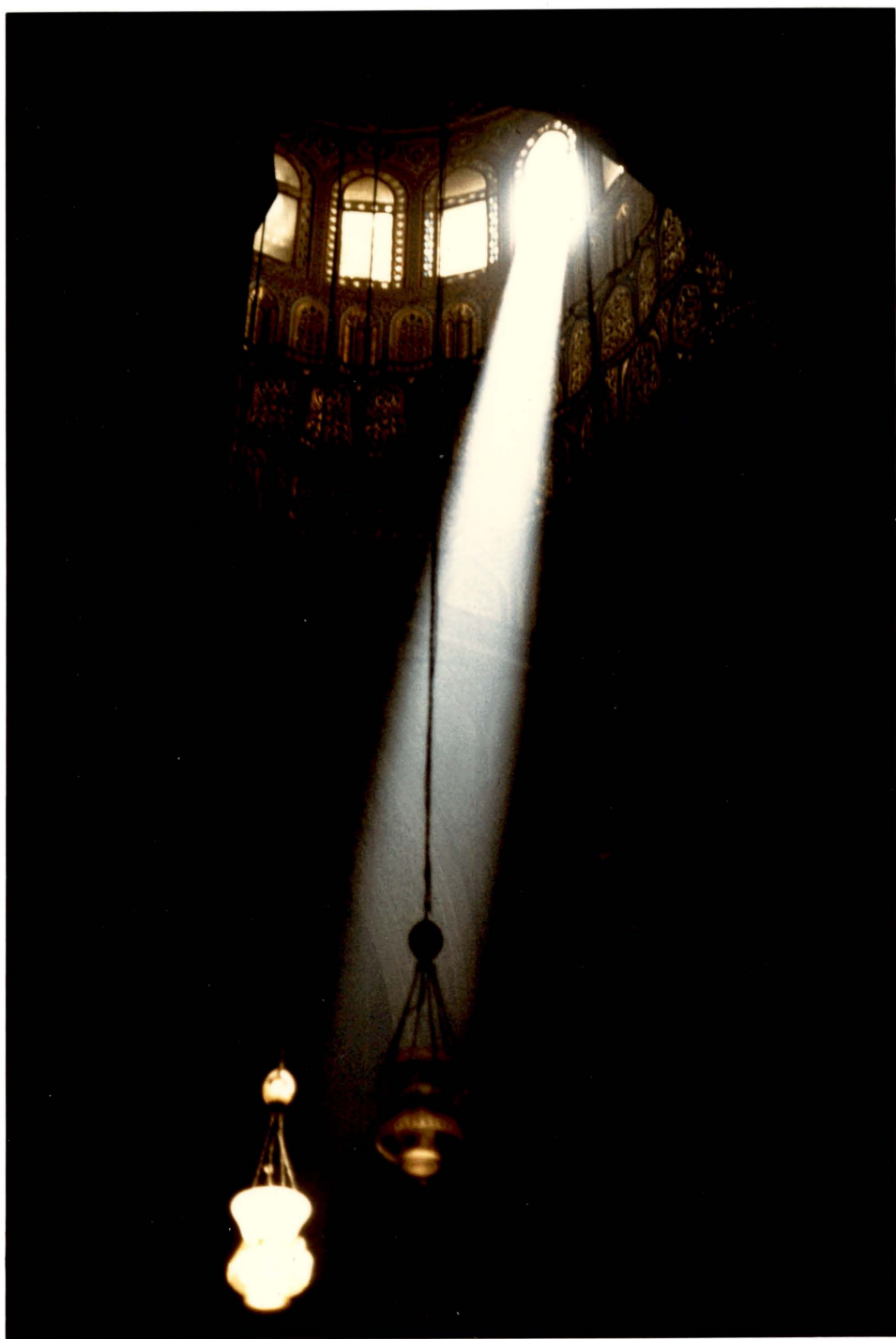


Figure 6. The Tangible Volume: Mausoleum of Sultan Hasan, Cairo, Egypt.

# Daylight and its Application in Architectural Space

*Buildings* are shelters, responding to a variety of climatic changes. They are built to respect apparent requirements of the human body, to protect human possessions, and to serve the organization of daily human life. That is all.

*Architecture* is more! Not only does it respect basic everyday needs, it relates to the human soul, providing *beauty, integration and transcendence*. A beaver-lodge, for instance, is not architecture but a building: there is no need for beauty, emotional integration is surplus, and an animal has nothing above which to transcend. What transcendence means in relation to architecture becomes obvious with H. Plessner's general explication, very readable in an architectural sense: "The subject of cognition and the object of cognition belong to the same life of the one human sphere, of which the objective phenomena as performances and productions are not brought to it, as it were, from without, remaining extrinsic as foreign bodies, but emerge from it [the sphere], since it is inherent to the essence of life to transcend itself, incorporating and dissolving the results of self-

transcendence."<sup>185</sup> Inquiring architecturally leads one to evaluate what architectural presence both emerges from a *human sphere* and *incorporates and dissolves* the results of self-transcendence. Norberg-Schulz' attempts to answer this question seem to focus too closely on a tangible world, thinking of life and place (*Ort*) only as a unity.<sup>186</sup> Bollnow's understanding of place (*Platz*), on the other hand, remains insufficient for man: "Things are also in need of a place, but space in the true sense is only needed by man. Place is something available in the world, while space belongs to the transcendental constitution of the human being."<sup>187</sup>

Both authors talk about place, yet, it is Bollnow who succeeds in acknowledging the potency of space as it exists to bring about transcendence, though not saying how. Moreover, a distinction between "place" and "space" is essentially equal to distinguishing between "building" and "architecture." Working architecturally means respecting space as much as possible instead of limiting architecture to a matter of styles, proportions, aesthetics, etc.

Directing the connection to light calls to mind what has been named earlier "the most advanced stage" in man's relation to light; its application in architecture as *one* way to achieve the totality of being unified with space. In a more poetical than scientific (because unprovable) hypothesis it may be assumed that man's desire to create architecture among his buildings was born not, the moment he became conscious of rain, wind, or heat, but the moment light struck matter to achieve alteration. Similarly, but with more

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<sup>185</sup> Helmuth Plessner, *Die Stufen des Organischen und der Mensch* (Berlin and Leipzig: Walter de Gruyter & Co., 1928), p. 22.

<sup>186</sup> Norberg-Schulz, *Vom Bild der Kirche*, p. 19.

<sup>187</sup> Bollnow, *Mensch und Raum*, p. 43.

self-confidence, O. Schubert even pushes as far as to state that human workmanship is essentially defined by a people's "attitude towards *light* and *gravitation*."<sup>188</sup>

Nevertheless, before an architectonic sculpture can be established, the site has to be determined. Today's choice for a building lot is settled on infrastructure and financing, a nice slope or some trees; adjustments on site rarely go beyond orienting some of the rooms towards the quarters of the heavens, if at all. Yet, to accept a qualitative space in its broadest sense presupposes the distinction of various energetic characters (here in regard to the sun or its light) because one can only totally comprehend the existence of a built object when keynoting the way "it managed its geographical prerequisites, or ... whether and how it gained ... potency from these prerequisites."<sup>189</sup> Modern man has to realize again, that neither is the energetic quality of a place just the background for an outdated symbolical whim nor is an ancient Chinese geomancer a mere juggler ridden by local superstition. Architecture did, and still must enhance or improve space according to the energetic qualities humans need and desire.

## Daylight and the Sculpture of Architecture

Light and space are dependent on each other to exceed their own single qualities through unification towards a new whole. To consider the *sculpture* of architecture in a treatise on architectural *space* may seem to be inconsequent; and yet, this does not at all mean explaining one thing with its antipode. It is more the contemporary mind that thinks of an apparent inconsequence since it perceives the world as simply consisting of objects

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<sup>188</sup> Otto Schubert, *Gesetz der Baukunst* (Leipzig: E. A. Seemann, 1954), p. 77, 20.

<sup>189</sup> Fritz Schumacher, *Der Geist der Baukunst* (Stuttgart: Deutsche Verlags-Anstalt, 1939), p. 214.

and voids, bodies or *environ*-ments, where empty space merely orders formed materials. It was Einstein who disclosed such an erroneous thinking by continuing it to the extreme when imagining a world where all material objects are supposed to have disappeared: "then to think of empty space has no meaning."<sup>190</sup> The contemporary mind is challenged to think of space just as space without being confused whether there are sovereign objects to claim part of it or not.

The following discussion of sculptures departs in space to end in space. Along a line of stages, most primitive architectural sculptures begin to grope into prevailing lighting conditions, maturing more and more until, finally, they gain spatial freedom. This amounts to concentrating, first, on *virginal space* and a *few crude stones* exploring it, then examining *one stone* in particular and, even nearer, its *surface*. Having focused closer and closer on such a single element and now stepping back again, *light and shade* come into view, then a *lacework* of shadows, and at last *spatial fluctuation* with all its implications.

In nature, in its unrefined form, space so far has been revealed as a more or less radiating field of varying energies with light-rays not only being relevant rays but the most impressive ones for human beings. When those of the remote times began to respond with the first architectural expressions one could not immediately expect a complex structure containing a series of enclosed rooms, not even one room, but rather an architectural archetype: some stones arranged as a spatial sculpture.

The first structural groping in the energetic space may have been an articulation similar to Stonehenge, a *circle of stones*, a consecrated site; nevertheless, incredibly precise in its reaction towards light. Perhaps Schubert is right in assuming that control over gravity

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<sup>190</sup> Max Jammer, *Concepts of Space*, with a Foreword by Albert Einstein (Cambridge, Mass.: Harvard University Press, 1954, 2nd ed., 1969), p. XIII.

was as important as control over the action of light, both determining harmony in architecture.<sup>191</sup> At least, Stonehenge was both. With its two stone circles, the inner one consisting of five trilithon arches, certain axes had been elaborated according to a variety of focal points inside the circles where vistas were revealed: extreme positions of the sun or the moon; halfway positions; north-south extremes, including solstices; and even devices to predict eclipses.<sup>192</sup> The climax of the year was in summer, when on a particular day the solstice sun would rise over the outside placed heelstone and cast its first morning rays along a prime axis through one of the stonegates into the core of the circles: "Stonehenge was locked to the sun and the moon as tightly as the tides;"<sup>193</sup> it was impossible to "look down lines which would point to no meaningful sun or moon position."<sup>194</sup> This monumental calendar was nothing less than the willpower to architectonically structure space, to compress it at certain axes and points.

These stones, not yet able to be penetrated or to be entered, but carefully placed within complex space, may be witnessed as the prototype of any architectural sculpture. Architecture begins when something material is consciously "inserted" into a medium of pure light or energy, taking an active part in the energetic process and transforming space; therein certain parts become shielded from energy, others are reinforced, overlaid, and so forth.

If space is just space, as stated earlier, having certain energetic qualities, then no embodiment therein is essentially distinct from that kind of space. Such an embodiment

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<sup>191</sup> Schubert, *Gesetz der Baukunst*, p. 9; 20.

<sup>192</sup> Gerald S. Hawkins, in collaboration with John B. White, *Stonehenge Decoded* (Garden City, NY.: Doubleday & Comp., 1965), pp. 94.

<sup>193</sup> *Ibid.*, p. 135.

<sup>194</sup> *Ibid.*, p. 116.

may even be thought of as being similar rather to a *Leib* (body of a living being) than to a *Koerper* (body of dead matter): “while the *Koerper* is strictly limited in space, the *Leib* (the consciousness of the *Leib*) is capable of either far exceeding the bodily limits, or contracting in a zone of the body, where the perceptive faculty then beds itself outside the skin, in certain, more-or-less concentrated layers, around the sensitive being.”<sup>195</sup> Of course, an architectural embodiment is not usually said to be a sensitive being with perceptive faculties, but it may be imagined as generating, at least, “more-or-less concentrated layers” around itself.<sup>196</sup>

The sculptural elements we have considered so far have been set up to structure space, but none of the surfaces have been crafted with special respect to light. Here, again, an archetype shall be imagined, not a man-made one, but one chosen from nature with, nonetheless, extreme care for its appearance in light: consciously selected according to its deep molding, the *rock* in an ancient Chinese garden layout was the most symbolic, metaphysical, completely unrefined and thus the most abstract element. Retrieved from riverbeds and often transported thousands of miles, its quality to reveal a fantastic play of light and shade was supposed to be the better, the deeper carved the holes were. Not yet being an artistic sculpture, or even architecture, it is a perfect manifestation of what has been expounded by Rodin: “That what a sculptor or an architect forms and models in the ultimate essence are light and shade;”<sup>197</sup>. Even more suitable the Chinese rock incarnates Schubert’s analogy between water and light in regard to stone. Schubert

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<sup>195</sup> Pulver, *Die Lichterfahrung im Johannes-Evangelium, im Corpus Hermeticum, in der Gnosis und in der Ostkirche*, p. 259.

<sup>196</sup> Interesting in this context is, how Merleau-Ponty relates *Leib* and space, perceiving the former as “the primary space of the soul, and as a matrix for every other existing space.” Bollnow, *Mensch und Raum*, p. 280, quotes Merleau-Ponty.

<sup>197</sup> Schumacher, *Der Geist der Baukunst*, footnote on p. 106, quotes Rodin.

speaks of water, when used in the fountain-art of the Roman baroque, as being commissioned to convey to the stone all those ecstatic excitations which in the last analysis are denied to rocks. Water is forced throughout its fall over the rocks to animate the dead matter with pulsating life.<sup>198</sup> In this sense a Chinese rock, when excavated from a riverbed and placed in a garden, is the only object among sculptures that has changed the cause of its animation from water to light.

The rock has already assembled all aesthetic guidelines that an architectural sculpture must obey. Appearance of form and size are dependent on the object's position to the light and how the latter is reflected: situated, for instance, against backlight, a sculpture seems to grow thin and demands additional reinforcement; the more acute-angled irradiating light rays hit a plane, the longer the shadows; on the contrary tangential light models softly; intense light causes sharp light-shadow contrasts; diffuse light almost completely reduces a sculptural appearance to mere perspective presence;<sup>199</sup> and bright objects in front of a dark background appear bigger than if its dark counterpart is placed in front of a white background.<sup>200</sup> In general, every sculpture, whether achieved through subtracting or adding its details from or to the volume, reveals its character through both various directions of reflected light and various intensities of reflections according to the prevailing colors.<sup>201</sup>

From here, it is only a short step to conceive a true architectural cube or form which becomes arranged with other cubes to correlate with space in a more and more complex

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<sup>198</sup> Schubert, *Gesetz der Baukunst*, p. 276.

<sup>199</sup> Ibid., p. 14.

<sup>200</sup> Ibid., p. 175.

<sup>201</sup> Ibid., p. 23.

relationship. Therein *shade* and *shadow* become the most immediate revelation in the visible world. Both terms, if not mixed up, clearly portray the whole span of expressions architectural sculpture is able to assume. *Shades* are those parts of impervious materials that are identical with all surfaces cut off from direct sunlight; they show a wide range of light-dark-gradations; and they may be called "shadings of light."<sup>202</sup> *Shadows*, on the other hand, are projected images of impervious volumes onto material surfaces and are mostly smaller in size when compared to fields of shades. Their realm is harsh contrast; transitions between dark and light are nearly always sharp and distinct.

Such a distinction is not a mere intellectual pastime. Rather it enables the artist to craft a sculpture along with the richness of shades and shadows. They have been called the "soul" of an architectonic form as compared to light being the "life-blood."<sup>203</sup> To comprehend the richness of the "soul" we do best to expose architectural masses to moonlight to envision nothing but evenly distributed light dividing the volumes in either plain illuminated surfaces or plain dark ones. Such architectonic masses, exposed to moonlight, were a key experience for the architect Boullée of how to distribute masses according to light.<sup>204</sup> The shadows and especially the shades are badly stripped of any lusciousness: no depth, no layers, spheres, etc.

On the contrary, shades and shadows conceived under daylight show a myriad of gradations. Some cultures like the Greeks, with their construction of temples, may be said to have created their forms not so much according to the *contrast* of light and shade (cf.,

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<sup>202</sup> Schubert, *Gesetz der Baukunst*, p. 185.

<sup>203</sup> Amos Ih Tiao Chang, *The Tao of Architecture* (Princeton: Princeton Univ. Press, 1956), p. 16.

<sup>204</sup> Sedlmayr, *Das Licht in seinen kuenstlerischen Manifestationen*, p. 10.

*shadow*) but to achieve refined nuances in the “shading of light”--“this whole play of light intensities superimposing on themselves.”<sup>205</sup>

As to the presence of shadows, they are highly dependent on the angle of irradiating light-rays and on the capability of the ground to reflect light back, hence, lightening up all too dark shadows which may be analyzed by comparing Mediterranean shadows with those of northern latitudes.<sup>206</sup> Moreover, carefully elaborated shadows are capable of unifying the different building masses with a kind of *lacework* even including the adjacent ground and overall shifting as time advances: “So light, through the plastic power of shade, not only explicates and sometimes accentuates form and space, but also transfigures and recreates them.”<sup>207</sup>

Yet, making a man-made sculpture as stereoscopic as possible was not the only goal architects pursued with their skillful elaborations. In the course of time they advanced to free their material elements from an all too tight anchoring in space. For instance, Erwin von Steinbach, the builder of the minster in Strasbourg, virtually dissected his facade into layers so he could free the tracery by placing it in front of the elevation to repeat outside the effect (from the inside) of light and space flowing into each other.<sup>208</sup>

Perhaps the ultimate accomplishment in crafting space is the wall in a Chinese garden. As one of the most crucial elements beside rocks and water, the wall serves first as a background for different plants and rocks plainly presented in front of it to let the sun

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<sup>205</sup> Schubert, *Gesetz der Baukunst*, p. 185.

<sup>206</sup> Ibid., pp. 19, 90-100.

<sup>207</sup> Koehler and Luckhard, *Lighting in Architecture*, p. 140.

<sup>208</sup> Schubert, *Gesetz der Baukunst*, p. 90.

draw the most various shadow-graphics on the surface. "Standing in the cobbled fore-court, the visitor begins to focus on the details and juxtapositions of the arrangement and changing effects of the sun and the shadows upon it."<sup>209</sup> "As the sun shifts, different patterns are cast upon the wall changing again its feeling of solidity and depth."<sup>210</sup>

Such a wall was refined into a *mirror-wall* perfectly that it should be pointed out how Chinese garden design derives from two factors: (1) inspiration from other realms of art, and (2) a perception of space foreign to occidental people: In this case, as so often before, it was painting which influenced the garden architect: "Landscapes become ever more personal as painters accentuate the atmospheric qualities of mist and disappearing space."<sup>211</sup> Regarding the second factor, Chinese space perception is almost the opposite of Western garden understanding. Whereas the latter tears down everything that hinders the eye from watching the distance, the former splits a relatively small space into even more tiny subdivisions. The wall serves therefore as the necessary element. Every opening within it gives the impression of another space beyond this border and glimpses through these openings are often attracted by patches of light or by a bright-dark-sequence of differently illuminated spaces. Keswick comes to the point when explaining the mirror-wall and its spatial consequences: "Indeed, the designer has made several subtle changes which increase the illusion of space; the long east wall, for example, is half-concealed behind trees and here is painted not white but grey, a soft, dark, cloudy grey which disappears like a misty shadow in the early light. There seems to be no wall at all, only a haze."<sup>212</sup>

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<sup>209</sup> Keswick, *The Chinese Garden, History, Art & Architecture*, p. 20.

<sup>210</sup> Ibid., p. 135.

<sup>211</sup> Ibid., p. 150.

<sup>212</sup> Ibid., p. 18.

Water is another important element in Far Eastern garden layouts. Displayed as a pond or little lake in the center of a garden, it plays a crucial role in regard to light when gathering its neighboring elements for unification. Generally, water can be said to be ideally connected with light. Its surface provides a huge horizontal mirror which intensifies every mood of the day or night within the changing lighting conditions. The reflections of all the different elements gathered in this enclosed part of a man-made environment are unified in the luminous surface of the pond. As in a watercolor, where a soft tinted veil laid over the whole ground prevents the single details from falling apart, so the soft prevailing hue of the water in a garden emphasizes the friendship between the single expressions. The pond's shimmering mirror places a part of heaven right into the heart of the transcendental spot on human Earth--here the garden. "When ... graceful forms vibrate in the mirror of the water, there is released something which is not merely form and line, but also music--a hymn to vibrating tones of light."<sup>213</sup>

The surface of the water stretched out between elements can thus be regarded as the most effective tool to work with light reflected from the ground--the inversion of all common lighting conditions. Since every man-made sculpture is extremely related to and determined in its appearance by reflected "ground-light," water, doubtlessly, gains prime rank among other architectonic elements. When turning our eyes from the reflection of forms to those of light rays there is no difficulty in realizing how the rippling water surface casts the rays back under eaves and roofs of open temples and pavilions usually present in a Chinese garden. Not only does this play of light above someone's resting place give perhaps the best expression of the world's constantly changing eternity, it also suspends the roofs from their local positions in space: they seemingly "hang" in the air. "If one sees the building in the right light, when the afterglow is reflected in the surface

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<sup>213</sup> Osvald Siren, *Gardens of China* (New York: Ronald Press, 1949), p. 112.

of the pond and the shadows are dancing between the rows and pillars, the reality merges into the imagined semblance, and one gets the impression that this gigantic bird is hovering over the darkening pond, fascinated by its own image."<sup>214</sup>

In summary, an enormous variety of light-sculpture relations have been witnessed, all of them more or less influencing the space to which they belong. The line being developed began with a somehow *virginal space*, first explored with only a *few crude stones*, groping to structure, single out, condense or block certain quanta of energies derived from the sun. The development of this particular stage of interaction can be pursued from its unrefined beginnings at Stonehenge (and comparable locations) to the outstanding examples of Greek temple architecture, as truly architectonic settings.<sup>215</sup> At the next stage we focused on just *one stone* to understand it as being "inserted" into a medium to take part in a constant exchange process. The *stone itself* has been revealed as being similar not to a "Koerper," but rather to a "Leib," generating more or less concentrated layers around itself. The *surface* of a material, exemplified by the rock in a Chinese garden, has been described in sculptural terms leading to the contemplation of the shifting play of *light and shade* on surfaces. Then, continuing with the integrating *lacework* of shadows, the single elements have gained *spatial fluctuation*: walls disappear, grounds are dissolved, roofs hover above the ground--virginal space has become *potential space*!

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<sup>214</sup> Ibid., p. 86.

<sup>215</sup> C. A. Doxiadis, *Architectural Space in Ancient Greece* (Cambridge, Mass.: MIT press, 1972, originally publ. in German: "Raumordnung im Griechischen Staedtebau", Heidelberg: Kurt Vohwinckel, 1937), p. 8, has proven that the Greeks--similar to the builders of Stonehenge--also invented visual axes within their sacred layouts: "The open axes in the twelve-part system was sometimes oriented toward the west. We can assume that this was consciously done so that a person entering the site by the propylon and following the open path had a clear view of the sunrise or sunset."

## Daylight and Materials

Each material exhibits with every surface two different qualities at once: the *intrinsic character* of the material itself and how it was *refined*. Refinement based on craftsmanship or nature's accidental influence has already been discussed in the previous section. Such craftsmanship may be compared with sculpturing on a reduced scale where not only the prime shape of an object is formed, but, moreover, the macro-structure of the surface as well. Each material also contributes to every outward manifestation on the scale of its micro-structure. Even the same act of polishing may result in very different appearances according to the material's intrinsic character. This material property now affects the light's presence in space distinctively.

In past centuries, specific concepts have been consistently established by a number of scholars who consider space to be a transitional constitution between bodily matter and light. Thus, it makes no difference in principle whether in this sense Ibn al-Haytham thinks of everything as a body (transparent and impervious -cf., chapter II), or Bonaventure perceives light as permeating the whole material world. Baeumker further explains Bonaventure's thinking as related to materials. "Not only is it [the light that permeates the whole bodily world] a property to the sun and the celestial bodies, but all bodies participate therein as can be seen with dark bodies becoming shiny through polishing, with glass made out of ashes, etc."<sup>216</sup> Goethe continues, and convincingly succeeds in retrieving matter--here as pigment--from the transparent void: "Space, if we assume it to be empty, would have the quality of absolute transparency to our vision. If this space is filled so that the eye cannot perceive that it is so, there exists a more or

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<sup>216</sup> Baeumker, *Witelo, ein Philosoph und Naturforscher des 13. Jahrhunderts*, p. 398.

less material transparent medium, which may be of the nature of air and gas, may be fluid or even solid. ... The extreme degree of this accumulation is white; the simplest, brightest, first, opaque occupation of space.”<sup>217</sup> Here, transitions between space and matter are flowing and overall; they are related to light. More than a century later Teilhard de Chardin tries to explain an even more advanced standpoint, not in terms of light, but in terms of energy, (sometimes called “cosmic energy”) which gives things their “within” and defines “*qualitative* and quantitative connections.”<sup>218</sup> Bearing in mind that he conceives the world as an energetic cosmos (“Energy ... a unifying power, expression of structure”--cf., chapter I) enables us to follow Teilhard de Chardin in establishing his concept of matter as a function of light: the faces of matter are “plurality, unity, energy.”<sup>219</sup>

Architecturally comprehended, this means that space does not simply end at a surface of concrete matter; space does not exclude matter only to begin at one of its opposite surfaces as a second space that is hardly or not at all related to the other one. Thus, for an example, two rooms divided by a wall are not at all to be thought as two different spaces, because this would be rather alien to a space of energies and pluralities but, nonetheless, unity. From here, with H. Muck, it is possible to draw the connection to architecture by following his explanation of Piaget’s “continuity” in architectural terms: “And then we walk along a wall of a farm-house and suddenly we find that we are inside, although we are outside in the street and only walking along. That is what is meant by

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<sup>217</sup> Johann Wolfgang von Goethe, *Goethe’s Theory of Colours*, transl. Charles Lock Eastlake (London: Frank Cass & Co., 1967; first publ. in English 1840), p. 60.

<sup>218</sup> Teilhard de Chardin, *The Phenomenon of Man*, p. 54.

<sup>219</sup> Ibid., p. 40.

the term continuity."<sup>220</sup> Without understanding this totality or continuity of space, light, and matter, the following discussion of materials and their surface qualities would be a mere step back to the conventional concept of "space within boundaries."

In the same sense that an architectonic sculpture is subject to design, equal attention should be given to materials, that is, to the surface quality understood as the combination of "light, color and texture."<sup>221</sup> Schubert even calls it the highest triumph of a human workpiece that the "captured sun-rays play on the form and only through reflection from craftsmen's work does it [the form] fully reveal its mysterious power and beauty."<sup>222</sup>

Quality, of course, is only one characteristic besides quantity and rhythm.<sup>223</sup> This is not a distinction by rather traditional means, if quantity and quality are seen as more or less dependent on each other. For instance, brightening a wall can be achieved by either "making its surface reflect more light compared with its surroundings, or by flooding it with light." On the other hand, with high surface quality (high reflection compared to adjacent ones) one only needs a small area of such a surface, compared to the opposite ratio.<sup>224</sup> Materials have the capability of transforming the irradiating light in three ways:

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<sup>220</sup> Herbert Muck, "Raumkonzepte bei Schwarz und Steffann," *Rudolf Schwarz, Emil Steffann--Ueber die Rueckfuehrung der Architektur auf die Philosophie*, ed. Ottokar Uhl (Karlsruhe: By the Author, 1985), p. 29.

<sup>221</sup> Ibid., p. 15.

<sup>222</sup> Schubert, *Gesetz der Baukunst*, p. 275.

<sup>223</sup> Wolfgang Schoene, "Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes", *Evangelische Kirchenbautagung--Stuttgart 1957* (Berlin: n.p., 1961), p. 100; more desirable would be a termination like "dynamic, character, rhythmic" of light.

<sup>224</sup> Amos Ih Tiao Chang, *The Tao of Architecture*, p. 17.

singularly--or in combination they can either *reflect*, *refract*, or *filter* the light-rays. Thus, they should be carefully chosen or refined according to their intended use.

The simplest design decision is to *choose* materials according to their natural existence. They may be impervious or translucent, thus, more or less refracting or filtering the light. The more natural or "rusticated"<sup>225</sup> a material is, the longer it usually lasts. It ages with dignity. On the other hand, materials may be *refined* with craftsmanship to serve a special design purpose, usually going along with a change in the grade or kind of reflection: diffuse or specular, preferential with flutes, dimples, projection, frosting, or sand blasting, etc. causing random arrays of surface irregularities.<sup>226</sup>

According to "choice" or "refinement" it is *materia brutta* and extreme luster that are the material antipodes in terms of craftsmanship; the former, represented by various kinds of stones as used in old-Roman and Romanesque architecture, has a very distant relation to light and is basically determined by the cutting angle in the quarry and stone-mason-like treatment. Whereas "all techniques providing luster and gleam reveal an intensified relation to light: the polishing of stones and cast metals, the lacquering of wood, the dressing of fabrics, the cutting and smoothing of glass and jewels,<sup>227</sup> the silvering and gilding and enameling--thereby the phenomenon of luster may be intensified to the point that it becomes a mirrorlike luster as exemplified in parquets. The same applies to light-augmenting and light-scattering elements: mirrors, crystal chandeliers and lusters, light-reflecting water surfaces and fountains."<sup>228</sup>

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<sup>225</sup> Ibid, p. 15.

<sup>226</sup> W.R. Stevens, *Building Physics: Lighting* (Oxford: Pergamon, 1969), p. 90, 103.

<sup>227</sup> cf., Siren, *Gardens of China*, p. 123.

<sup>228</sup> Sedlmayr, *Das Licht in seinen kuenstlerischen Manifestationen*, p. 15.

Between those two extrema, *materia brutta* and luster, the grace of materials needs to be judged. Marble, for instance, should not only be placed in front of a dark background, thus revealing soft transitions through already slight mutual inclinations of its surfaces,<sup>229</sup> but the *Pieta* in *St. Peter* demonstrates that its surfaces can even be treated so differently that “the crystals of the same block of marble are made capable of an either fleshly or material appearance.”<sup>230</sup> A characteristic of Greek marble is to let the light penetrate its uppermost layers “in order to let it gleam back from the depth.”<sup>231</sup>

It is the intrinsic character of any material, as exemplified with marble here, that makes it impossible to exactly copy a sculpture in another material; every material has its own crystalline structure and one has to be aware that either changing the material or its surface structure, like painting a stone, always entails a change in the way light becomes reflected.<sup>232</sup>

A craftsman’s skill enables every material to range between the two above described antipodes--*materia brutta* and luster. Since it is not within the scope of this work discuss every existing material in detail, only the principles will be examined. Thus, referring back to the last sub-chapter and the Chinese wall, the reader is introduced to the refinement of such a wall.

The author of the Yuan Yeh, cited by Siren, describes this craftsmanship in detail under the heading “White Plastering.” “Paper pulp and chalk have of old been used for plas-

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<sup>229</sup> Schubert, *Gesetz der Baukunst*, p. 15.

<sup>230</sup> Ibid., p. 7.

<sup>231</sup> Sedlmayr, *Das Licht in seinen kuenstlerischen Manifestationen*, p. 21.

<sup>232</sup> Schubert, *Gesetz der Baukunst*, p. 168.

tering the walls. Connoisseurs, who wished to give the walls a glossy surface, used for this purpose white wax, which they rubbed or patted into the wall. Nowadays one uses for the ground yellow sand from the rivers or lakes, mixed with a small quantity of chalk of the best quality, and over the whole is spread a little chalk as a covering surface. If this is rubbed carefully with a hempen brush, a mirror-bright surface will be produced; and should any dirt or dust collect thereon, it can be washed off. This is called a mirror-wall."<sup>233</sup>

The spatial impact of such a wall has already been talked about. Besides stone, whether it is metal like bronze, iron, or steel; mirrors or silvered glass; gold-glass mosaics; gilded metal or pure gold, every material affects space because of its relation to light. Gold-glass mosaics, for example, are absorbed in an "undefined glistening. Such a plane, like new-fallen snow in the sun, is not perceived as a spatial boundary; it becomes blurred."<sup>234</sup> Mirrors, as used in rococo, not only take away the things' heaviness, but also, when "covering whole fields of walls, interior space becomes blended with the outside."<sup>235</sup> Gold is the material most closely related to light, because "gold is not a color. ... [Its] metallic gleam, which is practically never found in natural conditions, is unearthly ... [and] takes away from the scene, the life and the body their substantial being."<sup>236</sup>

These few examples of materials, all more or less close to becoming light in their range between unrefined matter and luster, demonstrate how decisively space is determined

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<sup>233</sup> Siren, *Gardens of China*, p. 61.

<sup>234</sup> Sedlmayr, *Das Licht in seinen kuenstlerischen Manifestationen*, p. 22.

<sup>235</sup> Hans Sedlmayr, "Bustelli und das Rokoko," *Alte und Moderne Kunst*, vol. XIII (n.p., 1963), p. 16.

<sup>236</sup> Spengler, *The Decline of the West*, p. 248.

through light transformed by matter. "When we probe beyond a certain degree of depth and dilution, the familiar properties of our bodies--light, colour, warmth, impenetrability, etc.--lose their meaning."<sup>237</sup> And yet, however important they may be for architectonic layouts, materials are nothing but various faces of space.

### ***Translucent Materials***

Light can be considered with respect to quantity, quality, and rhythm according to our previous explications. Moreover, light itself becomes transformed in various ways before it enters the eye to stimulate our body and soul. As to the nature of an impervious material, which is very much restricted to reflection, its refinement is basically a matter of quality; change in this quality of light is achieved mainly through either change of material or change of color. A translucent material is different; not only quantity and quality are equally affected by the same substance, but light also becomes reflected, refracted, and filtered simultaneously. The latter two traits call for a separate discussion.

When diaphanous materials were introduced in buildings they were applied within the fenestrations. But thinking of windows today, one hardly thinks of any other material but glass, which exists only as clear glass for modern man. This notion of glass, with its long history, is incomplete. Pliny extensively describes<sup>238</sup> the various methods of producing and crafting glass, not without mentioning that, as a matter of fact, the Indians were regarded as masters in the making of glass. He obtained information about Roman workshops where glass was tinted and then some products were either "shaped

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<sup>237</sup> Teilhard de Chardin, *The Phenomenon of Man*, p. 41.

<sup>238</sup> Pliny, *Natural History*, (Cambridge, Mass.: Harvard University Press and London: William Heinemann, 1962), vol. 10, transl. D. E. Eichholz, p. 149.

by blowing, some machined on a lathe and some chased like silver,” and he mentions glass-mirrors. But we are lead astray if, behind his words of “clear colorless glass,” we assume quality and character similar to today’s products. Throughout the *Imperium Romanum* until the Middle Ages, glass was totally opaque; later, up to the eighteenth century, it was imperfectly transparent: “slightly greenish or darkish” and with “unevenness, burls, flaws, and enclosures.”<sup>239</sup>

Often too expensive and sometimes unavailable, glass had to be substituted with other materials, such as unbleached cotton, paper impregnated with oil, vellum paper, rice-paper, mica, feldspar, abraded plates of marble and alabaster.<sup>240</sup> All these materials, including early glass, have three virtues in common as W. Schoene lists: (1) they are absolutely not see-through, only translucent, (2) all of them are slightly colored, and lastly, (3) they hold a certain spatial depth within themselves.<sup>241</sup> All of them were held within either frames of wood or lead, placed within transoms or sometimes, as in China, only reinforced with elaborate and decorated wooden laths or lattices. From a spatial standpoint this means that all these devices fostered an interior completely isolated from the outside. Consequently, most of these interior spaces were mainly lit with artificial light: huge “crowns” and “wheels” loaded with candles and lanterns illuminated the earlier sacred spaces of the Byzantine and Roman era.

So far all these materials in use have been introduced more in terms of their being distinguished according to their specific properties rather than their being refined within

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<sup>239</sup> Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 101.

<sup>240</sup> Siren, *Gardens of China*, p. 55; Schubert, *Gesetz der Baukunst*, p. 124; Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 104.

<sup>241</sup> Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 104.

their properties. But just like their impervious counterparts, translucent materials are capable of achieving an enormous perfection with outstanding spatial consequences. An example is the unsurpassable treatment of glass going along with "Gothic concepts" of space and light and the idea that space is no longer illuminated from the inside but by daylight from the outside.

As a first attempt to understand the Gothic nature of glass one may follow Ibn al-Haytham in his observations that of "glass and transparent minerals, it is true, when the light of the sun beams on them, there goes forth from them also a second light, while, at the same time, the light passes through their interior."<sup>242</sup> This phenomenon in particular--"the second light," similar to the "gleam from within" of a crystal<sup>243</sup>--was cultivated to the extreme: not only differently colored glass of the same thickness was used, but glass of differing thickness within the same color; moreover, some of them provide a curved surface "thus radiating the light in different directions," refracting it the way prisms do.<sup>244</sup> Yet, the ultimate contrivance to ennoble a window made of transparent material took place under the auspices of Abbot Suger when melting down huge amounts of pulverized sapphire glass as a supplement to the regular glass.<sup>245</sup> The result was a Gothic window where, as Schoene puts it, fervent light erupts from incomprehensible depths, or, better said, "multilayered" and undefined depths.<sup>246</sup> Obstructing

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<sup>242</sup> Shastid, *History of Ophthalmology*, p. 8710.

<sup>243</sup> Sedlmayr, *Das Licht in seinen kuenstlerischen Manifestationen*, p. 17, cites J. Killian.

<sup>244</sup> Schubert, *Gesetz der Baukunst*, p. 84.

<sup>245</sup> Panofsky, *Abbot Suger on the Abbey Church of St.-Denis and its Art Treasures*, p. 53, 77.

<sup>246</sup> Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 114.

plain daylight, such windows “settle within the architecture itself the sources of light that fill the interior.”<sup>247</sup>

With the Gothic style entering its late phase, the tremendously colorful windows gave way to more brightly illuminated spaces; the renaissance then preferred bull’s-eye glass until the baroque developed techniques to produce large-scale window panes. Nevertheless, translucent materials remained the most effective and successful materials to dye the pure light nature provides. Until modern clear-glass was invented, light in interior space was always tuned according to the properties of diaphanous matter.

In summary, materials have been discovered as a variety of constitutions of the very same space. The latter continues to be within a certain material since space is not different from matter in principle. Yet, space not only changes its formation at every material surface; with every constitutional change it also reacts back upon itself by inflicting alterations upon those parts of space that would have stayed the same without being exposed to adjacent formations of different qualities.

The range of materials with such qualities varies between *materia brutta* (e.g., ashlar) and extreme luster (e.g., gold), that is, impervious materials on one hand, and translucent ones such as glass on the other. By means of reflection, refraction, and filtering, space alters itself, and changing any part of the matter results in a different spatial quality and even quantity, though the three-dimensional size might remain the same.

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<sup>247</sup> Ibid., p. 115.

## Daylight and its Penetration of Architecture

Two unique characteristics primarily distinguish architecture from other works of art; these characteristics are not found in any other art, yet, both decisively determine architecture's artistic being: *space* and (natural) *light*. In spatial terms, any other form of art is merely capable of becoming *ex-posed* to space--including the four-dimensional approach of music. It is not sculpture, the most stereoscopic object in a material sense, but architecture that entirely deserves to be called "the art of space," because it *im-poses* space onto beings. And in terms of natural light, every other art becomes degraded to the status of a sponger--ashamed and envious of architecture and its power over light. According to this second quality, which is also essential to the art of building, the other arts are all but condemned to sole *ex-position* to light rather than *im-posing* their own world onto and into the natural archetypes like architecture does. Amongst all who have written about building, it is F. Schumacher who so choicely summarizes the architect's work: "In the world conceived by himself he is able to prescribe the course of daylight within the setting of its cosmic movement; he may allow it to surge exuberantly, or may let it mysteriously drizzle; he can force it to appear solely within the garment of glowing colors: as the only one in the realm of art he reigns over the greatest power moving our emotions--the light."<sup>248</sup> Since a conscious control over both space and light is reserved exclusively to architecture, it is of great interest again to examine both according to their mutual relationship.

Over all, it is the interior of architecture where the controlled action of space and light takes place. Yet, interior space was not always the prime concern during the history of

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<sup>248</sup> Schumacher, *Der Geist der Baukunst*, p. 253.

architecture, nor did it ever incorporate an independent entity. Interior space developed along with the religious need for brakes, that is, distinguished and sacred places in space.<sup>249</sup> After developing beyond a mere brake in nature, like Stonehenge, “insides” were often hardly more than a terminus or religious “garage” for sacred objects or statues, but more often an outside extension into a construction, hand-in-hand with sacred processions, as is seen in the Egyptian temple design. Instead of fully ripened interior spaces, those insides were elaborated shells with no intention of gathering public conventions. Greek temples, for example, enhance the transcendence of a sculpture rather than the space in which it is situated.

In this treatise there is no intention to add to historians’ arguments whether Christianity was the first to develop a true interior space in the western hemisphere. Therefore, it is simply acknowledged that the inside has come to full terms along with the comprehension of the church as universe--“the new macrocosm,” as Pseudo-Chrysostom notes, “of which the Christian soul is the analogue in miniature.”<sup>250</sup> In Christianity, interior space has become the decisive symbolic form, able to transcend into supraspatiality<sup>251</sup> along with the developing ideas of the light’s revelation inside of church spaces.<sup>252</sup>

What, exactly, is the nature of an illuminated interior? Answering this question requires a confrontation with misconceptions about space and with some of its true characteristics: One of the most important truths about interiors is that “only an inside can in

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<sup>249</sup> Eliade, *The Sacred and the Profane. The Nature of Religion*, p. 72.

<sup>250</sup> Eliade, *Images and Symbols*, p. 162, quotes Pseudo-Chrysostom.

<sup>251</sup> Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 99.

<sup>252</sup> Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 30.

fact have openings.”<sup>253</sup> To be inside means to have crossed thresholds, doors, windows, etc. Illuminated insides, compared to exterior space, are completely artificial and totally controlled by human devices; being exposed to that highly intensified space results in realizing the sphere of influence of another being, whether it is human, divine, or something else. Nevertheless, those spaces are not different in their nature from outsides in principle, so that such an interior may be understood in Goethe’s sense, where “the inner light juxtaposes the outer light.”<sup>254</sup>

The French architect Boullée is among those who, rarely enough in the past two centuries, have observed the manifold features of light in nature. He departs from particular nature, studies the various seasons, develops an awareness for the emotional aspects of light, and fervently strives to apply the recognized inside his architecture. Beginning with seasonal observations, Boullée praises among other things the “depth of light” and its “vivid and dazzling” effects in summer, when “all is radiant” for him. He is impressed by how the “play of light and shadow produces countless surprise effects” in fall; but only to suffer thereafter the light of the winter time. He then grumbles about lost brilliance, about darkness, night, and sombre shades, where the winter light is nothing but “sad and gloomy.”<sup>255</sup> Yet, Boullée does not exhaust himself in plain observation; he partially understands the similarity of “outside” and “inside” and intends to apply the emotional effects of natural light inside his architecture. In his “*Architecture, Essai sur l’art*,” he is excited about the way light may be filtered into a temple, the possibilities of “magnificent light effects,” of diffusion, of producing “joy” or “sadness” by control-

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<sup>253</sup> Norberg-Schulz, *Genius Loci*, p. 10.

<sup>254</sup> see Chapter I, “Visual and Energetical Perception of Man.”

<sup>255</sup> Etienne-Louis Boullée, “Architecture, Essay on Art,” Helen Rosenau, *Boullée & Visionary Architecture* (London: Academy Editions; New York: Harmony Books), p. 89.

ling "the amount of light at will," and of inspiring "in our souls composure, compunction, and even religious dread."<sup>256</sup> In his vision, light does not simply tune human emotions according to moods found in nature; he envisions harmony between man and his thoughts when he imagines theaters in which lighting underscores the statements of plays, underscoring "gloomy thoughts" or "festive brilliance."<sup>257</sup>

Unfortunately, Boullée does not really derive spatial consequences from his contemplations and the reader of his *Essai* might all too easily be enticed into a dead end. His misconception begins with a moonlight experience that nourished Boullée's sensitive care about architectonic volumes<sup>258</sup> which became a trap concerning the *penetration* of architecture: "Seeking to discover this new type of architecture," he explains his enterprise: "I tried to find a composition made up of the effect of shadows."<sup>259</sup> Boullée criticizes his colleagues because their light "is not devised for the objects"<sup>260</sup> and demands certain qualities within shades: they must be "delicate" and "shapes must be flowing with light, elegant proportions." Ridden by ambitions he proclaims: "This type of architecture based on shadows is my own artistic discovery."<sup>261</sup> Among objects, shadows, and shapes, however, he forgets the true nature of interior space. Thus, one must ask where Boullée commits his error.

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<sup>256</sup> Boullée, *Architecture, Essay on Art*, p. 93.

<sup>257</sup> *Ibid.*, p. 96.

<sup>258</sup> cf., Chapter III, "Daylight and the Sculpture of Architecture."

<sup>259</sup> Boullée, *Architecture, Essay on Art*, p. 111.

<sup>260</sup> *Ibid.*, p. 94.

<sup>261</sup> *Ibid.*, p. 90.

First, Boullée wants to derive principles from exterior spaces to apply them within the interior of his architecture. That is acceptable as long as one does not think of both outsides and insides as different spaces as a matter of principle. Here he falls short. Yet, it would be too easy to reply to his failure simply with the statement that space is nothing but a continuum. When talking about spaces or sequences of spaces, one must be aware of merely facing different modalities of the same space, all of them dependent on light. Here, and for the second time, Boullée fails in the same way that Norberg-Schulz fails, considering light as ever-changing paint on palpable surfaces. In doing so he mistakes the out-cast of distinguished energetic volumes for formal capriciousness such as forms, ornaments, their proportions, or shadows as pleasing graphics. Instead, surfaces need to be understood as expressing space and not as some kind of “blackboard.” This means, in accordance with its exterior counterpart, space inside a building becomes revealed to the eye--and can be revealed only--through either *tangible volumes* and/or *revelations on palpable surfaces*. Similar to ancient Greek thinking, one has to consider a material surface as the *beginning* of something rather than its ending.

To clarify what is meant by “tangible volume” and “surface revelation” one should examine some of L. Feininger’s paintings. Not only are his objects differentiated, but, more importantly, space itself becomes dissected into distinct parts of the whole. Whether or not Feininger only thought of striped lines of composition is of no interest at this point. Rather one all-including space has to be imagined when considering that one principle covers objects and voids. In works by Feininger, skies or streets, for example, are dismembered into a variety of spatial modalities; not simply separated by lines, they exhibit different intensities of space. Now, assuming that Feininger’s space receives elements of building (for instance, walls that again intersect those dissecting planes between his different spatial intensities) one can vividly imagine the out-casts of all penetrated intensi-

ties as various gradations of light next to those of shades. This is what is meant by the term "revelation on palpable surfaces." On the other hand, there are cases conceivable where walls remain within the consistent intensity of one part of space (such as the same lighting intensity); consequently, they cannot reveal any other image but a consistent one. Now, the volumes themselves have to become tangible.

Both expressions go along with the history of architecture, and, despite many religious examples in the following, these expressions are characteristic of every interior space instead of only being privileges of the sacred ones. The same way as the chaotic space was originally ordered by "cutting out" certain areas and devoting them to divinities, any architectural composition has to proceed in similarly excising a hierarchy of distinct spaces (better said, distinct parts of the *one* space). Just as Bollnow refers to the Latin world *templum* and its original meaning of something "which is cut out"<sup>262</sup> the architect is capable of dissecting not only holy space, but any space, by repeating not exclusively holy power but any power provided in nature, like light in particular or energy in general. Every performed space is comparable to "holy space that is a location which becomes a place by the effect of power being repeated thereon or being repeated by man."<sup>263</sup>

This leads to an architecture of *zones* and to one of Schumacher's demands, although he should be interpreted in a slightly different light: "The architect's task is not merely the illumination of the respective single room; but the contrasts and the unfolding of light within a sequence of spaces forms above all the highest posing of problems."<sup>264</sup> His

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<sup>262</sup> Bollnow, *Mensch und Raum*, p. 143; cf., Webster's Ninth New Collegiate Dictionary, 1985 ed., s.v. "temple."

<sup>263</sup> cf., Bollnow's citation of van der Leeuw, *Mensch und Raum*, pp. 142

<sup>264</sup> Schumacher, *Das Bauliche Gestalten*, p. 32.

statement becomes clear only if understood not in the original sense of "one room equals one space;" but rather as one room made up of many different modalities of one and the same space with more or less floating transitions. "Every spatiality, according to its character, is determined by the intensity of daylight, its direction and its degree of diffusion."<sup>265</sup> Face to face with multitudinous changes of spatial intensities the potential comes to mind of adjusting them according to a certain proportionality.<sup>266</sup> Both expressions of space--the tangible volume and the surface revelation--need to be balanced like forms, along with moods of light, their tunes in color, warmth, etc.

First attempts to structure the *within* of space according to a certain proportionality were made in some Carolingian churches. The results are based on a symbolical concept, born of medieval mind, that shall serve in the following as a theoretical vehicle to gain a complete understanding of how space can be composed architecturally. This is a concept in which numbers, together with their proportional ratios, represent understanding and in this sense *claritas* for the scholastic mind.<sup>267</sup> Similarly, within architecture and, hence, space, geometry was employed to equally express such *claritas*--a geometry of light in particular that interlaces a number of those German churches of Carolingian times.<sup>268</sup> Here, from *differently* splayed jambs originate geometrical prolongations that establish--together with central axes, tangents, and other prolongations--meaningful points of intersections. In the *Einhartsbasilika* in Steinbach (Germany) these points and

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<sup>265</sup> Helmut Striefler, "Licht und Raum," *Kunst und Kirche* 4/75 (Linz: Diözesan-Kunstverein), p. 156.

<sup>266</sup> Schubert, *Gesetz der Baukunst*, p. 24.

<sup>267</sup> Sedlmayr, *Das Licht in seinen kuenstlerischen Manifestationen*, p. 18; Doelger, *Sol Salutis*, p. 70.

<sup>268</sup> Walter Boeckelmann, "Zur Konstruktion der Fensterbank- und Laibungsschraegen in der Einhartsbasilika zu Steinbach im Odenwald", *Karolingische und ottonische Kunst* (Wiesbaden: Franz Steiner Verlag, 1957).

lines, though invisible, can be traced in the ground plan, longitudinal section, cross section, and in drawings of interior elevations. On one hand splayed jambs are known as providing practically "a zone of intermediate brightness which 'softens' the change" of otherwise sharp contrasting "perpendicular surfaces."<sup>269</sup> Yet, on the other hand, the theoretical prolongations of these jambs, and others, establish an interior world of complete proportional adjustment to imagined light rays.<sup>270</sup> Of course, such a concept, which is alien to modern mind, is more a theoretical out-cast in medieval mind (because of not being visible) than a real image of space on palpable building elements. Nevertheless, here is an example of a compositional skeleton, based on light, that structures space. One might compare this skeleton with one in Feininger's paintings; existing in mind and on paper, the skeleton still awaits its visible realization in architecture. Once space is mentally structured, the roots are planted for its visible expression in architecture.

### *Revelation of Space on Palpable Surfaces*

One way to reveal the intensities of space is to show them on palpable surfaces; that is, on floors, walls, ceilings, cubes, and so on. On the contrary, mathematical space has nothing to reveal, since it is homogeneous, immediate, indifferent, compact -and dark. But neither is space human when thoroughly-paced and evenly illuminated; this category of space is not different from the dark version in principle, because at this moment space is also homogeneous, immediate, indifferent, and compact. The best example for such

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<sup>269</sup> Benjamin H. Evans, *Daylight in Architecture* (New York: McGraw-Hill, 1981), p. 72.

<sup>270</sup> To prove that those devices had been applied consciously, Boeckelmann cites two paragraphs written by Pope Gregory the Great, who refers to the splayed jambs and establishes a connection between the mind and the eternal light.

condition gives a plainly illuminated desert. Here the enumerated attributes--except darkness--have to be applied.

But the desert, that is its grounds, might be imagined as being separated from parts of the sky by a widespread cloud-cover. If, now, the clouds leave a huge hole open to the above space and its immediate light intensities, then a first, simply distinguished space comes into existence. On the deserted ground it reveals its being and dependence on this particular "cloud-window." Such differentiated space is the opposite result of Boullee's comprehension of light, because space does not rely on picturesque shadow patterns. Over and above, it is the eloquence of palpable surfaces that tells about the nature of space and its fractions. This eloquence of surfaces can be traced back until its first, yet insufficient, beginnings:

The Egyptians, for instance, calculated the rising sun of special days to underscore birthdays of gods when enlightening divine statues far inside their temples (e.g., Abu Simble, etc.). Unfortunately, in those days one considered sun-beams more as spot lights, than as erecting spatial zones; nevertheless, the divine figures catch "the light as it enters through the open doorway, and in the early morning, when the sun casts a ruddy ray over their features, their faces become marvellously lifelike. We are almost tempted to think that a smile plays over their lips as the first beams touch them."<sup>21</sup> Inasmuch as the light-beam changes with the course of the sun, so this "Egyptian beam" is highly selective, especially where it marks an object at a festive day. This beam is effective for an incredibly short moment, more of a break in time than in space. Much more truly *spatial* consequences were exacted in the huge entrance halls of Egyptian

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<sup>21</sup> Gaston Maspero, *The Struggle of the Nations Egypt, Syria, and Assyria*, ed. A. H. Sayce, transl. M. L. McClure (London: Society for Promoting Christian Knowledge, 1910), p. 414.

temples with small ventilation holes casting restricted sun-beams, seemingly at random, between the narrowly placed weighty columns which appeared uncountable in a gloomy and infinite space.

In this context, the Romans may be viewed as having dared to escape those murky temples, an outbreak, which let more light “break in.” The Romans played a considerable role in the development of interior space. They realized that the sun is capable of much more than just spotlighting. In the Pantheon in Rome a sun-beam was used to delineate a complete inside throughout the year by following exactly the “instructions” of the sun. Schubert has demonstrated that at the lowest altitude of the sun at Rome’s latitude, rays catch hold of the two uppermost rows of the coffered ceiling. “After four months the sunlight reaches the horizon of the room within the door niche. From May 22 until June 22, thus, with the highest position to the sun, the light rests on the floor.”<sup>272</sup>

Though having delineated the location of the building materials, the Pantheon’s wandering rays can not yet be called the ultimate crafting of space, which occurred first in baroque architecture. In its own self-understanding the baroque gains total control over light; surfaces are able to reveal every possible gradation in light or shade *and thus of space*. Schnell has summarized some results according to this special control of light: “the light could be scanned between bright and not so bright incidences, in alternate positions among ‘below’ and ‘above’ and from ‘behind’ towards ‘ahead,’ in perceptible and imperceptible light-pits, in slow intensifications to the choir, in sudden swelling and spreading within the choir....”<sup>273</sup>

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<sup>272</sup> Schubert, *Gesetz der Baukunst*, p. 145.

<sup>273</sup> Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 42.

Spatially considered, the baroque results are surprising; moreover, their appearance in interiors is sometimes strikingly similar to spaces as established in Chinese garden architecture which is all the more unexpected since both baroque gardens and the landscape of English gardens are so contrary to the Chinese attitude that does not foster long perspectives. Not so in the baroque *interiors*, where walls and arches swing back and forth so vividly that they generate spatial overlapping, which always includes a gradation of illuminated surfaces. Bollnow notes the multitude of vistas, illusions, non-enterable rooms, the concealing of circumscribed walls, all together hatching an infinity that is impossible in exterior space with its limiting horizon.<sup>274</sup> Furthermore, the proportions of the light-quanta themselves become distorted; mirrors, crystals, and other reflective and refractive surfaces multiply light *ad infinitum*. Revelation of light on the surfaces goes hand-in-hand with their "spatial behavior." Everything is space: before the surfaces, behind and between materials, inside walls, above and underneath--the totality of one all-embracing space.

Light that reveals a particular space on a surface bears another capacity not yet elaborated: the ability to include a concrete image, that is, a kind of stage-setting or story. It is something communicable, a symbolic object, which increasingly involves everything around it, likewise a spiritual and emotional suction that sometimes even causes a change in the human body's movement. Such an object may be--  
--a *silver* lamb, reigning high above an altar (Wieskirche/Germany) as a "eucharistic and apocalyptic sign, as 'light of the Light;'"<sup>275</sup>

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<sup>274</sup> Bollnow, *Mensch und Raum*, p. 86.

<sup>275</sup> Schnell, *Christliche Lichtsymbolik in den einzelnen Kunstepochen*, p. 43.

--Bernini's Saint Theresa, in front of golden embodiments of light rays, exposed to yellowish tinted energy irradiating from above, ecstatically transcending the perishable world with an expression on her face only understandable to adults;

--or the *Transparente* in Toledo, Spain, which, according to Schubert, receives its light from a breach in the vaulting; here the illumination increases with height and compels the observer to turn around and to envision descending angels within the brightest light.<sup>276</sup>

These examples demonstrate the coercive power that occurs when surface revelation of space becomes united with concrete and transcendental images.

Furthermore light, striking matter, can be used for mere design intentions, that is, for the purpose of improving

certain design solutions. The lighting engineers Hopkinson and Kay have analyzed what has to be taken into account: "In certain situations an object will command attention by virtue of its brightness alone if it has a physical luminance of at least three times that of the surroundings in which it is seen."<sup>277</sup> Bernini knew about these consequences and demonstrated how to practically solve a problem such as the two accesses merging into the *Scala Regia*. Pevsner explains that it was "a masterstroke of Bernini to place opposite the entrance from the church an equestrian monument to the Emperor Constantine. As we come up from the corridor it appears on the right and forces us to halt, before we enter the Royal Staircase itself. The sudden appearance of the white prancing horse against a storm-swept drapery lit by the window above serves to conceal the otherwise unpleasant change of direction."<sup>278</sup>

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<sup>276</sup> Schubert, *Gesetz der Baukunst*, p. 262.

<sup>277</sup> R. G. Hopkinson and J. D. Kay, *The Lighting of Buildings*, (London, 1972), p. 49.

<sup>278</sup> Nikolaus Pevsner, *Outline of European Architecture*, (N.p.: Penguin, 1950), p. 404.

Light! Illuminated objects! Transcendence or not! At this moment, objections might arise as to whether we are still dealing with space or just with well-displayed scenes worth little more than a trophy for good stage-setting. And yet, the maximum has not been seen: sharply delineated, invisible (and intangible) volumes of light which steadily shift in space while at the same time precipitating their luminous "out-casts" onto nothing but surfaces. These images, distinct and formal, may be grouped, aligned in rows, or arranged in any other ordered setting; they may cover huge areas or tiny little spots. Far from being simple spotlights as in the Pantheon, these out-casts tell us indirectly about subordinate space and about their intensities. In our century, C. Scarpa, as we have tried to show elsewhere,<sup>279</sup> may be suspected of having consciously designed according to such an understanding of space. Innovating unusually placed windows at room corners and edges in addition to a common window layout, he achieves the transformation of walls into ever changing luminous coats, the *beginning* of his space. Moreover, Scarpa even creates zones of transitions, for instance, on an intermediate landing, by introducing a variety of different spatial intensities through nothing but revelations on surfaces. "Here, the light is guided so skillfully that at noon, one sun-beam strikes the wall down to the floor while on the landing another three beams lay a row of light-squares of which the most outward rests exactly in the center between the steps."<sup>280</sup> Be that as it may, the bottom line of Scarpa's intentions is that light does not necessarily need to establish concrete images to be transcendental, as has been described in depth above. Rather, it is capable of speaking throughout itself without any other promotion: *the transcendence of pure space on a surface.*

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<sup>279</sup> Carsten Roth, "Ueber das natuerliche Licht in Bauten von Carlo Scarpa--oder: Zwei Moeglichkeiten zur bewussten Gestaltung," *Elemente des Bauens bei Carlo Scarpa*, ed. and auth. Franco Fonatti, Wiener Akademiereihe, vol. 15 (Wien: Architektur- u. Baufachverlag, 1984), pp. 46-51.

<sup>280</sup> Ibid., p. 48.

Understanding such spatial capacity calls for consciousness in detailing; one of the most outstanding artists with an awareness of the incredible potential of light was, remarkably enough, not even an architect but, the English painter--J. M. W. Turner; as appointed professor to the Royal Academy in London he elaborated surprisingly instructive, though sometimes highly complicated thoughts on this matter.<sup>281</sup> In painting, Turner approaches light as a body "of the first magnitude and Reflection [as] the medium, or in other words the 1/2 light, while shade is the deprivation of light only, but with the deprivation of Reflection likewise, [it] becomes Darkness." Yet, his awareness of these subtle gradations does not at all grow stiff as formal capricious. When calling for combinations of light and shade to "supply a class of proportion," he not only includes strength and quality therein, but also *power*, with "strength power and quality found to exist in the tripartite qualities of each light;"<sup>282</sup> and, even more important for the application in architecture, he speaks of the "generic power of lines [here the architect is called upon to substitute 'lines' with *surfaces*] distinguishable from those used as the means of obtaining the stereography of planes, their positions and situations as mere vehicles of light, shade and colours."<sup>283</sup>

### *The Tangible Volume*

Turner not only comprehended the power of *lines* and *surfaces*, he was also gifted in dealing with *space* that lacks any surfaces. This is all the more understandable since painters have to find ways of illustrating space on the restrictive plane of canvas or pa-

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<sup>281</sup> Joseph Mallord William Turner, "Passages on light and colour in sketchbooks and lectures," John Gage, *Colour in Turner--Poetry and Truth* (London: Studio Vista, 1969), p. 198-212.

<sup>282</sup> Ibid., p. 211.

<sup>283</sup> Ibid., p. 204.

per. Turner's friendship with a number of architects (he even conceived his own gallery)<sup>284</sup> and his broad preoccupation with light, make it all the more reasonable to discuss some of his considerations for two-dimensional work first, and then to apply his findings in architecture in the following; that is, to "flip" the painter's results into spatial reality.

Turner, like Goethe, perceives the color white as "the substitute of light, as it is the compound in aerial light,"<sup>285</sup> with aerial light (similar to aerial perspective) being understood as "a distance where colour becomes blended, ... gradation of tone"--"the last faint and trembling ray of restrictive rule."<sup>286</sup> He criticizes his painter colleagues for not taking enough care of the aerial qualities and for too often sacrificing the backgrounds in their works "to fill a space [presumably Turner means 'to fill with objects'], which might as well be occupied by anything else--or, in better terms, a space to be filled. There are many opinions of the subject, but one I will mention: space would be easily attained if emptiness could give it...."<sup>287</sup> Turner continues, condemning any *relative* gradation of space: "[we] should get immediately into combinations of quality and quantity, and say that if the area of one quality of light is equal to the area of another quality of light, these quantities would be equal, and of course [so would the] shadows."<sup>288</sup>

At this point, one must turn to architecture. Imagining one of Turner's paintings or watercolors as being deprived of *any* material things, consisting merely of aerial per-

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<sup>284</sup> David Watkin, "Soane and his Contemporaries," *John Soane* (London: Academy Editions; New York: St. Martin's Press, 1983), p. 40-59.

<sup>285</sup> Turner, *Passages on light and colour in sketchbooks and lectures*, p. 207.

<sup>286</sup> *Ibid.*, p. 201.

<sup>287</sup> *Ibid.*, p. 205.

<sup>288</sup> *Ibid.*, p. 211.

spective and haze permeating space, the *tangible volume* comes into existence. This tangible volume has to be understood as if Turner's two-dimensional work has been flipped into spatial existence to become the result of an architectonic device.<sup>289</sup> This may sound easy to understand, and yet, even an author as sensitive to light as Bollnow seems to comprehend the phenomenon only partly; though stating that he is able to "see" space, Bollnow still considers this space both empty and existing between things.<sup>290</sup> He feels himself unable to penetrate either the "space of the earth" or "air space."

It is presumable that, at times previous to Bollnow's, man indeed felt space as something material, with real existence. For instance, in his architectural drawings the English architect and friend of Turner, J. Soane, already manifested his ideas in complex and more or less tangible volumes of light. How much did Soane know about contemporary concepts of light and to what extent did he apply them? Soane was familiar with how the French artists regarded light and also was acquainted with the teachings of Boullée. The Britisher occasionally refers to expressions like "*lumière mystérieuse*"<sup>291</sup> in his writings. Soane did not hesitate to make use of his knowledge; in a number of commissions for art galleries and his own house, the future Soane-Museum, he extensively experimented with light, which he used to create for example, "demi-tints," or to diffuse it through a "curious pendant arched ceiling."<sup>292</sup> Above all, and perhaps most importantly, Soane was

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<sup>289</sup> Interesting in this connection is the fact that in 1807 Turner was appointed Professor of Perspective at the Royal Academy, a subject truly spatial in nature. He, nevertheless, prepared nearly "two hundred large drawings and diagrams to demonstrate his preoccupation with coloured light and reflections," according to Watkin. This was a revolution against conventional understanding of space.

<sup>290</sup> Bollnow, *Mensch und Raum*, p. 217.

<sup>291</sup> Sir John Soane, *Lectures on Architecture* (London: Sir John Soane's Museum, 1929), p. 126.

<sup>292</sup> G.-Tilman Mellinghoff, "Soane's Dulwich Picture Gallery Revisited," *John Soane* (London: Academy Editions; New York: St. Martin's Press, 1983), p. 91.

au fait of Gothic architecture; he appreciated the handling of light especially in cathedrals and churches despite his own quite different attitude towards the matter.<sup>293</sup>

The reference to the Gothic era is so remarkable because here, *space itself*, as something quasi-material gains prime consideration. Contrary to excessive sunlight-revelations on walls and floors, Gothic design concentrates on a relatively directionless space in regard to light. The only direction of importance is the orientation of the church's choir towards the east. Improving the idea of the Einhartsbasilika, where light was mentally imagined to penetrate equally from all sides, now, *real* light was forced to permeate *practically* from all sides. For that, a number of clues were developed to achieve a highly impressive space:

- (1) Artificial light, which had been used in huge hanging "crowns" and "wheels" loaded with candles and lanterns, was abolished in favor of *natural* light;
- (2) Light was aspired to *evenly* flood the interior;
- (3) The highest goal was *diffuse* lighting, *colored* through the use of special glass;
- (4) Despite the sun manifesting the ultimate source of light, the latter was supposed to be emitted in the *plane of the windows*;
- (5) Massive walls were constructively dissolved and replaced by nearly all-embracing *laceworks of glass* and mullions;
- (6) Most stony materials were covered with *paint*; and
- (7) The *air* was materially enriched to achieve a highly intensified medium.

The final result emerging from these and more devices is far too sophisticated to be comprehensible at this point. Thus, a number of phenomena need to be more closely examined. Among those, the extensive window areas and their material constitution may

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<sup>293</sup> Watkin, *Soane and his Contemporaries*, p. 44.

be regarded as the most crucial elements. To grasp fully their impact on Gothic space, both the crafting of glass in those days and some of Ibn al-Haytham's observations need to be remarked upon again. It has been discussed earlier that glass was crafted according to a very special diffusion and refraction of light-rays in various directions. Glass became a translucent material with all the characteristics Ibn al-Haytham had noted such as "a second light" proceeding from "glass and transparent minerals." Including most intense colors (remember the pulverized sapphire glass!) such a Gothic glass front suggests a "gleaming-out-of-itself," as Schoene puts it, "... a separate light which has nothing to do with the light of nature anymore."<sup>294</sup>

Yet, all these effects would have remained secondary, if the Gothic users had not provided a medium for which the gleaming light could make use to begin a melting process between light and space towards transcendence; by means of incense,<sup>295</sup> the air inside those buildings became materially enriched, that means Gothic spaces became highly intensified. The result has to be imagined in terms of Ibn al-Haytham's images of the air "growing luminous" and a "second light" proceeding from the air itself: such enriched air is receptive to becoming dyed according to the surrounding glass windows with their colors. Further, Schoene's observations reveal that, if the lighting level in Gothic churches is reduced enough (e.g., S. Francesco in Assisi), the colors on the building elements are seemingly freed from the matter to such an extent that they themselves become a component of the colored air, too. He expresses it with "liberatedly floating plane-colors" held in a certain balance where they are no longer tied to objects nor are

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<sup>294</sup> Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 114.

<sup>295</sup> Already Indian yogic practice knows--besides sun, fire, wind, phosphorescent insects, lightning, crystal, and moon--the luminous manifestations of *mist* and *smoke*; cf., Eliade, *Myths, Rites, Symbols*, p. 330.

they yet totally freed.<sup>296</sup> The more air that is contained in space or the brighter it becomes illuminated, the greater is the tinting effect. An additional fact is that highly *colored* air lets space appear as being contracted, that means a more intense appearance than *brightly* illuminated air, which results in the expanding of space.<sup>297</sup> The final result, outstanding and well described by Schoene,<sup>298</sup> is a *space-light-medium* which peaks in a *luminary space*.

Now, Schoene concludes that such luminary space is indeed sensual, though beyond one's grasp, which leads to transcendence. Remarkable, compared to common space-comprehension, he foreshadows the idea that space is not only visible but also capable of being felt by our *Leib* (human body). Yet, Schoene remains too indistinct, partly because he still thinks of space as a special constitution of something "between things." Nevertheless, the historian reaches the fringe of what forms the essence of an architectural space when he states that because of the material constitution of the space-light-medium, not only our *Leib* communicates with the architecture, but also our *Leib* and the space-light-medium, which is our *Leib* and the spatiality of an inside.<sup>299</sup>

The communication between Leib and architecture has been put in more comprehensible terms, which at this point shall complete the present section about light in architectural space; Abbot Suger is said to have handed down one of the most famous passages about how to transcend the worldly existence throughout a "trancelike state" of which he elu-

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<sup>296</sup> Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 137.

<sup>297</sup> Schubert, *Gesetz der Baukunst*, p. 16; Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 134.

<sup>298</sup> *Ibid.*, p. 141.

<sup>299</sup> Schoene, *Ueber den Beitrag von Licht und Farbe zur Raumgestaltung im Kirchenbau des alten Abendlandes*, p. 144.

cidates: "When--out of my delight in the beauty of the house of God--the loveliness of the many-colored stones has called me away from the external cares, and worthy meditation has induced me to reflect, transferring that which is material to that which is immaterial, on the diversity of the sacred virtues: then it seems to me that I see myself dwelling, as it were, in some strange region of the universe which neither exists entirely in the slime of the earth nor entirely in the purity of Heaven; and that ... I can be transported from this inferior to that higher world in an anagogical manner."<sup>300</sup>

The main outcome of this inquiry into the application of daylight in architectural space is the demonstration of how architecture is able to structure space to its perfection while respecting both the presence of light and its influence on human existence. First, it is the virginal space, with its multifarious energetic quanta, provided in nature, that becomes "formatted" with every architectural contact. Space is understood here as filled with a medium of material character that enables the light's active influence on everything it contains. Each stone, each cube, each arrangement of building components or structures that becomes inserted in such space, takes part in its energetic transformation. Each architectural act refines virginal space towards potential space, which means that each such act widens man's notion of space and life. Since the being of space is material, all building materials are part of the same space merely in different constitutions. When intruding upon virginal space, building materials create and improve the energetic conditions by means of reflection, refraction, and filtering light, altogether conducting and transforming the energy. Ranging between *materia brutta*, extreme luster, and translucent matter, these materials enable man to impose newly arranged spatial and energetic conditions upon living beings including himself. Within interior space totally controlled action and ultimate perfection of light and space are possible. In such insides, all parts

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<sup>300</sup> Panofsky, "Abbot Suger on the Abbey Church of St.-Denis and its Art Treasures," p. 21.

of this whole space need to be arranged consciously as distinct sections comparable to Feininger's two-dimensional acts or theoretical dispositions in Carolingian churches. Light that penetrates the architectural shell creates a highly intensified space, which tells about itself either (or both) on palpable surfaces or through tangible volumes. In this space the images of light may overlay the appearance of objects, conveying meaning based on the objects' concrete forms, or these images may strike the eye with abstract configurations. In both cases the surfaces of enclosing building materials always exact a generic power in addition to their task of circumscribing certain rooms. Conversely, this all-including and all-intruding illuminated space out-casts itself on those surfaces far differently from pleasing shadow graphics; in general, all arrangements are combinations of quality and quantity. The result is an architecture of luminary zones--where all zones have one thing in common: providing lively space for humans and at the same time giving them the freedom to transcend this space again.

## **CHAPTER IV / CONCLUSION**

## Space in Contemporary Discussion

The present tract on light has the ambition to reshape our conception of space. Yet, before commencing the general conclusion, it seems helpful to repeat some of today's prevailing and ineluctable positions about space.

As summarized earlier, space has been discussed by a number of scholars (e.g., Teilhard de Chardin, Arnheim, Piaget, Bollnow, Norberg-Schulz) either as based on three-dimensional geometry hand-in-hand with descriptions and classifications of shapes, as resting on phenomenology, or as a perceptual field leading to the study of concepts, imaginations, and behavior.<sup>301</sup> Scholars like Piaget have successfully proven that those two categories were not merely a matter of credos, but different stages in the mental development of the human being: "The construction of space begins on the perceptual level and continues on the representational one [thought and imagination];" in other words, the "psychological development ... begins with topology and continues jointly

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<sup>301</sup> cf., for example, Norberg-Schulz, *Genius Loci*, p. 11; Teilhard de Chardin, *The Phenomenon of Man*, p. 175.

with projective, Euclidean, and the intermediate concepts.”<sup>302</sup> The adequacy of the so-called mathematical space, with its homogeneity, has been questioned, because such space lacks any references for orientation; hence, it is insufficient on the existential level (cf., Eliade, Bollnow, and others).

In ancient times, man had partly been more successful--from a human viewpoint--in structuring space geometrically, yet in a way alien to our understanding of three-dimensionality. Doxiadis produced evidence that the ancient Greeks applied “a natural system of coordinates ..., known as the system of polar coordinates,” which places man in a center where all the things he sees are measured “by their distance from him.” The determining factor for their site planning was thus “the human viewpoint.”<sup>303</sup>

Such an understanding of the living human as the focal point leads to Eliade who, as has been shown in chapter II, discourses religious man in relation with a non-chaotic space of brakes, interruptions, qualitative differences, etc. The outcome is meanings and communications between space and man comparable to Kevin Lynch’s landmarks and signs such as “nodes, paths, edges, districts, etc.”<sup>304</sup> --with Lynch’s work being, so to speak, a “profane” version of Eliade’s. Both authors analyze how man’s orientation was established--with the slight difference that modern man is freed, better to say deprived, from spiritual or spatial significances, hence decisive in his choice for a place or site.<sup>305</sup>

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<sup>302</sup> Piaget and Inhelder, *The Child’s Conception of Space*, p. 38, 483.

<sup>303</sup> Doxiadis, *Architectural Space in Ancient Greece*, p. 4.

<sup>304</sup> Kevin Lynch, *The Image of the City* (Cambridge, Mass.: MIT Press, 1960)

<sup>305</sup> Eliade, *The Sacred and the Profane. The Nature of Religion*, p. 28, 178.

Another contemporary line of thinking pursues a phenomenological comprehension of the “being” of things, objects, materials, etc. When man is located in space he is thought to be “exposed to a certain environmental character;”<sup>306</sup> where an object among other things has its own being that determines a certain character of the whole. The dilemma begins with Norberg-Schulz’ viewpoint of space being set up mainly by its material boundaries (“how is the ground ..., how are the boundaries...”) His own words demonstrate that he is close to the subject but not on the point: “similar spatial organizations may possess very different characters according to the concrete treatment of the space-defining elements (the boundary).”<sup>307</sup>

Piaget, on the other hand, fights the common belief that man has *inherited* a mathematical thinking. His working with children, whose “actions” are basically concentrated on objects, since things are easily comprehensible, entails *exclusive* continuity of space; that means, because his work concentrates on tests with children, he is still led on to believe that there exists “*empty* [italics mine] space, for as yet there exists no single space embracing all objects and all observers.”<sup>308</sup> He pursues a line of focusing on humans until they mentally develop the “universal framework” of geometry.

After all that has been elaborated in this thesis, both authors--Norberg-Schulz and Piaget--have to be at least partially contradicted, concerning their understanding of space. Teilhard de Chardin has expressed this in his own words when criticizing the comparative “isolation from the things,” similar to looking “from the shelter of an ob-

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<sup>306</sup> Norberg-Schulz, *Genius Loci*, p. 19.

<sup>307</sup> Ibid., p. 11.

<sup>308</sup> Piaget and Inhelder, *The Child’s Conception of Space*, p. 459.

servatory into which they [the things] were unable to enter, as though we were spectators, not elements in what goes on."<sup>309</sup>

At this point, it seems worth while to refer to Muck and his approach to space as "a process of *Erarbeitung* (elaboration)" and as "coordinating performance of conception" taking place on the "level of gestalt-finding" which peaks in his summarizing hypothesis: "Space is *never* given."<sup>310</sup> And, more of a footnote than a major thesis, he adds that perception not only includes optical perception but also acoustic coordination, thermal coordination, etc.

Here, Bollnow's distinction between two different movements in space--going and dancing--may be seen in a new light, now; that is, as degrees of actively "elaborating" space, where dancing achieves a more advanced degree than going. "While dancing the human gains an altered relation to space.... 'When going we are moving on through space, from one place to another; when dancing we are moving in space.'" <sup>311</sup> Piaget continues to clarify precisely the far more fundamental role action plays compared to what image does: "because thought can only replace action on the basis of data which action itself provides" --"spatial concepts are internalized actions."<sup>312</sup> In this sense, Muck points out that the relation between space and behavior is more than simply a matter of simultaneousness: such "relation is to be regarded not merely as a relation of space that determines behavior; also it is behavior that can determine space."<sup>313</sup> Here, behavior

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<sup>309</sup> Teilhard de Chardin, *The Phenomenon of Man*, p. 219.

<sup>310</sup> Ottokar Uhl, ed. *Rudolf Schwarz, Emil Steffann--Ueber die Rueckfuehrung der Architektur auf die Philosophie*, (Karlsruhe: by the Author, 1985), p. 56.

<sup>311</sup> Bollnow, *Mensch und Raum*, p. 252, partially citing E. Strauss.

<sup>312</sup> Piaget and Inhelder, *The Child's Conception of Space*, p. 452.

<sup>313</sup> Muck, *Theoriemodelle zur vorausgegangenen Diskussion*, p. 74.

starts the process of *Erarbeitung* of space. Referring to the work of E. Steffann and R. Schwarz, Muck gives examples that space can be approached beyond a mere "self-evident extension of architecture;" since space is not first and foremost form but "participation, integration" -a disposition of stones or a construction that promotes meaning and interpretation "leaving space open for a lively space-gestalt."<sup>314</sup> Furthermore, Schwarz' concerns about *Leitbilder* (patterns) of primary orientation are explained as extremely contrary to "standards of biological and psychological determination."<sup>315</sup>

Yet, *Erarbeitung* is not the only -because active- mastering of space by man as a spatially exposed being; space also exerts major influences on humans. It was Aristotle who stated that space possesses its own power and, thus, exerts a certain influence on man. Where Aristotle speaks of power, the present work uses the term energy, which, according to Feldenkrais, if "not converted into movement turns into heat within the system and causes changes that will require repair before the system can operate efficiently again."<sup>316</sup> Universal integration cannot be extremely contrary to biological and psychological influences, rather elaboration, integration, and determination go hand-in-hand.

Some scholars have paid attention to this universal integration. In this context two expressions are used in particular: *Stimmung*, as Bollnow says, or *Stimmigkeit*, as Muck uses the term. It may be translated insufficiently with mood, disposition, affection, unison, concord, or "human tuning" and describes the "undivided unity"<sup>317</sup> between man and his environment. It begins where space and man mutually exchange influences; "the

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<sup>314</sup> Muck, *Raumkonzepte bei Schwarz und Steffann*, p. 27.

<sup>315</sup> Ibid., p. 33.

<sup>316</sup> Feldenkrais, *Awareness Through Movement*, p. 58.

<sup>317</sup> Ibid., p. 231: "*Stimmung* itself is nothing subjective 'in' man, and nothing objective to be found 'outside' in his environment."

psychic disposition of the human determines the character of the surrounding space, and then, conversely, space reacts back upon his psychic condition."<sup>318</sup> Muck remains non-specific when demanding that "the *Stimmigkeit* and relation towards the whole of coherence of life and orientational space ought to be perceptible (*fuehlbar*);"<sup>319</sup> whereas Bollnow is more specific when relating *Stimmung* to "atmospheric conditions" that tune man in terms describable with adjectives such as bright, light, gloomy, sober, or solemn, of which all are more or less related to light as nature provides it.

The contemporary discussion of *Stimmung* and *Stimmigkeit* has related space, again, closely to man. Yet, being aware of such capacity of space--the ability to provide integration--nevertheless, space needs to be designed with the least possible limitation for human actions. The situation of man in space has to be potential, that means, man needs possibilities rather than restraints.

Translated into architectural terms, some contemporary positions, like Eliade's, seem to be too restrictive though distinct; Eliade, for instance, implies that "man's integration into the cosmos can only take place if he can bring himself into harmony with the two astral rhythms, 'unifying' the sun and the moon in his living body..., the two centers of sacred and natural energy."<sup>320</sup> On the other hand, Teilhard de Chardin's standpoint, for example, remains too indistinct, when circumscribing the world as "a system by its plurality, a totum by its unity, and a quantum by its energy; all three within a boundless

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<sup>318</sup> Bollnow, *Mensch und Raum*, p. 230.

<sup>319</sup> Herbert Muck, "Kirchen-Raum," *Rudolf Schwarz, Emil Steffann--Ueber die Rueckfuehrung der Architektur auf die Philosophie*, ed. Ottokar Uhl (Karlsruhe: By the Author, 1985), p. 117.

<sup>320</sup> Eliade, *Myths, Rites, Symbols*, p. 402.

contour.”<sup>321</sup> A bit nebulously, he claims that “resonance to the All [is] the keynote of pure poetry and pure religion.”<sup>322</sup>

Only Bollnow becomes specific enough in this context when discussing Minkowsky and the effect of music--an effect explained as “a melody, a symphony, or even a single tone, ... prolonging itself into ourselves, penetrating us to the bottom of our soul, indeed echoing within us.”<sup>323</sup> This, precisely, is the adequate way to conceive architecture; similar to experiences of music, which do not at all enforce exclusive reactions from man. Architectural experiences need to be provided--as energies erected, transmitted, and reflected, yet without restricting the life of man.

The results of the following conclusion should be viewed under the premise that they have been undertaken to widen the contemporary concepts of space by means of unveiling additional aspects rather than to fight those concepts as contrary in principle. (This thesis opposes just such investigations, pretending to be exclusive within their findings.) Of course, a structure that cannot be analyzed according to three mathematical dimensions is impossible on Earth, and a building that is incapable of becoming “elaborated,” of receiving attention and intentions, cannot be construed. Yet, the holistic existence of architecture will remain concealed by those means.

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<sup>321</sup> Teilhard de Chardin, *The Phenomenon of Man*, p. 43.

<sup>322</sup> Ibid., p. 266.

<sup>323</sup> Bollnow, *Mensch und Raum*, p. 306.

## General Conclusion

The purpose of this treatise is to demonstrate that natural light is a unique element completely affecting man, consciously as well as unconsciously--and, moreover, that man is capable of controlling this process. Consequently, man holds sway over a reality that reveals itself to the human body as well as to the human mind, where the body is not merely "touched" but penetrated, and the mind not only orders the perceived, but becomes structured in a global sense. Furthermore, it is space where mankind and light meet each other, and it is spatiality that endows man with the power of totally controlling the energy he encounters; since delineating space is the subject of architecture, mankind is furnished with the tool to craft the condition of both body and soul.

To illustrate that upon which this crafting process depends, the topic needs explanations at three levels:

- (1) the unconscious level of light affecting man,
- (2) the conscious level of mental conceptions about the world, that are born under the presence of light, and

(3) the applied rung, where architecture manifests human thinking spatially to change the effect of light.

Yet, it is impossible to think of these three stages as separable entities, because none can convey as much understanding about its being when examined in isolation; all three stages are facets of one inseparable unity. The proof comes with no single aspect able to explain how the worldly existence may be transcended with the help of light.

Firstly--light is visible radiation emitted by the sun. It leads on to the solar body itself and from here to the presence of invisible, yet experiential wavelengths, also irradiated by the sun itself. In general, light and matter are different stages of energy; that means, light on Earth becomes irrelevant if it is imagined as completely immaterial--just as matter always conducts and transforms energy. Both converge on the premise that space is not empty but furnished with a medium of material character; without the presence of such a medium, life on Earth is impossible. The environment acts upon living beings via radiation creating both health and installing a time schedule within the human organism. The most outstanding development of man's adjustment to his environment is the eye; with its two pathways--one connected with the human organism, the other linked with the brain--the eye is the best evidence of man's organism being tied to the energetic outside world. There is unconscious regulation of bodily functions as well as visual perception, the latter entailing orientation and, thus, spatial experience. Since he is dependent on the illuminated environment, each individual is, to a certain extent, *affected* by light.

Secondly--by virtue of visible radiation, nature generously illuminates its being. Man, once mentally aware of light, begins to structure the chaos into which he was born. The chaos is mastered at the moment when two perpendicular axes, with the four extreme

points, called East, South, West, and North, are imposed. The unknown, not yet explored, receives the names of the heaven's quarters and, furthermore, terms such as "up" and "down," which represent the different values of heaven and hell (because the zenith of the sun has no equal antipode). Dependability on the sun and its light enables orientation; mankind becomes mobile and conquers natural space. This space, now, unveils itself not merely through illumination but, moreover, via something of opaqueness that results in the air growing luminous. Since both space and light are not completely immaterial, they establish a unity where space becomes a function of light, and, finally, becomes comprehensible. Space is receptive to haze, fog, and thus color; not only visually, it contracts and expands according to the energetic activations that natural light exacts. Contrary to being homogeneous, space is distinguished, and its parts maintain more or less divided intensities. Beyond enabling merely observation, light is even observable itself. Consequently, man is connected twice with light; physiologically and mentally; and it is particularly the eye with its two pathways to both organism and brain that is the most evident incarnation of light connected with a living mankind in spatial existence. Within the eye, the outside and a twofold inside are united. For the following it is eminently important that natural light emitted by the sun has become the prime subject of various religious concepts. Why is this so important? Nature's self-expression alone is not satisfying for man who needs meanings to survive; this, exactly, is the beginning of his spiritual *communication* with nature: self-expression by nature and interpretation by man. In numerous religions, either natural light or the sun becomes the prime subject for various concepts, myths, or interpretations about man's being in the world--that is, the same phenomena described above (according to their numerous unconscious and sensuous effects upon man) add to the practical meanings of orientation, the existential meanings of life through religious concepts or, later, philosophical ideas. These concepts originate nearly always from the equation of light with life; they define

light as experiential beyond mere physiology, as comprehensible beyond plain understanding, and as tangible beyond ordinary senses. Light becomes object to the mind while still remaining subject to the human body! The ultimate complexity is achieved when light also obtains the function of symbols, since symbols refer to the sensuous world just as much as to the imaginative mind, yet--prior to reflection. At this point, light has become inseparably welded together with human existence on all levels: physiologically, sensuously, orientationally, imaginatively, mentally, and metaphysically. This is the background where man manifests his experience by virtue of architecture.

Thirdly--architecture manifests man's environmental parameters as well as his conceptions and imaginations about the cosmos. In architectural terms, the "where" in life is constituted, the "how" is stated, and thus meanings are translated into material existence. Focusing on the nature of architecture, space has been recognized as filled with a medium that is material in principle, and energy has been discussed as consisting of light and matter. The result is one all-embracing space of which the character is energetic when exposed to the sun. Consequently, every architectonic sculpture, even if reduced to a simple stone, will cause an impact on formerly virginal space. Each sculpture "inserted" into this space will take part in the latter's energetic transformation; i.e., it will condense, reflect, conduct, transform, or block certain quanta of energy. Since the energetic account of virginal space is not homogeneous at all, each architectural act takes place either in accordance with the prevailing spatial condition or contrary to it. Building materials, being themselves merely different constitutions of one and the same space, inflict numerous "re-formations" on space. Ranging between *materia brutta*, extreme luster, and translucent materials, they reflect, refract, and filter light for the sake of altering the spatial presence. Three-dimensionally considered, various building materials might enclose the same volume; yet, the enclosed space never remains the same. By vir-

tue of materials, man imposes newly arranged energetic conditions upon living beings including himself; inside interior space, man has total control over light that penetrates buildings. Such interiors, when consciously dissected into more or less distinct sections, promise ultimate perfection of light unified with space: building materials exact more than a generic power upon insides; furthermore, these illuminated interiors outline the images of their complex zones, either on palpable surfaces or within tangible volumes. Beyond the mere graphics of picturesque shadows, such "out-cast" images may assume even completely abstract configurations. Such a conscious application of natural light results in an architecture of zones, where all arrangements are combinations of quantity and quality.

It may seem that light is discussed as *exclusively* responsible for controlling the organism, enabling orientation, or structuring the mind, etc. This, of course, is not possible--nor is this the case for anything concluded further on. In both cases, illuminated space is simply an extraordinary challenge for human life.

The thrust of this investigation is (1) to show that space is not merely a void, to reshape our conception of space in regard to light, and (2) to explain how light achieves a new integrity; that is, how it can become a spatial element unifying man and his architecture.

(1) As to space, this work has tried to put as much emphasis as possible on space as something neither void nor empty. An improved understanding of space has been made possible by two descriptions; it is the nature of light not to be completely immaterial; and so is this the nature of space on Earth. Space is always enriched with a *material* medium, so the moment it is exposed to the sun, it becomes a *function of light*. Inquiring into these two phenomena--the in-fill of space and its exposure to light--the present work has helped to overcome the gap between human existence and its palpable boundaries.

Thereby, in the first instance, man misses his aspired independence, since natural light thoroughly affects one's body, its growth and existence. In the second instance, he commences to be mentally mindful of the phenomenon of light permeating space. Though his awareness does not cover exactly the *same aspects* unconsciously influencing him, nonetheless, it is still the *same phenomenon* (i.e., light) that concerns him. A major consequence throughout this inquiry has been that space and its relation towards the whole of life *has indeed become* perceptible to *both* the mind and the human organism in regard to light. Finally, man begins to deduce that a somewhat material and perceptible space can be subject to being crafted, hence, it can be re-structured, improved, perfected. This means, the skill to control light by conducting, reflecting, diverting, transforming it, thus, to control the constitution of space, and--to make the new constitution *known to the eye again*. This may be by way of revelations on *palpable surfaces* of building materials or by virtue of visible, *tangible volumes*. These are the opportunities of treating space architecturally that have been disclosed throughout this thesis.

(2) As to unification of man and architecture, the present investigation has shown that unification results neither entirely from the sum of various experiences of light, nor from their plain translation into concrete shape; i.e., further spheres of experience prove unattainable before unification. The keys to understanding unification are the three stages of unconscious reception, conscious perception, and creative application of light. In addition to dealing with one and the same subject -"light"-, these stages demonstrate that each circle has a slightly *different center*, where each one does not have all aspects of light in common with each other. This amounts to saying, that when thinking of light, man does not comprehend *exactly* the same facets influencing his body and, again, he does not apply exactly the same facets he had comprehended. Consequently, the number of commonalities lead necessarily to further aspects assembled around various other

centers. For example, when man speculates about the sun and its meaning in the cosmos, he cannot help but include physiological impacts of the sun, though he is not aware of all these impacts at this moment. Constructing a piece of architecture always involves cosmic understanding and biological effects although they might not be intended. This thesis has demonstrated that successful treatment of all aspects, since circling about related centers, leads to mental visions by means of uplifting phenomena from the perceptible world; this is called transcendence. In the case of light, transcendence sprouts from the *same* sphere, subject and object of cognition are the same, so that what has been incorporated can be dissolved without maintaining the capability to comprehend the act of transcendence. This new sphere of leaving the spatial-temporal-sensual world is based on unification between man and architecture which, in turn, is based on the presence of light in space. It has been the goal of this thesis on "natural light in architectural space" to show that such unification is possible, how it can be achieved, and, finally, that it can be transgressed.

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