



DAYLIGHT &
ARCHITECTURE
MAGAZINE BY
VELUX

WINTER 2008 ISSUE 07 SHADES 10 EURO

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DISCOURSE BY JEREMY WOLFE

Because we concentrate on change in light and not light itself, we are misled into thinking that the left side of this page is darker than the right. It isn't. The left gets darker only toward the center. The right gets lighter in the same way. The resulting light-dark edge causes us to infer light and dark elsewhere, even though the left margin and the right margin of this page are exactly the same.

Prof. Jeremy Wolfe graduated from Princeton and obtained his PhD from the Massachusetts Institute of Technology. He worked on binocular vision and visual adaptation before taking up his current interest in visual attention. Today he is Professor of Ophthalmology at Harvard Medical School and the director of the Visual Attention Lab of Brigham and Women's Hospital in Boston, USA.

Rudolf Arnheim, who died this year at the age of 102, quite literally wrote the book on "Art and Visual Perception". His chapter on Light comes surprisingly late; sixth out of ten chapters. Arnheim comments that, "If we had wished to begin with the first causes of visual perception, a discussion of light should have preceded all others, for without light the eyes can observe no shape, no color, no space or movement." However, he goes on, "since man's attention is directed mostly toward objects and their actions, the debt owed to light is not widely acknowledged." Light has these two faces for us. The Bible proclaims pure light as the first creation, well before the sun and stars. They appear only on Day Three. Jewish tradition imagines that this primal light made it possible to see from one end of the earth to the other but that this light was so overwhelming that 6/7ths of it had to be withdrawn. Because Psalm 97 declares that "Light is sown for the righteous", the tradition imagines that the light that was taken back is preserved as a reward, to be revealed to the deserving at the end of days.

In the meantime, we are less attuned to light, itself than to differences between the light reflected from one surface and another. As Helmholtz phrased it, we "discard the illuminant". We throw away information about light itself in order to recover information about objects in the world. Hansel (of Hansel and Gretel fame) can collect "white pebbles" during the day with the assurance that they will shine "like newly coined silver pieces" in the moonlit night even though a white pebble at night reflects much less light than a lump of coal in the day. We barely notice the yellowness of light from an incandescent bulb. Our visual system is more concerned with assuring that the banana that is yellow in the kitchen, looks yellow on the playground.

Still, we have not completely lost contact with that primal light. It modulates our mood and adjusts our internal clocks. Light, as light, functions largely outside of our routine awareness while we are preoccupied with what it illuminates.

In this issue we explore how human beings experience and perceive light and space. Experience and perception are very personal phenomena; constantly influenced by physical and psychological conditions, as well as by the cultural values of the societies.

We see some common denominators that should be taken into consideration. One of them is raised by Juhani Pallasmaa in his article 'Tangible Light'. He points out that light is not only experienced through our eyes, it can also be 'sensed' through our skin. This view is closely related to the work of Philippe Rahm, which features the unconscious, immediate physical reactions of human beings to their surroundings, whether they are provoked through light and darkness, heat or cold, or other 'atmospheric' influences. In an interview with Ahmet Gülgönen, the Turkish-French architect, he speaks of how light and space can be perceived as the same and challenges the duality of volume and space. To him, "a void without light is not a black space", but a dark void will only turn into space if light enters it through an opening or a window. How to convert a dark bunker into daylight inhabitable spaces? In the Cologne suburb of Nippes, a World War II bunker was literally sliced open to convert it into spacious apartments filled with daylight. The huge bunker walls and ceilings,

meanwhile, are still present in the new spaces and can be experienced with all the senses.

In this issue we are also proud to present a series of unique light and space installations that students at the Oslo School of Architecture and Design (AHO) have designed, and that have now been built with the help of VELUX Norway. These 'light machines' "do nothing but reveal emotions", writes Rolf Gerstlauer, professor at AHO – but by doing so, the machines also open up entirely new ways to experience light and space. In a like-minded attitude, the founder of VELUX, Villum Kann Rasmussen, strove to convert the thousands of dark attics in European cities into liveable and usable space when he developed his first roof window in the 1940s and brought daylight and fresh air through the roof.

We hope you too experience light from a different perspective as you read Daylight & Architecture 07.

AUTUMN 2007
ISSUE 06

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MANKIND AND ARCHITECTURE
TANGIBLE LIGHT

8 **8** The visual sense has always been considered the 'noblest' of man's five senses; its predominance in our culture has increased even more with the advent of the media age. According to Juhani Pallasmaa, this has also affected the way in which architecture is now designed. Pallasmaa argues that the five senses and their interrelationships need to be rediscovered as an essential element in our perception of space, light and shade.



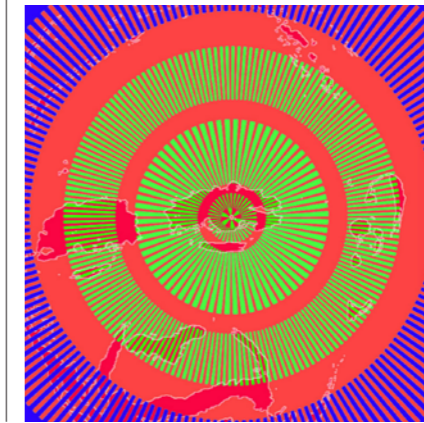
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PHILIPPE RAHM:
THE UNCONSCIOUS AND
THE LIGHT

14 **14** The Swiss architect Philippe Rahm designs installations and buildings which turn day into night or generate an alpine climate at sea level. By focusing on the effect of space on the human psyche and not on form or function, Rahm sheds light on processes which usually only take place at a sub-conscious level.



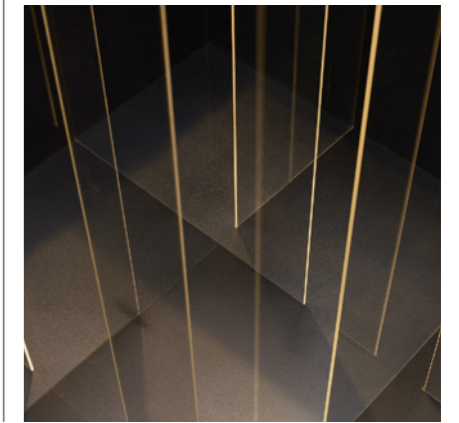
REFLECTIONS
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30 **30** Modern high-power tomography scanners allow brain scientists literally to see into the soul. And they have gained new insights into how seeing 'works'. But has this really changed the way we perceive the world? In his article Nicholas Wade investigates the mystery of three-dimensional vision which has preoccupied artists and scientists since the renaissance.



VELUX DIALOGUE
THE STUBBORNNESS
OF ARCHITECTURE

48 **48** Students of the Oslo School of Architecture and Design (AHO) designed eleven 'light machines' and built them with the support of VELUX. "They do nothing but uncover emotions", Rolf Gerstlauer, the supervising professor, describes the light and space installation. But this allows the light machines to raise questions about the traditional limits of architecture and our perception of space.



VELUX INSIGHT
A TOUCH OF
HEAVINESS

40 **40** What should be done with the bunkers of the Second World War now that they are starting to show their age? A residential building in the Cologne district of Nippes offers a possible answer to this question: instead of tearing down some of the remaining bunkers still above ground Luczak Architekten incorporated the massive walls into a series of newly built town houses and lofts. The interior rooms are spacious and full of light – and yet the past is still sensually present.



The things that make architecture tick: events, competitions and selected new developments from the world of daylighting.

PIXELS IN THE CHURCH VAULTS

Cologne cathedral, the third largest gothic place of worship in the world, has been enriched by a new work of art that has fuelled controversies and provoked contradictions. In the middle of August, the 106 m² south transept window by Gerhard Richter was inaugurated. Richter, who also lives in Cologne, is considered to be one of the most expensive living painters in the world and was the only one whom the cathedral chapter thought was capable of giving an appropriate, contemporary expression to one of the largest windows in Germany's largest cathedral. The principals had relatively fixed ideas about the imagery that was to be used in the commission; it should show six German martyrs of the 20th century. However, the painter, who was born in 1932, surprisingly came up with a completely independent design of his own – an abstract pixel pattern of 11,263 coloured squares in 72 colours. Richter's painting '4096 colours' from 1974 provided the basis of the design, the coloured panels of which were filled out at the time by the painter purely at random. However, the new window is not entirely the result of chance; Richter manually reworked the colour distribution for the tracery disks divided into small sections, in order to obtain a harmonious general impression. He preferentially used darker colours as the transept window faces directly south and is at no time during the day in the shade of abutments or other buildings.

In contrast to historical church windows, the individual squares are not separated by leaded dividing bars. Instead they are connected to a carrier pane and to each other by a non-hardening silicone gel. In this way, the glazing has a filigree appearance and even high temperature differences will not result in the panes cracking.

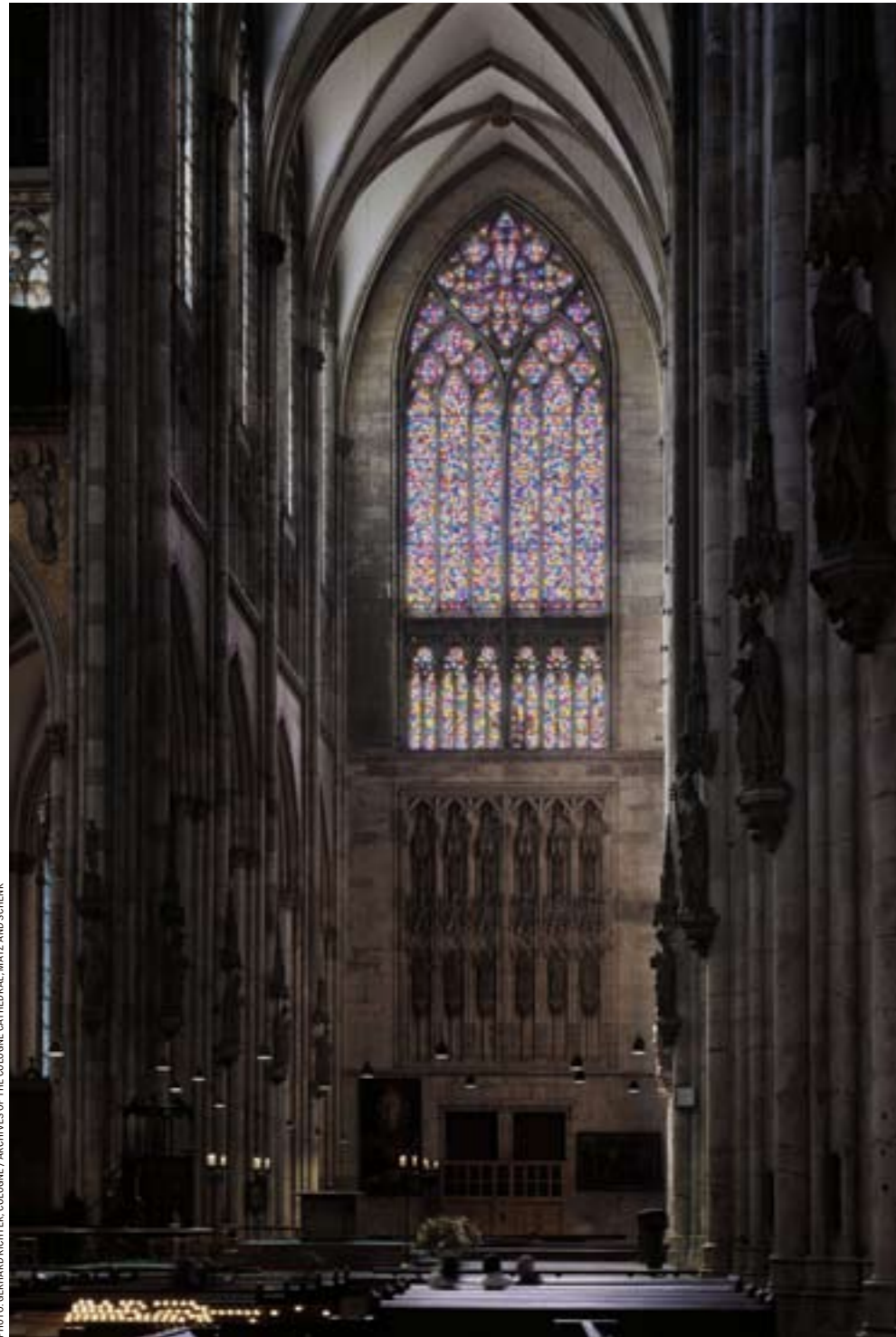


PHOTO: GERHARD RICHTER, COLOGNE / ARCHIVES OF THE COLOGNE CATHEDRAL, MATZ AND SCHIEK





PHOTO: FERNANDO ALDA

LITERARY SHADOWS

For two and a half weeks in spring 2007, the Madrid Parque del Retiro was characterised entirely by a single theme – reading. As part of the Feria del Libro de Madrid, 362 exhibitors presented their programmes at the Madrid Book Fair, readings were given, and a prize was awarded for the best book of the year.

Two and a half weeks is a short life span for a building. Tents and re-usable container structures thus dominated the scene at the book fair for most of the time. The pavilion of the town council of Madrid was an exception. The architects Nomadoco from Seville designed a simple timber house with a gable roof and a shining black painted outer shell. Its few glass windows and doors are printed with ornamental, intricate letter patterns, whose silhouettes form a lively contrast to the smooth surfaces. Inside the building, the mysterious black gives way to radiating white and the simple overall form becomes a differentiated succession of three rooms: the entrance area, book information stand and lecture room. The rooms have not been placed directly against the outer walls, but follow their own geometry. In this way, space-containing intermedi-

ate zones are created between the interior and exterior walls, which are interrupted by 'light chimneys' and deep window embrasures.

Nomadoco used the novel 'The Paper Palace' by Paul Auster as the model for their design. It tells the story of the writer Sydney Orr, who purchases a mysterious note book from a Chinese stationer and later experiences that many of the things he writes down in it seem to have an effect on reality. The letters also have an unmistakable effect in the Madrid pavilion. The ornamental windows and doors fill the area like wrought iron lattices with light and shade patterns that move along the walls during the course of the day. The passages between the rooms are likewise framed with text motives printed in white on a black background, thus representing a reversal of the 'window pictures'.



PHOTO: FERNANDO ALDA

LIVING IN THE CLOISTER

San José del Valle, a community of 4,200 inhabitants not far from Cadiz in southern Spain. On the slopes of Monte de la Cruz, just above the town centre, Carmelite nuns founded a cloister in 1695 and had already given it up again by the middle of the 19th century. After numerous remodelling attempts, and having stood empty for a long time, the former convent has now been put to a new use: a 32-unit subsidised low-rent housing scheme has been developed to plans drawn up by Ramón González de la Peña and his office RGP Arquitectos on the hillside. The typology and layout of the new buildings – mostly two-level terraced houses – orientates itself to the character of the former cloister, with several courtyards opening onto views of the surrounding landscape forming the common centre of the building complex. Retaining walls of concrete and quarry stone delineate the different site levels.

At the northern end of the area, the former convent church towers above the other buildings overlooking the valley. Today, it serves as a general-purpose hall for the entire village; here theatre, music performances and exhibitions are to

take place. For this purpose, three extensions, almost as high as the building itself, with adjoining rooms were newly erected in the west. Daylight falls between them through three high windows into the nave of the church. The church roof is completely new; it was designed as a single, folded reinforced concrete plate, anchored to the existing outside walls and whitewashed on the underside. The thick external walls, the asymmetrical roof shape and the irregularly distributed openings for daylight ensure that, inside the church, a finely shaded, but nevertheless constantly changing lighting effect prevails. Side light falls into the church nave through the two entrances; three windows light the room through dormers cut out of the roof in the west. The main source of daylight is an elongated strip of windows in the east that brightens the strongly structured under-face of the roof with its streaks of light and gives the multi-purpose room gentle, indirect lighting. Ramón González de la Peña consciously decided on the unusual roof shape for a church building. It lends a "civilian expression" to the room, he writes, "which is appropriate for its new use".

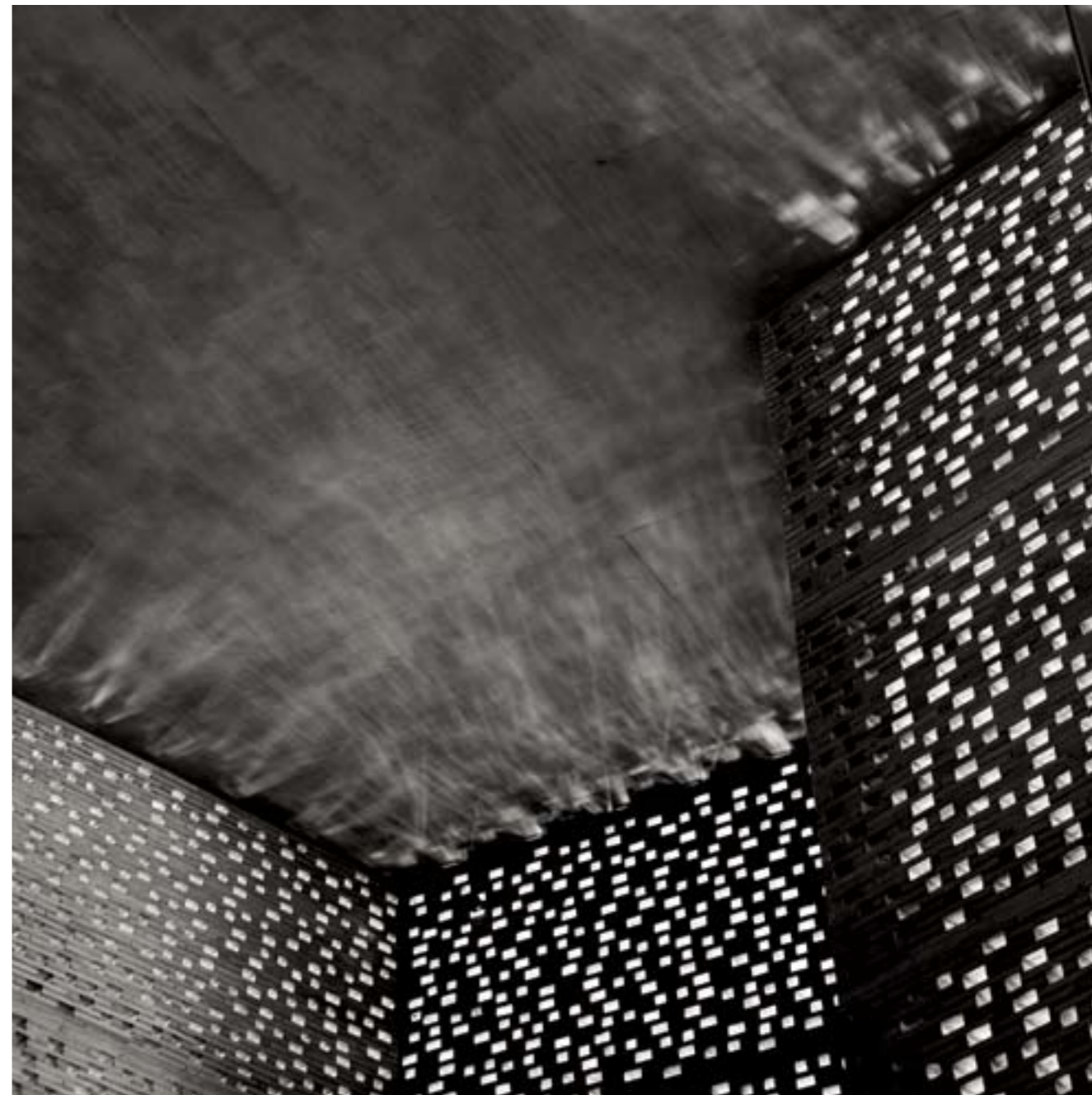


PHOTO: HELENE BINET

FILTER MADE OF STONE

For many decades, a provisional timber roof protected the ruins of St. Kolumba, the focal point of the largest church community in Cologne during the Middle Ages and later to fall victim to the Second World War. Now this interim solution has yielded to a much praised permanent solution: 'Kolumba', the established art museum of the diocese of Cologne,

erected according to the plans of Peter Zumthor, is now a museum, archaeological shelter and chapel all in one. It integrates in its interior constructions from three millennia; a chapel was built over part of the destroyed church to plans from Gottfried Böhm.

In his plans for Kolumba, Peter Zumthor decided to build over all the existing layers of past history completely, including the Böhm chapel. A total area of approximately 3,700 m² is available in the three levels above ground and the two underground floors of the new building. Massive

outside walls 60 cm thick made up of flat, greenish-grey bricks contribute to creating a constant indoor environment all year round. On the two upper levels, the walls are repeatedly interrupted by room-high windows that open onto views of the city to museum visitors. In contrast to this, the large, hall-like area over the church ruin is intended to give an outdoors feeling. Here the masonry stones were shifted "to keep their distance" and thus produce a filter that is both light and air-permeable and immerses the area into semi-darkness for most of the time. Peter

Zumthor describes the concept for this area as follows: "The objective of the new building was not that of the light-flooded museum but - on the contrary, Kolumba is a museum full of light and shadow; the change unfolds during the day and with the seasons and also at twilight."

TANGIBLE LIGHT

Integration of the senses and architecture



HERBERT BAYER, 'VEBILD', UNIST

By Juhani Pallasmaa

The preeminence of the visual is all pervasive: anyone who investigates how our society stores and passes on knowledge, and how people communicate with one another, will quickly discover the extent to which the visual determines our lives. But our body does not 'see' only with its eyes; light and color do not address our sense of sight alone. It is time to reconsider architecture in the light of this realization.

WE ARE LIVING in a logocentric culture dominated by the sense of vision. Also architecture is theorised, taught and practised primarily as a purely visual discipline. This visual understanding of the art of building is manifested in Le Corbusier's poetic credo: "Architecture is the masterly, correct and magnificent play of masses brought together in light." Particularly during the past couple of decades architecture has increasingly aimed at a striking, unforeseen and memorable visual image.

The world view of 'naïve realism' takes for granted that the human senses are biologically determined, autonomic functions that mediate percepts of an objectified world. Yet, 'reality' itself, as well as the ways that we perceive, interpret and prioritise our perceptions, are all cultural products.

The notion of the five senses is attributed to Aristotle, and he also established the hierarchical order of the senses from the highest to the lowest: vision, hearing, smell, taste and touch. Ever since Aristotle, touch has been regarded as the lowest and most primitive of the senses. The depreciated position of the tactile sense resulted from the observation that it could be found in all animals. Also the fact that the essence of haptic experiences cannot easily be expressed in language has reinforced the low status of this modality. In Aristotle's view, touch is needed for being, whereas the other senses are necessary for well-being. Medieval, Renaissance and Enlightenment thought continued to consider smell, taste and touch merely as the domain of beasts. In today's design consciousness these sensory realms continue to play an undervalued role.

In addition to being regarded as the noblest of the senses, vision has also been connected with thinking and truth, thus granting vision an added authority. As early as in classical Greek times, thought based certainty on vision and visibility. "The eyes are more exact witnesses than the ears", Heraclitus wrote. Plato even saw the origins of philosophy in vision and for him philosophy was "the greatest gift the gods have ever given or will ever give to mortals". The impact of vision on philosophy is well summed up by Peter Sloterdijk: "The eyes are the organic prototype of philosophy. Their enigma is that they not only can see but are also able to see themselves seeing. This gives them a prominence among the body's cognitive organs. A good part of philosophical thinking is actually only eye reflex, eye dialectic, seeing-oneself-see".

In addition to the visual bias of western thought, almost all our knowledge of past cultures exists as material and visual records, and human history "exists in matter and space rather than time and sound". No doubt, our countless scientific instruments and inventions as well as the current digital universe have only reinforced the dominance of the sense of vision.

THE REDISCOVERY OF THE SENSES

During the past couple of decades, however, the long neglect of the human sensory and sensual essence, as well as the disregard of the embodied processes in our existential experiences and cognition, have given rise to a swiftly expanding literature on the senses and the various dimensions of human embodiment. The significance of the body has even been extended to processes of thinking. This arising critical attitude is exemplified by philosopher David Michael Levin's statement: "I think it is appropriate to challenge the hegemony of vision – the ocularcentrism of our culture. And I think we need to examine very critically the character of vision that predominates today in our world. We urgently need a diagnosis of the psychosocial pathology of everyday seeing – and a critical understanding of ourselves as visionary beings." Also in architectural writings and educational approaches today the body and the senses are gaining increasing weight.

I believe that many of the critical aspects of architecture today can be understood through an analysis of the epistemology of the senses, and through a critique of the ocular bias of our culture. The air of distance, alienation and unyielding hardness in today's buildings and cityscapes can be understood as a negligence of the body and the senses, an imbalance of the sensory systems, and the disappearance of the existential dimension from architecture.

A characteristic of vision that has hardly been studied at all is the implicit capacity of vision to interact and integrate with the other sense modalities. The interest in the significance of the senses has tended towards regarding them as independent and detached realms instead of understanding our sensory relation with the world as a fully integrated existential condition. "The hands want to see, the eyes want to caress," as already Goethe observed.

As the Aristotelian concept of the five separate senses has

Previous: Herbert Bayer: *Ein-samer Großstädter [Lonely city dwellers], 1932.* The photo-montage is intended as an illustration of the alienation from metropolitan architecture felt by many at the beginning of the 20th century. People – and this is something which we experience repeatedly our daily life – do not 'perceive' their environment with their eyes alone but also with their sense of touch.

Opposite: James Turrell: *Wide Out, 1998.* "I use light as if it were matter" is the way James Turrell describes his work. Light and color are almost 'palpable'. But on coming up close to the surface of the light the visitor moves into a 'fog of light' where spatial depth and spatial borders disappear and the sense of equilibrium is confused.

been accepted in western culture as an unquestioned historical cultural agreement, the essences, functionings and interactions of the sensory systems need to be seriously reconsidered. Instead of the five independent and isolated senses the psychologist James J. Gibson categorises five sensory systems: visual system, auditory system, the taste-smell system, the basic-orienting system, and the haptic system. Medieval philosophy identified the existence of a sixth unifying sense, the sense of selfhood. Steinerian philosophy goes even further in arguing that we actually utilise no less than twelve senses.

The senses are not merely passive receptors of stimuli; they actively stretch out, seek, investigate, and shape the entity of the world and the self. In an interplay with our whole bodily being the senses are centres of tacit knowledge, and they structure and memorise our existential condition. All the senses "think" in the sense of grasping utterly complex lived situations.

The relative roles of the senses are also culturally determined, and there are significant differences in how the various sense modalities are emphasised in various cultures. In some cultures, for instance, our private senses have social functions. In the western understanding, the importance of the sense of touch is slowly emerging from the shadow of more than two millennia of biased thought. We are finally discovering that our lowest sense may well end up being the most important one, the sense that integrates our entire existential consciousness.

FEELING WITH YOUR EYES – SEEING WITH YOUR SKIN

All the senses, including vision, are extensions of tactility; in fact, Aristotle already describes taste and seeing as forms of touching. The senses are specialisations of skin tissue, and all sensory experiences are fundamentally related to hapticity. Our contact with the world takes place at the boundary of the self, through specialised parts of the enveloping membrane and its extensions and projections. The senses expand the human body amazingly: "Through vision we touch the sun and the stars".

Skin and the sense of touch are essential for the "philosophy of mingled bodies" of Michel Serres: "In the skin, through the skin, the world and the body touch, defining their common border. Contingency means mutual touching: world and body meet and caress the skin. I do not like to speak of the

place where my body exists as a milieu, preferring rather to say that things mingle among themselves and that I am no exception to this, that I mingle with the world which mingles itself in me. The skin intervenes in the things of the world and brings about their mingling."

Maurice Merleau-Ponty formulates the idea of touching an artistic work beautifully: "How would a painter or a poet express anything other than his encounter with the world."

Even more importantly than rendering a boundary, touch is the sensory mode that integrates our experience of the world and ourselves. Even visual and other perceptions are fused and integrated into the haptic continuum of the self; my body remembers who I am and how I am located in the world. "[T]he first feeling must have been touch. Our whole sense of procreation has to do with touch. From the desire to be beautifully in touch came eyesight. To see was only to touch more accurately", Louis Kahn, the architect, reasons.

The miraculous consistency and permanence of the world cannot arise from fragmentary visual imagery; the world and our sense of self are held together by the haptic system and memory. My sensing and sensual body is truly the navel of my world, not as the viewing point of a central perspective, but as the sole locus of integration, reference, memory and imagination. "I am what is around me," argues Wallace Stevens. "I am the space where I am," establishes Noel Arnaud, and finally, "I am my world," Ludwig Wittgenstein concludes.

In his important book *Art As Experience*, first published in 1934, John Dewey points out the significance of the sensory interplay and exchange: "Qualities of sense, those of touch and taste as well as of sight and hearing, have aesthetic quality. But they have it not in isolation but in their connections: as interacting, not as simple and separate entities. Nor are connections limited to their own kind [...] colors to colors, sounds with sounds [...] The eye, ear and whatever, is only the channel through which the total response takes place [...] In seeing a picture, it is not true that visual qualities are as such, or consciously, central, and other qualities arranged about them in an accessory or associated fashion. Nothing could be further from the truth [...] When we perceive, by means of the eyes as causal aids, the liquidity of water, the coldness of ice, the solidity of rocks, the bareness of trees in winter, it is cer-

"Once words came to dominate flesh and matter, which were previously innocent, all we have left is to dream of the paradisiacal times in which the body was free and could run and enjoy sensations at leisure. If a revolt is to come, it will have to come from the five senses!"

Michel Serres

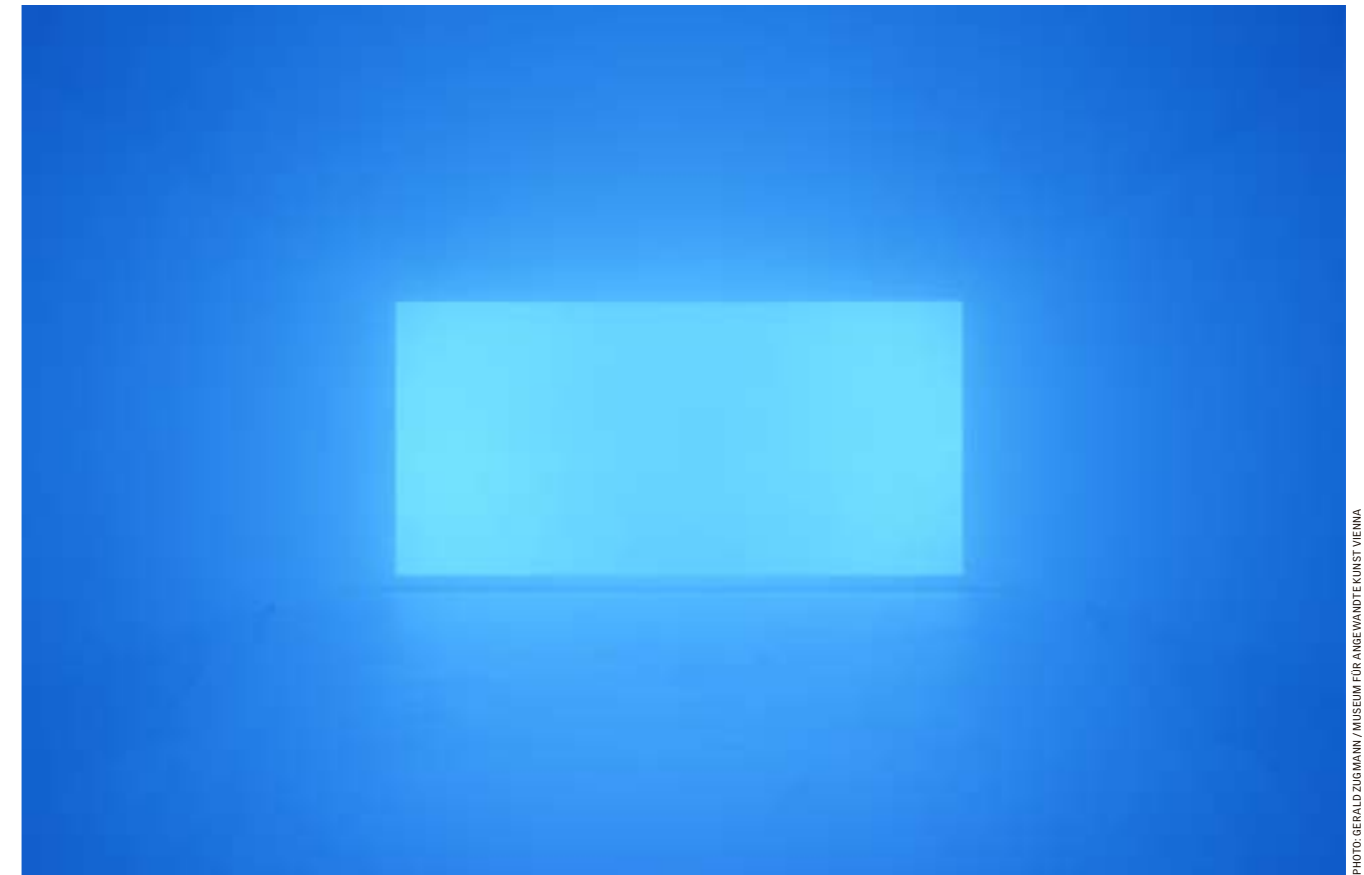


PHOTO: GERALD ZUGMANN / MUSEUM FÜR ANGEWANDTE KUNST, WIENNA

tain that other qualities than those of the eye are conspicuous and controlling in perception."

Also Merleau-Ponty points out the essential integration of the sensory realms: "My perception is not a sum of visual, tactile and audible givens: I perceive in a total way with my whole being; I grasp a unique structure of the thing, a unique way of being, which speaks to all my senses at once." Gaston Bachelard calls this fused sensory interaction "the polyphony of the senses".

Synaesthesia, the transference of stimuli from one sense modality to another, such as seeing music as colours, or vice versa, is regarded as an exceptional capacity, but in fact, our senses collaborate normally and inform each other. Most

important of these sensory interactions are the haptic sensations in vision. As we look at a surface of a material, we immediately sense its weight, density, temperature and moistness. Tactility can be regarded as the unconsciousness of vision, and without these sensory interchanges our visual world would be lifeless, a mere picture, instead of projecting a sense of lived and continuous world. It is evident that the coherence and permanence of the lived world arises from sensory interaction and embodied memory rather than merely visual perceptions.

THE TACTILITY OF LIGHT

Human skin has actually maintained the capacity to sense and identify light and colour, and these normally suppressed

Luis Barragán: Casa Gilardi, 1975–77. In his buildings Luis Barragán manages to almost materialize light using coloured glass or reflections onto coloured walls. Juhani Pallasmaa describes this light as a 'coloured liquid' melting spatial contours. In this example the effect is intensified by the water basin placed below the panel.



PHOTO: KIM ZWARTS

sensory functions seem to be activated in case of lost or weakened eyesight. We are not usually aware of the strong haptic and embodied ingredient in our normal visual perceptions. However, when night falls, the world or the space that we are in does not disappear; it continues to exist experientially with unweakened authority although we do not see it at all. As we recall a place or space, it appears in its full spatial, embodied and multisensory essence, not as a mere retinal picture. No doubt, the entire body sees and collaborates with the eyes.

Confirming the philosophers' assumptions, today's research in the neurosciences provides swiftly increasing information on the extraordinary interconnectedness and interactions of the various sensory areas of the brain. The unexpected flexibility of the sensory system has become especially evident in studies of the capabilities of the blind. "The world of the blind, of the blinded, it seems, can be especially rich in such in-between states – the intersensory, the metamodal – states for which we have no common language," argues Oliver Sachs.

Although architecture has been, and continues to be regarded primarily as a visual discipline, spaces, places and buildings are encountered as multi-sensory experiences. Instead of seeing a building merely as a visual image, we confront it with all our senses at once, and we live it as part of our world, not as an object outside ourselves. The building occupies the same 'flesh of the world' as our bodies. Every building has its auditive, haptic, olfactory and even gustatory qualities that give the visual perception its sense of fullness and life in the same way that a masterful painting projects sensations of full sensual life.

James Turrell, the light artist, speaks about "the thingness of light": "I basically make spaces that capture light and hold it for your physical sensing [...] It is [...] a realisation that the eyes touch, that the eyes feel. And when the eyes are open and you allow for this sensation, touch goes out of the eyes like feel." In his view, normal illumination levels today are so high that the pupil contracts. "Obviously we are not made for that light, we are made for twilight. Now what that means is that it is not until very low levels of light that our pupil dilates. When it does dilate, we actually begin to feel light, almost like touch."

James Carpenter, another light artist, makes a similar claim about the tactility of light: "There is a tactility to something,

Prof. Juhani Pallasmaa (b. 1936), Architect SAFA, Hon. FAIA, has practised architecture since the early 1960s and established his own office Juhani Pallasmaa Architects in Helsinki in 1983. He has taught and lectured widely in Europe, North and South America, Africa and Asia, and published books and numerous essays on the philosophy and critique of architecture and the arts in twenty five languages. Juhani Pallasmaa has held positions as Professor and Dean at the Helsinki University of Technology (1991–97) and Director of the Museum of Finnish Architecture (1978–83) In 1999, he was awarded the International Union of Architects' Award for Architectural Criticism.

which is immaterial, that I find rather extraordinary. With light you are dealing with a purely electromagnetic wavelength coming in through the retina, yet it is tactile. But it is not a tactility that fundamentally involves something that you can pick up or hold on to [...] Your eye tends to interpret light and bring to it some sort of substance, which, in reality, is not there."

Light tends to be experientially and emotionally absent until it is contained by space, concretised by matter that it illuminates, or turned into a substance or coloured air through mediating matter, such as fog, mist, smoke, rain, snow, or frost. "Sun never knows how large it is until it hits the side of a building or shines inside a room," Louis Kahn says poetically.

The emotive impact of light is highly intensified when it is perceived as an imaginary substance. Alvar Aalto's lighting arrangements frequently reflect light from a curved white surface and the chiaroscuro of the rounded surfaces give light an experiential plasticity, materiality, and heightened presence. Even pleasurable light fixtures, such as those of Poul Henningsen and Alvar Aalto, articulate and mould light, as if slowing down the speed of light.

The narrow roofslits of Tadao Ando and Peter Zumthor force light into thin directional sheets that contrast with the relatively dark spaces around. In Louis Barragán's buildings, such as the Chapel for the Capuchinas Sacramentarias, light turns into a warm coloured liquid that even suggests sonorous qualities that can almost be heard as an imaginary humming sound – the architect himself writes about "the interior placid murmur of silence". The coloured windows of the Henry Matisse Chapel in Vence and many of James Turrell's light works similarly turn light into coloured air that invokes delicate sensations of skin contact, that feels like being submerged in a transparent substance.

We have simultaneously two domiciles: the world of culture, ideas and intentions, and the physical world of matter and sensory experience. The mental world and the physical world constitute a continuum, an existential singularity. It is the profound task of architecture to "make visible how the world touches us", as Merleau-Ponty writes of the paintings of Paul Cézanne. Of all the materials and means to express this touching of the world, light is the most emotive and sensuous; light and shadow can communicate melancholy and sorrow, as well as joy and ecstasy.

The natural gift of daylight put to practice in architecture

THE UNCONSCIOUS AND THE LIGHT

The works of Philippe Rahm



By Federico Nicolao

In his designs and installations, Swiss architect Philippe Rahm explores the relationship between architectural space, physical phenomena and the human physique. He decreases the oxygen content of inhaled air and exposes observers to extreme brightness in order to induce an intoxicated state in them; he organises buildings into "climate zones" instead of according to functional aspects and he designs apparatuses that turn day into night and winter into summer. With his work on the basis of perception, he has opened up to himself and others a new way of looking at the apparently deadlocked basics of architecture.

Previous and left: Diurnisme, Installation in the Musée National d'Art Moderne – Centre Pompidou, Paris 2007. In this installation Philippe Rahm literally turns day into night: fluorescent lamps emit an orange-yellow light with wave lengths above 570 nanometers, which switches the inner circadian clock to 'sleep'. The room lives through its inner contradiction: the color of the light corresponds to the light found at night while the intensity of the light is that of natural daylight.

When the usual classification of a very unusual work or author becomes problematic, the inherent ability to comprehensively capture content and Zeitgeist disappears. In this moment of emptiness that is created, this notional vacuum, the thing that remains most important is that details exceed their limits and become a symbol of the whole. The work and the artist fade into the background in order to release something more existential that enlivens culture in its entirety. This often manifests itself in a connection in which genres, categories and classifications lose their meaning gradually – due to apparently marginal phenomena and almost always imperceptibly into hidden areas, where the unusual takes command and opens up entire epochs to new experiences.

Philippe Rahm is a contemporary artist who is difficult to classify: as an advocate of free self-determination, he obviously follows his own exceptions to the rule, works with great creative enthusiasm in extremely diverse fields and is consequently controversial amongst all those who advocate a separation and classification of the arts.

Many see Philippe Rahm as an architect, others as an artist and yet others as a theoretician. This is certainly not a rare phenomenon, since many authors have had a similar fate: once a definitive creative force in a certain field has been acknowledged, he or she can only skate on thin ice in other fields and is regarded with scepticism. For example, "He is not a film-maker, he is an author" was the judgement passed on Alain Robbe Grillet by film experts, so that this brilliant author, who is indeed well known to a selected audience, found his calling in literature. For many years, Philippe Rahm has attempted with commitment and obsession to strengthen his own position in architecture, although many people hold it to be indefinable. The most interesting points for us are Rahm's insistence in resisting stereotypic forms of architecture, and the reaction of the architectural world to his interdisciplinary approaches in theory and practice. As a starting point for this analysis, we shall take Rahm's understanding of light, which appears in several of his most recent works.

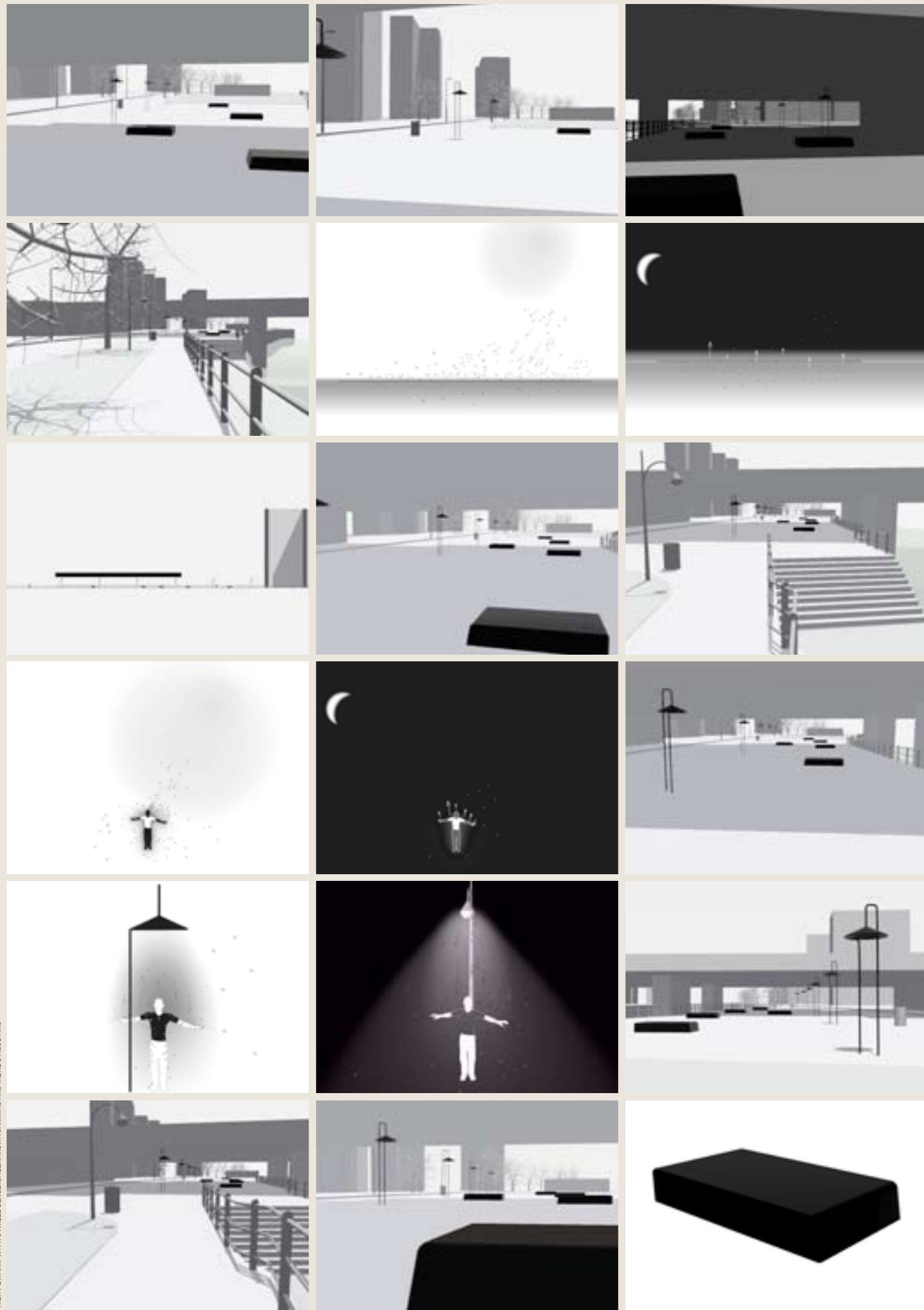
The limits of the apparent and the beginning of the unconscious.

We can only perceive a building as exactly as our partial reconstruction of its mental and physical spaces allows us to. To accept and demonstrate this should be the main function of architecture, in order to reveal the random size of space and limits. What does this aporia mean for the buildings, artistic installations and studies by this young Swiss architect? Does it make him reach his limits? Rahm's name is inevitably linked with the renewal and further development of architectural rules and laws, which consequently cease to be targets and become rather a mysterious starting point.

The potential of a room can never be captured by the eye alone, neither by real perception of its dimensions nor through imagination that conjures up a world as a result of the architect's work.

Perception of that which is visible is generally considered to be a predominant factor in architecture and can certainly be of assistance in an understanding of the fundamental roles of emptiness and fullness. On the other hand, restricting everything

FOTO: ADAM RZEPKA/CENTRE POMPIDOU



PHILIPPE RAHM WITH CYRILLE BERGER, ALEXANDRA GANNAS AND IRENE D'AGOSTINO

Left: Jour Noir, Project for the streets Szopy and Kamienna, Gdansk 2006. As in 'Diurnisme' Philippe Rahm turns day into night. Street 'lamps' with over-large shades cooled to a temperature of almost 0°C emanate invisible electromagnetic waves with similar properties to that of the night sky. At the same time the difference in temperature draws off body heat and creates a 'sensation of night-time' which is perceived with all of the senses.

Next spread: Ghost, exhibition installation in the Frac Centre, Orléans, 2005. In this exhibition installation Philippe Rahm plays with the different visibility of objects contingent upon different colors of light. The concept was based on an idea of Philippe Rahm for an apartment in which three rooms partly interpenetrate each other and only become visible (and usable) within a narrowly defined spectrum of light.

Page 22: Eternal Spring, 2005 (Philippe Rahm with Michael Terman, Stephen Fairhurst and M. Raynault). With this installation, created in 2005, Philippe Rahm designed an artificial season or rather a day - May 15th - which was continually repeated over several months. The spotlights were programmed so that the daily duration and intensity of light corresponded exactly to the average amount of sunshine on that specific spring day.

The exhibition began on March 12; visitors were able to observe how plants placed under the spotlights began developing buds and leaves earlier than conspecific plants outside the exhibition.

exclusively to things that are visible leads to an undermining of the identity and a loss of sensual perception in architecture. Architecture can no longer be, indeed never could be, content with being identified only with its immediate and obvious side; what is more important, is to define architecture anew and appeal to its origins and basic principles. Is this perhaps the thing about Rahm's work that is disturbing to traditional architectural thinking?

The foundations of this specialist field are re-worked on a regular basis, whether due to basic realisations, adventurous impulses or necessary changes in the assessment of the way a person can experience and mentally discover a space. Often, crossing the boundaries of recognised rules causes a look back at the creative origins of a discipline.

"The king is naked": Rahm's work emphasises in an astounding way that the direct and central meaning of factors like temperature, humidity and light are still not, in practice, taken into account sufficiently in architecture, although every style of architecture has been oriented around these parameters since ancient times. These aspects are con-

sidered more to be technical details than important architectural basics - or at least that is what the architecture of today lets us assume from the way it is put to use. If, however, we apply ourselves to the utopia of trying to analyse these factors, they quickly become the chief subject of thought and prove to be essential criteria.

Architecture that returns to these basics and in this way supplies new impetus for the way architectural studies are organised, would affect people's lives immediately and decisively. However, theoreticians and practitioners in the field of architecture seldom occupy themselves with these criteria as such, and these subjects are almost never a constituent part of technical architectural studies. But why not turn the clock back and inspire the students of today to take specific analysis of these factors as a starting point for their work? Convinced that this is the right approach, Philippe Rahm the lecturer encourages his pupils to explore the paradox in creative nature of that which is real and the mysterious relationship between that which is visible and the subconscious.

His initial theory is that practically eve-

rything that affects the concrete experience of a room can be depicted in a propagandistic study, but that the existential essence of everything that is not immediately apparent in architecture can never really be captured. Is it possible that the necessary fields of research will at last develop in architecture as a result of this - not least thanks to Philippe Rahm - in order to renew this discipline slowly but surely from within? Will the fact that every architect ought, in future, to turn his attention from a general analysis of a building and its environment and instead occupy himself with the conditions of its existence, lead to the development of new utopian and provoking ideas, behind which continue to be hidden concrete thoughts about space, which are only suited for our own times?

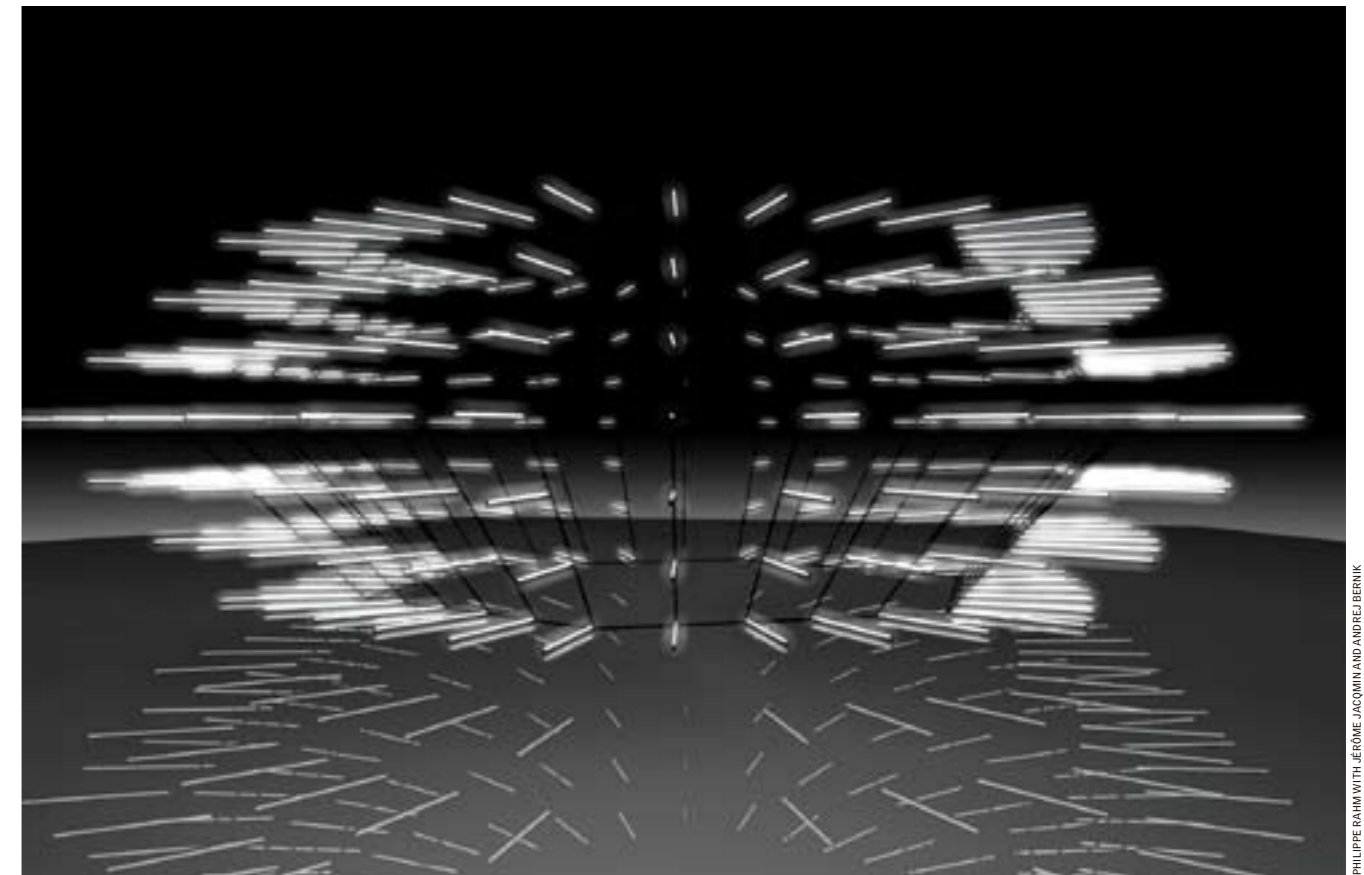
Day into night and night into day: Philippe Rahm and light

The invention of electrical light in the 19th century led to a complete change in the way space was perceived, since towns began to be illuminated at night. Like enduring day, the light penetrated into every corner, boule-





PHOTO: MARC DOMAGE/TUTTI



PHILIPPE RAHM WITH JÉRÔME JACQUIN AND ANDRÉ BERNIK

wards were created and the concept of work and time changed in the 20th century with the consequences of which we are all aware. "Around the clock" became the motto of our times. Even if we do not attribute much importance to it, it is still enough to change radically not only our habits but also the functions and principles of architecture. The opening up of certain spaces, a change in the way we use other spaces, the precise use of materials, the conception of completely new places – we have the use of light to thank entirely for all this, as Rahm emphasises.

As a development on his reflections about modern times and the possible effects of artificial control over light sources, Philippe Rahm created a hall in the Centre Georges Pompidou with ironic provocation and true pioneering spirit: the installation *Diurnisme* plunges visitors into artificial night during the hours of broad daylight, generating an atmosphere that makes them feel sleepy.

Rahm's town planning project *Jour noir* (*Vers un diambulisme*) in Szopy and Kamienna streets in Gdansk (Poland) sets innovative new standards for the architecture of the

future by apparently making day into night with the help of special electromagnetic rays. Here, Rahm propagates concentration on the effect of light, not as an architectural symbol or design tool, but rather in order to overcome the limitations of time.

How can light be used as a limiting factor – not in the sense of spatial limitation, but by opening and closing a room, not as a secondary phenomenon, but as an endless and enduring point of entry and escape?

Light, whether natural or artificial, permeates a place and changes its shape, density, purpose and structure – its life. It would, consequently, be an unforgivable error to rely on first impressions. Several of Rahm's recent works have been groundbreaking in the growing awareness that light does not only affect architecture in a purely visual sense.

Apparently coincidentally and often unnoticed, Rahm redefines artificial light in an almost provocative way, in order to overcome the limitations of our visual capacities, which are by nature restricted. In architecture, emptiness can be used to create a world within a world; a minimal change is

sufficient to create a different space inside a space, to create what is to some extent an irreversible transformation, to develop a new and different feeling for the space. Since the very first beginnings of architecture, whether passed on by word or mouth or in written documents, we have a tendency to make all transient, intangible phenomena excessively abstract, although these are without doubt absolutely decisive in the concrete, absolute discovery and experience of a space.

**Crossing borders:
a new perspective of architecture**

So why is it so difficult to describe Philippe Rahm's works? Why should we not simply see them as architectural art?

The physical experience provided by the spaces he creates cannot be reproduced adequately with either photography or drawings – a criterion that should apply to every form of architecture. However, if we concentrate exclusively on Rahm's understanding of light, we are at risk of banalising a direct encounter with his works, which, when observed immediately are difficult to

Previous: The medium is the message, Luxemburg 2007. Here Philippe Rahm focuses on the specificity of borders: in peep-shows the beholder is usually separated from the object of his desire by a pane of glass. Rahm suggests replacing this by a permeable barrier of light, which would satisfy both the need to see while also blocking the production of melatonin in the brain, which in turn boosts libido.

Opposite: 18 Diurnes for the piano (after John Field), 2007. The Irishman John Field (1782-1837) is considered to be the 'inventor' of nocturnes, a musical genre which was later perfected by Frédéric Chopin. For 'Diurnisme' (pp. 14-16) Philippe Rahm used an inversion of the score of Field's 'Nocturnes' as background music.

describe and have a lively and mysterious effect. Is it not initially our ability to see, our vision, that has doubt cast on it as we observe Rahm's works?

Thorough analyses of phenomena such as humidity and light in the history of architecture could and certainly would prove that many houses, urban districts and sometimes even whole towns could look entirely different today and that the fate of entire countries or the Zeitgeist could have been influenced. Temperature, too, has always affected the form of human habitation, and also creates new routes and opens up surprising possibilities again and again. But how can we determine how far architecture can be defined using factors of this kind without neglecting the aspect of the visible and at the same time bringing up new questions and developmental ideas?

Philippe Rahm is committed with passion, but at the same time with apparent naivety, leisure, lightness and irony, to the exploration of spaces, whereby in contrast to many of his colleagues, he insists on not allowing himself to be limited by general principles that might irretrievably freeze and constrain his creativity and work.

The idea that the factors light, humidity and temperature might be used differently has convinced Rahm that all innovative developments and demonstrable findings in this area can provide thought-provoking impulses for entirely new forms of building and solutions. Aspects of this kind that are currently only considered incidentally from a technical point of view, could, therefore, become determining factors in modern architecture. Rahm's apparently utopian research approach is actually a demand for new possibilities in the future.

Spatial utopias and a return to things concrete

But how can architecture, of all things, convey how much there is hidden, how much movement there is and how much that cannot be reduced to the theory that exists in every real approach? This question is still open and is certainly not easy to answer. Rahm's answers to this are not universal, but concern partial aspects; they are personal, well-founded and certainly capable of causing certain principles of architecture to waver.

The immediacy and speed of architectural studies that are based mainly on form and cut and consequently on the abstraction of space, have increasingly lost significance in the last few decades. Architecture should no longer expose itself exclusively to the judgement of the eye. It is now more important to move forward into unlimited areas of research in order to reinvent the way spaces are perceived – one of the greatest challenges for modern architecture.

Analysis of the unconscious (which, as ancient civilisations knew, does not only give things form and structure, but covers everything that gives them energy, temporality and transience) is Philippe Rahm's main concern. To meet this challenge with irony and intuition, however, also means emphasising – carefully, but no less importantly – that the interest declared by the international community of architects in fundamental innovation is all too often focussed on usefulness and is frequently subject to temporary fashions.

Aspects of this kind that are not only important for the planning process but also for our life, but which many like to reduce simply to politically correct content,

are abruptly made into central themes in Rahm's works – and staged with irony. He approaches them in a certain literary, sometimes even a seemingly utopian way, but by doing exactly this, he lets them achieve their absolutely realistic effect. It is, therefore, by no means his aim to create an image of the city of the future that virtually inspires fear or terror, in which the use of light which Rahm sees simply as provocation (with all its consequences) is actually manifested.

Federico Nicolao, writer and philosopher, was born in 1970 in Genoa and divides his time between Paris and in Italy. He was Programme Director of the Museum of Modern Art in the City of Paris in 2004 and at the Picasso Museum in Antibes in 2005. As exhibition curator and moderator, he has worked with numerous international institutions, among others the Marc Chagall National Museum in Nice, The Academy of Schloss Solitude in Stuttgart, the CCA in Japanese Kitakyushu and the Centre international d'art et du paysage in Vassivière. He runs the magazine "Chorus una costellazione", which he founded, and translates many authors into Italian.

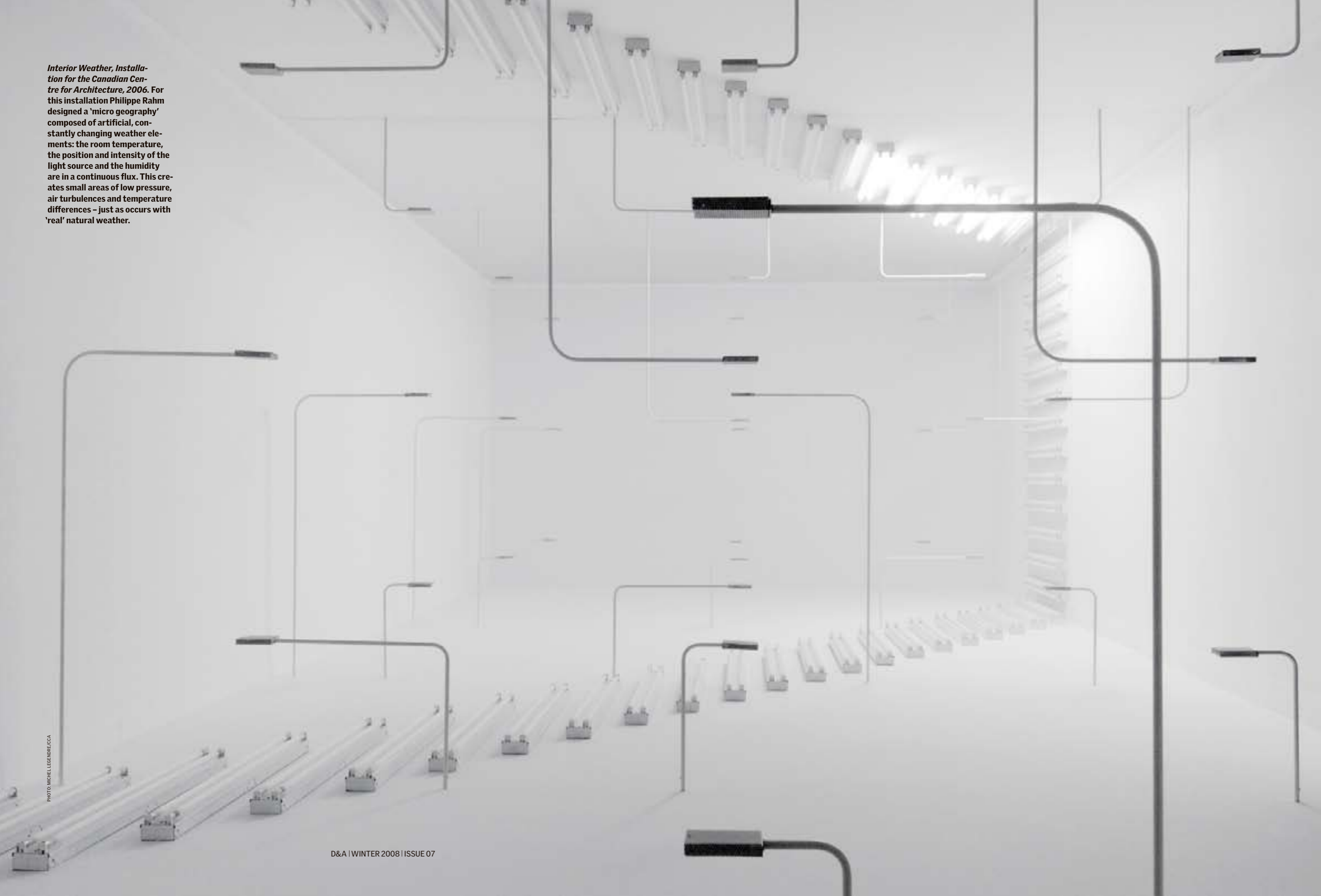
18 Diurnes for the piano

Philippe Rahm
after John Field



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Interior Weather, Installation for the Canadian Centre for Architecture, 2006. For this installation Philippe Rahm designed a 'micro geography' composed of artificial, constantly changing weather elements: the room temperature, the position and intensity of the light source and the humidity are in a continuous flux. This creates small areas of low pressure, air turbulences and temperature differences - just as occurs with 'real' natural weather.



45°26'N, 12°19'E
2006

Camera Obscura Image of
Santa Maria della Salute in Palazzo bedroom.
Venice, Italy

Photography: Abelardo Morell
www.abelardomorell.net

Simply put, a camera obscura is a room of any size that is made totally dark, except for a small opening to the outside.

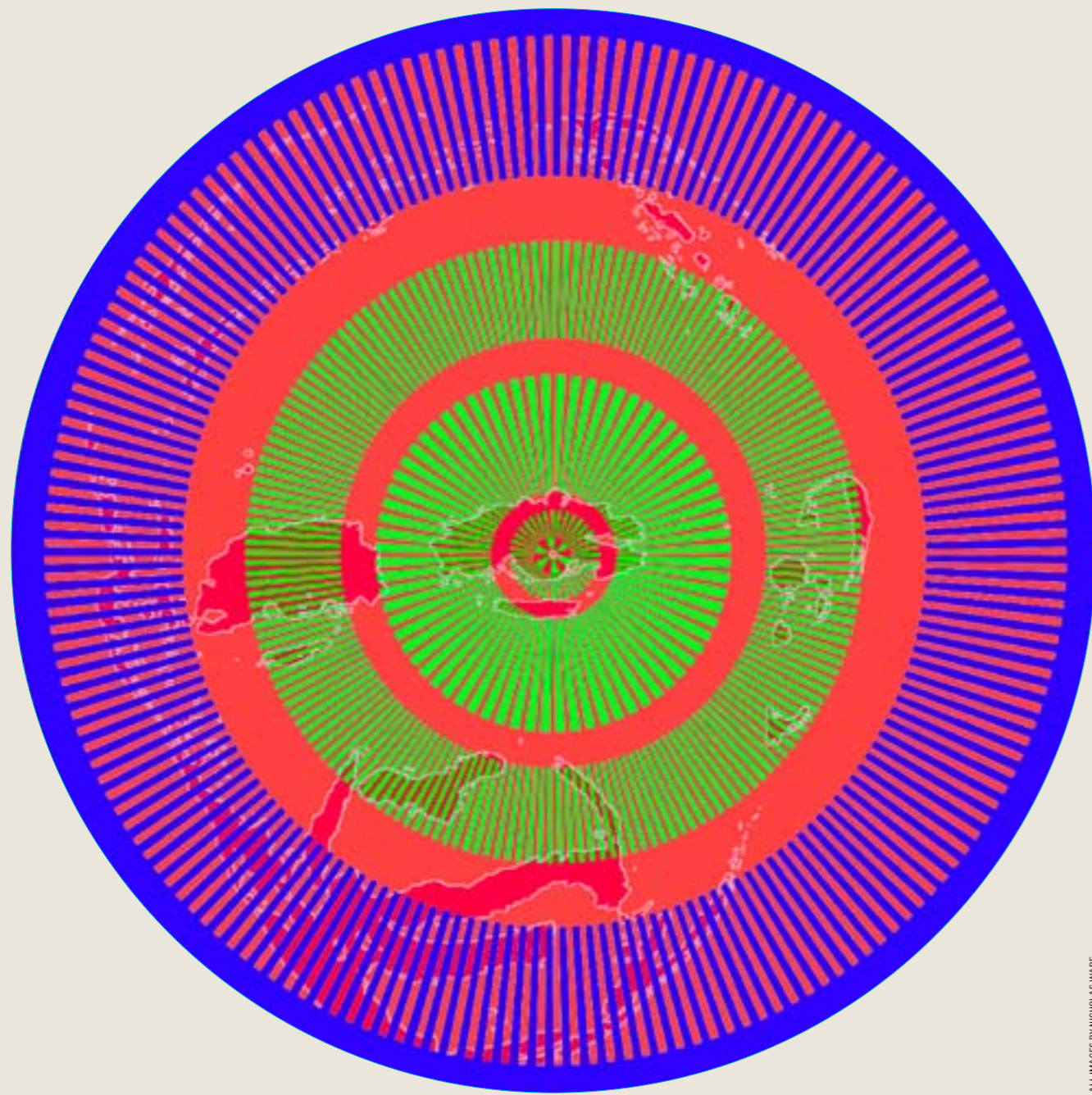
The tiny amount of light entering the enclosed space produces an upside down image of the exterior world on the walls of the room.

The smaller the aperture, the dimmer but more sharply focused the image will appear. A larger opening will produce a brighter but less sharply rendered image.

Abelardo Morell



WINDOWS ON THE WORLD



ALL IMAGES BY NICHOLAS WADE

By Nicholas Wade

Are our eyes 'windows' to the external world? Do they send out rays which make us see the objects around us? And why does the combination of two separate pictures in our brain give us a three-dimensional image? For centuries researchers have puzzled over the way our sense of sight functions, and even in times of modern neuroscience some of the questions they raised continue to be topical.

WHEN LEONARDO DA VINCI described the eye as the "window of the soul" he knew little about how spiritual illumination took place. Indeed, he did not appreciate how the eye itself operated optically—as is evident in some of Leonardo's drawings. Despite having compared the eye with a camera obscura, he made a second inversion and reversal of the rays so that the image, like our vision, was upright. Leonardo was confused by two aspects of vision, and his confusion pervades many of our contemporary ideas: he thought that seeing takes place in the eye rather than in the brain. Light passes through the transparent parts of the eye, as it does through the glass of a window or the lens of a camera, and falls upon the retina. The crystalline lens of the eye focuses light as does the glass lens of a camera, but the surfaces upon which the focussed images fall are radically different. The retina is a dynamic and complex biological structure whereas the film (or light sensitive array in a digital camera) is static and simple. Light transforms the chemical composition of rod and cone receptors so that the ionic balance of the subsequent structures is changed, resulting in a nerve impulse that passes along the optic nerve towards the brain¹. There is no shutter in the eye: it operates dynamically and continuously rather than with sequential time slices. The image in a camera requires processing (either chemically or electronically) before the image can be seen, but it still requires the eye to see it.

We now know quite a lot about how the receptors in the eye function, and this knowledge has been derived from elegant studies of the electrical activity in the visual pathways. For example, Ragnar Granit (who received the Nobel Prize in 1967) was able to show that there are three different types of cone receptors, sensitive to the short, middle, and long wavelength regions of the visible spectrum. However, the eyes do not see but transmit the neural signals to the brain for further processing. We also understand more about visual cortical processing from the use of similar techniques measuring the electrical activity of single nerve cells. David Hubel and Torsten Wiesel were the pioneers of such recording and they received the Nobel Prize in 1981. They were able to show that single cells respond to simple patterns of light falling on the retina—like lines in specific orientations and moving in particular directions. It is as though the complex patterns of light falling on the retina are broken down into simple line elements or features for processing in the brain².

When the magazine is tilted backwards and forwards, an apparent wave movement is produced in the picture on the left. Semir Zeki, one of the pioneers of visual neurosciences, has investigated how the human brain reacts to these Moiré effects (and to other properties of patterns, such as colour, movement and direction). Zeki's portrait is left as a silhouette in the picture.

LOOKING INTO THE BRAIN: THE METHODS OF NEUROSCIENCE

The arsenal of neuroscience has been extended since the days of recording from single cells in anaesthetised animals. More sophisticated techniques for recording the electrical changes from the surface of the scalp, reflecting the activity of many brain cells, have been developed. Several novel methods of neural imaging have been developed, like positron emission tomography (PET scans) and magnetic resonance imaging (MRI). Both rely on computerised tomography which converts small signals from a range of positions into a model of the brain; the images can subsequently be sliced and rotated. They measure activity in the brain and they have proved helpful clinically because the location of lesions or tumours in the brain can be made with greater accuracy. They can also be employed to correlate activity in a variety of brain sites with perception and cognition. The computer manipulated images can be coloured to signify the regions in which activity has been strongest. Because short-lived, radioactively labelled substances are needed for PET scans, there are limits to the measures that can be taken from one person. These constraints do not apply to MRI measures; the subject is placed in a strong magnetic field that aligns atomic particles in the brain cells. Bombarding them with radio waves results in them producing signals, which differ according to tissue type, that can be detected. Functional MRI (fMRI) measures are much more useful for perceptual research, as they are concerned with differences in MRI measured in control and experimental conditions. Cells that are active under the experimental conditions utilise more oxygen and can be detected and imaged. The techniques are being applied to studying a variety of perceptual processes.

An alternative strategy to recording brain activity is to disrupt it in some way. This is achieved with transcranial magnetic stimulation (TMS). A magnetic coil is positioned over a particular area of an observer's head (usually defined by prior MRI measures) and a current is briefly passed through the coil. The magnetic field so produced induces an electrical current in a specific part of the brain. The timing of such TMS is very precise, so it can be applied at known intervals after some visual stimulation has taken place. It is as if the technique produced virtual patients because the disruption is temporary.

All the techniques mentioned have virtues and drawbacks, typically depending on their ability to resolve neural activity in space and time. Magnetoencephalography (MEG) and event related potentials (ERPs) measure events in time very well, but it is difficult to determine precisely where in the brain the signals originated. PET scans and fMRI have the opposite problems; their spatial resolution is good (they can localise areas of activity within the brain) but their temporal resolution is poor (they require long periods, seconds or minutes, to obtain their measures). TMS has good temporal resolution for its application but it can be difficult to determine the spatial localisation; brain currents induced in one area might extend beyond the desired brain location.

great artists returned to the science of optics – particularly that of the Greek mathematician Euclid, writing around 300 BC. Euclid's *Optics* were both physical and psychological; the rays in his diagrams represented not only light but also sight. He described visual space in terms of visual angles, so that the perception of space was analysed geometrically. The visual angle of an object decreases with increased distance from the eye; conversely objects of different sizes (like the letters in the figure) can subtend the same angle at the eye. According to Euclid, all the letters in the drawing below, and the arrow, would appear the same size. However, Euclid had little knowledge about how the eye functioned. Indeed, he accepted the then received view that light is emitted from the eye rather than received by it. After all,

the Natural Objects". In other words, the allusion to relief or depth in a painting of a scene, no matter how well it is painted, will be different from the perceived depth separating the actual objects in the scene. The clue to this distinction was grasped by Leonardo but the solution eluded him. The clue was that we view scenes with two eyes but a perspective painting captures visual angles from a single station point. Leonardo struggled long and hard with the contrast between monocular and binocular vision.

came to the same conclusion that he could not depict correctly on canvas everything he saw with two eyes. He was unable, in the terminology of virtual reality, to simulate what he saw with two eyes. Alberti's procedures (for conveying visual angles to a picture plane) simulate the monocular visual world on a canvas, but not that of the binocular visual world.

It is an irony of history that one who saw the future more clearly than his contemporaries was constrained by the past. In his binocular studies Leonardo employed a sphere – the object that Euclid had used in his cursory discussions of vision with two eyes. Over three hundred years later, Charles Wheatstone wrote "Had Leonardo da Vinci taken, instead of a sphere, a less simple figure for the purpose of his illustration, a cube

'ALBERTI'S WINDOW' AND THREE-DIMENSIONAL VISION

He was able to utilise the concept of Alberti's window which provided a monocular match between a picture and a view



FROM EUCLID TO LEONARDO:
THE DISCOVERY OF PERSPECTIVE

Returning to Leonardo, he distinguished between natural and artificial perspective – between perception and pictorial representation. This distinction had been made before him by Piero della Francesca. Unlike Leonardo, Piero did not concern himself with the eye and perception, but with pictures and perspective. He pursued perspective with mathematical precision and his paintings captured spaces which can be reconstructed in three dimensions³.

Both Piero and Leonardo addressed issues that are fundamental to the representation of space in vision, art, and architecture. How can three dimensions be compressed to two? Both

we cease to see when we close our eyes, preventing the light from leaving them! Thus the arrow did not penetrate the eye but was projected from it.

Euclid's optics defined the principles of linear perspective, and there is little wonder that his work was so eagerly consumed by Piero and Leonardo. However, Leonardo appreciated that natural perspective (perception) differed from artificial (linear) perspective. Our perception does not follow the visual angle: objects do not appear to shrink as they recede from us. He encompassed this in his famous statement "A Painting, though conducted with the greatest Art and finished to the last Perfection, both with regard to its Contours, its Lights, its Shadows and its Colours, can never show a *Relievo* equal to that of

of a scene from a single point. But what happens when two viewpoints are adopted? Leonardo examined this many times in the context of a small object lying in front of a background. He returned to the issue repeatedly as indicated by the many diagrams he made of it. In each instance, vision with two eyes was optically and phenomenally different from that with one. The example he used, of viewing a sphere with a diameter less than the distance separating the eyes, reflected one condition Euclid analysed, but Leonardo added the characteristic of seeing the whole background⁴.

Leonardo was addressing an issue at the heart of the very modern concern with virtual reality (creating an imitation of the visual world). Every time Leonardo returned to the struggle, he

for instance, he would not only have observed that the object obscured from each eye a different part of the more distant field of view, but the fact would also perhaps have forced itself upon his attention, that this object itself presented a different appearance to each eye. He failed to do this, and no subsequent writer within my knowledge has supplied the omission". In 1838, Wheatstone himself supplied the omission with the invention of the stereoscope, an instrument that permits presentation of slightly different figures to each eye independently. If the figures have the characteristics of the left and right eye views of an object, then the impression obtained is of a solid or three-dimensional figure rather than a flat one. There are several ways in which this can be achieved optically. Wheatstone's

1. Piero della Francesca (ca. 1412–1492) was a mathematician as well as an authority on linear perspective. He developed the distance method, shown here, for defining the dimensions of a tiled surface painted in perspective.

2. Charles Wheatstone (1802–1875) invented the stereoscope in the early 1830s and published his account of it in 1838. It consisted of two mirrors, each at 45° to the line of sight, so that slightly different drawings (with horizontal disparities) could be placed on the side panels. A single object (like the truncated pyramid) would be seen in depth.

3. Diagrams of viewing a small sphere with two eyes taken from Leonardo's Notebooks. These have been reproduced in ref 4. When the sphere has a diameter smaller than the interocular separation then the whole of the background can be seen when two eyes are used.

4. Leon Battista Alberti (1404–1472) formalised the principles of linear perspective in his book *On painting* published in 1435. He also suggested a method of capturing visual angles by looking at a scene with a fixed eye through a window: the contours can be traced on the glass.

Previous The arrow in the eye has been used as a metaphor for both perspective and vision. It is based on Euclid's analysis of light and sight in terms of visual angles.

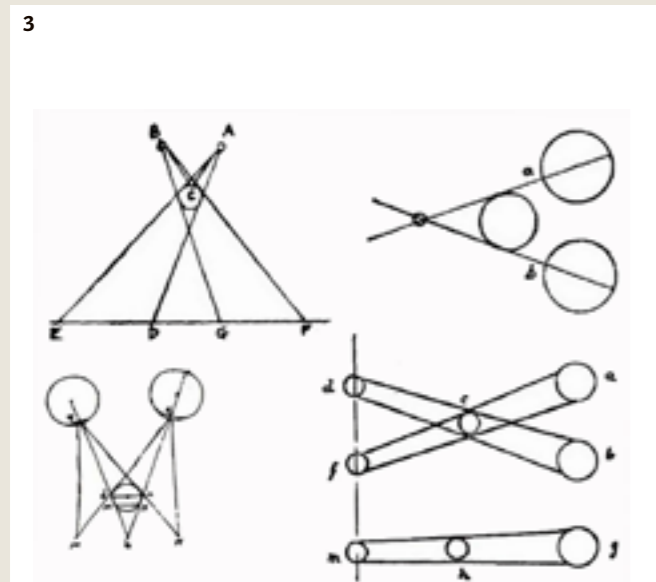
Ragnar Granit (1900–1991) developed the microelectrode for measuring the electrical discharges from single cells in the retina. He was able to record activity associated with the three different cone types – sensitive to short, middle, and long wavelengths.



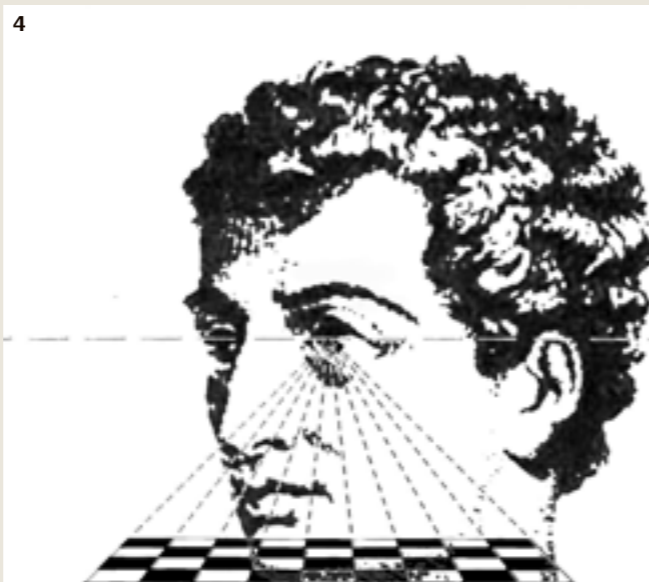
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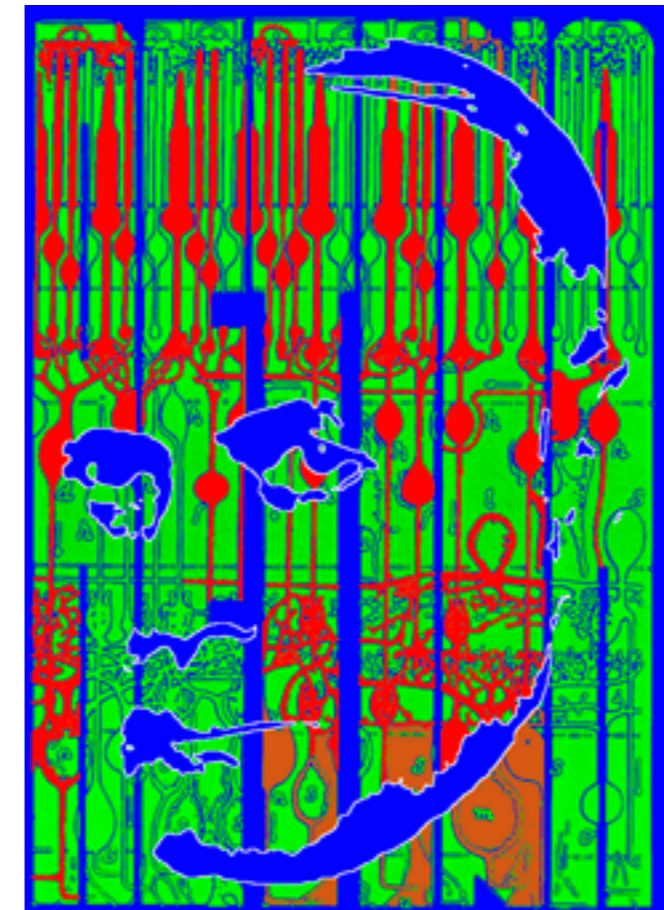
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4



stereoscope consisted of two plane mirrors, at right angles to one another, that reflect figures mounted appropriately on the side arms⁵.

With his invention of the stereoscope, Wheatstone was able to match binocular incoming messages and create a virtual reality that can be considered as satisfying Leonardo's desire to imitate nature binocularly. Wheatstone was also able to enlist photography to facilitate capturing visual angles and to simulate seeing in three dimensions.

Leonardo's "window on the soul" was a singular view of the world, and one that generated frustration for him. Why did natural and artificial perspective differ? It was like trying to square the circle! The solution was a long time coming, but when it arrived it transformed our understanding of vision. Wheatstone changed not only our vision of pictures, but also our picture of vision. He established depth as a fundamental feature of binocular vision and he proposed that perception involved complex mental processes of inference. The visual angle is a useful device for thinking about the optical functioning of the eye, but it does not define what we see⁶. We now know a little more about how the two windows work together to yield a perception of the world that is anything but perspectival.

Nicholas Wade is Professor of Visual Psychology at the University of Dundee, Scotland. He received his BSc in Psychology from the University of Edinburgh and his PhD from Monash University, Australia. His research interests are three main topics. First, the representation of space and motion in human vision. Secondly, the history of research in visual science. Thirdly, the relationship between visual science and visual art. He has written 12 books and his artwork has been exhibited internationally.

¹ Nicholas J Wade: *A Natural History of Vision*. MIT Press Cambridge MA 1998. Nicholas J Wade: Image, eye, and retina. *Journal of the Optical Society of America A* 24 1229–1249 2007

² David H Hubel and Torsten N Wiesel: *Brain and Visual Perception*. Oxford University Press Oxford 2004

³ Judith V Field: *Piero della Francesca. A Mathematician's Art*. Yale University Press New Haven 2005

⁴ Nicholas J Wade, Hiroshi Ono, and Linda Lillakas: Leonardo da Vinci's struggles with representations of reality. *Leonardo* 34 231–235 2001

⁵ Nicholas J Wade: *Brewster and Wheatstone on Vision*. Academic Press London 1983

⁶ Nicholas J Wade: *Perception and Illusion. Historical Perspectives*. Springer New York 2005

LIGHT, SPACE AND ARCHITECTURE

Interview with Ahmet Gülgönen



PHOTO: WILKIN SPITTA / TRANSIT

Interview by Frédéric Nantois

There is little doubt that our perception of space, of light and shadow, depends on the culture we were raised in and the society that formed us. However, as the Turkish-French architect Ahmet Gülgönen explains, the opposite is also true: light and shadow define how we perceive, appropriate and inhabit space. "For me," he continues, "space and light are synonyms."

Opposite Light defines space, and only through light does a dark void become space: This basic phenomenon of perception is observed not only in architecture, but also in nature.

Mr. Gülgönen, the theme of our conversation will be the perception of space, of light and shadow and its cultural backgrounds.

To start with, I would like to clarify one important point. All the things I shall talk about concerning space are feelings we have developed all over the years. They are part of our conception of architecture, and we cannot separate practice from theory. I have been working with my wife Florence Gülgönen in my studio for 30 years. All our projects reflect our belief in architecture. Conceptual tools and theories are necessary for the spaces we create. But also, conversely, we have to re-create spaces in order to create and verify theories.

Next, I should clarify certain definitions. You said "the perception of space, light and shadow". I would like to suggest that we rephrase the theme a little: it could be the perception of space as light and shadow.

Are light and shadow different aspects of space, or is space light and shadow?

I believe that in order to find the meaning of any concept, we should consider the language of ordinary people, the way they feel and talk about things. People don't use the word "space"; that's a bit of architects' professional jargon. For example, imagine a marvellous place (Hagia Sophia in Istanbul or the Pantheon in Rome). When ordinary people walk into such places, they say "Oh! What beautiful light," they never say "what an extraordinary space". An architecture critic might say that.

The richness of these places lies in the unity of their structure of light, along with other qualities we perceive by means of light: surfaces, volumes, textures, and colours.

What I am trying to point out is that space is a very large and abstract concept. It is also difficult to define architectural space. For me, it is not the opposite of volume. It is not a void, and a void without light is not a black space. It is not sufficient to make a hole in the envelope of a void to turn it into space. It is the light coming in through the hole that turns the void into a space. Because the space is the light. To me, space and light are synonyms. The way light is seen is the way that space is perceived and felt. Of course, in the organization of a building there are other concepts like sequences, transitions, and many others. But even spatial sequences can be seen as sequences of light, and of transitions of light.

The other aspect, if we define space as light, is that space and light can be manipulated to create scenic effects, as happens in nightclubs, or for other decorative purposes. Decorative light is changeable and consumable, depending on the purposes it has to serve. But light as space has a relative permanency, which includes its cycles in the course of day and night and of the seasons. Real light is also a living thing. Because it lives, it changes hour by hour, depending on the atmospheric conditions. These changes condition human psychology and behaviour in their turn.

But here you are discussing natural light, whereas in building we often use artificial light.

There is no such thing as artificial light. We could call it fabricated light. The way it is fabricated it can be another dimension of light. For example there are transitions in space and there are transitions in light, and fabricated light can enforce these transitions. So this is another aspect of light. And

just as we don't say 'natural space', why should we say 'natural light'? I would rather use the terms 'outdoor space/outdoor light' and 'interior space/interior light'.

Is architecture fabricated space? Does light add a dimension to space?

For me architecture is existential. There is a difference between existential space and decorative or manipulated space. They have different cycles of change. Existential space is space which is part of people, of their lives, their existence; this is true for any culture. It is a part of the cosmological order and so is important for our world.

So for me, architecture is not fabricated space. To start with, space exists, as light exists. Human beings modify it, redefine it, create new outdoor/indoor relationships, and create private and collective parts of it with different densities of light.

How do 'ordinary people' perceive space, and light, how are space and light dealt with in everyday architecture?

At the existential level they are the same. A good building can be seen as a symphony. It has a structure, and a structure of light. Parts of it may be changeable and others permanent, and the fabricated light may add even more dimensions to it. Natural light is a living thing, and if we are attentive to this living force and use it creatively and serenely, we will be able to conceive spaces as light symphonies

In our western world, industry has a tendency to homogenise things. It provides the same brightness for everybody. Electric lamps have become quite similar in terms of the light they emit, as the lighting industry moves towards homogenisation. This is

Agence APRAH: Social housing on the Boulevard de Charonne, Paris. "Inner courtyards are transitional space, they capture and filter light, they provide a certain intimacy and a kind of density", says Ahmet Gülgönen. This process becomes visible in this housing project, which Gülgönen designed 1989 with his office Agence APRAH.

a kind of production which is easier to control, and advantageous on the financial side. Products are standardized, there are norms, more or less for everybody, all over the world, and I think this situation destroys architecture, since it reduces its diversity. However, it is also a result of our society, and therefore we should be careful. For me the role of contemporary architecture is to identify specifics, to keep diversities, and to find appropriate spaces with appropriate light. This applies on all scales, from architecture to urban spaces.

Do you see cultural differences in the way architecture enters into a dialogue with light?

Light is architecture, and architecture is light. There is an existential force, in the sense of dwelling. Dwelling is existential. Of course there are different communities at different economic levels, and their dwelling patterns vary. But if we ask the basic question: 'What is light, and what is space?' then we realize that we share the same light, appropriate part of it and redefine it. I don't use the word 'creation' for this process. If there is any creation in it, we can call it 're-creation'. I believe it is a cultural process, and I don't see architects as creators - they are re-creators of their societies' aspirations. Man needs shelter, and in that sense architecture mediates between our fragile skin, the roughness of the earth and the sky. Architecture is a kind of transition.

A building is a concrete object: it is constructed to create interior spaces and to re-qualify exterior spaces. There are two basic kinds of construction, one consists of massive walls and the other of post-and-lintel or frame systems. A wall is a structure made of



PHOTO: AGENCE APRAH

earth, brick or stone. In this kind of construction, the envelope or 'skin' of a building is part of the load-bearing structure. The post-and-lintel system is a structure related to wood, steel or concrete. In this system the skin, the envelope, can be independent of the load-bearing structure.

Within these two different concepts, we employ two different processes in order to

make an opening in the envelope. In massive construction, we are more or less struggling to control nature. First we 'close the box' to create a dark room or a void. Then a hole, an opening is made, just as large as we need it. This way of building is more defensive and results in more introverted spaces.

In the second case, we are more at one with nature, creating limits of space and

light. In this case the lightweight walls and panels (which carry only their own weight) serve as boundaries, filters or reflectors. The relationship between exterior and interior spaces can be more continuous, there is less of a break between the two.

So even in the construction phase there are two conceptions of light and of the symbolism related to light. They also correspond with two different cultural attitudes. Massive construction occurs more in countries where there are fewer trees and where the climate tends more towards extremes, as in the Mediterranean countries. Frame construction, on the other hand, is more prevalent in countries where wood is available, and where the climatic conditions vary less between day and night and between the seasons. Many cultural differences are related to these two ways of building. But as I said, these differences are existential. They can be observed in the architecture of ordinary man, in his houses and temples or churches.

A building has its limits. Architecture is defined by its limits, by its envelope or 'skin'. The skin protects and breathes at the same time, it is a filter and a mask between inside and outside. When you make a hole (small or large) in a wall (thick or thin), this hole has its own space; it is a space in its own right, independent of the thickness of the wall. It can be considered a transitional space, a place between inside and outside. One can sense this transition even over one millimetre or through a frame; it's a question of material quality. Here we are talking about density of transition and thickness of transition. Density can exist within a very small thickness. Even a paper screen (shoji) is already a transition element, it filters light, and belongs to the interior and exterior at the same time.

One thing we should not forget is that people live together. They share walls, spaces and light. The way they share them varies from one culture to another. And this makes architecture and cities different from each other. Consider, for example, a house with a courtyard, as in Mediterranean countries. A courtyard is a transitional space, it captures and filters light, it provides a certain intimacy and a kind of density. A transitional space is thus the place where light and shadow meet and coexist.

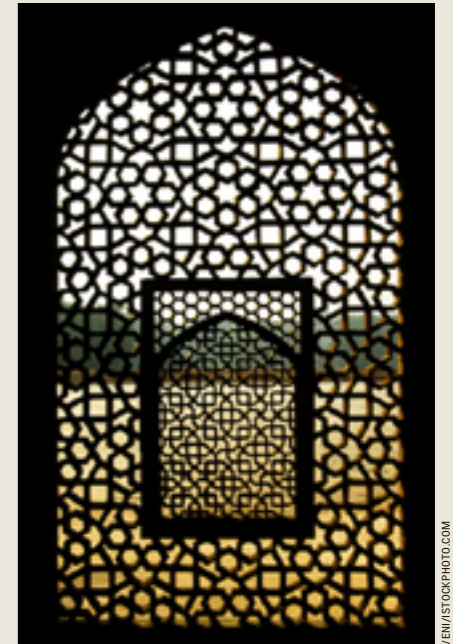
Is architecture a way to create shadow?

We don't create shadow, as we do not create light. By using building materials one way or the other, we orient and control light, we let it come inside or not. Using surfaces and volumes, we create filters and obstacles for light. But light is there, it enters into a dialogue with surfaces. By doing so it becomes part of our being, of our joy or sadness.

Architecture is light and shadow. Shadow and light are two sides of a coin. You can't define light without shadow. Here, architecture works as a kind of mediator, it creates the condition where light and shadow work in harmony. Both light and shadow, in turn, condition our living: shadow creates intimacy in order to find silence, whereas light brings people together in order to share life.

Architecture is a synthesis of light, space, and structure. The architecture that we are devoted to is born of that synthesis. Our materials are light as a living thing, and those things we perceive, such as textures, materials and colours. In a dynamic way, we conceive architecture as a succession of transitional spaces where shadow meets light on different scales from the architectural to the urban scale.

"A window is a transitional space, a place between inside and outside" (Ahmet Gülgönen). Oriental architecture in particular has used this transition as a theme with its ornamental window grills - shown here on the grave of Humayun in Delhi.

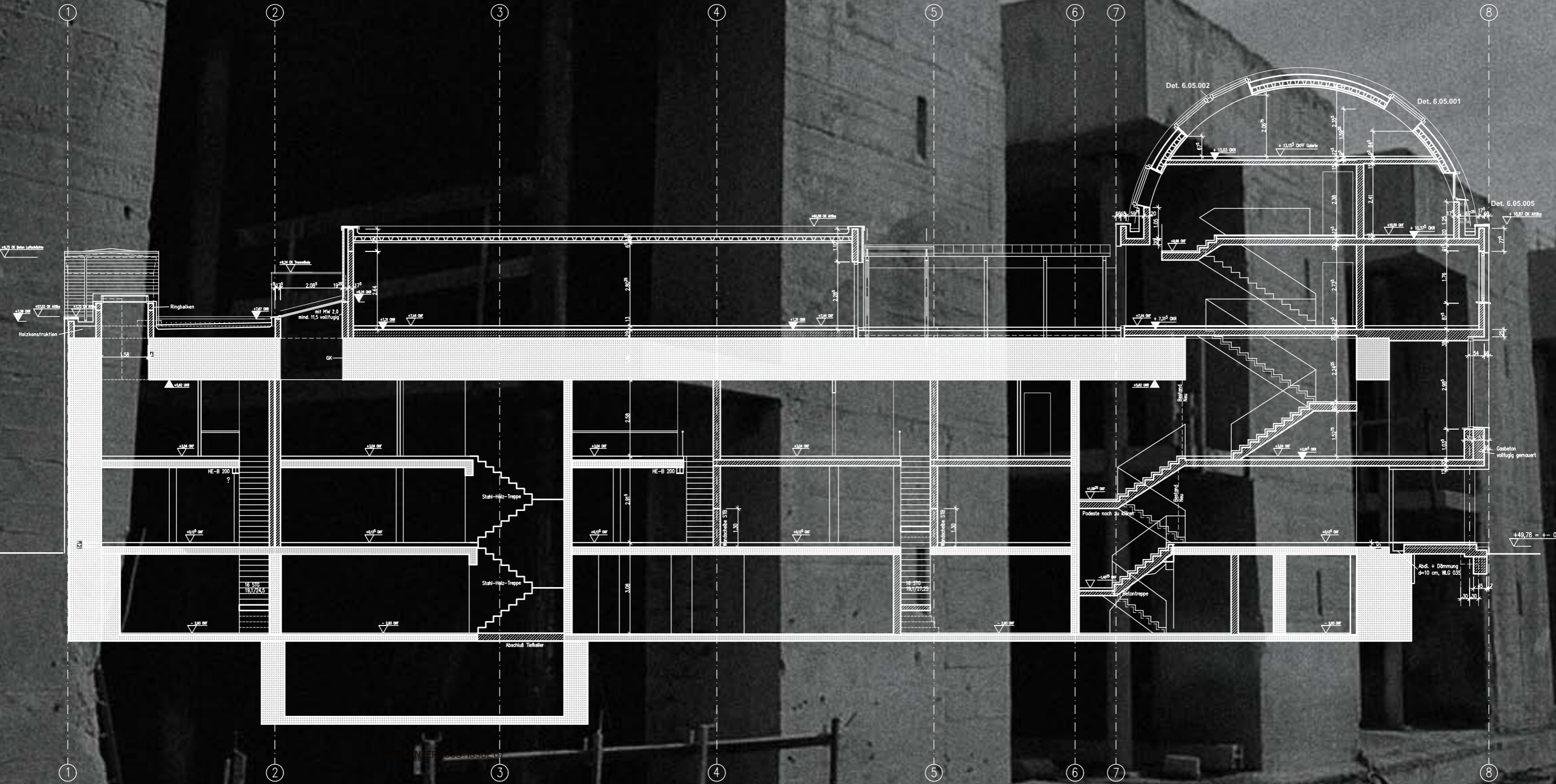


VENI/STOCKPHOTO.COM

Ahmet Gülgönen obtained his B.Arch from METU in Ankara and his Masters of Architecture and Urban Design from the University of Pennsylvania in Philadelphia/USA. After his graduation, he worked in the office of Louis Kahn. Almost 30 years ago, he founded the architects' office APRAH (Atelier de Projet et de Recherche en Architecture) in Paris, where he works together with his wife, Florence. Since 1972, Ahmet Gülgönen has been a professor at the École d'Architecture Paris-Belleville. He has lectured in many universities in Europe, the United States and in developing countries and has been visiting professor at the Massachusetts Institute of Technology (MIT) in Cambridge/USA.

A TOUCH OF HEAVINESS

Bunker conversion in Cologne



Previous The high bunker in Nippes lost about 5,000 tons of material during the conversion process. To this day, the part of the building that faces the courtyard gives a sense of its volume.

Two-level maisonette flats with suspended galleries have been developed in the barrel-shaped roof of the building. They are illuminated from both sides through roof windows.



By Jørgen Søndermark
Photography by Constantin Meyer

A massive bunker has been converted into luxurious dwellings in Cologne. Wondering how it feels to be inside a bunker, we made a house call and got a surprise. Optimum solutions for light, living and urban integration characterise the apartments in the colossus that is perceived by your mind as well as your senses.



The roof-level apartments open up to the south into large terraces cut into the roof cladding.

Left like a huge chunk of ice by a retreating glacier, a bunker 45m long, 15m deep and 7.5m tall was the sad remains of the war in the quiet and neat Cologne neighbourhood of Nippes. Defiled by graffiti, heavy and mute with no openings in its massive walls, the bunker had become a white spot on the neighbourhood's mental map. The citizens simply didn't see it anymore.

They do now. Five years ago, a young entrepreneur bought the bunker and ran a competition aimed at making it habitable. Winning Cologne architects Luczak Architekten, achieved a successful conversion, surprisingly light and friendly. In addition to the transformed bunker, a new-build traverses the bunker's short end, delineating and completing the street's facade line.

Catalyst

Passing by in the street, the new-build is all you see. No trace of any bunker is discernible. The architects' courage not to allow the bunker personality of the building to dictate their design is impressive; they have focused on classic virtues such as intelligent and well-considered urban integration and excellent

living conditions. Almut Skriver, a partner in Luczak Architekten, explains that they wanted the final result to have just as strong and individual a character as if it were built from scratch on empty ground.

"We felt quite free in the facade design," she says. "This street is far from homogeneous; you have slim gable ends, traditional facades, small workshops mixed with dwellings; and opposite you have this open, green dwelling complex typical of the fifties. So we found that a barrel roof would be an interesting addition that would also match the interior layout we had in mind".

The new apartment building has completely changed the neighbourhood. What was before a randomly developed urban district, now seems to have fallen perfectly into place with the new build as natural centre piece and focal point. While any new project obviously would have removed the sad sight of the bunker, this project has made a difference beyond that, visually as well as to the character of the area. This single intervention sparked any upgrade of the whole neighbourhood; it has functioned as a catalyst.

Mrs Skriver points to the roof of the new-

build. Its many openings to the sky, along with the building's abundant openings in the facade, replace the bunker's silent and rejecting expression by a pleasing facade that communicates vigorously with the surroundings. The architectural expression avoids a traditional 'block with openings' and puts an object-oriented design into play instead. Most remarkable is how the asymmetrical main opening resembles a cut through the building volume; this gives the new-build a larger, more imposing scale. The bunker, however, has disappeared from sight. Mrs Skriver suggests that we go inside and return to the issue once we are back in the street.

Light inside

Christoph had invited us to take a look at his apartment. What strikes you immediately on entering is the light, despite the fact that it is in the middle of the bunker. Any expectations of dungeons and dripping caves have to be abandoned right away in this flowing space of light.

All the apartments are more or less different. Those that span ground and first



floors, however, all have a large cut in the bunker massif towards the garden. These cuts represent the most radical intervention and are the key to why this conversion was a success, unlike previous attempts – cutting length was crucial.

Looking at the raw facts alone – walls 1.10m thick, decks up to 1.40m high, all solid reinforced concrete – it is easy to understand that every centimetre of heavy diamond cutting (a costly process) counted when working within the restraints of a budget.

Cutting edge

Light and budget therefore went hand in hand when the design focused on keeping the cutting length to a minimum. The considerable care taken in placing the cuts has produced a rational as well as highly functional and beautiful result.

The cut follows the dividing wall to the next apartment to one side, while creating a niche that reveals the full wall thickness to the other side. The cut runs up the facade, breaks orthogonally and slices up part of the roof before returning. This allows daylight to flood into the apartment. This is

combined with an almost Corbusian interior design, with the upper apartment floor cut back from the window opening. An elegant wooden staircase, reaching towards the light, connects ground and upper floor behind a half wall.

In this apartment, the impressive wall cuts have been left free from plaster, with the marks made by the diamond saw used to carve out the light sources on full display. Other owners have gone for a more serene and clean look by having everything covered with plaster and painted white. Some will regret this loss of story, but in my opinion it is exactly the point of this conversion - the history of the building is not forced on the inhabitants.

The architects did not rely on the bunker story as a 'selling point' in their project – their project has all the qualities demanded of a new, 'story-less' project, and can do without the bunker. It is an optional extra one can choose or not.

Sensible heaviness

Standing in the apartment, I am determined to find out if the bunker construc-



tion's extreme heaviness can be detected physically. My imagination can see it and my eyes tell me what happened when the diamond saw went to work here. But what else? I try to examine the other inputs.

The ears register less than normal. There is a remarkable silence – the acoustics are definitely influenced strongly by all this weight around us that seems to absorb all sound waves. There is hardly any traffic in the small street to make noise, so I have to rely solely on this peculiar feeling in the ears, with the eardrums almost pushed inward by the absence of sound.

My nose is also activated. It detects something even harder to explain in words, let alone to retain the impression long enough to grasp it. There is a certain coolness in the air, a 'church' or 'basement' feel. I cannot decide if it is a smell or a sense of temperature, or a subtle combination of both. It makes good sense that the enormous mass functions as a heat storage sink that reacts very slowly to changes in the surrounding temperatures, hence keeping the apartment at a slightly cooler level on this autumn day. It also makes sense that there

is a slight change in the air's humidity due to the difference in temperature.

So maybe the heaviness really does have an impact, above and beyond what you see and know.

We go out to the garden and I ask Christoph about the climate – and get an unexpected answer. Because of the large openings facing west, the focus is on heat, not coolness. Assisted by the roof opening, the light also brings in heat radiation that warms up the massive walls slowly but effectively. Normally this causes no problems but on very hot summer days, Christoph has experienced a peculiarity.

"We sat outside all evening and when we finally decided to go inside, the apartment had become quite warm so we opened the large sliding doors to let in the cool night air. After ten minutes the temperature had dropped and we closed the doors again. Within another five minutes, though, we had to open them all again – the massive concrete walls and decks had absorbed so much heat that they kept the whole apartment warm until next morning!"

Opposite Between the remaining L-shaped sections of the former bunker, glass windows and roofs have been integrated, which also give light to the dwellings from above.

Left: In some of the apartments the tenants have left the bunker walls in their original state. In order to cut through the 1.20 metre thick concrete, diamond-tipped cutter cables up to 20 metres long were used, the marks of which are still partly visible on the concrete.

Page 46: The four-and-a-half floor building clearly towers over its neighbours on the street to a large extent and also highlights its originality through the aluminium covered barrel-shaped roof.



Opposite (top left) Inside the former bunker, the architects created Corbusian double-height living spaces. The glass roof adds a sense of lightness and counteracts the rough, heavy concrete walls.

Opposite (top right) The windows on the ground floor are often set back one metre or more from the facade. Thus they show the thickness of the bunker walls which, in this case, are clad in colourful clinker tiles.

Opposite (bottom) Nothing about the street facade forebodes that inside this building there is a high bunker. The bunker walls start in the two lower levels just a few metres behind the facade. Just the two upper floors and the aluminium roof were constructed completely new.



Comparison

To enable a comparison, we visit one of the top floor apartments in the new-build towards the street. The balcony overlooks the gardens that front the bunker apartments; another added feature stemming from the bunker's awkward position on the site. The fixed bunker building divides the site in two parts resulting in a layout that would not have been first choice had the site been 'tabula rasa'. Given the circumstances, though, a great deal has been achieved from it. In addition to lawns, the 'backyard' apartments also enjoy an intimate paved courtyard to the opposite side where the residents meet for barbecues and where the children play.

The tall and light top flat has a small extra floor under the barrel roof, which gives the apartment a special atmosphere. Standing here, I try to mobilise all my sensory powers to conclude my investigations. Is there a difference in the sound experience, and how about the coolness in my nose I felt before? I may be influenced by my knowledge of being in a much lighter construction, but I believe my senses are not fooling me. The sound is

back to 'normal', more open and present; and my nose detects only the slightly humid and 'closed' air, typical of modern apartments.

This convinces me that my feelings inside the bunker were more than figments of my imagination – you actually do feel those hundreds of tons of concrete surrounding you. Of course, most people will just spend time there without consciously turning on all their antennae, but they will still experience a special atmosphere, colouring their overall impression of the bunker apartments.

Back in the street, I remind Mrs Skriver that she promised to explain about the bunker seen from the street. She smiles, and points to the large window openings. "See how the apartment's ceiling is much taller near the facade than just a couple of metres to the back inside! The height gains almost one and a half metres outside the bunker perimeter because of the deck's extreme thickness, so it is clear where the bunker ends. It is easier to see at night when the apartment is lit from inside," she explains.

Subtlety is truly the keyword in this Cologne bunker conversion.

Facts

Type of building	Residential building complex with 17 lofts and town houses
Construction	Hohr Immobilien GmbH, Cologne, D
Architecture	Luczak Architekten, Cologne, D
Location	Werkstattstraße, 950733 Cologne, D
Completion	2004

Jørgen Søndermark is Architect MAA, educated at the Aarhus School of Architecture in Denmark. He worked with 3XN Architects 1996–2007, for the last nine years as Head of Communications. He lectures and writes articles on architectural and sustainability issues and co-authored a forthcoming upcoming book on 3XN Architects (due November 2007).



THE STUBBORNNESS OF ARCHITECTURE

The B3 Light Machines

Photography by Torben Eskerod
Text by B3 Teaching Unit – the Oslo School
of Architecture and Design

Can daylight be considered an architectural material? Programme B3 students at the Oslo School of Architecture and Design (AHO) made this question the basis for creating a series of unique space-and-light installations that explore ways of manipulating and perceiving light. Eleven of these 'Light Machines', each of which is housed in a cube of 1x1x1 metres, have been built with support from VELUX. They will be exhibited throughout Scandinavia in the next few years.

The B3 light machines, produced during an elective-course in autumn 2004, have no other program or intention than the logic of the machines and their capacity to contain and process light. The only true offering of these machines is the perception of their 3-dimensionality and the acknowledgement of spatiality as the outcome of the machine in its processing of light. The beauty lies in recognizing the machines limitations; they do nothing but uncover emotions.

For the first time at least since academia entered the scene, architecture can be regarded as completely open. It lacks a clear program, a distinct praxis, and is without the guidance of a particular moral code. There may exist no other clue then to come into being, and in this sense it is the solely matter of perception.

Recent praxis in architectural education asks if there are still true and common connotations of production and reading of architecture. Architectural education's motivation remains tied to the discussion and production of the physical, virtual and/or mental space, or it concentrates on the new potential in advanced technology.

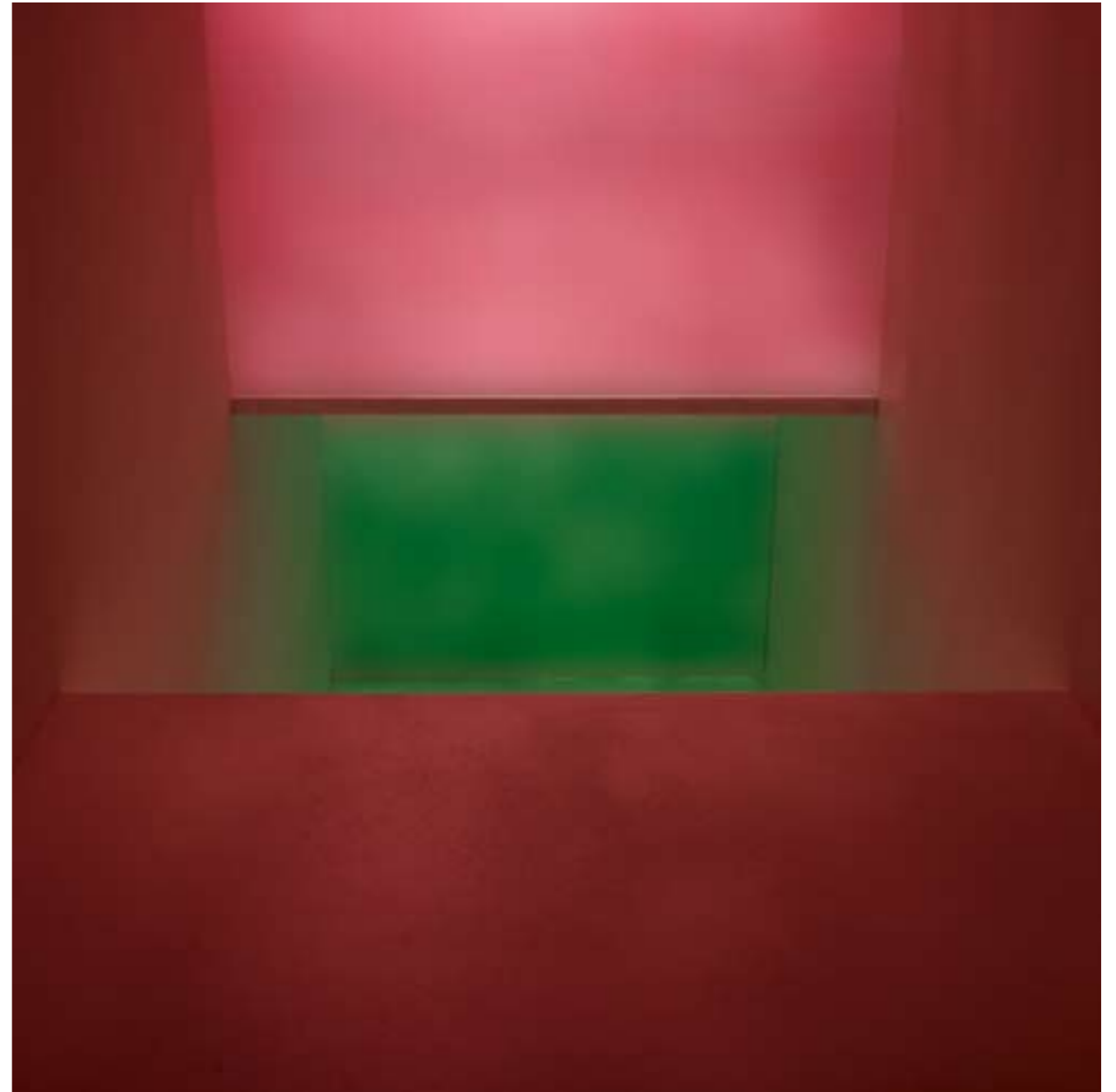
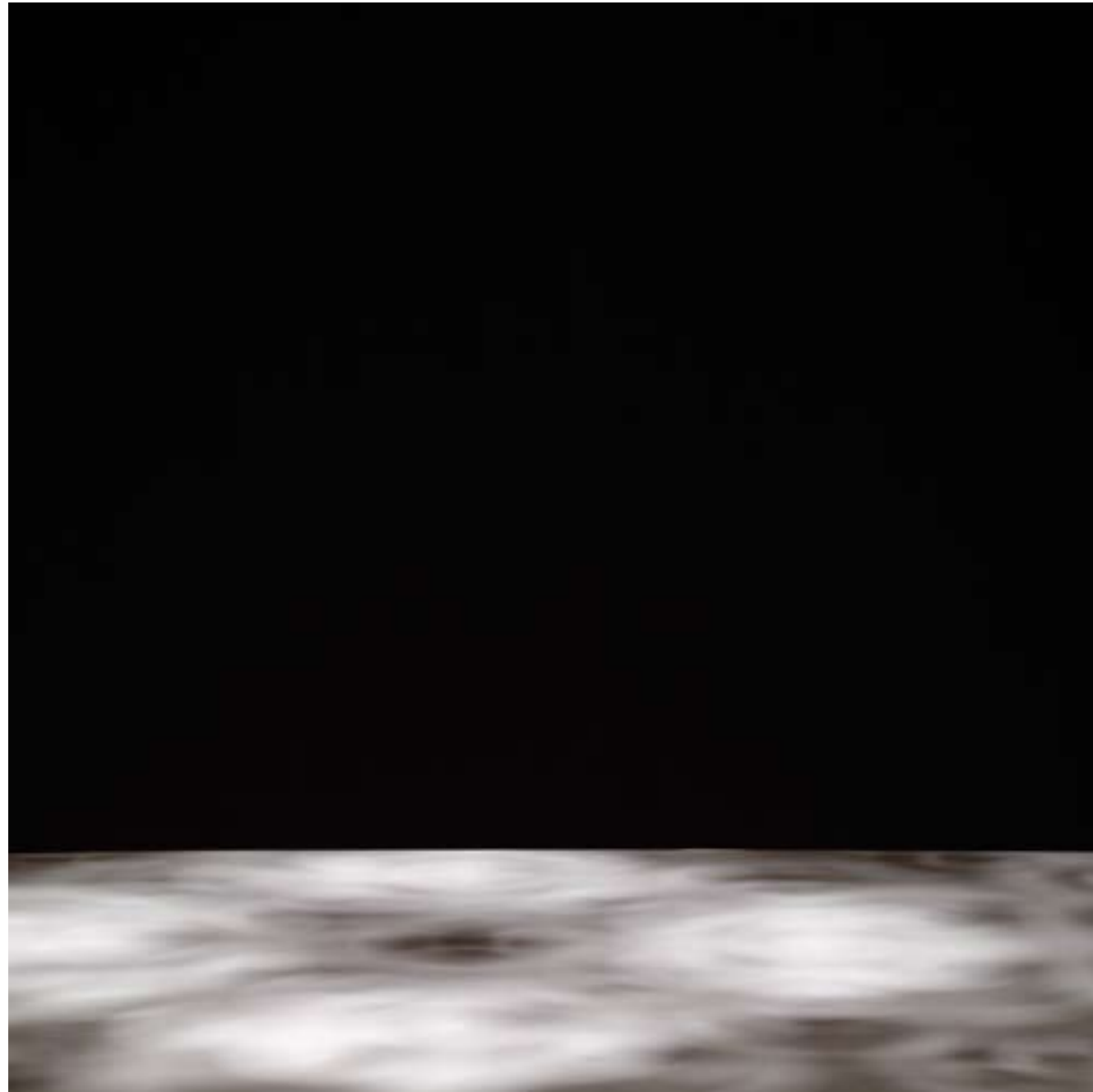
What these two discussions have in common is that they question the traditional limitations of architecture. Not only can architectural space move, but the virtual and physical as place can co-exist at the same time. These different spatial time aspects and interpretations of duration and communication have reached a complexity which affects our perception of space.

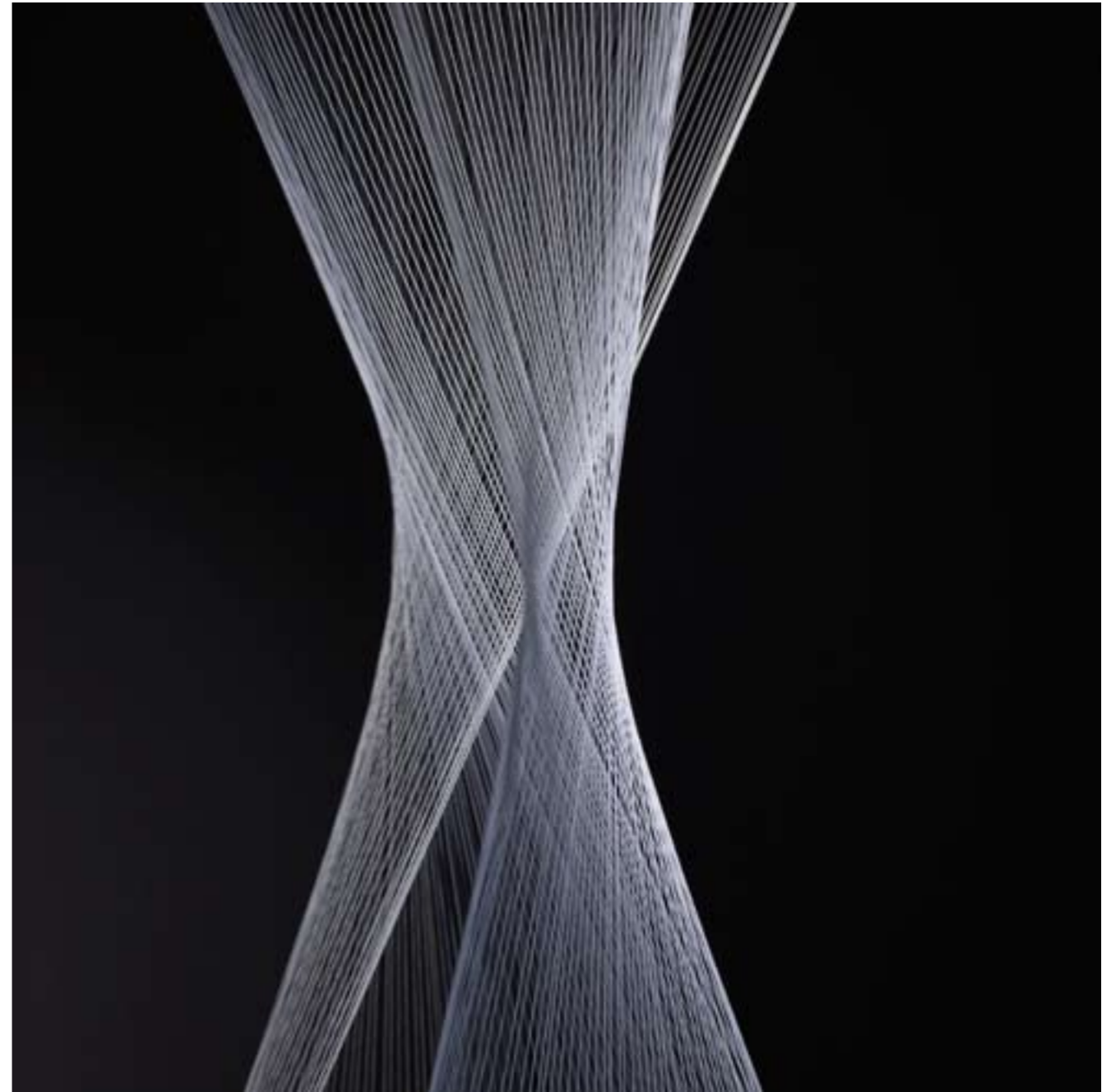
In education, this extension of the 'traditional' limitations of architecture has led to the idea of new potential belonging to the individual. The potential is released on to its own and has an unique capacity to mature towards a 'personal' architectural awareness. This individual capacity to mature architectural content is still academia's toughest challenge, and this in turn affects the notion of 'human perception'.

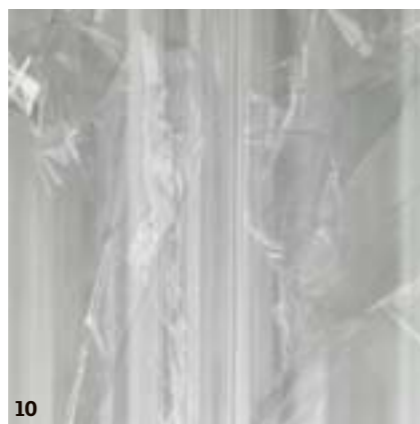
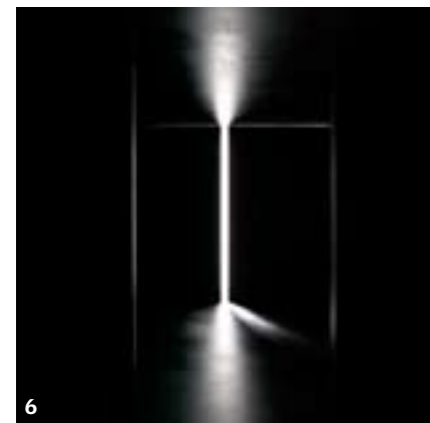
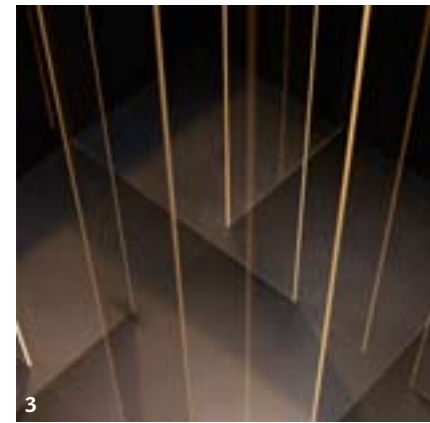
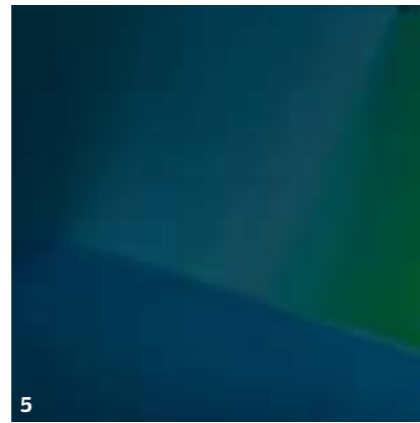
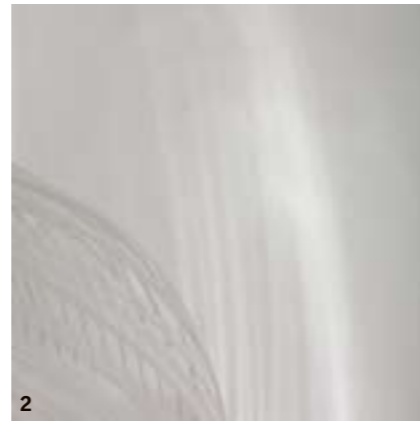
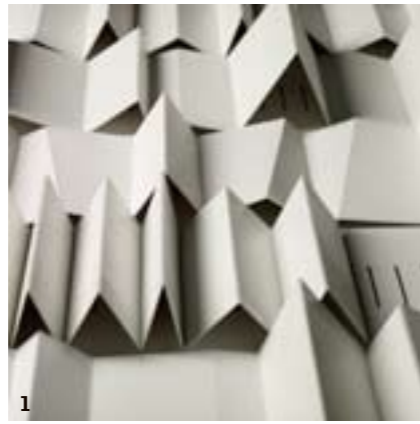
Since we are moving away from an idea-based society to a process-based society where traditional chronological knowledge is being replaced by complex fields of information, how can we be sure that 'human perception' is still a viable tool to negotiate and discuss architectural space? Is it possible within the complexity of duration and communication to have a common denominator for spatial cognition?

The B3 elective course "Light/Shadow. Daylight as an architectural material", which resulted in the design and construction of the Light-Machines, was run and initiated by the B3 teaching unit. They are Per Olaf Fjeld, Neven Fuchs-Mikac, Lisbeth Funck and Rolf Gerstlauer.









1. Anna Nilsson

The light machine makes it possible to explore the interaction between light and shadow. This machine processes different types of material, varies the themes in the material or varies the same theme within the same material. The machine functions as a base with a constant set of rules upon which the materials create the various light situations.

2. Preben Bie

The light machine causes movement and variation in space, and creates moving and varying space. Distance, light and reflection affect the plastic strips, and they alter the spatial effect of light and shadow. The contrast is variable, and the lighting dynamics create different three-dimensional depths.

3. Eivind Tandberg

A tiny input of light is carried longitudinally through a glass pane and reflected on to a piece of the same material opposite. If all the panes of glass are arranged so that one input ends as an output, and the output ends as an input, one can start to define the spaces beyond the physical borders of the machine.

4. Øystein Olsen

Light Machine
A cubic room 1m x 1m x 1m
The room's ceiling is a machine
The machine's job is to change the space with the help of light
The machine has a sliding panel system where perforated sheets shift their positions and overlap one another. The system has three layers. The middle layer slides in the opposite direction to the other two. The sliding sheets have 3 different sizes of perforation.

5. Morten Hosen

The light machine was made with the intention of producing different light situations. It can be used to dim light through different filters. At each opening there is a holder where different "cassettes" of material are placed. One can for example place a filter on two of the openings and study the effects by way of the third opening. The machine can also study light situations related to material's reflective ability; this is done by placing a filter at the other end of

the opening, so one is studying light through a spatial sequence. For this to be possible the middle opening must be closed and its "cassette" material will be crucial for the degree of reflection.
If one wishes to study a material's translucency and its ability to challenge the spatial volume's inner form the method above can be used, but it can also be achieved by placing a filter on the opening opposite the middle opening. If the filters change

places one can view the situation from the outside, but the light must first go through the machine. The filters included with the machine are chosen to give a variety of colored light. The choice of filters can be expanded in relation to what material's light effects one wishes to study.

6. Mathilde Herdahl

The walls have openings whose width can be varied by moving boxes. The openings in combination with the sliding boxes can vary the amount of light they produce and how far that light can enter the space. For example, a small opening would create sharp, clearly defined light. And this light in combination with the overall space will give the impression of a greater depth in the space than if the light opening was wider.

7. Christine Eng

Threads stretched between two plates form two double curved shapes that intertwine. These forms and their crossing points and shadows interact. If there is a direct light source, the threads' shadows will have clarity but the distinction between what is thread and what is shadow will be diffuse.

8. Ingrid Kirkerud

Insistent Approach
The light blasts in
The light rays stretch towards you
Stab
Trickle
Fall
Beat, fondle, reveal
Inform and shatter

Insistent approach of light

9. Pau Fernandes Canals

The machine works with the idea of controlling light. One experiments on how the machine can manipulate its own light to generate different effects. Sliding the upper part of the box changes the size of the opening and, as a consequence, the light within the machine.
The machine has the ability to capture different intensities of light. We can see light emanating from the openings. And yet, some light is still withheld, and we know it is still inside the machine.

10. Emelie Tornberg

The intention of the light machine is to absorb light, eliminate material and become light.
Light's capacity for dissolving material and reappearing as a mass is one of the functions of the machine. Material as the receiver will again reflect the light and dismantle the true form of itself.
"I don't look for light. Light is a part of the material, manifesting itself, through it." – Eva Hesse

11. Marit Skarstøl

Machine and intention
The machine is shaped like a transparent plexi-glass cradle with a neutral base plate. The cradle's bottom curves along a spiral. The light source is attached to the cradle and shines an even light into the interior of the machine. Near the light source the cradle is shaped to carry a 15 litre ice block. A fog component is attached at the cradle's centre of gravity. The machine operates on a base plate that defines its operating area.

The machine is driven by interaction between time, gravity and temperature. It is dependent on electrical power, but it moves independently. The machine has six different movements that all influence the space. The machine's form is shaped to create visible changes of position over time. The water from the melting ice rises, and will at all times flow to the cradle's lowest point. The fog component is activated in contact with water, creating fog, and the fog will

spread over the surface of the water. As the fog uses up water, the gravitational mid-point changes again until the fog-component is deactivated, and the machine stops moving.
The ice spreads the light evenly, but it is somewhat dimmed. The weight of the ice gives maximum volume to the space. The water conducts the light well. The surface of the water refracts the light, and a concentrated light reaches the base. The spatial effect is influenced by a sharp transi-

tion from light to shadow. The water forms a wall that reaches out into the space and increasingly compresses the space. As the water raises the illuminated surface becomes larger, but the intensity of the light lessens. The fog component creates movement over and under the water, and emits a flickering light into the space.

PERCEPTIVE MACHINE RESIDENTIAL HOUSE IN ADNET/AUSTRIA

47°40'48"N/13°8'12"E: The coordinates of the apartment building in Adnet near Salzburg also depicts the official name under which the building is handled at the architects. And this once again says something about the builder-owner married couple: Friedrich Ebner and Heike Kröpelin travel extensively between Germany and Austria on business; they typify the frequently described "modern nomads" in a particularly marked way. The choice of their home was not entirely influenced by the mountain panorama of the Tennengau, which they can now enjoy every day from their patio - but more by the fact that the nearest motorway is also just two kilometres away! The downside of the conveniently placed autobahns and the intensive closeness to nature is a certain isolation regarding village life. From the residence, no shop or pub can be reached on foot; the couple are dependent upon their car for all purchases.

In the words of the architects Maria Flöckner and Hermann Schnöll, house 47°40'48"N/13°8'12"E is not "made for a definite place". It could just as well be "somewhere else", they stress. And sure enough at first sight it feels as though it was parked in the meadow by chance and brought into a horizontal position with gentle pressure. The structure is sunk about a metre into a southern corner of the slope; to the north, is detached from the earth over a length of about eight metres. It captivates at first glance by its simplicity: a floor slab and a poured-in-place concrete flat roof, between which stretches the living space as a "refuge with a glass curtain" (Maria Flöckner & Hermann Schnöll). However, as is often the case, well-devised detail solutions are to be found hidden behind the apparent simplicity. The roof protrudes on the northwest corner by eight metres. This span was made possible only with an 'inverted'

laminated ceiling, whereby a grid of steel girders was doweled onto a 16 cm thick reinforced concrete slab.

The living floor plan is based on a multiplication of the Farnsworth type: Nine wooden cubes each 2.4 x 2.4 metres divide up the room. They contain storage space and installation cores as well as steel columns that bear the roof. Four of them (three bathrooms and the cloakroom) are lit by skylights, which can be opened and closed by a window control and thus also help to facilitate the ventilation of the rooms. For the windows, light flues were created from insulated three-layer slabs on the flat roof, which vitalise the silhouette of the house also externally as playful elements. The windows are all uniformly inclined at 30 degrees to the horizontal; their direction varies, however, with the utility of the room: The skylights in the bathroom face east in order to catch the morning sun - the cloakroom window is inclined to the north to prevent the room from overheating. A fifth window above the kitchen area faces west and catches the evening sun.

All around these fixed points the inhabitants move in a room divided only by glass walls stretching over 300 square metres. It consists of living and sleeping areas, garage, kitchen and patio. Different compared to Mies van der Rohe's glass house, the living room and the fixtures that subdivide it are not linearly arranged but combined into a semi-circle, the curvature of which follows the panoramic scenery outside.

The inner openness of the house and the often dark room surfaces give the inside rooms a particular lighted atmosphere. From all over the house, views and perspectives form in the landscape with the changes of light throughout the day. Direct sunlight, on the other hand, only penetrates the large room through the skylight above the kitchen block at certain

Architecture with VELUX from all over the world.

Facts

Type of building	Residential house for 2 persons
Builder-owners	Friedrich Ebner & Heike Kröpelin, Adnet, Austria
Design	Maria Flöckner & Hermann Schnöll, Salzburg, Austria
Location	Riedl 79, Adnet near Salzburg, Austria
Completion	June 2006

times, including the early morning and late evening, when the sun is low on the horizon and warms the occupants with its rays.

The interior furnishings of house 47°40'48"N/13°8'12"E are reduced to a minimum, also the number of sensory stimuli, in order to sharpen perception of the environment. Just as much as the outer world is colourful, so monochrome are the room surfaces inside. Abstract tree trunk images placed upside-down cover the walls of the cubes and the kitchen block. The projecting floor and ceiling slabs keep the nature that is all around at bay, but focus attention at the same time on the snippet of scenery. Channelled by the untreated visible concrete of the ceiling and from the seamless asphalt floor, the eyes travel unhindered into the distance. The few filigree built pieces of furniture intervene just as little as the glass walls: they are only a climatic mantle and also follow a different geometry from the floor and ceiling slabs. From the side, the room continuum is framed only by black curtains running in tracks along the edge of the roof (and thus outside in front of the façade). If they are closed, the panoramic view has to give way to a moving picture of light reflexes and half-shade, due to the movements of the lengths of textile by the wind.

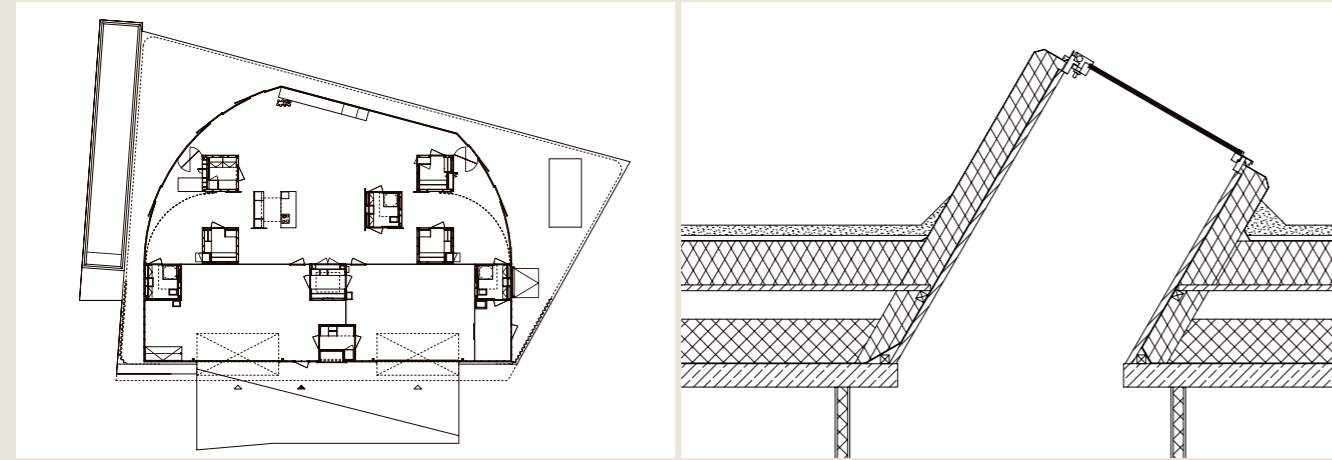


From the street, the house 47°40'48"N/13°8'12"E gives the impression as if it has been placed temporarily onto a meadow. Its flat silhouette is only interrupted by the light chimney with the inclined roof windows.

Top left Floor plan

Top right Detailed sectional drawing through the roof window

Bottom The virtually semi-circular, room-high glass facade clearly regresses behind the projecting ceiling and base plates. In this way, two large terraces emerge as buffer zones between the room interior and the landscape.



Top (left) Except for a nearby farm, house 47°40'48"N / 13°8'12"E has few neighbours. Nevertheless, the interior rooms are protected from inquisitive eyes with black curtains.

Top (right) Just as the perspective is so versatile from the outside, the house is also as minimalist from within. Light falls almost exclusively from the side in the living room. One exception is the skylight above the kitchen block.

Bottom The curtains, which are attached on the outside along the edge of the roof, flutter in the wind and add to the perception with continuously changing light and shadow reflexes.



BOOKS

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LOUISIANA AND BEYOND

The work of Vilhelm Wohlert

Author: John Pardey
Edition Bløndal
ISBN 978-87-91567-07-0

The Danish architect Vilhelm Wohlert is one of those architects for whom public recognition of their name always takes second place to their most important work. As John Pardey states in the introduction to his book, Wohlert "was hardly known outside Denmark and even then only amongst the architectural fraternity". Meanwhile, the Museum of Modern Art, Louisiana, in Humlebæk north of Copenhagen, which Wohlert built together with Jørgen Bo in 1957–58 and continued to extend until 1991, has achieved worldwide fame. The Danish professor Christian Elling once described the building as "the beginning of the end of architecture", and he meant this as a compliment. Unlike many of their contemporaries, Wohlert, Bo and the patron who commissioned the building, the dairy owner and art lover Knud W. Jensen, were not pursuing the dream of an

urban 'tabula rasa', nor did they intend to create an artistic monument – quite the contrary.

John Pardey did not, as he himself says, simply want "to write another book on Louisiana". All of Wohlert's lifework interested him: the furniture, the lamps and the interiors demonstrating the influence of Wohlert's training under the famous Danish 'furniture architect' Kaare Klint, the guesthouse for the physicist Niels Bohr built by Wohlert in 1957, the residential houses in the vicinity of Copenhagen, his churches of the '60s and '70s, as well as the school buildings in North Africa and his design (which was never implemented) for a national museum in Kabul. Wohlert travelled extensively and enjoyed it, and the last-mentioned projects demonstrate his virtuosity in adapting his genuinely modern vocabulary of forms to different climatic conditions and regional building traditions.

'Louisiana and Beyond' is a timeless, even conventional, book on architecture: the photographs used date exclusively from the time when the various buildings were created; they are usually in black and white and include no human figures. Numerous original plans and detailed drawings betray the hallmark of an architect who, in this book, once again takes second place to his work. All of the instances in which Pardey quotes Wohlert focus on his buildings and the process of their creation. Even after reading 'Louisiana and Beyond', Vilhelm Wohlert remains a shadowy figure. Thus, despite the meticulous description given of all the buildings, the book somewhat lacks vitality. But a reader for whom this is no object will find in 'Louisiana and Beyond' a detailed discussion of Wohlert's work that sets a standard for artistic precision and care.

UNDER THE EAVES OF ARCHITECTURE

The Aga Khan:
Builder and Patron

Author: Philip Jodidio
Prestel Verlag
ISBN 978-3-7913-3781-4

He is a religious leader and a businessman, the sponsor of one of the most important architectural awards as well as being one of the most influential philanthropists in the Islamic world. Yet the Aga Khan, the spiritual leader of 15 million Ismaili Muslims, is committed to pursuing a very secular goal: that of improving the living conditions in developing countries, particularly in countries with a predominantly Islamic population. He views the architectural award which bears his name in the same light: "You cannot conceive of quality of life change without integrating the physical environment. Every day you live under one roof."

To mark the occasion of the fiftieth anniversary of the Aga Khan succeeding to his position, the American art historian Philip Jodidio has brought out a new book portraying the Imam, who was born in 1936, together with his ramified network of foundations and endowments. Jodidio states that he interviewed more than 50 friends and associates of the Aga Khan for "Under the Eaves of Architecture". In eight chapters he paints a picture of the Aga Khan's varied activities, which range from the Aga Khan Award for Architecture and the Aga Khan Historic Cities program (a fund for the restoration of historic buildings and monuments in the Arab world), to the Aga Khan University in Karachi and the Aga Khan Museum, which will be built over the next few years

in Toronto to the designs of Fumihiko Maki.

Why this extraordinary interest in architecture? In a very readable interview he gave to Jodidio, the Aga Khan gives the following explanation: "The first indicator of a community's poverty [...] is the physical context in which they live. Therefore, my interest in architecture was driven [...] by the question of what to do to improve the quality of life of the ultra-poor."

"This book is not about architecture" is the book's first sentence. Of course, that is not quite true, but initially the author does give architecture a wide berth, starting his book with a somewhat wordy disquisition on the history of the Ismaili Muslims and the Aga Khan's career. Where Jodidio's account always comes to life is when he allows former friends and companions of the Aga Khan – or the Aga Khan himself – to have their say. Then the Aga Khan shows himself to be an unconventional thinker opposed to the mainstream; in his projected new buildings in Dubai, for example, where he consciously weighs against the deplorable excesses of the local architecture: "The whole debate about the tallest building in the world concerns ambition, vanity, pride, or whatever you want to call it. These are not particularly strong forces in our value system. I wanted a building there that was historically correct, and, secondly, I wanted it to be on a human scale." Although certain passages would have benefited from some pruning, "Under the Eaves of Architecture" is, in the final instance, a successful portrayal of a man who, in addition to hospitals and universities, wanted above all to build one thing: bridges of reconciliation between people and cultures.

LESSONS FROM BERNARD RUDOFSKY

Editors: Architekturzentrum Wien / The Getty Research Institute, Los Angeles
Birkhäuser Verlag
ISBN-13: 978-3-7643-8359-6 (German edition)
ISBN-13: 978-3-7643-8360-2 (English edition)

It is said that Bernard Rudofsky (1905–88) had eighteen different professions in the course of his life. Born in Austria, he was an architect and a designer, a curator, an author, a scholar, a painter, a photographer and much more besides. But above all he was an indefatigable traveller, which is why this book also bears the subtitle 'Life as a Voyage'. In quotations, photo spreads and essays together with facsimile reprints of the journal 'Domus' where he briefly worked as an editor in 1937, the book presents the work of Rudofsky in all its dazzling variety. All his life, Rudofsky searched for a timeless, humane style of architecture for human dwellings which would take full account of the needs and habits of everyday life. "The house has to become again what it was in the past: an instrument for living rather than a machine for living," he stated in a lecture given in 1982. Rudofsky's own oeuvre is rather thin on the ground: only a few residential buildings in Italy and Brazil, where he had fled from the Nazis in 1938. Like many of his contemporaries, the buildings demonstrate the impact of modernism, but Rudofsky's modernism is mingled with forms taken from traditional Japanese architecture and traditional buildings around the Mediterranean.

"It is pointless for experts to discuss the finer points of residen-

tial architecture as long as we do not consider how its occupants sit, sleep, eat, bathe, wash themselves and want to dress." This quote of Rudofsky explains his deep seated interest in how people dress, which led to him curating the exhibition 'Are Clothes Modern?' at the New York Museum of Modern Art in 1944. Two years after the exhibition Rudofsky designed the eponymous 'Bernardo Sandals', which remained a top seller for over 20 years. In the exhibition in the MoMA, Rudofsky contrasted the designs of contemporary couturiers with traditional garments from various exotic cultures. He took a similarly iconoclastic stance in an exhibition which has probably become his most famous one: 'Architecture without Architects' – conceived as an act of homage to the talents of anonymous architects all over the world. Rudofsky himself commented on the exhibition as follows: "My study of non-pedigreed architecture is mainly a parable – a parable of complacency and of our inability to deal with our environment in a satisfactory manner."

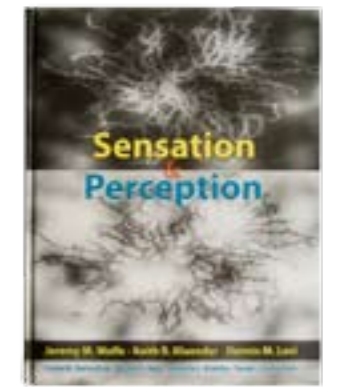
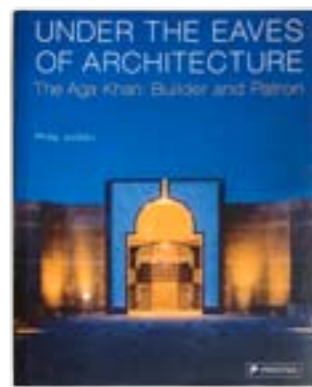
'Lessons from Bernard Rudofsky' shows Rudofsky to be a master in many areas: photography, architecture, and graphic arts as well as the art of turning a pithy phrase. Full-page photographs give evidence of Rudofsky's eye for those details which speak to us of life. Every reader will have to decide for himself what the 'lessons' of Bernard Rudofsky are (to which the title of the book refers). One option, phrased as an exhortation, was – travel and learn through your own observations! For, as one of the many Rudofsky quotes in the book puts it, "getting to know strangers is one way of getting to know one's self; learning something about the architecture of other countries permits us to see our own architecture in a new light".

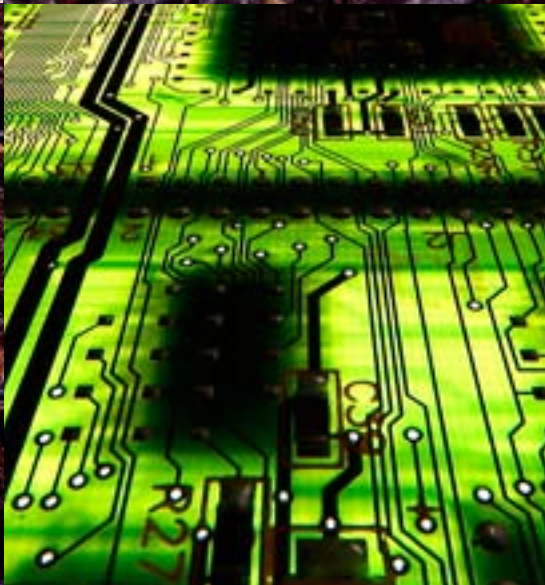
SENSATION & PERCEPTION

Authors: Jeremy M. Wolfe, Keith R. Kluender, Denis M. Levi et al.
Sinauer Associates
ISBN 0-87893-938-5

Why do we have two eyes but only perceive a single picture? Which phenomena attract our attention and which do not? How 'comprehensive' is our sense of touch? Why do we recognise faces? These are just four of the many hundreds of questions which the book "Sensation & Perception" examines – and the answers to these questions offer the layman new insights, some of them quite surprising. The team of seven authors, all of them psychologists or neuroscientists, set out to explain systematically and intelligibly how our five senses work – and how these senses come together in our brain to form the 'picture' we make of the world. The fact that people receive the majority of their sensory stimuli through their eyes is mirrored in the book's contents: there are seven chapters dealing with the sense of sight, three on hearing and one chapter each on the senses of touch, taste and smell. "Sensation & Perception" was originally conceived as a textbook for students studying human perception. But this should not discourage anyone, because the book has embraced all current didactic trends: numerous illustrations and some quite astonishing experiments make the subject matter comprehensible. Because the sheer breadth of the subjects which the authors wish to communicate would have far exceeded the scope of the book, the authors additionally set up a website (www.sinauer.com/wolfe), which contains further supplementary essays and interac-

tive tests. "Sensation & Perception" combines findings from physics, neurophysiology and psychology – and occasionally even ventures into the realms of philosophy. The introduction of the book, for example, discusses such key questions as: What is perception and which image of the world would be possible even without perception? How can we be sure that that which our senses communicate to us really exists? The authors state that their aims were to write concisely and precisely without compromising their scientific standards and to arouse the readers' interest without 'swamping' them with an all-encompassing flood of knowledge. It cannot be doubted that their balancing act was successful. "Sensation & Perception" is a gripping introduction to the world of sensory perception which is also of interest to non-specialists – if the reader is prepared to read selectively and occasionally skip over certain sections which go into too much (anatomical or physiological) detail.





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