

Architecture of the Forest

Observations on the relationship between spatial structures in architecture and natural spaces

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Nordic Journal of Architectural Research
Volume 20, No 3, 2008, 16 pages
Nordic Association for Architectural Research
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Abstract:

Architecture of the Forest deals with the relationship between the spatial and formal structure of the forest and architectural space and form. A good introduction to the topic is provided by a study of forest-related biological knowledge, literature, art and environmental aesthetics. Also included within the scope of interest is the architect's interpretation of this relationship.

This type of study falls into three strands of inquiry, with the first one focusing on the physical and spatial structure of the forest from an architectonic viewpoint. The second strand is concerned with cultural and individual interpretations of the forest as it appears in, for example, literature and art. To shed light on these issues, we can examine relationships between the natural world, culture, biology and architecture. In the third strand, the focus of interest lies in exploring how the forest has been used as a source of architectonic space and form, using examples from modern Finnish architecture to illustrate the presented ideas. Architectonic interpretation is conducted as part of the design assignment, using architectural methods. Such interpretations can be analyzed to determine what opportunities the forest offers as a theoretical framework.

One of the aims of this study is to introduce concepts that could be used to characterize spatial structures in both nature and architecture. Illustrative and practical terminology helps us to understand the essence of architectonic space, viewed within the framework of natural spatial structures and representing an interpretation of the way humans inhabit their environment. In my dissertation, the aim was to illustrate the theoretical perspective using my own design examples and to put forward some preliminary interpretations of the relationship between the forest and architecture. In this way, this article provides an example of integrating the artistic and scientific approach in architecture.

Treating architecture, forest biology and culture as facets of a single study object allows us to look at architectural spatial structures in terms of topological relations.

Keywords:

Architecture, forest, topological relations, transforming spaces and patterns of nature to architecture, Finnish modern architecture; Alvar Aalto and Reima Pietilä

INTRODUCTION

This article is based on my doctoral thesis "Metsän arkkitehtuuri" (Architecture of the Forest) in which I explored relationships between spatial structures in nature and architectural space and form. I drew my examples from the works of two Finnish architects, Alvar Aalto and Reima Pietilä, and from my own designs created during the research process. In this respect, my thesis represented the 'research by design' approach – a pioneering endeavour in Finland. Since this aspect of the research will be discussed elsewhere, I shall take this opportunity to focus firstly on examining spatial analogies between forest landscapes and modern Finnish architecture, and secondly on reflecting on the cultural background of these analogies. My research led me to consider the notion of applying concepts derived from phenomenological theory of architecture to shed light on these theme. Christian Norberg-Schulz¹ has emphasized the explanatory power of topology in the interpretation of modern architecture. His observations form the starting-off point for my work, but – as the following pages will show – I shall apply the concept of topological relation for a very concrete purpose: to compare specific works of architecture and particular spatial structures in nature. Although my approach here, in keeping with that of Norberg-Schulz and Juhani Pallasmaa², is phenomenological, it is essentially founded on a biological basis arising from a combination of personal experiences in the nature and my career as an architect. This paper presents the view of an architect living in the Finnish countryside, surrounded by forests, that all human architecture has a parallel in nature and that our organically evolved sensory systems – our world view apparatus, as biologists describe it – govern our perception of the built environment and its quality.

My thesis consisted of three interweaving strands: 1) the biology and spatial structure of the forest, 2) cultural interpretations of the forest in literature, visual arts and myths, 3) materialization of forest structures in modern Finnish architecture. To illustrate the ideas under discussion, I presented my own designs, which were explained as a part of dissertation and in more detail in the attachments. This current article deals primarily with the third strand, with only a brief description of forest structures and their cultural interpretations, although they play a significant role in the thesis by providing a background for understanding the ideas presented in it. In this context, I have assumed that the Nordic reader has personal experiences relating to forests, providing a point of comparison and stimulus for reflection. For centuries, people have attempted to explain the relationships between forest structures and architecture through analogies³, and my thesis included references to a number of these, such as the Gothic cathedral and the Greek temple. However, the central focus of this article will be on interpretations of modern architecture. Using the notion of 'topological relation' as key concept, I shall treat specific features in architecture and forest



Picture 1
Aavasaksa Hill, 2005,
Photo: Lauri Louekari



Picture 2
House Foni, Oulu, 2005, Lauri
Louekari.
Photo: Ilpo Okkonen



Picture 3
Koli Hills, 2003.
Cosy twilight in an old forest.
With time, the spatial structure of the forest has acquired an open and spacious appearance with the great trees occupying their own growth space under a closed canopy.
Photo: Lauri Louekari

landscapes as analogous spatial phenomena. Becoming cognizant of these analogies may serve as a source of inspiration for practicing architects in their everyday work.

In my doctoral thesis, "Architecture of the Forest", I sought to describe the forest from a structural viewpoint and to characterize it in terms of the built environment. Compared to the urban environment, the spatial structure of the forest is typified by *incomplete spatial confinement, free-flowing nature of space, layering of views in the depth direction, clustering of views and the nature of light*. Although these features are rather general, they take on a variety of different forms in Finnish forests with their shifting spatial experiences. Visually and bodily based experiences from the forest environment become laden with significance when architects, in their work, make references to the forest and create a symbolic or spatial connection with it.

My research discussed cultural and individual interpretations of forest space. Forest structures help to explain characteristic features of ideal places when they are compared to descriptions of forests in literature and art. Mark Twain, for instance, provides a graphic description of the spatial atmosphere of a forest as Huckleberry Finn, the young runaway, wakes up on Jackson Island:

The sun was up so high when I waked that I judged it was after eight o'clock. I laid there in the grass and the cool shade, thinking about things and feeling rested and ruther comfortable and satisfied. I could see the sun out at one or two holes, but mostly it was big trees all about, and gloomy in there amongst them. There was freckled places on the ground where the light sifted down through the leaves, and the freckled places swapped about a little, showing there was a breeze up there. A couple of squirrels set on a limb and jabbered at me very friendly.⁴



Picture 4
Koli Hills, 2003. Room in a forest,
with a view onto an open landscape,
extending to the horizon over the tree tops in the valley.
The ground cover is invitingly soft, while the rocks and tree trunks offer hikers a cosy, contained resting place and support their backs during a coffee break.
Photo: Lauri Louekari

From the viewpoint of a hiker or even a builder, for that matter, a good natural place can be said to possess the following characteristics: it has a *backdrop* instilling a sense of safety and security; it is situated at the interface of different types of space, such as the *interface* between warm and cool, light and shadow or enclosed and open. Moreover, the place offers a view conveying a sense of visual control over the immediate surroundings. A good natural place also has a size appropriate to the *nature of the activity* in question; for example, it may represent a room or a hall in the spatial structure of the forest. On top of these features, an ideal place may have a contrary or an accentuated relationship with its surroundings when it is *elevated above the immediate area*. There are, of course, other ways of characterizing ideal places, but the crux of the matter lies in perceiving places through their spatial relationships.

In the architecture designed by Alvar Aalto and Reima Pietilä, spatial and formal structures of the forest constitute part of the architectural expression. Finnish organic modernism showed a deep interest in *landscape integration, organic growth* and *structural exposure*. In addition, these architects mentioned above have investigated the relationship between free-flowing and geometrical forms, which manifests itself in a synthesis of international influences and local environmental experiences. Aalto can also be considered the originator of that strong sense of location which is one of the hallmarks of Finnish modernistic architecture.

When we study the essence of a place, natural spaces provide a useful baseline for comparison. By describing the environment in terms of spatio-structural relationships or topological relations, we can use a common language for the exploration of natural and architectural spaces.⁵

AALTO AND THE BIOLOGICAL PERSPECTIVE

But I would like to add as my personal, emotional view that architecture and its details are in some way all part of biology.⁶

Alvar Aalto's biologically inspired view on architecture has been discussed in countless articles and books.⁷ From a biological viewpoint, humans are in many ways bound by their essence as animals that evolution has endowed with an innate predisposition to respond in certain ways to environmental stimuli. Thus, an aesthetic view of the environment may seek to explore the basic spatial relationships to which humans produce an instinctive or consistent reaction. Among the most distinct and strong relationships induced by specific locations is the sense of security instilled by a wall or a rock face. A group of hikers will often spontaneously break or camp at this type of "safe" place, where a large rock, forest edge or cliff face provides a boundary to the north or east, and the space opens out towards light and warmth. It goes without saying that, at this level, architecture is intimately tied with the qualities of the natural location. However, when trying to interpret the essence of individual architectural designs, we often have to consider more subtle aspects. Aalto had the ability to introduce dynamics and rhythm to large spaces using cascading levels, as seen at Rovaniemi Library. The sense of intimacy and joining together which pervades the library's descending recess is almost palpable – so much so that it has become a recurring design feature also with other architects, who have at times applied it to rather humble buildings.⁸ This subtle instinct for blending the human body and senses with basic topological relations is perhaps one of the most striking elements in Aalto's architecture.

Remarking on the relationship between building technology and architecture, Aalto has pointed out the natural environment as the origin of all experience, an adversary that forces us to seek new solutions: "Through the ages, we can observe in man's struggle with nature a conscious striving to deal with any problem he encounters in such a way that the importance and life-inhibiting effect of the problem diminishes as the ideal solution is approached."⁹

Aalto's intuitive formulation resembles ideas brought forward in the biological philosophy of the 1980s and 1990s, particularly in the work of many ecological epistemologists and Karl Popper. In his book "Objective knowledge" (1972), Popper describes evolution as knowledge growth. Both biological evolution – the development of life forms and their specialization into different species – and the growth of human knowledge proceed through a process of trial and error.¹⁰ All organisms are constantly facing situations where they have to solve a variety of problems. In terms of species, this results in genetic variation and natural selection.¹¹ In terms of individuals, the problems involve everyday interactions with the environment; and solutions are typically based on experience. When confronted by an entirely new problem, solutions are obtained by trial and error.⁶ At a species level, this process may lead to such developments as the evolution of the eye. Kauko Honkala discusses the issue from the standpoint of a biologist:



Picture 5
Rovaniemi Library, 1968, Alvar Aalto.
In Aalto's Rovaniemi Library, lighting from above in conjunction with reading hollows creates fundamental spatial relations, which are familiar to us from the natural environment. Lit obliquely from above, the niches seem to offer shelter and comfort which is comparable to that of forest rooms, whose sense of space inescapably invites us to spend time in them. In every library he has designed, Aalto uses the decorative quality of bookshelves and backs of books as spatial elements; the shelves form arbitrary raanu-like hangings on the walls, which serve to provide a white background – an essential element in this context. At the same time, the shelves comprise a geometric element that complements the otherwise mainly topologically structured space. Photo: Simo Rista

More highly developed species have evolved functions, control mechanisms, to prevent erroneous behaviour. Their senses collect information about the surrounding environment that can be used to adjust behaviour, such as to circumvent obstacles and proceed towards a food source. The existence of senses presupposes a central nervous system, which combines sensory information into a "world view" and is further connected to components of the nervous system that control activities. One key characteristic of the central nervous system is memory, which is used to retain information of the consequences of past behaviour.

Individuals have access to control mechanisms that have evolved during the evolution of the species. In a way, each individual is always a guinea pig, tested by its environment. At the same time, however, it also chooses its environment and may even change it.¹²

Honkala defines senses as constituting a "world view apparatus" that gives different species a different perception of the world around them. Human senses and knowledge management have evolved to register features in our environment that are crucial for survival and reproduction. Of particular importance for humans are our visual ability and eye level. Thus, in contrast to many large mammals, the human perception of space is forward oriented; we are only able to perceive our environment in one direction at a time.

For architects, the biological and Darwinian world views seem professionally rather natural. Ilkka Niiniluoto refers to the three-level Popperian world view as emergent materialism.¹³ Nature as a material reality represents the first level, while human and animal consciousness, developed through evolution, represents the second level. The third level comprises the man-made world including such cultural activities as language and architecture. Each level is based on the previous one, yet each level affects the other by its own existence. In biological philosophy, the three levels are represented by chemical, biological and cultural evolution.¹⁴

According to this viewpoint, the architectural product is a cultural object, which is physically connected with nature through its position and construction materials. Furthermore, because it is a result of human creativity, it is produced by a blending of individual expression and cultural conven-

tions. Taking the connection between evolution and the senses as a starting point, we will soon approach the essence of architecture. As Frank Gehry once so succinctly put it, "We all want to live among flowers and trees".¹⁵ Intuitively, we know what kind of environment is suitable for us. Thus, knowledge acquired through our senses and conceptualized by our higher faculties also informs architects of the crucial qualitative characteristics of our living environment.

Humans conceive of nature in two ways. Firstly, sense and perception have laid the foundation for the idea that humans and nature are interconnected through *sensory analogy*: the structures of nature and the perceiver are similar or at least have a common evolutionary foundation. To be able to receive sensory information about the natural environment, our sense organs must be part of nature; they are produced by the laws of nature and have developed for the versatile perception of our environment. Hence, nature is extended to include humans, who are an integral part of it in terms of evolution and growth, and thereby capable of living in nature. Humans have an inherent relationship to natural environments they inhabit, and those environments have governed their sensory evolution.¹⁶ Organic architecture represents a romantic approach, which appeals to our senses and emotions.¹⁷

Picture 6
Villa Mairea, Alvar Aalto
Confinement adjustments and elevation changes can be used by architects to create a "forest-like" space.
Photo: Simo Rista



Secondly, there is *rational analogy*: the “structure” of intellect is analogous to geometric and mathematical ideals.¹⁸ To put it into architectural terms: pure geometrical forms appeal to our mind, which seeks to find holistic unity, order and form. Submitting itself to the mind, the eye finds pleasure in the “purity” of form represented by basic geometric objects. Rational architecture views geometry as the human domain, in contrast to the endless variation found in nature.¹⁹ Through geometrification, the human mind refines and humanizes its frightening and chaotic environment. At the same time, it creates its own interpretation of nature, whose structure corresponds to human understanding and the need for order and control.

In terms of shape, geometric proportions can be thought of as specifications of topological relations, while representing simplifications in a material and practical sense. However, as components of our environment – on the scale of buildings and blocks – it appears that the repetition of regular geometric elements is not fully satisfactory; people do not, after all, see their environment as a “machine for living”. And yet modern architecture often emphasizes the significance of geometric properties, perhaps with a view towards production costs and general applicability.

Biologically-based organic architecture – such as that of Alvar Aalto – can be said to comprise two different aspects: the perspective of a good natural place, corresponding to our emotional experience, and the idea of a fixed overall contour, which indicates formal unity and control. Thus, good architecture shows sensitivity to the natural characteristics of the site based on an understanding of the primary significance of topological relations; but it also masters geometrical patterning, which manifests itself in correct proportions and harmony of shape. Alvar Aalto’s architecture is sensuous in an original and essentially Finnish way, showing a grasp of the primal, biologically-based aspects of place, while being permeated by the geometrizing tradition of our culture.

ARCHITECTURE AS AN EXTENSION OF NATURE

*The architect should have a good memory for natural phenomena, a morphic sensibility of material and spatial concretions.*²⁰ (Reima Pietilä)

Reima Pietilä (1923-1993) had his own characteristic way of transforming nature experiences into constructed forms. He seems to have had an eye for combinations of forms in nature, for the primary local structuring of spaces and shapes. Seeing in this context embraces the potential to apply organizing architectural principles to perceptions. At the second stage, the perceived impression is abstracted and geometrized; allusions contained within the impression are converted into a visually manageable form in which the chaotic diversity of nature is seen as variation controlled by some explicit form principles. Stage three involves transforming the abstracted form into a construction form, whose characteristics are in agreement with those of the task at hand; a construction form is a practical variable form element whose implementation is within economic and technological limits. A construction form can refer either to the overall form of a building or some varying, repeated form element.

Among the most beautiful and illustrative examples of this type of approach are the Suvikumpu housing estate in Tapiola (1969), the Dipoli Conference Centre (1966) and the Finnish Embassy Building in New Delhi, India (1985). Pietilä himself has commented on the Dipoli Center: “Dipoli is a composition where the nature is the creative artist and sylvan *genius loci* its theme.”²¹

Pietilä’s design method involves carrying out a series of practical steps. Firstly, the seeing stage involves acquiring a concrete understanding of the site and includes several methods of inspecting it, including maps, cross-section drawings, photographs and drawings and, in Pietilä’s case, also the activation of the mind

Picture 7
Dipoli, Reima Pietilä, 1966.
In Reima Pietilä’s Dipoli Center,
window alignment is used to
transpose spatial relationships
from the forest to the building
facade, 1966.
Photo: Malcolm Quantril





Picture 8
 Dipoli Center, Otaniemi, 1966,
 Reima Pietilä.
 Ground plan. Rocky forest landscape from a bird's eye view;
 Reima Pietilä's graphical illustration mirroring the natural environment of the Dipoli Center.

through touching. He has reported having criss-crossed the area in the dark before construction began in order to memorize its topography through the tactile sense of his feet.²² Abstracting the space and form of the site is accomplished by sketching; from the diversity of natural forms, the architect's pencil traces manageable rhythmic outlines and form principles. Transforming this unique, local "world" into a functional construction form represents the actual creative leap for the architect, a mysterious event, which is nonetheless founded on an exact understanding of practical construction techniques.

In his festschrift on Pietilä, Malcolm Quantrill writes: "His whole life and thinking are rooted in an intelligent perception of nature and man's interaction with it."²³ Quantrill puts nature in first place when describing Pietilä's thinking, whereas Aalto's approach is generally characterized as highlighting the connection between humans, nature and technology. For Pietilä, nature represents an abundant supply of morphological knowledge; as an observer and experimenter marvelling at the cornucopia of nature's abundance, he is in direct contact with natural phenomena. Contrary to Aalto, Pietilä does not interpose cultural impressions between the experimenter and the experienced. In this respect, Pietilä's impression of nature is more authentic and original. As Norberg-Schulz has asserted, Aalto's architecture does not contain metaphoric references to nature or specific places; in his work, nature is present in a general sense as a source of informality.²⁵ Pietilä, on the other hand, is looking for the architecture of place, attempting to materialize the Finnish spirit of place. He wants to regress to a "precognitive understanding", an immediate, intuitive and tangible experi-



ence of place.²⁵ In the light of these notions, Dipoli Center indicates that Pietilä sees the landscape, i.e., the particular, recognizable form of a place, not in terms of a framework for a building, but as a basic morphological element of architecture, part of the grammar of form and space that holds the solution to the task. Our attention is thus channelled toward the explicit material shapes and forms of the natural place.

Picture 9
Finnish Embassy Building, New Delhi, 1983–85, Reima Pietilä.
Photo: Simo Rista

In describing the Suvikumpu housing estate, Pietilä remarks that “the disposition of the mass of buildings is isomorphic with the topographical forms of the site. The mass is broken down like the irregularly eroded rock, responding in the isomorphoses of the horizontal and vertical directions to the form of the rock itself”.²⁶ Pietilä’s landscape or site-inspired form language stands out from the mainstream of Finnish modernism: his construction form emerges from natural form through abstraction, simplification and “straightening”. Aalto’s characteristic free-flowing curve symbolizes the presence of nature’s irregularity. To Pietilä, geometry is artificial, while topology is natural, representing the gradual transformation and variation of form which generates form relationships or form families. Constructing an entity, these form families are fragments of forms constituting a coherent series of variations and a connection to the structure of the surrounding landscape. Pietilä himself explains the background for his architecture as follows:

Picture 10
Barcelona Archery Range, 1991,
Miralles & Pinós.



Genius loci is an atmosphere; it comprises the associations or character of a place. (...) The architectural "thing" either has it or not. A genius loci trait is chromosomic for the growth of identity in the process of de-sign. (...) In this modern sphere, the study of elements of the genius loci turns our attention to the integration of the natural with the cultural environment.²⁷

For Pietilä, the approach he adopted when designing the Dipoli Center represents an application of a larger concept of landscape, in which buildings sup-plant some of the site's natural qualities with temporal and spatial organizations that are man-made, yet no less environmentally well-balanced. He maintains that buildings have a "cultural task".²⁸ They are expressions of and comments on a specific cultural context, analyzing and synthesizing our notions of its significance here and now. Pietilä's approach to construction culture stresses a sym-biotic relationship with the natural world.

However, the forest may also take other expressions. In the Embassy building in New Delhi, Pietilä further elaborates some of the themes present in the Dipoli Center and adapts them to another culture and climate without losing the characteristic Finnish attitude. A central element in the building's exterior is the motif created by the beautifully billowing roof, analogous to a forest edge which, akin to a canopy, provides shelter from excessive light and heat. Here, Pietilä avails himself of a design method where elements arranged at different levels to mimic the spatial structure of the natural world are interdependent, yet follow their own transformation logic, which makes them somewhat detached from each other. Processes at the floor or terrace levels and at the wall and ceiling level are all autonomic transformation objects which, just like the terrain, tree trunks and canopy of a forest patch, constitute a whole allowing, for example, a single tree growing in a particularly favourable spot to extend its branches further than those of its neighbours. A similar method²⁹ was used by Enric Miralles in the design of the Archery Range in Barcelona, the ground plan of which, despite its dissimilar form, reveals a close relationship with Pietilä's work. In the same vein, the view toward the roof is spatially analogous with the Embassy building.

Picture 11
Park Café, 1998, Kazuyo Sejima.



BUILT LANDSCAPE

In general, Pietilä's morphology is based on topological rather than geometrical patterns of organization. (Norberg-Schulz, 1988)³⁰

In Norberg-Schulz' phenomenologically-inspired architectural language, it seems natural to classify Pietilä's major buildings as topology-based and geometry-based (e.g., Hervanta Center, 1979). Being familiar with the architectural accomplishments in question, it is easy to understand what the author is trying to say: the Dipoli Center grows out of a natural place with its variety of elements, while buildings such as Lieksa Church (1982) allude to a cultural tradition in architecture in which geometries of form and organization are visible in the rectangular overall form and the shape of the dome cap.

This article has dealt with nature's storehouse of forms and the forest as a starting point for architecture. Against this background, Norberg-Schulz' conceptual dichotomy is an interesting and perhaps widely applicable tool for the analysis and understanding of the quintessence of architectural works. In the previous sections, I have referred to the strongly-felt

sensation of natural place in some of Aalto's designs. When analyzing architectural interpretations of forests and the natural world, I strive to adopt a primarily topological viewpoint, albeit one that can be substantially altered by geometric considerations.

In architecture, topological relationships arise from the mutual ordering of elements governing a building's spatial structure (as in Aalto's Rovaniemi Library), the relationships these elements assume with regard to the surrounding landscape (Dipoli Center) or an idealized aspect of landscape structure (e.g., Kazuyo Sejima's Park Cafe). If architecture is not based on topological relationships, it can be said to be based on geometric ones. Le Corbusier has talked about "pure volumes"; in the context of his machine for living, the only useful aspect is "geometry; prisms, cubes, cylinders, pyramids and balls, as pure volumes."³¹ As a result, the building is governed by geometric abstraction, which may emphasize a detachment from the natural world or place as in early neo-plasticism or in Peter Eisenmann's (1932-) cardboard architecture of the 1960s.³²

However, even purely geometry-based architecture may have a topological undertone. In Tadao Ando's architecture, for example, a concrete wall transmutes into a cliff face when it is bordered by a water surface. A narrow yard confined by walls is transformed into a rock-bordered clearing when the confining walls are reduced into plain surfaces with no practical details. Simplification may also serve to turn elementary spatial relationships into an active topological structure as in Louis Barragán's (1902-1988) house (1947). In his study, the simple presence of a banisterless staircase creates a basic up-down relationship as well as an interconnecting route.

Almost invariably, modern architecture mingles topological relationships with geometric elements. When discussing Pietilä and his work, I have made a reference to his special ability to give a geometric expression to the Finnish landscape.

Juha Leiviskä's architecture, on the other hand, is often based on interpreting and further developing nature's spatial structures. As a method of architectural interpretation, a comparison between topological and geometric relationships may prove a useful starting point.

"Design places, not buildings."³³ This advice Reima Pietilä gave to architecture students at the University of Oulu in the 1970s was intended as an exhortation to shift the accent from an image-centered division of building surfaces to a spatial and perceptual experience of the environment. Similar ideas have been expressed by one of the most important reformers of architecture in the 1990s, the Spaniard Enric Miralles: "*The new extension (Rosenmuseum in Steinfurh) would not be a building, but the place where the growth of the flowers would be exhibited outside.*"³⁴



Picture 12
Kidosaki House, Tokio, 1982-86,
Tadao Ando.
View from inside out.



Picture 13
Luis Barragán House, Mexico
City, 1947, Luis Barragán.
Photo: F. Lagrange.



Picture 14
Kiasma, Helsinki, 1998,
Steven Holl.

As a design object, "place" is different from building. When we design a building, the emphasis tends to fall on surface projections, ground plans, facades and their internal and mutual relationships. The focus is thus on the two-dimensional structuring of surfaces. Key points of interest are what the building looks like and what impression the surfaces create. Place as a design object involves having a conscious relationship with the environment and an awareness of depth. When the design focus is on place, we are actually designing the relationship between a building and its environment. We thus zoom in on the depth impression of the site rather than the building surfaces. A cross-section or perspective drawing can be used to relate the structure of the building to that of the site or, conversely, elucidate how the spatial structure of the site is reflected on that of the building. Manipulation of the structure of the site gives rise to the building's relationship with the surrounding landscape, the characteristic integration of natural landscape in architecture.

It is also interesting to note how the proportions of the human body harmonize with the spatial structure of a place, i.e., a building and its site. This involves observing how the environment illustrates the spatial proportions and arrangements that stem from the proportions of the human body and kinetics.

A building's most fundamental topological relationship is containment, i.e., how enclosed

it is in relation to its environment. Within itself, each building contains a world constituting a confined space set apart from the outside world. This space can be endowed with a special character by the residents, reconciling differences between their inner world and the outside world. The mediating quality of buildings may also be expressed by their physical appearance through integrating symbolic representation. A building's character may contain subtle topological relationships that establish tangible associations with the natural world, our original dwelling. It is precisely this regulation of confinement that allows architects to regulate a building's spatio-structural character. Topological relationships may help us to understand and describe basic characteristics of architectonic spaces. Such disparate interiors as that of the study in Louis Barragan's house (photo 13) and Kiasma's entrance hall by Steven Holl (photo 14) share a number of similarities; their reduced forms accentuate the analogous nature of the divisions, walls and upward movement of a route, stair or ramp. They both can also be likened - albeit on a different scale - to a path or road ascending a rock surface.

Aalto's architecture captivates the attention of visitors through small changes in elevation, which are used to structure space and give it a forest-like impression. For example, the stairs in Villa Mairea which serve to divorce the entrance hall from the main level bring to mind variations in the elevation of natural terrain. The same is true for the eight steps which descend to the sitting room of Maison Carré that then opens onto a slope, toward light. Located in a grove of tall pine trees, Säynätsalo Town Hall has induced Aalto to elevate the building's spiritual center, the council chamber, via a narrow staircase lit from above, to the third floor, locating it amid the foliage. Several of Aalto's architectural works exhibit this use of elevation changes, with the reading niches of Rovaniemi Library being among the most delightful examples.

Interesting features in this approach to architecture include the size and scale of the active *spatio-structural unit*. Typically for Aalto (and in Bauhaus thinking), this unit often coincides with the build-



Picture 15
 Maison Carré, 1956-1959, France,
 Alvar Aalto.
 Maison Carré's curving ceiling
 and top lighting, together with
 the easily flowing and widening
 spatial rhythm, create an atmos-
 phere of a natural place.

ding's functional unit and is distinguishable from the rest of the building in terms of function and space. This contrasts with Pietilä (Dipoli, Suvikumpu, New Delhi), whose spatio-structural unit tends to be smaller than the functional unit and arises from the spatial structure of the natural environment, structure of trees and their distances, geomorphological variations and stratification of the forest stand. As for Leiviskä, his work is characterized both by functional grouping and a microscale division that may be influenced by the dimensions of the surrounding forest (Myrämäki, Männistö and Pakila Church).

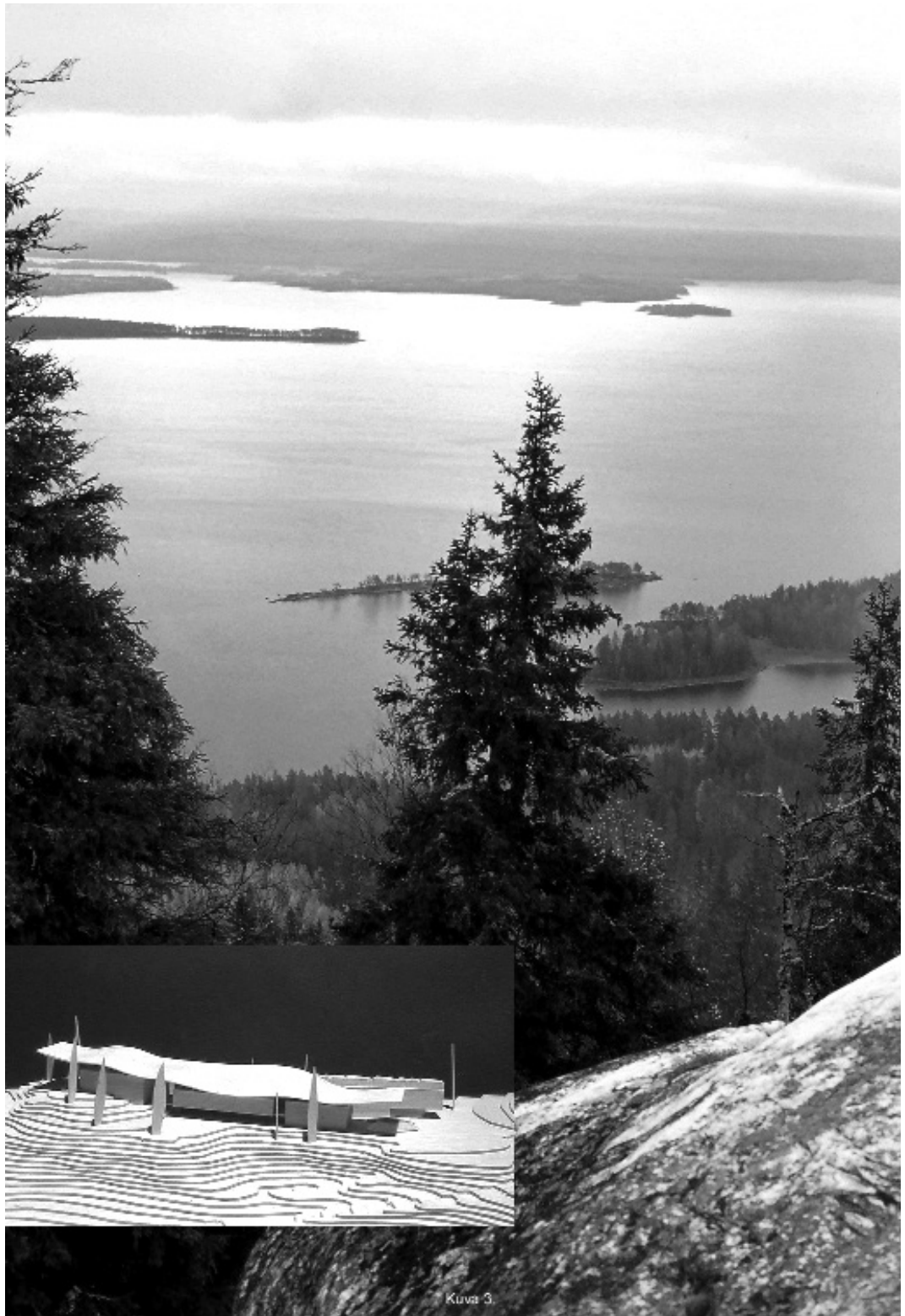
In the Dipoli Center, to give a practical example, Pietilä links variations in microscale structures (trees) in the facade to the overall impression of the building (forest) which, in turn, has its own larger scale shape, forming an element in the spatial structure of the site and participating in the creation of topological relationships at landscape level.³⁵ Hence, topological relationships can be studied at the level of the human body (at the level of the interspace between trees and their forms), in which case the transformation objects are in room-scale or smaller. Adopting a different approach, we may also look at topological relationships at the landscape level, where spatial relations are generated by large-scale objects such as forest silhouettes, water courses, ridges or simply by open and confined spaces. These different scales correspond to different viewpoints: the body scale, which allows spaces to be experienced from the inside, or the landscape scale, in which the building is perceived from the outside.³⁶ In a forest, trees create a structural level that organizes the space, converting it into a forest interior scaled for human proportions. Seen from outside, the trees describe the shape of the forest; thus, combined with the natural contours of the terrain, they constitute active structural units even at landscape level. Similar double coding can also be ascribed to the columns of a classic Greek temple.

CONCLUSIONS

In this paper, I examine natural spatial structures from the viewpoint of ideal human habitation. My focus of interest is on those structural characteristics of space that are experienced as positive due to human kinetics and the inherent qualities of the human perceptual space. These structures are experienced as having a protective and calming quality as well as accommodating human bodily orientation. As a result, humans (and buildings) have an ideal relationship to the natural landscape and use it in such a way that both its concrete spatio-structural and metaphorical cultural features

enrich the nature of human existence and support corporality. When landscape structures harmonize with mental structures, we enter deeper dimensions of living in a particular landscape or building. This almost mystical state can sometimes be reached in the sheltered, yet spacious "rooms" of Finnish forests.

Familiarization with the physical structure of the forest and forest-related cultural traditions permit us to look at architecture as a nature-related human activity; at the way in which one species inhabits its environment. This habitation involves modifying the natural environment to make it more



Picture 16

Background photo:
View east from Koli Hills, 2003.
Autumn light on Lake Pielinen.
Lauri Louekari.

Embedded photo:

As landscape fragments, buildings transpose and geometrize characteristic local features of the surrounding landscape.

In our competition entry, the silhouette of Koli Hills is transformed into a hyperboloid saddle-shaped structure over the nature center and the adjacent hotel.

Photo: Lauri Louekari

suitable and practical for humans. At the same time, the end result is that living environments, buildings or cities are part of the natural environment in a larger perspective. The architect's task is to rearrange natural materials so that they better serve human purposes. To this end, he or she utilizes architectural design methods to create environments or spaces for social life where a range of human activities may take place. Buildings are also mental objects that construct and reflect meanings. Essentially, it is this ability to create and read meanings that lies at the core of architecture. In Finnish architecture, sensing the presence of a spatial and formal structure that is reminiscent of the forest is a defining characteristic, founded both on our national mythological tradition and an individual experience of the quintessential significance of woodlands for our living environment.

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PICTURE SOURCES

Picture 5

Shildt, Göran. *Inhimillinen tekijä, Alvar Aalto 1939–1976*. Otava. Keuruu, 1990. p. 250

Picture 6

Weston, Richard. *Alvar Aalto*. Phaidon. London, 1995. p.96

Picture 7

Quantril, Malcolm edit.. *Reima Pietilä, Architecture, Context and Modernism*. Otava. Helsinki, 1985. p. 57

Picture 8

Connah, Roger. *Writing Architecture: Fântomas Fragments Fictions: an Architectural Journey through the 20th Century*. Rakennustieto. Hanko, 1989. p. 253.

Picture 9

Finnish Embassy Building, New Delhi, 1983–85, Reima Pietilä. Entrance view, *Arkkitehti* 2/1987 (photographer Simo Rista), p. 35. Level 2 floor plan. *Arkkitehti* 2/1987, p. 40. Cross-section. *Arkkitehti* 2/1987, p. 40.

Picture 10

View, el croquis: Enric Miralles & Carme Pinos. Madrid, 1991. p. 59. Ground plan. el croquis: Enric Miralles & Carme Pinos. Madrid, 1991. p. 58.

Picture 11

el croquis 99: Kazuyo Sejima+Ryue Nishizawa. Madrid, 2000. p. 124.

Picture 12

Architectural Monographs 14: Tadao Ando. Academy Editions/St. Martin's Press. London, 1990. p. 53.

Picture 13

View from the study, Rispa, Raúl (ed.). *Barragán, The Complete Works*. Thames and Hudson Ltd. London, 1996. p. 119.

Picture 14

el croquis 93: Steven Holl. Madrid, 1999. p. 71.

Picture 15

Karl Fleig (ed.), *Alvar Aalto*. Artemis, Zürich 1963. p.245.

Picture 16

Kristiina Helin, Lauri Louekari, Anu Marjamaa, planning competition for Koli Nature Center, competition entry "Kaltio", 1997, scale model by Veli-Pekka Tolonen, architecture student.

NOTES

¹ See, for example, Christian Norberg-Schulz: *Genius Loci – Towards a Phenomenology of Architecture*. Academy Editions, London, 1980.

² Juhani Pallasmaa has, in many contexts, written about architecture of the forest, for example in his beautifully illustrated book *“Encounters”*, published by Rakennuskirja, Helsinki, 2005. He also acted as the pre-examiner and opponent of my doctoral dissertation.

³ See, for example, Paolo Portoghesi: *Nature and Architecture*, Thames and Hudson, London, 2000.

⁴ Mark Twain, *Adventures of Huckleberry Finn*, Dover Publications, Inc., New York, 1994, p. 27. Originally published in New York, 1885.

⁵ In architecture, topological relations describe the mutual arrangement of entities that are used to manipulate spatial structures. Perception (Piaget) involves making a distinction between topological and geometric relations, or location-related forms vs. exact geometric forms. In theoretical modelling (geography, data processing, wiring systems), topological relations may represent relationships in a network or between different parts of a network.

⁶ Alvar Aalto, “The Trout and the Stream”, in *Alvar Aalto in His Own Words*, edited and annotated by Göran Schildt, Otava, Helsinki, 1997, p. 108. Translated by Timothy Binham. Originally published in *Domus*, 1947.

⁷ For example, Göran Schildt, *Inhimillinen tekijä, Alvar Aalto 1939–1976*, op.cit., p. 269. or Richard Weston, *Alvar Aalto*, Phaidon Press Limited, London, 1995.

⁸ Such as *Oulainen Library*, Harju ja Karjalainen, 1969

⁹ Alvar Aalto, “Influence of Structure and Material on Contemporary Architecture”, in *Alvar Aalto in His Own Words*, edited and annotated by Göran Schildt, Otava, Helsinki, 1997, p. 99. Translated by Timothy Binham. Originally the Lecture at the Nordic Building Congress in Oslo in 1938.

¹⁰ Kauko Honkala, “Tieto ja tietäminen biologian näkökulmasta”, *Kulttuuriläin: Ihmistutkimuksen biologiaa*, edited by Matti Kemppainen, Pasi Laihonon and Timo Vuorisalo, Otava, Helsinki, 1989, pp. 175–184.

¹¹ Ibid.

¹² Ibid.

¹³ Ilkka Niiniluoto: *Maailma, minä ja kulttuuri*, Otava, Helsinki, 1990. Popperian levels form a hierarchy, while another type of hierarchy exists within each level, so that the time-bound development of evolution can be thought to have given rise to increasingly high (and complex) life forms at the level of nature, pp. 90–91.

¹⁴ Kamppinen, Laihonon, Vuorisalo, op.cit., pp. 175–184.

¹⁵ Frank Gehry, “Suvantoja sekasorron keskelle”, a programme on Gehry’s architecture TV 1, FST, 1.10.2002.

¹⁶ Natural environment is an extensive concept here encompassing all potential living environments, of which the hiker or nature lover perceives one alternative. The analogy concerns our bodily and perceptual relationship with our environment. From the vantage point of science, our senses may appear rather limited in scope or even misleading to a degree.

¹⁷ Features of this dichotomy can be traced back to Immanuel Kant. According to Ralph Walker, Kant maintains in his *Metaphysical Elements of Ethics* (1785, s. 452) that “a rational being has two standpoints from which he can consider himself and recognize the laws for the use of his powers and hence for all his actions. (1) As belonging to the sensible world, he falls under the laws of nature (heteronomy). (2) As belonging to the intelligible world, he is under the moral authority of laws that are independent of nature, and so are not empirical but based entirely on reason.”

Ralph Walker, “Kant”, in *Surety philosophic (Great Philosophers)*, Ray Monk and Frederic Raphael (eds.), Otava, Helsinki, 2004, p. 354.

¹⁸ This idea goes back to Plato and his theory of ideals that are capable of showing the true forms of reality better than erratic nature. Reijo Työriñoja, for example, writes in *Luonnon luonto* that Plato presented the idea that mathematics best represents the form of intellect which in the ever-changing physical world is only imperfectly realized.

Reijo Työriñoja, “Tuomas Akvinolaisen luonnon käsite ja sen kritiikki keskiajalla”, *Luonnon luonto*, Jussi Kotkanvirta (ed.), Jyväskylän yliopisto, Jyväskylä, 1996, p. 60.

¹⁹ Gössel ja Leuthäuser, *Architecture in the Twentieth Century*, Taschen, Köln, 1991, p. 317.

Mario Botta asserts in this work: “Architecture is a counterpoint to Nature, a dialogue with Nature. Architecture is an artificial factor. The only means of paying tribute to Nature is to be in exact opposition to her, in confrontation (...) Architecture is a violation of landscape; it can not simply be integrated, it must create a new equilibrium”.

²⁰ Reima Pietilä in Christian Norberg-Schulz’ article “The Way of Reima Pietilä”, in *One Man’s Odyssey in Search of Finnish Architecture*, edited by Malcolm Quantrill, p. 12. *Rakennustietosäätiö*, Helsinki, 1988.

²¹ Norberg-Schulz, in *Quantrill*, op.cit., p. 13.

²² Professor Reima Pietilä during a lecture at the University of Oulu, present author’s lecture notes, 1975.

²³ Malcolm Quantrill, Reima Pietilä, *One Man’s Odyssey in Search of Finnish Architecture*, *Rakennuskirja*, Helsinki, 1988, p. 9.

²⁴ Reima Pietilä in Christian Norberg-Schulz' article, "The Way of Reima Pietilä", in *One Man's Odyssey in Search of Finnish Architecture*, edited by Malcolm Quantrill, Raken-nustietosäätiö, Helsinki, 1988, p. 13.

²⁵ *Ibid.*, Reima Pietilä, pp. 21–33.

²⁶ Reima Pietilä in Christian Norberg-Schulz' article, "The Way of Reima Pietilä", in *One Man's Odyssey in Search of Finnish Architecture*, edited by Malcolm Quantrill, p. 14. Rakennustietosäätiö, Helsinki, 1988.

²⁷ Reima Pietilä, "Two Approaches to "Genius Loci": Historical and Modern, in *One Man's Odyssey in Search of Finnish Architecture*, edited by Malcolm Quantrill, p. 20. Raken-nustietosäätiö, Helsinki, 1988.

²⁸ Professor Reima Pietilä during a lecture at the University of Oulu, present author's lecture notes, 1975.

²⁹ I have termed this approach as the organic overlapping method, in which the various construction elements of buildings, such as walls and roof structures, are fictitiously - and sometimes even factually - designed on separate sheets of paper, which are then super-imposed on each other to give full play for random effects.

³⁰ Christian Norberg-Schulz, in Quantrill, *op.cit.*, p. 5.

³¹ Peter Gössel and Gabriele Leuthäuser, *Architecture in the Twentieth Century*, Taschen, Köln, 1991, p. 165. In his *Vers une architecture*, Le Corbusier writes that: "The surrounding forest is full of disorder"... "Geometry is a human language"... "axes, right angles and circles are geo-metric truths, which our eye recognizes". Le Corbusier, *Kohti uutta arkkitehtuuria*, Avain, Helsinki, 2004. Originally published in: *Vers une architecture*, 1923, pp. 62–63.

Although Le Corbusier's work from the 1920s is based on the abstract ordering of plain, slab surfaces, some of them also allow a topological interpretation. For example, the line of pillars on the ground floor of Villa Savoy can be perceived to constitute a forest theme, connected intimately with the reticular structure of the entrance with its softly curving glass facade. The long-lasting repercussions of Le Corbusier's work can be said to originate from precisely this versatility of spatial structures which, regardless of representing simplified forms, evokes positive associations.

³² According to Gössel and Leuthäuser, Eisenman claims: "(the house looks like) a card-board model and demands to be read in a conceptual manner (...)." Gössel and Leuthäuser, *op.cit.*, p. 281.

³³ Professor Reima Pietilä during a lecture at the University of Oulu, present author's lecture notes, 1975.

³⁴ *el croquis 72*: Enric Miralles, Madrid, 1995, p. 52.

³⁵ The rhythmically folding variation series of the Dipoli Center's façade may have derived its scale from the rhythms of the surrounding trees, their mutual distances and vertical organization into trunk and foliage, which is mirrored by the architecture of the eaves. At the same time, perhaps on account of the projecting construction elements, the architecture of Dipoli is related to the projecting elements of trees, i.e., branches and foliage. Various expressive and often "empty" eave constructions are the building's topological equivalent of foliage. A similar, active eave construction can be found in Tampere Library, for example.

³⁶ A building's outward appearance may also carry reflections of topological elements that correspond to the proportions of the human body. This can be illustrated by comparing a high-rise from the 1970s, constituting a single mass, to the elaborately organized local massing of Suvikumpu, mirroring human bodily proportions at building scale.