WHERE BUILDING MEETS SKY
The Dialogue Between Horizontal and Vertical

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ABSTRACT

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The roof is man's basic shelter against the elements.
The form of the roof itself affects the image of a building.
The problem of shelter has been approached in different ways
by different cultures. A wide range of forces such as climate,
technology, available resources and social, personal and
stylistic influences give form to the roof.

These forces are particular in both place and time. As
a framework for investigation that can apply to all roofs, this
thesis looks specifically at roof forms as a response to the
force of gravity, approached in terms of a dialogue between
horizontal and vertical. Assuming the ground to be horizontal
and the building essentially vertical, the building is seen as
aspiring to some connection with the vault of the sky. The
roof is explored as the meeting of building and sky -- a
transition zone between shelter and openness. The forms,
materials and spaces that work to resolve that connection as
well as the associations and meanings they have for man are
explored. The purpose is to better understand the
fundamental forces that affect the form of roofs and people's
perceptions of them.

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I began looking at roofs as a way to study the place of one element in buildings, considering forms and materials in light of diverse human needs and contexts. I found roofs interesting, somehow captivating. As I began to talk to other people and discuss images, I found that others were also fascinated.

For a while, I searched for a way to get at this topic in a structured way, without losing or drowning out the delight which inspired it. Eventually I realized that the attraction of roof forms, their captivating power, interested me the most; I set out to look at the sources of that power and of the delight that roofs can inspire.
In an attempt to select generic forces as a framework for investigation, I chose to focus on the force of gravity and the dialogue between horizontal and vertical. As a result, this thesis is broad but not meant to be complete. It is a collection of observations, ideas, quotes and images that represent my thoughts filtered through and organized by this framework. Many of the ideas are still settling, some are just starting to form. It is a beginning, however, of a way to look at and understand roofs: some of the forces acting upon them, their significance to man and their potential to delight. I hope that it can provide a stimulus for people (designers and others) to think about roofs in new ways, appreciating their importance to man.
INTRODUCTION

"A roof is the most essential part of the building. People have lived without walls, but never without roofs."
Buildings provide man with shelter - shelter that fulfills both functional and emotional needs for security. The roof is man's basic shelter, it is cover from snow, rain, wind and sun. As a primary element in a structure, it affects the way a building works and looks. Because of its importance to man's survival, it has become the focus of much energy and attention.

The roof is important both physically, in the forms and the spaces it makes, and perceptually, in terms of the associations it evokes and the experiences it makes possible. Dictionary definitions begin to hint at the meanings the roof has for man:

"(1) The outside covering of a building or structure, including the roofing and all the materials and construction necessary to maintain the cover upon its walls and supports. (2) A shelter or house, home (3) The highest point or reach of something, summit (4) Something that covers, includes or completes (5) The vault of the heavens."
There are a few basic forms and systems from which roofs are built and a few general classes of materials used. The different combinations of those forms and materials lead to a wide variety of designs. The shape of each roof is a resolution of manifold forces. Functionally, the roof is a response to the constraints imposed by climate, technology and available materials. Beyond this social, cultural and personal values, as well as style affect which forms will be used and how they will be built. The roof becomes a highly specific expression of these forces and their resolution at a particular time and place.
There are, however, certain forces which affect all roofs. One of them is gravity, felt everywhere on earth; all buildings are a response to this force. Gravity makes existence on earth spatially asymmetrical and distinguishes two separate dimensions - the horizontal and the vertical. Orthogonal to one another, they are fundamentally different with particular spatial qualities.

The horizontal dimension is perpendicular to the pull of gravity and parallel to the ground. In it no direction is spatially distinguished because the force of gravity is uniform throughout; it accommodates movement within freely. The horizontal plane, manifest in the horizon, establishes a base from which to gauge movement in the vertical direction. The vertical realm is parallel to and distinguished by the pull of gravity. Movement in this dimension is restricted by gravity - it follows a line, with up being very different than down. Moving up, away from earth, requires the input of energy and stores it in potential energy. Moving down, falling with gravity, releases that energy and moves toward rest. There exists a tension between these two directions - staying up requires energy to resist the constant pressure down.
A vertical line standing perpendicular to the ground is balanced, but possesses some potential energy because it is not at rest - horizontal. Combining components of the two dimensions creates slope, which provides for movement in both directions. With it, vertical movement up can be achieved gradually, lessening the expenditure of energy by using support from the horizontal to counter gravity. Slope can also slow downward movement by displacing it horizontally. The sloped line is highly unstable - it is neither balanced nor at rest. In this it embodies the tension between the two realms and makes the latent energy visible. The relationships between horizontal and vertical become more apparent once they are physical.
A line, whether horizontal or vertical, can be read in either of its directions unless it is anchored on one end. A simple vertical element, such as the column, would read infinitely both up and down if not ended with a base and a capital. The base and capital serve as mediators to the meeting of horizontal and vertical. Pieces of smaller scale that contain components of each direction, they mitigate the piercing quality of the intersection.
Regardless of their overall proportions, buildings are essentially vertical. They rise up out of the ground plane to enclose space: "the vertical direction expresses the very process of building".\textsuperscript{5}

Reading a building along the vertical axis is more complex, however, than reading a simple line or column. Because a building is generally anchored in the ground with a free end toward the sky it might suggest upward movement. But there are also downward forces, especially the visual weight directed down toward the center of gravity.\textsuperscript{6} The reading of a building in either direction is highly subjective - it depends upon the overall proportions and the treatment of end connections to the ground and sky.
The roof zone is where building meets sky - it is the transition zone between the two. Moving up from the ground, it aspires to some relationship with the space that envelopes it. Like the capital of a column, the roof mediates the connection of the vertical building with the vault of the sky. In order to provide cover, the roof must have some horizontal component. It can range from flat to a very steep slope. The mixture of horizontal and vertical elements and their interplay within the roof zone determines the character of the transition.
A transition is a matter of degree - it can be gradual and smooth or sudden, abrupt. The zone can be as thin as a line or as deep as a building. The most minimal transition is the flat horizontal plane, which provides for little connection or exchange with the sky. As some vertical component begins to appear, in either sloped or upright pieces, the roof becomes less of a barrier. These vertical elements give the roof zone some depth and provide for a more open and gradual transition. A thick transition allows for some exchange - some building gets up into the sky and some sky gets down into the building. It creates a knitting together that strengthens and enriches the connection.
FORMS & SPACES

"It is in the roof design that we find the first and also the most varied expression of form and materials."
Buildings provide shelter by enclosing space. They do this with some combination of horizontal, vertical and sloped elements. The shape and material of the forms used determine the nature of the spaces they create. The roof, in particular, is shelter from above - from falling rain and snow and the beating sun. Its configuration is a response to the force of gravity. The horizontal components of roof forms provide a barrier on top and create space underneath; vertical components build some connection to the sky and create spaces within.
In its most basic form, the roof is a direct response to climate and the technical/material problems of spanning space. The roof is defensive by nature, but is not totally exclusive; it is a barrier to some things, but permeable to others. As with any natural sheltering membrane, such as skin or fur, it is a filter that controls what penetrates it, allowing the beneficial in, excluding the undesirable.

In most cases, roofs are designed to keep water out. Precipitation, whether rain or snow, needs to be directed off the roof quickly before it can leak through. This is achieved through slope - the pitch of which is suited to the amount of rain or snow expected. A steep pitch is particularly important in moving snow, which drains less easily than water and can create unmanageable loads on the roof. Other aspects of the
weather, such as sun and wind, are considered valuable in certain climates, but detrimental in others. In response, roofs can be oriented to the sun or can provide shade when needed with overhanging eaves. They can also be shaped to catch or resist prevailing winds. The particularities of climates throughout the world have lead to a wide range of variations on the simple theme of cover.
As the primary generator of building loads, the roof must be designed to carry its own weight as well as changing loads such as snow or wind. Spanning space and protecting it from the elements is achieved through a combination of systems of structure and closure. These systems use horizontal and vertical components to resist gravity.

Two major categories of structural systems of roofs are the frame and the continuous surface. In the frame, usually made of wood or steel, structural support comes from a composition of linear elements. These pieces, under a combination of the forces of tension, compression and bending, can take on a wide variety of shapes. Closure comes from some material that infills between and is independent of them. The means of support can either be expressed or covered by this closure.

The continuous surface structure, on the other hand, is usually made of masonry, either bricked or poured. In it support and enclosure are one. These structures, including domes and vaults, have only the force of compression within them. When bending or tension is introduced, as in flat planes or freeflowing curves, some reinforcement is needed within the masonry, and a hybrid between the two systems develops.
Since frame systems can support roofs independent of closure, these forms have the ability to be very open. They need no support from walls and can have openings between structural members. Because the continuous surface system is fully dependent on the walls for support, opportunities for openness are restricted to holes punched through the surface.
The roof spans above. As a simple horizontal plane floating overhead, it defines a volume of space between itself and the ground plane - a space that is undifferentiated vertically. As such, it is a parallel hovering between earth and sky. In accommodating movement in the horizontal direction and limiting it in the vertical, it can function as raised ground, lowered sky or as a barrier between the two.
The horizontal line is the "line of repose", it is at rest with gravity. Once raised from the earth, it hovers in tension, endowed with greater potential energy. The horizontal roof plane requires some vertical piece to support it, to hold it up above the ground. This vertical element, whether it be wall, column or pier, begins to define the space underneath more fully. Functionally, it can be a barrier to horizontal movement but it provides a vertical connection to the roof and sky.
The simple and straight termination of a building with a flat roof is closed above; it provides for no formal or spatial exchange in the vertical direction. When horizontal pieces within the roof zone are moved up and down, creating terraces for example, openness out can be achieved.
As the roof acquires some vertical component it becomes sloped or curved. Formally these elements start to make a connection up; spatially they are capable of total enclosure. The pitch influences the volume of space defined and the degree of connection to the sky.

Unlike a flat plane, sloped and curved pieces define spaces underneath them that are vertically differentiated. Because each has particular qualities, they create space quite differently. The sloped plane embodies tension - it is neither balanced (vertical) nor at rest (horizontal). Being straight, it defines geometrically similar but complementary spaces on either of its sides. These spaces are different in their orientation to the ground. The space underneath relates predominantly down, but is led up by the rising roof plane. The upper space opens above, but is grounded by the descending plane.
The curved element, on the other hand, flows smoothly from horizontal to vertical. The relationship of horizontal to vertical is constantly changing - a curve can be envisioned as a series of infinitely small sloping elements of gradually changing pitch. In contrast to those defined by a straight plane, the spaces defined on either side of a curving element are radically different. One is concave, directed inward centrally and the other is convex, directed radially outward.

Sloped or curved elements that sit directly on the ground can become buildings within themselves: such as igloos, teepees and tents. There is no clear distinction between roof and wall - in embodying both vertical and horizontal components, shelter from above merges with shelter from the side - roof and wall become one.
These forms, though structurally simple and stable, are restricted in the amount of space they enclose in proportion to the ground area they require. To establish more space underneath and allow for multiple floors within, they can be raised up on walls or columns, becoming separate as roofs. At this point the distinction between roof and wall is clear from the outside, but still ambiguous from within.
Also in the interest of more space, the mansard roof evolved as a means to create a full extra story for living that was not allowed by building codes. In it the top story "wall" is slightly sloped in and has the exterior look, material and finish of a roof, with dormer windows pushing out. The "actual" roof on top is either flat or slightly sloped down - the mansard becomes an intermediary piece between roof and wall, manifesting characteristics of each.
Both the proportion of roof to wall and the nature of their intersection are important to the expression of a building. Clearly proportions affect which will read more strongly. The junction between roof and wall can modify the perception of this ratio and can happen several ways. The roof can dominate in an eave that tends to hug the ground, or the wall can dominate with a parapet that soars up to the sky. The two can meet equally in a stagnant block, or their intersection can be mediated with a sloped piece like the mansard.

The simple elements of roof forms—flat, sloped and curved pieces—can be roofs within themselves, but more often are used in combination. When put together, their qualities and orientation change. The choice of elements and the way they are composed determines the formal qualities of the roof zone and the nature of the spaces within. These together with the choice of materials establish the nature of the transition from building to sky.
The permutations of these combinations are endless; to understand them more simply, they can be broken down and seen as organized around a point, a line or a plane.\textsuperscript{10} When the elements are directed toward a single point, the form is centralized. As such, sloped elements form a pyramid or hipped gable; curved form a cone or a dome. These unstable pieces come together to balance one another and in combination are stable. They rise vertically, up to a point, in their centrality they are static and inward directed. The spaces they create are ambiguous. They open downward and hence seem earth-bound, at the same time they point up, even if to a closed apex.
In a second type, the composition of forms is linear, extending out from a line with a very clear direction. Gables, and the many variations on them, are linear sloped forms. The rounded version is a horizontal half cylinder or vault. The gable and vault combine two unstable pieces that balance against one another and then stretch out directionally. They too develop ambiguous spaces that have both upward and downward orientation. The reading of the interior space here, however, depends strongly on the treatment of the longitudinal ends - these can be open outward, closed with a vertical wall or turned inward by a sloping hip.
A third and diverse group of roofs are organized along planes. The simplest of these is the horizontal plane. Also, a number of centralized or linear roofs can be composed to form a complex roof on one level. When several levels are introduced the composition becomes cascading or terraced; building up or down, they create multiple levels for use. As floors and roofs move up and down, the distinction between roof and ground can become unclear.
The large form of a roof establishes its formal and spatial orientation. This form can also be tempered by smaller pieces that qualify and support that orientation. Their functions are often space-making, climate control and ornament. Beyond this they function to either accentuate, mediate or close the transition to the sky.

There is a whole range of pieces that occur in the roof zone which define habitable spaces. In making a formal connection either up or down, these spaces exist on the edge, as a combination of inside and outside spaces. When the inside pushes out through the roof, "little houses" or rooms are stuck out into space. These include dormers, cupolas, turrets and clerestories as well as other similar but nameless varieties.
The outside can also push into the roof to create partially defined spaces. Some have sides and no cover, such as a roof terrace surrounded by parapet walls, a porch set in amidst the roof forms and a widows walk bordered by railing or balustrade - their openness above orients them up. Others have cover and no sides, including the overhanging eave, which provides cover outside of the walls and the portico, porch or veranda where the roof extends out over a room-size space. These spaces open out, not up - when raised high in the roof zone they connect out to the horizon.
Rooves contain even smaller formal pieces. Horizontal pieces such as the entablature, eave and cornice, close and punctuate the ending of the building by elaborating upon it. Other ornamental parts are often abstractions or ghosts of structural pieces. Vergeboards, crenellation, crestings, and trusses in the gable draw attention to the roof and accentuate it. Though not a formal connection, they do elaborate the forms, mark the passage from one form to another and
I acknowledge the meeting with the sky. Many pieces are vertical: the weathervane, chimney, antenae, balustrades, pinnacles and mechanical systems, whether picturesque or unsightly, serve to break the line of the roof and penetrate the sky.
The materials used to enclose the forms of the roof zone modify their orientation and affect the character of the connection between building and sky. From the outside, materials influence the reading of forms with texture, color and patterning. In the case of flat or very shallow roofs, a change in surface treatment of the wall may provide the only
acknowledgement of the transition. In some cases, like the mansard and gambrel, the materials of the roof come down along the wall. While still providing for ample space within, they give the roof zone an apparent depth that is important to the exterior composition of the building.
The ceiling, the inside enclosure of the roof, has a primary influence on the space within; it can either express or deny the form and structure of the roof. The materials used, especially their transparency or opacity, affect the orientation of the space. The roof can become a filter for light - direct, indirect and diffused - through transparent, translucent and moveable pieces. Varying qualities of light and the possibilities for views to the outside open up and animate the interior space.
ASSOCIATIONS & EXPERIENCES

"Flat roof, ranch slope or attic, there is more in a roof than just a form"
The roof is essential to man in a fundamental, pragmatic way. As a result, roof forms reflect the climate, and the technology and materials available when they were built. The slope of the roof is often considered one of the surest indications of climate. Because of its importance to survival, the roof is the focus of much time, energy and care.

Roof forms, however, go beyond mere function to encompass fundamental psychological, philosophical and poetic meanings that embrace dreams, memories, imagination and ideals of beauty, as well as the need for shelter. These meanings are shaped by social, cultural, stylistic and personal values. As such, they are highly subjective and individual, specific to both place and time, and strongly bound up in perception.

Perception is itself subjective - it is an interactive process involving both an object and an observer, who brings with him past experiences, knowledge and associations.
this, it is a combination of the present and the past: "to at least some extent every real place can be remembered... because it has affected our bodies (present) and generated enough associations (past) to hold it in our personal world." 14 Meanings become very personal and take on the importance of values: "the roof plays a primal role in our lives; what is the best shape for a roof is the most loaded, most emotional question that can be asked about building construction." 15

Man's perception of roofs is also affected by his orientation to the world. Directions take on special connotations from "the extrapolation of the coordinates of the body out into space." 16 and their relation to both gravity and movement. The horizontal and vertical realms have deep significance to man. The horizontal plane, accommodating movement freely, is man's concrete realm of action, his "zone of communication and social interaction." 17 It embodies a sense of the immanent, the rational, the everyday. 18 Manifest in the horizon, it is important for its stability and grounding quality.
The vertical realm, on the other hand, is less stable, polarized by the force of gravity. Because it is affected by a pull beyond the human body, movement is "loaded" with both energy and meaning. Best expressed as a line, "the vertical is considered the sacred dimension of space; it presents a path towards a reality which may be higher or lower than daily life, a reality which conquers the gravity of the earth or succumbs to it." 19

Thus differentiated by gravity, the directions of up and down have specific perceived qualities and take on particular meanings: "Up/down, our most basic orientation, is the most unstable and yet the most splendid. Its origin as a heroic dimension is as elementary as a child's struggle to stand up and walk and the desire to grow up." 20 Up then, personified by standing, is active; it has heroic connotations indicating striving, fantasy, freedom from the pull of gravity and even aloofness. In its connection with the sky and open "space" it becomes "divine, spiritual, ethereal, light and rarefied." 21 Man has long accorded being up with superiority. These meanings pervade our language: we speak of being "on top" of things, dealing with those "higher up", walking "tall" and thinking "lofty" thoughts.

Movement upwards becomes liberating as one conquers gravity -it is a metaphor for growth, longing and reaching. 22 Ascending from the ground requires energies or means beyond the capabilities of the human body. Slopes found in ramps, stairs and ladders are the common forms built to
accommodate vertical movement, but they also entail horizontal displacement. Ways of moving directly up vertically have special appeal: "an unusual fascination has always been exercised by spiral staircases, where one really experiences rising up along the vertical axis." Man has devised other ways to experience this movement up: "to rise in an elevator or balloon is to experience being liberated from weight, sublimated, invested with superhuman abilities."
Down, personified in lying, is more humble and passive; earth-bound, it suggests stability, realism and the mundane. In its relation to the earth, it takes on the qualities of "material, dark, firm and a cave." Being below implies inferiority: being "depressed", "at a low point" or "under the weather" all have negative connotations. Movement downward is a submission to gravity, an absorption or submersion, a coming back to earth.

Both up and down have values to man - there are psychological pulls in both directions. The play between the opposites of "gravity and grace" is fundamental to man's existence. The pull downward is manifest in man's need for grounding and centering. Grounding refers to the ground plane - the stability and realm of movement it provides. Centering comes from a vertical piece as it locates a place in the horizontal plane. Together they provide a base from
which to venture out. The need for these foundations is countered by the attraction to the metaphysical aspects of the sky and "the profound desire to escape from the remorseless discipline of gravity." There is a dramatic tension between the two pulls: "all strongly terrestrial beings - and a house is strongly terrestrial - are nevertheless subject to the attractions of an aereal, celestial world."
Man's biological need for shelter, for protection from outside threats, becomes an instinctual drive and a psychological need. It often takes on the form of fantasy, as in children's play of making small forts: "the primitive and universal love of the fantasy of the little house -- the idea of neatness and serenity within, contrasting with the wildness and confusion without." The house, as shelter, provides both grounding and centering; it "becomes the cradle from where we can start our wandering again."
The definition of shelter, "that which shields or covers from exposure or danger," relies on the definition of its opposite. A sense of shelter or a feeling of security is dependent upon the existence and knowledge of the exposure to danger. To obtain basic needs such as food and water, man has had to venture out, to face challenge and danger. This has given rise to instinctual and psychological drives to go beyond the limits of shelter and security: "space, a biological necessity to all animals, is to humans also a psychological need, a social perquisite and even a spiritual attribute." Space, light and connection to a larger world represent freedom, opportunities and challenges, the positive aspects of exposure: "Only when people feel vulnerable do they feel alive."

Just as buildings provide shelter, they also strive up, to openness and space: "to come into existence means to detach oneself from the earth - the organic growth of plants, the upward thrust of mountains - the human equivalent is building." As vertical beings, they push up from the ground, toward the sky: "all building represents the raising of the basis of human action beyond the safety of the common ground - at the heights it exposes man to the elements active in open space."

Openness and possibilities make life exciting; shelter and security make it possible. Existence becomes a balance between these two necessary poles. Buildings play an
important role in maintaining this balance: "no natural shelter is an enclosed capsule; shelters are more like active membranes which filter and select, screen and balance." In building and inhabiting shelter, passing through its doors and opening its windows, man participates in the filtering. Through this screening he experiences the tension between the poles of shelter and openness, gravity and grace.

The differences between up and down and the connotations of movement up lead to a vertical differentiation of space in the built environment. Different levels take on particular qualities; they become more private as they become more removed from the ground. The upper regions of the
building are intimate, they can become the domain of dreams and fantasy: "haven't dreams always liked to perch on high?"\textsuperscript{37}

The uppermost stories, ranging from the dusty attic to the penthouse suite, have ambiguous qualities. The romantic aspect endowed by their elevation and remoteness gives them an aloof superiority, a certain prestige. In the past, this was
mitigated by the everyday inconveniences of living above, the extra work involved in getting there and in transporting the essentials of life up and down. The introduction of technical means to do this - plumbing, central heat, electricity and elevators - has changed the situation. Being up has lost the heroic, ascetic quality but retains the values of privacy, overview and connection to the sky.
Buildings can be built and seen with particular images in mind; concerning this, there are several schools of thought that purport opposing models for the built environment. Two of these are particularly valuable to consider here for their attitude towards the upper regions of buildings. Both accept buildings as the intermediate between the human body and the world; the first envisions them as an extrapolation of the body outward, the second as a shrinking into of the larger world.

The anthropomorphic interpretation was initiated by Vitruvius and has its roots in classical thought. It sees the act of building as an extension of the body out into the environment, the establishment of the first tangible boundary beyond the body. This view is based on the concept that everything that man sees and experiences, he does so through his body. He is thus profoundly affected by both its shapes and principles: "if we look for fundamental principles of spatial organization we find in them two facts: the posture and structure of the human body and the relations (whether close or distant) between human beings."
The second, or organic interpretations, see buildings as formed from images outside the body, coming from the natural landscape. On the larger scale, they can be a small model of the world:

"From ancient times the house has been a microcosmos. As a space within a space it repeats the basic structure of the environment. The floor is the earth, the ceiling the sky and the walls the encircling horizon. The etymology of the words floor, ceiling and wall will confirm this."  

Smaller models can also be taken from the landscape. Trees, and the canopy of the forest, in addition to providing some of the first shelters and materials for building, supply principles from which to build--the roots, trunks and branches have their parallels in foundation, walls and roof.

Each of these models indicates a vertical differentiation into three parts or zones -- the ground zone (legs, roots, earth), the mid zone (body, trunk, "multifarious between") and the roof/sky zone (head, branches and sky).
The roof zone, as the top zone, becomes very special, endowed with the importance of the head (dreams), the flowering qualities of branches and the openness, light and spirituality associated with the sky. As the high point or summit, the roof is an area in architecture that allows and even provides for very sculptural and active forms. Because of its importance and many meanings to man, it has often been highly ornamented and detailed. It has been the crowning of the building, "architecture's glorified end."
The roof communicates these special qualities on two levels - the visual and the experiential. Visually, the forms of the roof provide vicarious appreciation of being up: "perhaps we attribute to all perceived (raised) objects empathetically what we observe about the behavior of things not bound to earth, such as birds, airplanes and clouds and the proud independence of the sun and moon." These forms can evoke diverse associations that make the roof important to man and give it meaning. Experientially, the forms and the spaces they create allow man to physically experience the qualities of elevation - one can get up into and on the roof and participate in the meeting of building and sky. Although different, the visual and the experiential cannot truly be separated; vision is part of experience, after all, so the two need to be discussed together.
The roof provides cover; in its many forms it has come to symbolize shelter and security for people of different cultures, climates and times. The sloped roof, simplified in the gable or pediment, carries these meanings for many people in a variety of places. As a triangular form it is both inherently stable and an embodiment of the tension between horizontal and vertical. It is strongly based and builds up to an apex; for some it is a symbol of power and aspiration, others a sign of security and prestige.

The specific connotations and exact shapes may vary, but in general the connection to the fundamental need for shelter carries through - the sloped/gabled roof means home.
Variations on this roof can be found throughout the world. In addition, its image pervades the built environment on other levels. Pediments and gables appear on smaller pieces of buildings, such as porticoes, dormers, windows and doors as well as other built objects like gravestones, fences and gates, even mailboxes.
There are certain qualities of the roof that give a feeling or sense of shelter and others that express openness. In addition to the general orientation of the form, these characteristics have to do with proportions of roof to wall and how they interact, which one dominates. The sense of shelter comes from seeing and understanding cover. The presence of the sheltering roof is felt in the overall image and form of the building. It sweeps out over walls, covering with eaves and envelopes spaces to be inhabited, sometimes coming down to the ground, close enough to be touched.
The sense of openness to the sky comes from the verticality of elements, either wall or roof pieces, soaring up. Steeply pitched roofs provide qualities of both - the slope moves up and connects to the ground. More gentle pitches tend to hug the ground. The reading of flat roofs depends more on their connection to a wall - they can sweep over with eaves for a sense of shelter or be subordinate, as the wall reaches up with a parapet.
The perception of the roof zone is strongly influenced by one's point of view. The vantage point determines how the transition will be both seen and experienced. From the outside, perception is limited to vision. A roof zone can either be open, with both horizontal and vertical components providing some formal exchange with the surrounding sky, or closed by a simple and straight termination. There are several ways to see the roof from the outside: from the ground either up close or far away and from above at a distance.
The individual roof, as seen up close, can either be a major element in the image of a building, or can be subordinate, even invisible. It has the power to tell a lot about the larger organization of the building. How far up the roof is directly influences its relationship with both the ground and the sky. Raising the roof weakens the connection to the ground and endows the roof with tension. It appears to have more visual weight from the potential energy it gains, but at the same time it seems freer; lightly tethered to the ground, it appears to float against the expanse.
From afar, shape and silhouette dominate and roofs blend together, either with the natural landscape or with other roofs, to form a roofscape. Skylines and roofsapes can have sculptural qualities and active forms -- they can become a new landscape.
The distinction between an open and a closed roof is not as clear inside a building as from without. Finer gradations of closure create varying qualities of light and views that influence the perception of inside and outside. Within a building one can both see and experience the unique forms and spaces created by the roof. Experiencing a building means going beyond vision; the perception of space involves the sense of orientation - including the knowledge of up, down and the ground plane - and the sense of touch as it affects the whole body.

The roof can be experienced either under, on or within its forms. Shape and materials determine the orientation of spaces which range from totally closed to totally open. In addition, they can define spaces that have qualities of both. These in-between realms heighten the awareness of forms and spaces by allowing perception of both inside and outside; they accentuate the tension between shelter
and openness. Being on the roof, they combine the openness and overview of being up with the sheltered feeling of being within.

Under the roof shelter dominates the experience. This experience is influenced by the treatment of the ceiling; its relationship to the roof and the degree of enclosure. The form and height of the ceiling are powerful elements in defining interior space; they can either express the roof structure and form or deny them. Flat surfaces, coming either from dropped ceilings or flat roofs, do little to differentiate space. When low, they create intimate spaces and direct openness outward; when high they are more
expansive. Sloping ceilings are usually expressive of roof forms; they can provide a sense of overhead uplift, a feeling of spaciousness. In their analogy to the vault of the heavens, they can become evocative of the sky.
Ceiling treatment also determines how much of the structural system is seen or can be touched. Expressing or opening up the structure gives some knowledge of how the roof is formed and supported: "the structure brings forth the relationship between up and down; namely by expressing the force of gravity." Seeing the rafters, trusses and posts can be exciting and fun, a new way of looking at forms. It allows vicarious participation in the process of construction. This knowledge provides a direct connection to and understanding of the definition of physical boundaries and limits: "it is reasonable to be interested in how things are made because when that information is suppressed, we become suspicious, eventually frustrated."
The degree of enclosure influences the orientation and experience of a space. Under a roof the treatment of the sides can range from totally open to a solid wall. The roof itself can become a filter with pieces of openness ranging in size from the punched hole skylight, through bands of clerestories to full screens of glazing over structural frames. The use of glass and translucent materials allows for particular views and a spectrum of light qualities under the roof.
To be on a roof requires a flat roof -- a roof garden or terrace. Experience of the roof from on top, is limited - it involves mostly sky and very little building. There are pieces of building that do get up on to roof terraces, including parapet walls that provide their only enclosure and other sculptural and landscaping forms. This "raised ground" involves no cover, it is totally open to the sky: "using the top of the roof does not give one a feeling of shelter, in fact it turns the womb inside-out and a person perched up on a roof can feel a sweep of freedom, a giddy sense of liberation from earth-bound problems." ⁴⁸

Being up on a roof can be exhilarating because it is up. Up is removed and safe from both the activities and the threats on the ground. With its connotations of the spiritual, this position is above, higher, detached and privileged.
Encompassing 360 degrees, this realm of overview gives a unique perspective on the world below: "the instinct to climb up to some high place from which you can look down and survey your world, seems to be a fundamental human instinct." We often attribute to our gods this state of being above, looking down over us all. There are parallel experiences in being on top of mountains, towers and aloft in ships; "one can feel oneself cut off from the world and yet owner of the world."
Experience on the roof can define a world in itself. Viewed from here surrounding roofs combine to form - between earth and sky - a roofscape that becomes a new landscape. The height of the roof above the ground affects the perception of and relation to things below. Closer to the ground, within tree height, one can see and still feel a connection to activities below. The roof can go so high up as to be completely detached; because of winds and other dangers at these great heights, most buildings this tall remove you one step further by enclosong observatories.
Experience within the roof zone combines the qualities of being under and being on top; it is in between shelter and openness. Experiencing the roof within means directly under or in the roof, close enough to touch it, amidst its forms. In an attic or a dormer, one can become involved with the roof, allowing for mutual exchange. This is only possible when the roof zone has some thickness, coming from a combination of horizontal and vertical elements. Thus the roof becomes permeable not only formally but spatially - it allows one to take part in the transition from building to sky.
From within the roof, the degree of enclosure and expression of the structure strongly impact perception: "In the attic it is a pleasure to see the bare rafters of the strong framework; here we participate in the carpenter's solid geometry".52 The roof forms envelope and surround the observer. Spaces of great variety and unique formal qualities can create a wide range of inside and outside relationships. Clerestories as well as structural pieces it can become a playland of delightful forms.

As with being on the roof, being in the roof often provides unique and interesting views, both of the roof and outside landscape. Because they are seen from within, however, they take on new dimensions:
"The exciting dual quality of a person's experiencing a space on the one hand, and sensing the image it has to others at the same time. This comes from being able to see the rest of the roof through a frame of the roof: from under or through the structure of joists, eaves, slope or roofing material...The romantic notion may also stem from the ability to peek at the outside from a small place, a place formed by the sloping of the roof."
From here there is a chance for overview, but it is framed, restricted. Because the senses of both shelter and spaciousness feed on contrast, the framed view of the
landscape can accentuate the tension between the two. The view from within can intensify the feeling of being inside and sheltered, while increasing one's longing for the broad stretch of the horizon.

This in-between realm is one where opposites can coexist. Like the treehouse, it can have the qualities of both the cave and the bird's nest:
"To be in a treehouse is to be inside and yet outside, to be free and yet protected, to be held up in the air and yet rooted, held. It is a distant retreat, yet conveniently near. It is being adventurous and yet home-loving, a wayfarer and a nest-builder, a pirate and a lighthouse keeper. Treehouses enclose all the spirit which needs enclosure and liberate all the spirit that needs to see from horizon to horizon and guess what lies beyond."
The habitable roof zone is a realm of contradiction.

As part building and part sky it embodies the tension between the opposites of shelter and openness. In the attic or the mansard, up near sloping forms, roof and wall cannot be differentiated. On sloping ground or in a cascading
roofscape, habitable outdoor terraces can open directly off of indoor spaces and also form the roof to spaces below - here there is little distinction between roof and ground. In both cases qualities of the elements melt together; the resulting complexity and ambiguity allows for richness of experience.
The roof is an important element in the form and image of a building -- it is the resolution of many forces, both physical and psychological. As the delineation of one of the many boundaries within man's environment it controls the interaction between the opposites of shelter and openness, gravity and grace. The balance between these poles is at the core of values about life. As such, the roof zone and the character of the transition it defines is highly personal and individual; it does not lend itself to sweeping generalizations.

Clearly, though, some roofs are better than others. In order to fully realize the potentials of roof forms, we must understand the forces, both physical and psychological, at work in their creation. For reasons of either economy or indifference, many of these possibilities are often ignored or treated superficially. When recognized for the powers it possesses, the roof can become more than a neutral cap dropped on top of four walls. It can be an integral part of a building, a zone that, on some level, acknowledges the end of the building and the meeting with the sky.

On the previous pages I have speculated about some of the forces acting on roofs and their implications for man. This is a beginning of a way to understand and appreciate roofs and the delight they can inspire. Many of the formal ideas touched on here are well treated in other literature. The bibliography that follows, refers to those that I have found useful; it may prove helpful, also as a beginning, to those who wish to explore the topic further.
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Notes


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28 Bachelard, p. 52.

29 Summerson, p. 2.

30 Norberg-Schulz, *Dwelling*, p. 108.

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40 Norberg-Schulz, *Dwelling*, p. 91.

41 Ibid., p. 91
42 Arnheim, p. 46

43 Norberg-Schulz, *Dwelling*, p.84.

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46 Norberg-Schulz, *Dwelling*, p.119.


48 Bartos-Packard., p.63.

49 Alexander, p.316.


51 Prangnell, Authenticity, p.27.

52 Bachelard, p.18.

53 Bartos-Packard, p.54.

54 Tuan, p.52.

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