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Time, Space and Material. The Mechanics of Layering in Architecture
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This book examines the application of the principle of layering in architecture, its mechanics, possible application and meaning. Layering is widely used in the discussions of the 20th and 21st centuries architecture but rarely defined or examined. Layering bridges the tectonics of structure and skin, offers a system for the creation of different architectural spaces over time and functions as a design principle without hierarchy. Three types of layering are identified: a chronological sedimentation of planes materializing changes over time (temporal layering), the additive sequence of spaces (spatial layering), and the stratification of individual planes (material layering).

   Like a palimpsest, historic cities frequently reveal temporal layering and aspects of change over time, a condition familiar to archaeologists who study layer upon layer of remnants of civilization, including architectural remains and urban organization. In historic cities, one can read at least the most recent layers to determine a physical chro-nology of the city's history; contemporary architects add strata of the 21st century. Cities are composed of several layers, offering a complex understanding of time in which a view of the present includes also the perception of the past.

   At a building scale, layers can be part of the spatial composition, multiple elements of walls, the skin, the structure or decorative and narrative elements. Just as the position and order of geological strata contain information related to their age, formation, and origin, the position and form of architectural layers come with information about their function, intellectual scope, and provenance. The possible elements of such an architectural strategy include materials, light, water, and color as well as associations, memories, and analogies embedded in the layers or in the voids between them.

   Material layering is based on a perceived separation of spatial enclosures into floor, wall, and ceiling or roof elements and combinations thereof. Individual elements may consist of multiple planes fulfilling a series of specific functions. The architectural enclosure can represent the physical wrapper of a building and might transport the structure's narrative, tectonic information, cultural expression, the architect's design intent, and other topics that might be embedded.

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»Long before the human spirit was moved to build, a movement to create structure existed in the universe, and thus layers and joints were formed. And so it has remained to this day. Just as we erect our walls, the earth, since the beginning of time, has been creating layer by layer from the precipitation of the air and the sediments of the water.« Rudolf Schwarz[1]

1. Archaeological site exposing layers of the city, Verona, Italy.
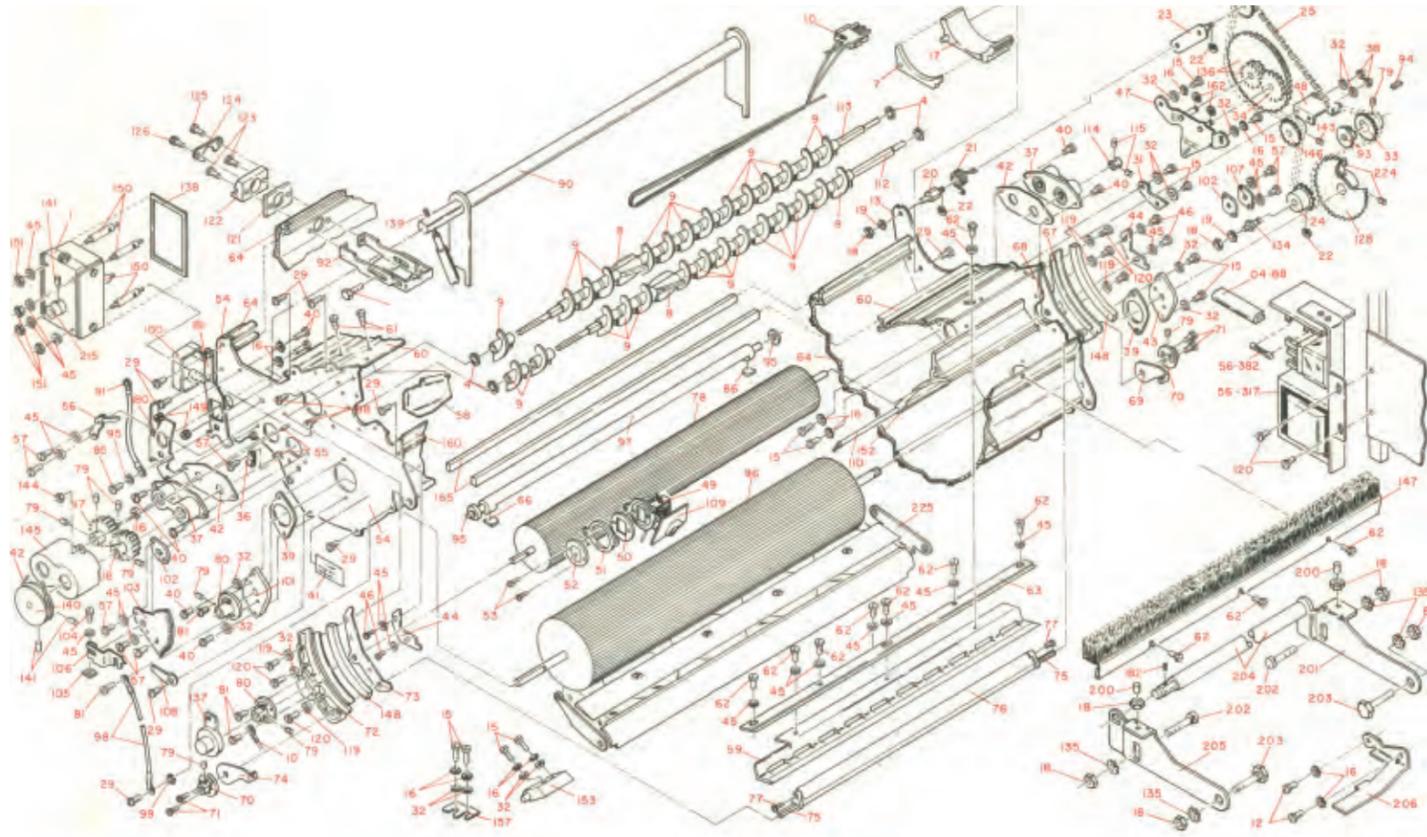
Introduction

Urban areas and architecture can be seen as the product of continuous change – change that in many instances accumulates as layers of sediment. Our cities and buildings are continuously exposed to additions and subtractions according to changes in the built environment but also according to changes in social structures, use patterns, technology, transportation, and economy. Archaeologists uncover layers of different cities and settlements constructed on top of each other over centuries, seemingly never reaching a final state. City fabrics are a puzzle composed of building blocks, grids, and development patterns based on a variety of urban planning strategies to be used by different people. Over time, generations of vehicles and transportation systems, information technology, and communication are embedded, connecting the physical world with the virtual world. Buildings themselves are created from a series of layers defining the skins that separate outside from inside. Cultural and interpretative layers complement the physical world, adding immaterial strata to all of it.

This book explores the term layering and its application in the built environment. It provides examples of scholarly writing that address »layering« and present a theoretical framework for a widely used architectural idiom. These observations, in an attempt to put a face on a term that is commonly used but only rarely defined, reside in the spheres of narration, analysis, and speculation. The consideration of such a broad term will undoubtedly lead to omissions and certainly allow diverging opinions regarding how to define layering as a principle of architectural design and composition.

Layered systems are all around us, literally and phenomenally, possibly identifiable as the simultaneous existence of matter and content that usually does not necessitate, but often reflects, a hierarchy. As Rudolf Schwarz states in the opening quote, the physical conditions of our geological and man-made environment have been complemented by a system of computer-based operations and virtual spaces in which humans live in the 21st century. We continuously interact with layers of information provided by a multitude of sources and networks. In the realm of graphic design, many of us manage and evaluate different layers of data and information on a daily basis and have no problem identifying what we need to process. In architecture, buildings have been traditionally represented as ink drawings on sheets of vellum that could be laid on top of each other. Architectural CAD drawings and digital representations frequently are structured by systems of layers pertaining to topic areas within the project, to be turned on and off as needed, creating the same possibility of layering of information.

Edward R. Tufte writes about the layering of information that requires good planning and intelligent organization, especially when using computers; he anticipated that »all sorts of unplanned and lushly cluttered interacting combinations [will] turn up, with changing layers of information in miscellaneous windows surrounded by a frame of system commands and other computer administrative debris«.[2] Although at the time he wrote the book *Envisioning Information*, Tufte could not have anticipated the changes in information presentation that would come with the evolution of the worldwide web, he is quite clear about the need for proper relationships in graphic representation and two-dimensional layering. Moreover, he writes that the »layering of data, often achieved by felicitous subtraction of weight, enhances representation of both data dimensionality and density on flatland«.[3]

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New York, NY	12.10	12.40	1.30	3.52	4.50	6.10	6.25	6.35	6.50	7.10	7.30	7.33	7.45	7.50	8.05	8.25	8.40	8.50	9.10	9.40	10.10	10.25	10.40	11.10	11.
Newark, NJ	12.24	12.55	1.44	4.07	5.04	6.24	6.38	6.49	7.04	7.24	7.45	7.47	7.59	8.04	8.19	8.39	8.54	9.04	9.24	9.54	10.24	10.39	10.54	11.24	11.
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Elizabeth	12.31	1.03	1.51		5.11	6.31		6.56	7.11	7.32		7.54		8.13	8.26	8.46	9.01	9.11	9.31	10.01	10.31	10.46	11.01	11.31	12.
Linden	12.36		1.56		5.16	6.36		7.01	7.15	7.37		7.59		8.18	8.31	8.51	9.06		9.36	10.06	10.36		11.06	11.36	12.
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Rahway	12.40	1.11	2.00		5.20	6.40		7.06	7.20	7.42		8.03		8.24	8.36	8.57	9.10	9.18	9.40	10.10	10.40	10.53	11.10	11.40	12
Metro Park (Iselin)	12.44		2.04	4.26	5.24		6.56	7.10	7.25		8.04	8.07	8.15		8.40		9.14		9.44	10.14	10.44		11.14	11.44	12.
Metuchen	12.48		2.08		5.28			7.14	7.29			8.11			8.44		9.18		9.48	10.18	10.48		11.18	11.48	12.
Edison	12.51		2.11					7.17	7.32			8.14			8.47		9.21			10.21			11.21		12.
New Brunswick	12.55		2.15		5.35		7.05	7.21	7.35			8.18	8.25		8.50		9.25		9.54	10.25	10.54		11.25	11.54	12.
Jersey Avenue	1.02		2.18					7.28				8.21					9.28			10.28			11.28		12.
Princeton Junction			2.31		5.50		7.19		7.50			8.34	8.41		9.05		9.41		10.09	10.41	11.09		11.41	12.09	12.
Trenton, NJ			2.42	4.58	6.03		7.28		8.01		8.31	8.44	8.52		9.16		9.52		10.19	10.52	11.19		11.52	12.19	12.
TRAIN NUMBER	3701	3301	3801	67	3803	3201	51	3703	3807	3203	61	3809	47	3901	3811	3903	3813	3205	3815	3817	3819	3207	3821	3823	38
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The meaning of layering

Although the term is broad by nature, its application in other fields is often more specific than in architecture. In architecture, layering can be the configuration of multiple surfaces, but is also associated with the notion of the skin of an object or building. A look at other disciplines reveals that the term »layering« is frequently used to refer to the simultaneous existence of planar elements or phenomena.

In the realm of engineering, layering is used to describe the analysis of materials and expresses the combination of materials in a single engineered product. The coating of materials is common practice – veneers have taken the place of formerly solid materials, causing purists to look for homogeneous materials rather than accepting the reduction of a material to millimeters.[4] In the political sciences, the term stratification refers to the »vertical structuring of the members of a society on the basis of socially relevant characteristics that influence the behavior of people toward each other«.[5]

In geology, layering refers to the deposits of various matter sedimented over time and altered by the earth's tectonic movements: »The type of stratification establishes the relative age of the rock strata.«[6] The order and composition of the layered assembly that is part of the Earth's crust contains information about the development of the geological formation. The chronological component of the succession is an essential component of the definition. In archaeology, too, the positions of individual strata contain information about how the strata align chronologically. The study of archaeology involves the analysis of how largely horizontal strata created as cultures, peoples, or settlements have declined and how they have been reorganized.
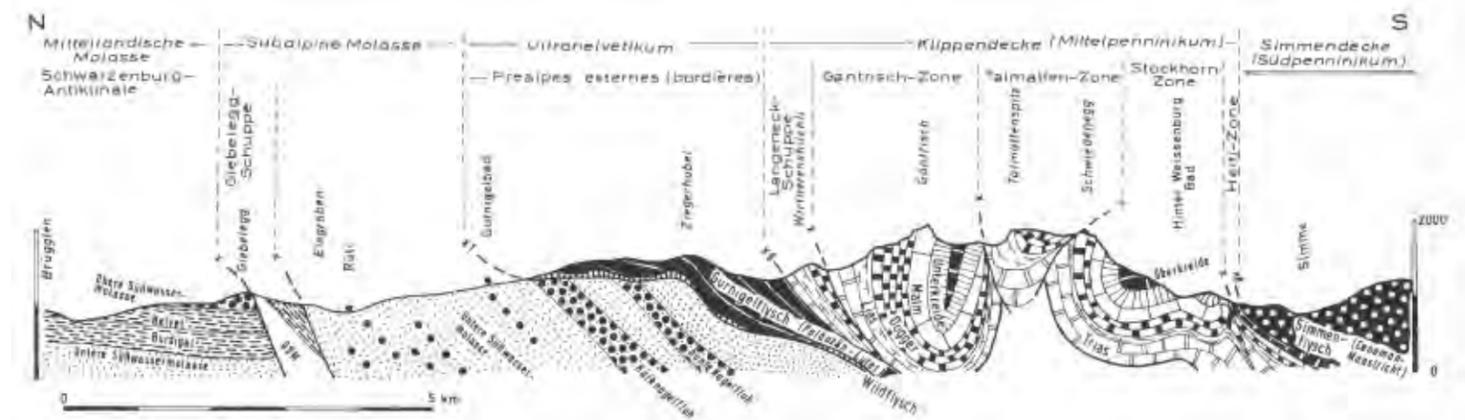
In the field of psychology, various theories are concerned with the stratification of the human personality and its repercussions. According to psychologist Wolfgang Viktor Ruttkowski, the development of each layer of personality is built on the layer that underlies it.[7] In a slightly different interpretation, the computer sciences articulate a layered architecture as an arrangement in which system components or network components are isolated in different layers in order to allow changes to be executed on one layer without impacting other layers of hardware or hardware.

A graphic design manual provides the following definition of the term related to information architecture: »Layering involves organizing information into related groupings and then presenting or making available only certain groupings at any one time. Layering is primarily used to manage complexity, but also can be used to reinforce relationships in information. […] Use two-dimensional layering to manage complexity and direct navigation through information. Consider linear layers when emphasizing relationships within the information. Use three-dimensional layering to elaborate information and illustrate concepts without switching contexts. Consider opaque layers when presenting elaborative information, and transparent layers when illustrating concepts or highlighting relationships in information.«[8]

The use of the term as outlined above suggests an interdependence of the layers, belonging to each other, being created in a time-based sequence that might be manipulated later.

In the fine arts, layering as a way of arranging paint or collaged elements is commonly practiced, especially when artists are working with physical and narrative elements. Countless examples of the work of painters, sculptors, photographers and writers display a conscious and systematic approach to layering in which context and a broader set of circumstances are incorpo-

rated into the work. Once more, layering seems ubiquitous but requires definition if used as a conscious strategy. In a discussion of an artistic version of layering, artist and writer Mary Carroll Nelson's essay »Approaching the Layer as a Formal Element and a Significant Metaphor in Art Making«[9] investigates several artists whose work was affected by »Jungian psychology, especially the concepts of the collective unconscious, the anima/animus, and synchronicity«.[10] Nelson calls the protagonists of her theory »layerists« and notes: »The layerists' interest in the continuum of time and space is revealed in a synchronist perspective whereby multiple events or multiple points in space are connected within the layers of their work. As I perceive it, layering is a postmodern approach to artmaking that grows directly from the emergence of a holistic insight within society at large.« She explains further: »Layering is not a style, nor it is limited to either art or craft but affects both.«[11] In the essay, she suggests that the use of multiple layers allows penetration through the first – more recent – layers into the past.

»The artist Robert Smithson at times uses geological terms to describe his sculptural work and writes about »wedges of sedimentary strata«,[12] describing the arrangement of parts and associating his work with the expanded timeframe of the earth's history. Smithson applies the strategy in his sculpture and his writing, finding analogies in the creative process. Sculptures such as *Leaning Strata* (1968), *Shift* (1967) and *Glass Stratum* (1966) exhibit visibly layered planes. As the artist describes one of his glass works: »It's very green, very dense and kind of layered up.«[13] Literally using the images of fossils, Smithson introduces a sense of extreme distant past and an expression of the earth's gravitational force.

Instead of building up layers, Gordon Matta-Clark's work cuts into buildings, exposing material and spatial layering not visible in the intact structure, and breaking the functional surface of rooms into primal spaces seemingly on the verge of destruction. He seems to be acting as the anti-architect but in fact reveals the core of architecture more obviously than the buildings were able to convey without his interventions. Matta-Clark (who studied architecture at Cornell University in Ithaca, New York) describes his process in an interview with a journalist: »At that point [around 1973] I was thinking about surface as something which is too easily accepted as a limit. And I was also becoming very interested in how breaking through the surface creates repercussions in terms of what else is imposed by a cut. That's a very simple idea, and it comes out of some line drawing that I'd been doing. […] It was the kind of the thin edge of what was being seen that interested me as much, if not more than that, the views that were being created […] the layering, the strata, the different things that are being severed. Revealing how a uniform structure is established.«[14]

The interest in the edge and the curiosity about what is beneath the top layer leads Matta-Clark to manipulate average buildings into what architects like Carlo Scarpa carefully worked out through their design process. Matta-Clark reveals views that are unexpected, destructive, and informative. In his interest in the layering that lies beneath the established and known object, he is looking for the edge that is testimony to the process of construction.[15]

More recently, the Japanese artist Nobuhiro Nakanishi has worked on showing the passage of time and an ambivalence of the image through his series titled *Layer Drawings*, consisting of images printed on sheets of Plexiglas presented in a spaced assembly.[16] The photos displayed in such multiples create an alternative space and simultaneously represent a sequence of time, as if memory is being visualized.

5. Robert Smithson, *Leaning Strata*, 1968.
6. Robert Smithson, *Shift*, 1967.
7. Robert Smithson, *Mirror Stratum*, 1966.
8. Nobuhiro Nakanishi, *Layer Drawing-Snow*, inkjet print on film, acrylic plastic, 2011.
9. Gordon Matta-Clark, *Conical Intersect*, 27–29 rue Beaubourg, Paris, 1975.
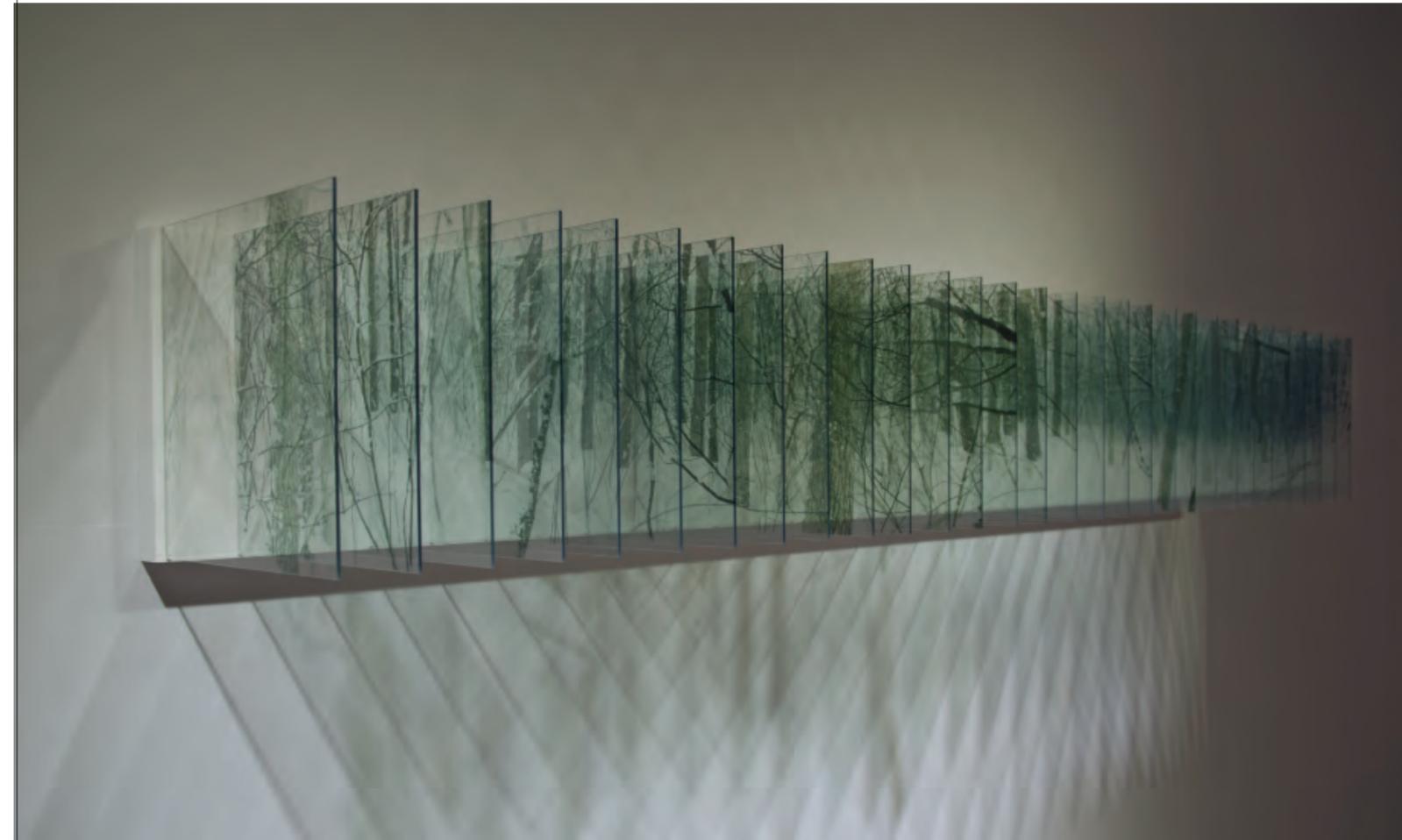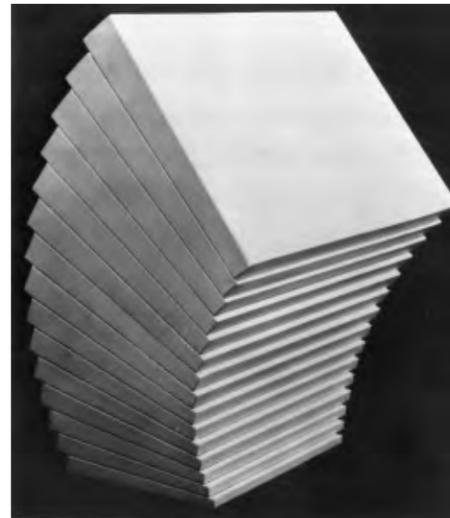
Layering in architecture

Architectural layering involves the realms of time, space, and material. If an important role of architecture is the demarcation of space, the starting point of layering consists of a series of planar elements that constitute skins and spatial separations and that simultaneously speak about their time and cultural content. One or multiple layers of material are necessary to define architectural space. Architectural layers relate to the architectural skin, the façade, surfaces, cladding, and enclosure.

Although the various types of layering are often intertwined and appear in the same project, three types of layering will be discussed: a chronological sedimentation of planes materializing changes over time (temporal layering), the additive sequence of spaces (spatial layering), and the stratification of individual planes (material layering). Even if this text suggests a clear separation of the different types of layering identified, the examples will document that the transition between material and spatial layering is sometimes fluid, and temporal layering in its sedimented configuration can be part of all approaches.

Temporal layering

Like a palimpsest, historic cities frequently reveal temporal layering and aspects of change and intervention over time, a condition familiar to archaeologists who study layer upon layer of remnants of civilization, including architectural remains and urban organization. In historic cities, one can read at least the most recent layers to determine a physical chronology of the city's history; contemporary architects add strata of the 21st century. Cities are composed of several layers that simultaneously display what was built at different times, offering a complex understanding of time in which a view of the present includes the perception of the past. For example, Heinrich Schliemann documented the layers of the historic site of the city of Troy, where he peeled back layer after layer, documenting different historic time frames. The archaeological layers of the city of Rome can be viewed throughout at locations such as the Forum Romanum, which lies below the level of contemporary Rome and offers a sense of the chronological buildup of settlement. Leon van Schaik confirms this view: »Intuitively we all know that architecture grows in cities – which are all tangible manifestations of the mental space of their citizens, buildings superimposed in layers by generation after generation. If in our mind's eye we were to imagine a time-lapse record of a city's growth through the centuries, we would see spaces being formed by jostling ranks of buildings.«[17]

At a larger scale, temporal layering can be observed in urban views that show the overlaying of different plans or maps as they evolve over time. At a building scale, layers can be multiple elements of walls, the skin, the structure, decorative and narrative elements, or part of the spatial composition. Just as the position and order of geological strata contain information related to their age, formation, and origin, the position and form of architectural layers come with information about their function, intellectual scope, and provenance. The possible elements of such an architectural strategy include materials, light, water, and color as well as associations, memories, and analogies embedded in the layers or in the voids between them. The simultaneous perception of different layers is similar to listening to an opera, an experience that encompasses voices and instruments as well as story – the simultaneous reading of the parts and their meaning.

Vittorio Gregotti looks at the impact of technology on architecture history and discusses how different design techniques seem to merge over time when several architects contribute to the same building. Stating that the layers do not necessarily remain legible, he writes, »A very special but frequent case is a work of architecture constructed over a long time that displays the layered work of different architects at different moments, thus turning it into a repertory of diverse techniques that today, with historical distance, we see as completely amalgamated if not homogeneous.«[18]

The principle of layering is testimony to the passage of time and illustrates a sequence of creation. The sequence of elements is not necessarily linear but is nevertheless often readable, allowing for a didactic explanation of how individual layers came together and changed over time. Layers co-exist without a required hierarchy; individual elements, influenced by their neighboring strata, form a complex whole without a specific focus point. Layers can reflect a link between material and message representing a universal whole.

10. Diagram of urban layers densifying over time.
11. Diagram of space defined through separate two-dimensional planes.
12. Diagram of monolith.
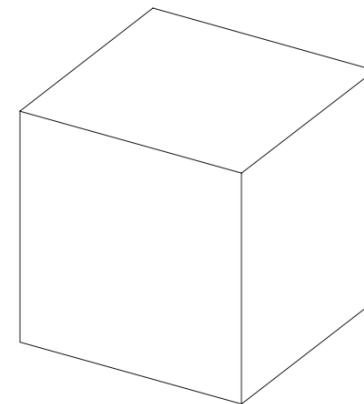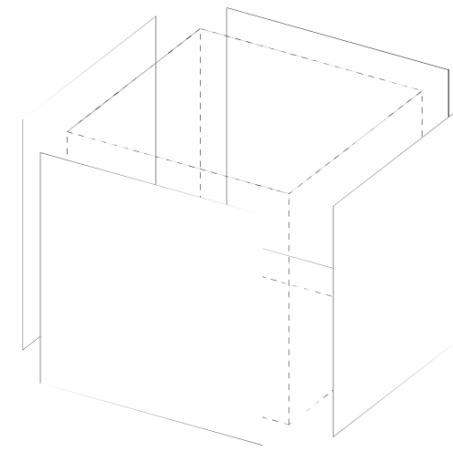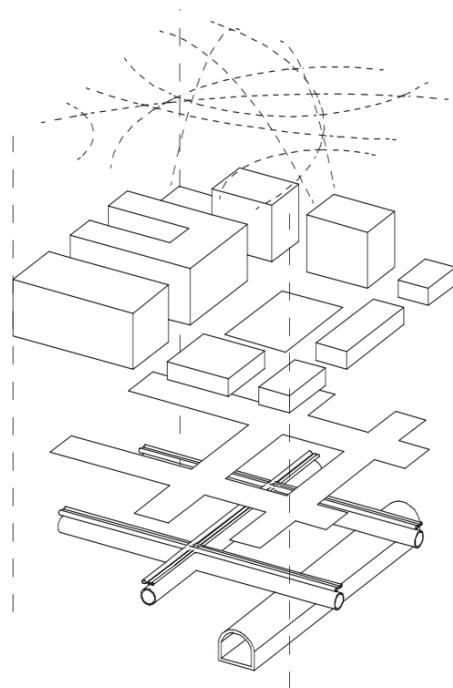
Spatial layering

The separation of spatial and material layering is going to remain opaque in many projects – both are frequently present in the same building, especially in instances where the wall becomes inhabitable and the boundaries between space and enclosure are blurred.

The German theorist Jürgen Joedicke defines (architectural) space as »something enclosed by planar surfaces. This general layman's understanding of architectural space indicates that one has to distinguish conceptually between two elements if one wishes to comprehend the phenomenon of space. These elements are space itself and a spatial demarcation. The fact that space is not identical with its confining elements, in other words with wall, floor and ceiling, seems obvious, for space is defined as the thing existing between these surfaces. Another definition of space as the ›thing between‹ does not exist for the moment.«[19] Joedicke also explains how spatial perception is based on individual processing and cultural formation resulting from a »common tradition or education«.[20] Space is defined by its physical demarcation (even if partial) and the human reading of space based on the experience of occupying it. The physical demarcation is created by the wall and the roof or the overall skin. Corresponding to Joedicke's definition of architectural space, Dom van der Laan defines architectonic space as what is happening in-between the walls: »Architectonic space offers us both limited mass and limited space, in its walls and the space between them.«[21] He describes further how space is related to the enclosure: »Because the space is dependent on the wall, the form of the space can as it were lie alongside of that mass, despite the fact that both forms owe their existence to the formlessness of their immediate environment. The key to this is that the form of the mass arises from the mutual correspondence of opposed surfaces while the form of the space arises from the mutual correspondence of the opposed forms of the wall. Architectonic space makes natural space habitable by coming into being in its midst; the form of the wall makes architectonic space visible by marking it out.«[22]

Although architecture is hollow by nature – providing habitable space of different dimensions – not all architecture expresses its nature as a container. Rodolfo Machado and Rodolphe el-Khoury address the topic of monolithic architecture and its »necessary hollowness«:[23] In much of monolithic architecture, the representational elaboration of the »monolithic« is carried out along and across the limit between the interior and the exterior. »Monolithic Architecture«, we may say, is concentrated in the thickness of the envelope, in the surface.[24]

In the following, the authors distinguish the monolith from concepts such as Venturi's »decorated shed« because the distinction between space and skin in the monolith does not exist. They speculate that monolithic architecture is closely related to industrial design, where the object is at the center of exploration and with that the enclosure is designed to »contain the internal complexity within a compact and hermetic package that has a recognizable and distinct form«.[25] The monolith is eager to wrap space in its entirety, concealing any joints, while layered systems act out their section and visualize the overlap. Both Machado and el-Khoury acknowledge the surface as an »autonomous architectural system«[26] that became responsible for wrapping »more or less complex programs into one package«.[27] They further describe curtain walls of the 20th century: »The surface may be hard, polished, and highly reflective. It may have a discernible thickness in the texture of the revetment and even greater physical depth in the layering of more or less transparent cladding membranes. But the ambition is the same: to endow surface with depth, literal or phenomenal.«[28]
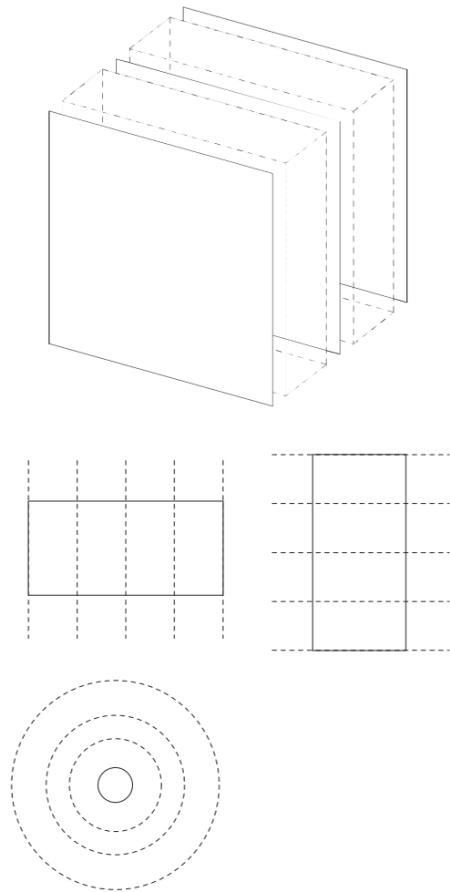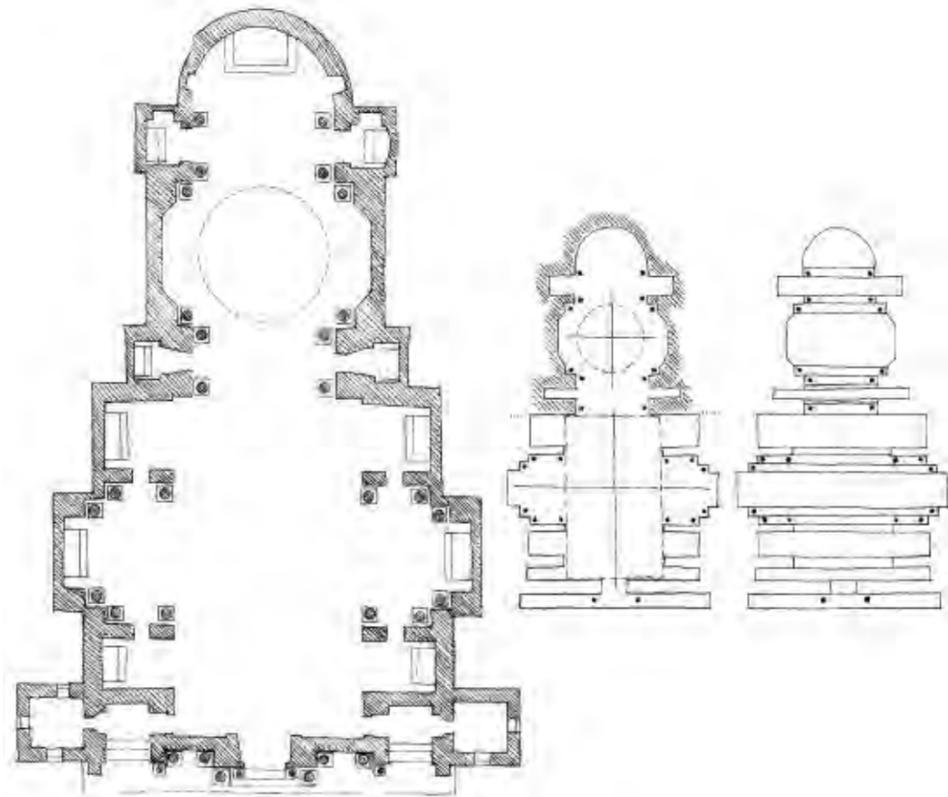
Spatial layering in architecture contrasts the monolithic approach and takes advantage of the space »in-between«, areas separated by a series of zones of different use and atmosphere that allow the simultaneous perception of the areas separated. Spatial layering allows the coexistence of spaces of different character, function, or date of construction. Arrangements can be horizontal, vertical, or concentric, with the axis of the observer frequently being perpendicular to or at least at an angle to the actual spaces or areas. Spatial layering can be used horizontally in plan (following, for example, an organization of increased privacy) or vertically along the section of a building (allowing for different zones of decoration and lighting, especially in spiritual spaces). Horizontal arrangements of spatial layers can create program-related zones that transition into one another, while a vertical arrangement might offer zones of altered lighting and a shift from the human scale to more monumental dimensions (as can be found in religious buildings or spaces).[29] Arrangements of spatial layers can vary geometrically among concentric, parallel, horizontal, or vertical configurations. A moat or multiple walls around a medieval castle constitute spatial layers for defense. Japanese and Chinese pagodas create spatial intensification and concentration above a stupa shielding and marking the relics with a vertical sequence of spaces. Other ex-

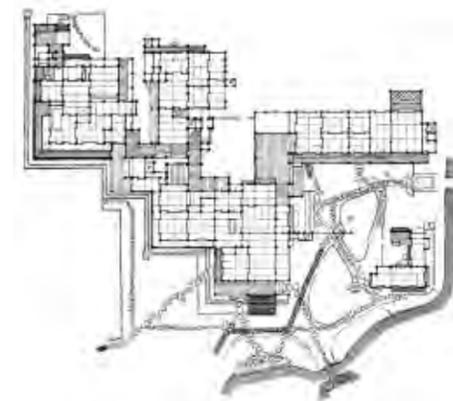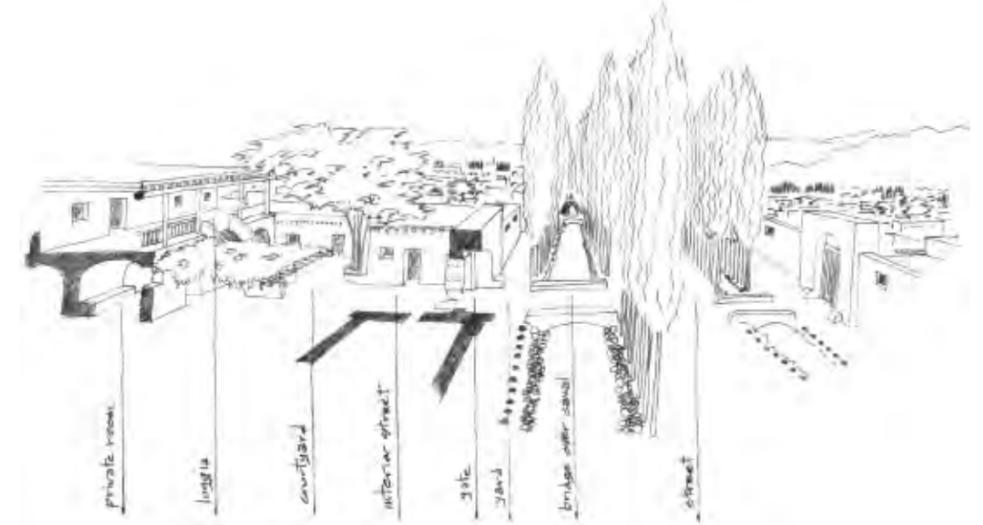amples of spatial layering support the generation of connections and simultaneity of rooms or spaces.

In the 18th century, castles and large-scale palaces organized spaces as enfilades, spatial layers that are connected and perceivable through aligned door openings. Traditional Japanese architecture also is highly layered and inspired early modernists looking for ambiguous non-hierarchical spaces that would allow an inclusion of interior and exterior.[30] For example, the Imperial Palace in Kyoto, Katsura, exhibits how space is created through the presence of graphic qualities of lines that articulate modules and elements and through a multiplicity of fixed or mobile planes, openings, and view connections. Proportions are governed by modules arranged along multiple axis systems reaching for compositional balance rather than symmetry. Spatial continuity is achieved through a layered arrangement of planes – a method and mindset also reflected in Japanese painting. Japanese principles enjoyed wide interest in the West – according to Salvator-John A. Liotta, »Frank Lloyd Wright was particularly impressed by the ability of Japanese painters to recreate depth without using perspective. In particular, he got to know and appreciate the work of Utagawa Hiroshige and Katsushika Hokusai, whose work embodies many elements of the Japanese concept of space and layering in particular.«[31]

Don Hanlon uses the central Asian town of Turpan, China, as an example of horizontal layering used to control social relationships: »In the daily life of Turpan we find seven distinct layers of space between the public life of the street and the most intimate family of spaces of a house.«[32] Another arrangement of spatial layers can be concentric, which is frequently seen in religious buildings with central plans such as Brunelleschi's Santa Maria degli Angeli in Florence or the Dome of the Rock in Jerusalem. Hanlon defines layering in this way: »A compelling use of layering is to control social relations.« […] Visitors may penetrate the layers of space to varying degrees depending on their status in relation to the family […]. In contrast, spatial layering may be devoted to purely aesthetic purposes, as in Rome's Church of Santa Maria in Campitelli. Here the layers of space are entirely for visual effect, an illusion of deep atmosphere and ambiguous scale – an intense theatricality typical of Roman Catholic churches built during the Counter-Reformation in Italy.«[33]

Fumihiko Maki chose the term »oku«, originally used in poetry and painting, to analyze the depth of architectural space and the city – it represents a mysterious and unattainable core. Oku describes not only an inner core but also the experience of approaching the core, which can hap-

pen through a series of layers. In Maki's own words, »The Japanese have always postulated the existence of what is called oku (innermost area) at the core of this high density space organized into multiple layers like an onion. The word oku, expressing a distinctive Japanese sense of space, has long been a part of the vocabulary of daily life.«[34] For Maki, these types of multi-layered spaces are observable only in Japan, where the depth is generated by an onion-like arrangement of space with an innermost area, the aforementioned oku.[35] Maki writes of the cultural evidence of depth through various disciplines:

»The word oku, expressing a distinctive Japanese sense of space, has long been a part of the vocabulary of daily life, as is evident from such literary classics as the 8th-century anthology of poetry called the Man'yoshu (Collection of Ten Thousand Leaves), the 10th-century Ise monagatari (Tales of Ise), the 14th-century Tsurezuregusa (Essay of the Idleness), and kabuki plays of the Edo Period. It is interesting to note that the use of the term with respect to space is invariably premised on the idea of okuyuki, or depth, signifying relative distance or the sense of distance within a given space.«[36]

Matteo Belfiore analyzes the origins of spatial layering in Japan in the book *Patterns and Layering – Japanese Spatial Culture, Nature and Architecture*. He traces its origins in ancient Japanese culture, emerging in painting and in the tradition of Japanese gardens, where depth is created through planes overlaid in varying distances.[37] He connects the mechanics of layering to a strong two-dimensionality, which is used to generate spaces in a way similar to how stage design operates.

In Chinese landscape painting, the depth of a sensory experience can be linked to the existence of multiple viewpoints going hand in hand with the representation of nature as a series of layers extending from foreground to background. Similarly, Japanese garden design can reveal an arrangement of spatial layers in which near objects overlap with those farther away, creating a view of the garden as a whole where the landscape beyond includes the viewer. The overlapping planes act as if framing a theater stage with collapsed layers of landscape elements arranged to emphasize depth and complexity.

Layering is a mechanism that can condense a multitude of information into the skin and wall system used to define contemporary buildings. The masonry wall has turned the vernacular massive masonry wall into a stone veneer. Glass curtain walls constructed of multiple strata have become the norm for many building types. Revealed sectional skins illustrate the thickness and complexity (depth) of the envelope – real or suggested – exposing a possible sequence of several planes in order to form a system emphasizing the interaction of the parts over the singular object. Historic façades often are articulated specifically toward their principal representative side, exhibiting more costly materials and ornamentation on the plane facing the street or a main plaza. The separation of planes can be attributed largely to modern architecture and its predecessors with the intent to break open that box. Arguably the most noted proponent of the approach was Frank Lloyd Wright, who described his strategy of an open plan and spatial freedom in his autobiography and elsewhere.[38] A direct attachment of planes to one another leaving no or little space between qualifies as material layering, which depends on the intent of revealing the built planes.

Material layering indicates the depth of multiple materials and defines zones or sub-spaces within existing spatial realms without the necessity of erecting separation walls. Façades are an obvious place for the use of material layering. A series of different (often planar) elements can be responsible for structural performance, thermal separation, sun protection, waterproofing, information, and ornamentation or decoration. Associative layers allow the narrative of the building and its location to be communicated. As artist and architect, James Wines writes: »Some attention should be paid to the various interpretations and applications of narrative in architecture. On the most obvious level, buildings tell stories when they are endowed with some form of illustrative information. For example, a structure in a politically volatile community might be covered with graffiti or emotionally charged murals. Although these depictions are not intrinsic to the concept of a building, this use of narrative element in relation to architecture is certainly meaningful and valid. There are, however, other methods that are more integral to architecture.«[39]
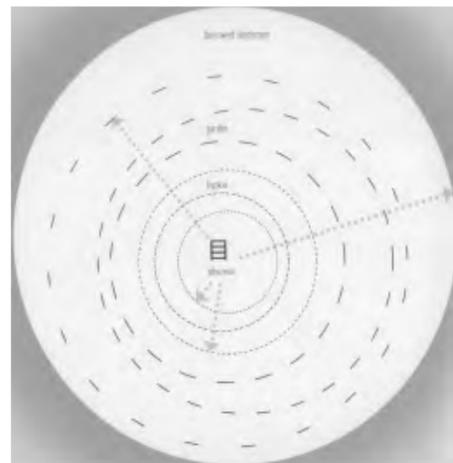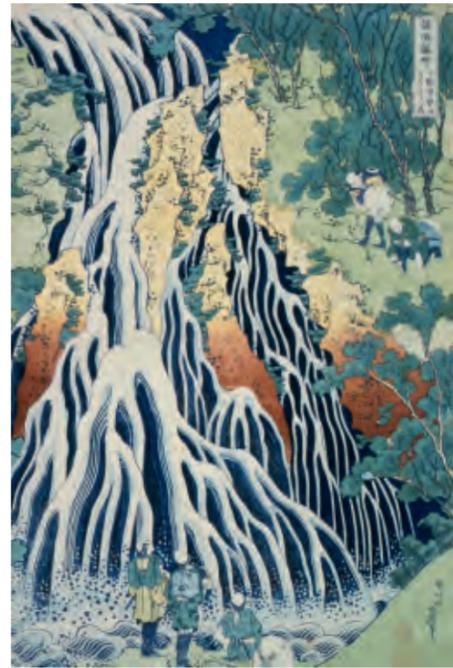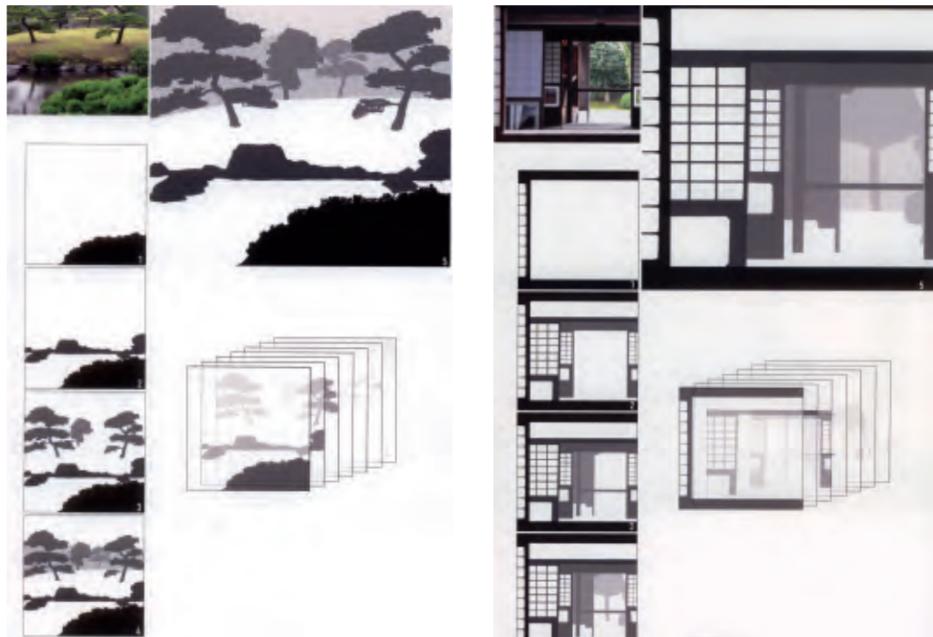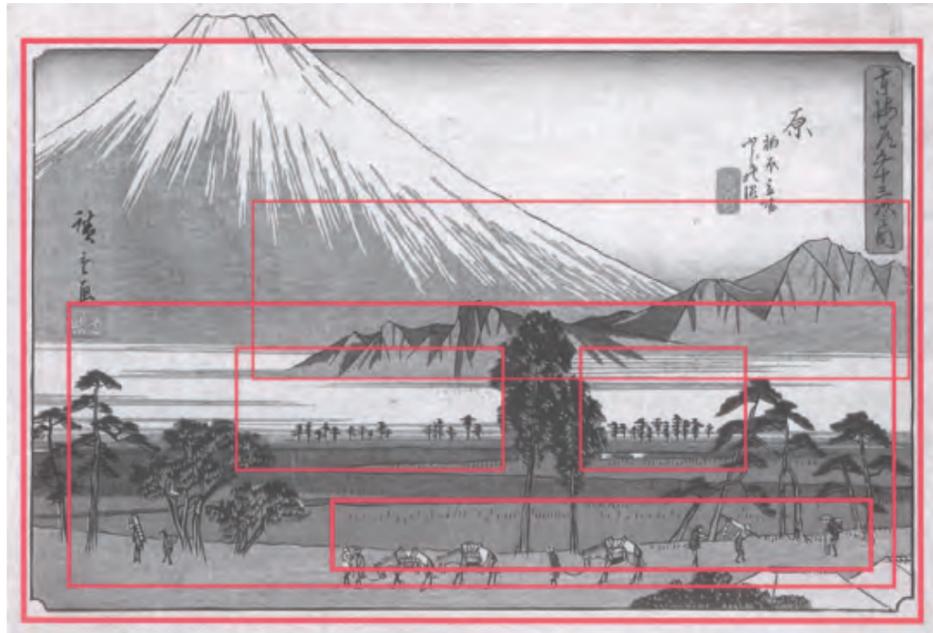
21. Utagawa Hiroshige, *53 Stations* (*Gyosho Tokaido*), Hara, 1840. Framing and spatial layering of views of increasing depth.
22. Diagram by Matteo Belfiore. Japanese design concept of superimposing layers, Suizenji Garden, Kumamoto.
23. Diagram by Matteo Belfiore. Japanese design concept of superimposing layers, Hosokawa Residence, Kumamoto.
24. Katsushika Hokusai, Falls of Kirifuri at Mt. Kurokami, Shimotsuke Province, ca. 1832.
25. Diagram by Matteo Belfiore. Sightlines of an observer in a Japanese house.
26. Diagrams of breaking open the box.
27. Hans Scharoun, Mohrmann House, Berlin, 1939. Sequence of spatial layering in the interior.
28. Hans Scharoun, Mohrmann House, Berlin, 1939. Axonometric diagram of the interior spatial layering.
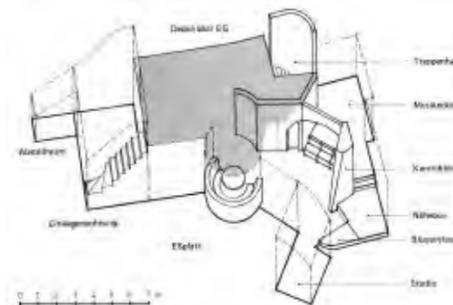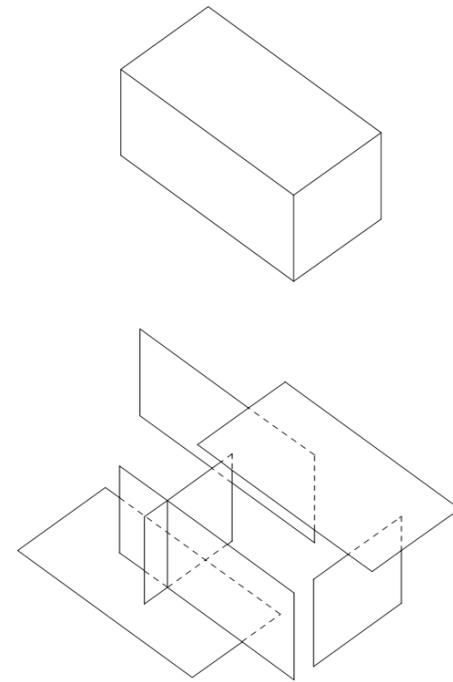
Leon van Schaik writes about »Zaha Hadid's layered mental space«,[40] discussing her winning entry for the Hong Kong Victoria Peak project (1982), in which she »coopted the entire mountain into a Hadid-defined tessellated surface into which the program was slid on small rectangular shelves.«[41] He discusses Hadid's use of layers that appear to fold out of the terrain, integrating implied or real planes of the site into the architecture. Hadid mentions layering frequently in a lecture about her recent work, referring to the building skins broken into several band-like layers as well as interior spaces organized around spatial layering of circulation. She identifies layering as a condition that continues through her entire body of work from Hong Kong's Victoria Peak to the Dong-daemun Design Plaza in Seoul, Korea, which opened in 2014.[42]

In examples of spatial analysis, the term layering is commonly used to describe the succession of spatial sequences. Eckehard Janofske identifies spatial layering in his description of Hans Scharoun's Mohrmann House in Berlin-Lichtenrade (1939):

»A sequence of layers is noticeable when we look through from the dining room in the direction of the window for flowers and houseplants. Apart from the doorlike opening of the room in the direction of the dining area, the buttress between the semicircular dining area and the straight wall of windows in the living-sitting area represents the first layer; the fireplace block is the second. The window behind it, or rather the flower window, is the third and last layer before our eyes are arrested by the landscaping in the garden. It is basically because of this sequence of layers that we have an impression of spatial complexity and distance. As a result of components such as the fireplace block, the surface arch over the sofa, or the masonry pillars between the two spaces that move into our field of vision, the borders of this space are not immediately recognizable, as is the case in a room with four walls.«[43]

In his own house, Robert Venturi applies spatial layering using multiple walls. He describes the house as »a rare manifestation of the idea of a multiple enclosure in my work […]. It exploits the idea of contrasting spatial layers between the inside and the outside in the series of parallel walls in plan and in the open inner domes supported on diagonal frames in section; the idea of contrapuntal, rhythmic juxtaposition in the relation of the pier openings of the porch, and of the lower and upper windows and of the cupolas above the inner dome, and the idea of a series of spaces en suite which are general in shape and unspecific in function.«[44]

Architect and author Franco Fonatti applies the term layering to Giuseppe Terragni's work. Separating the functions of construction, shell, openings, and shading elements, and shifting them horizontally means that construction is separate from weather protection and causes the elements to appear »layered« because of their additive arrangement. In his analysis of Terragni's Giuliani-Frigerio House, Fonatti separates the façade into four (material) layers. The metal frames of the balustrades form the first layer; the projecting parts, such as the balconies, form the second layer; and the perforated façade forms the third layer. The fourth, innermost, layer is formed by interior parts such as windows and shutters. Fonatti analyzes the agglomeration of the elements, but without ascribing a function to them. The façade creates a transition between inside and outside that gains depth through vertical differentiation.[45]

Toyo Ito intensifies the experience of the horizontal layers of a building's floors in his Sendai Mediatheque, completed in 2001, a glass-clad volume with bundles of columns connecting the vertically stacked spatial layers (that is, floors) of the building, instilling them with views and light. Any multi-story building could be said to stack spaces, but only an act of connecting the spaces visually and functionally would allow that phenomenon to be considered spatial layering.
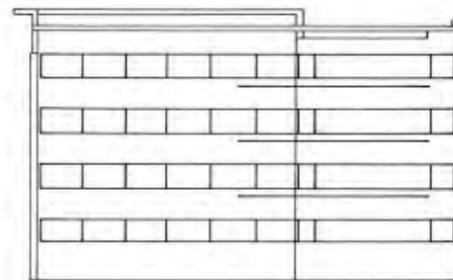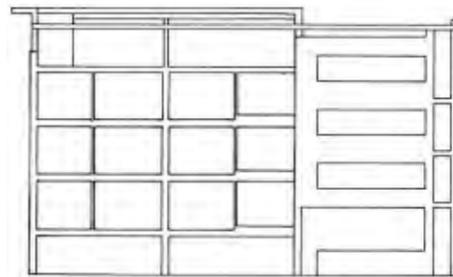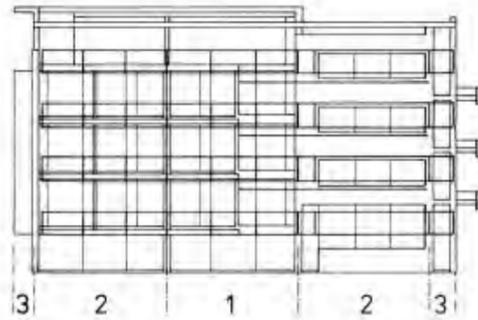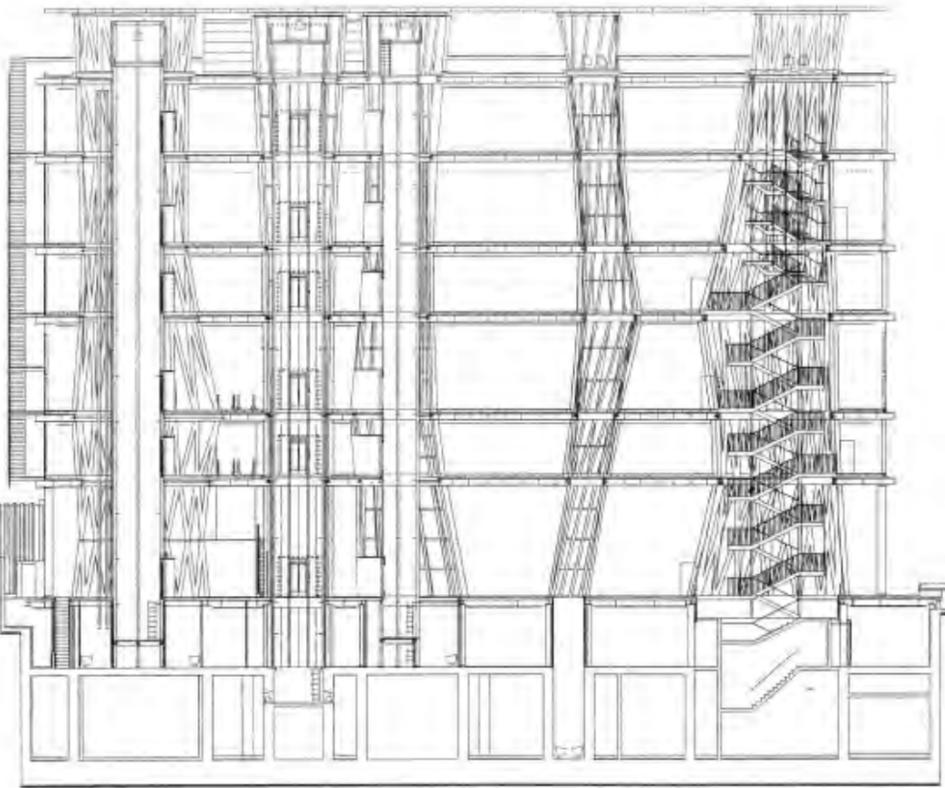
29. Toyo Ito, Mediatheque, Sendai, Japan, 2001. Section.
30. Toyo Ito, Mediatheque, Sendai, Japan. Façade: horizontal layering of the building's floors.
31. Giuseppe Terragni, Casa Giuliani-Frigerio, Como, 1939/1940. Façade.
32. Giuseppe Terragni, Casa Giuliani-Frigerio, Como. Façade analysis of layered elements by Franco Fonatti.
33. Diagram of floor, wall and ceiling elements.
34. Diagram of material layering.

Material layering

Applying the term layering to an individual building rather than an urban fabric can slightly alter its definition. At the scale of a building, layering is based on a perceived separation of spatial enclosures into floor, wall, and ceiling or roof elements and combinations thereof. Individual elements may consist of multiple planes fulfilling a series of specific functions (such as rain screens, optical screens, sun shades, insulating layers, or formal statements and ornamentation). The architectural enclosure can represent the physical wrapper of a building and might transport the structure's narrative, tectonic information, cultural expression, the architect's design intent, and other ideas that might be embedded. The notion of layering understands architectural space as being contained in-between physical boundaries, not distinguishing only between interior and exterior, but also articulating different functions and messages. The curtain wall acts as the building's skin that can be independent from its structural skeleton. A building's planes document its construction process and reflect current society and culture, possibly without the architect's awareness. Layering allows varying formal expressions within one structure altered over time. If layering is viewed as being able to unfold in the physical and informative realm, decoration and advertising become part of the system, and signs and significance exist in addition to the physical structure.

The historically monolithic masonry wall was broken down over the course of time into layers of structure (made from masonry, brick, or being a wood skeleton), cladding or infill (which will be discussed as material layering), and possible elements of sculpture, ornamentation, and communication applied in different thicknesses, real or suggested. Alterations and modifications lead to added layers, stylistic updates, or an emphasis on the parts of a building that are »seen« and thus lead to distinctly visible planes added to existing structures.

The complexity of the façade becomes obvious at openings and points of interaction with light, ventilation, and views. Thomas Herzog writes in the *Façade Construction Manual*: »The composition of multi-layered main façades led to a grand interplay between wall and opening, as in the achievements at the cathedrals in Lucca and Ferrara, where this resulted in three-dimensional façades with all details taking on a sculpted form.«[46] Light and shadows further enhance the notion of depth and complexity expressing superimposition and dynamic forms. Façades are the canvas for decoration and messages on the outer surface that a building, its owner, or the institution it is serving might want to communicate – through sculptural textures or through paintings or other applied two-dimensional graphics.

In his work on surfaces, Joseph A. Amato writes that surfaces »present us with and come as part of wholes, configurations, and contexts. […] As coverings and epidermises – homogeneous and heterogeneous, permeable and impermeable, permanent and transient – surfaces constitute an immediate and tangible geography of the world and a prima facie index of all its different things.«[47]

Layering relates to elements of the surface, especially at the point where the section is exposed like eroded mountains or incisions into an animal's skin. Architectural and art historians have used the geological metaphor of layering in their descriptions and analytical texts describing the relationship of decoration to the architectural wall. Writing about late Byzantine architecture in Serbia and Thessaloniki, Robert G. Ousterhout describes »the trend from a complex layering of decoration to a simpler, tectonically oriented system«.[48] Material layering in architecture can be defined as the readable sequence of planes, placed or evolved in a way that multiple elements can be read as a system. Different geometric arrangements of layers can be employed, and concentric, horizontal, or vertical compositions can unfold in plan, section, or elevation.[49]

Layers are related to elements such as space, skin, surface, and façade, all potentially made of parts that can overlap and reveal one another. As spatial layering is apparent in the connected room sequences of traditional Japanese architecture or the European Baroque enfilade, material layering evolves around an architectural boundary made from multiple planes. Buildings that undergo changes over time can adopt multiple layers. In such instances, the composition of material layers is defined by the sequence and timing of their placement. Layers can transport the narrative of a built area, and they can act symbolically or illustratively. A formal approach to layering reveals the multiplicity of its objects in section. An exploration of layering involves the analysis of the physical layers, their method of arrangement or evolution, the interstices between the layers, and the embedded narrative. Although much of a façade's materiality might be dedicated to separating an interior from a weather-exposed exterior, articulating transparent and opaque surfaces, another part of it is dedicated to identifying the building with its context through formal and material choices, through a message that is carried through ornament, text, or other media. Formal at-
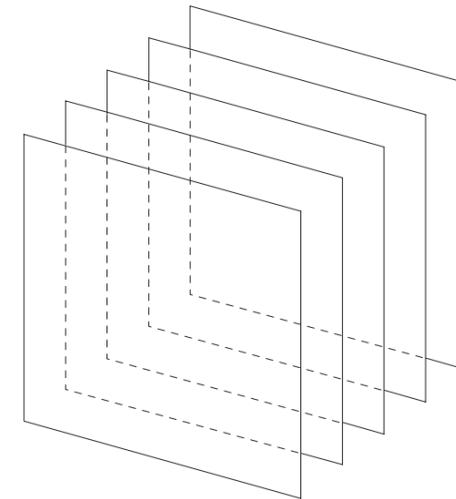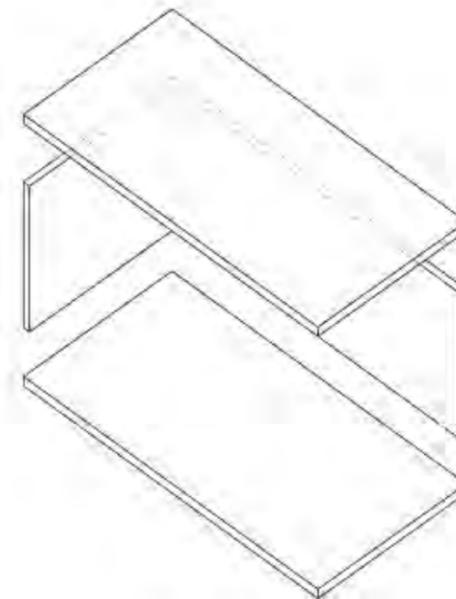
Enhanced transparency simultaneously expressing both, spatial layering and material layering is dominant in the German Pavilion of the World Fair in Brussels 1958 by **Sep Ruf** and **Egon Eiermann**. The complex is comprised of a series of eight pavilions based on square plans, connected through covered walkways – all based on a repetitive and standardized grid for structure and fenestration. The façade itself expresses lightness and light. It is set back and offers openings for natural ventilation, while a fine metal structure was installed with generous spacing from the glass, allowing vertical sunshading at the end of the roof overhang. An integrated and minimized system of linear metal elements wraps the low volumes made from concrete slabs.
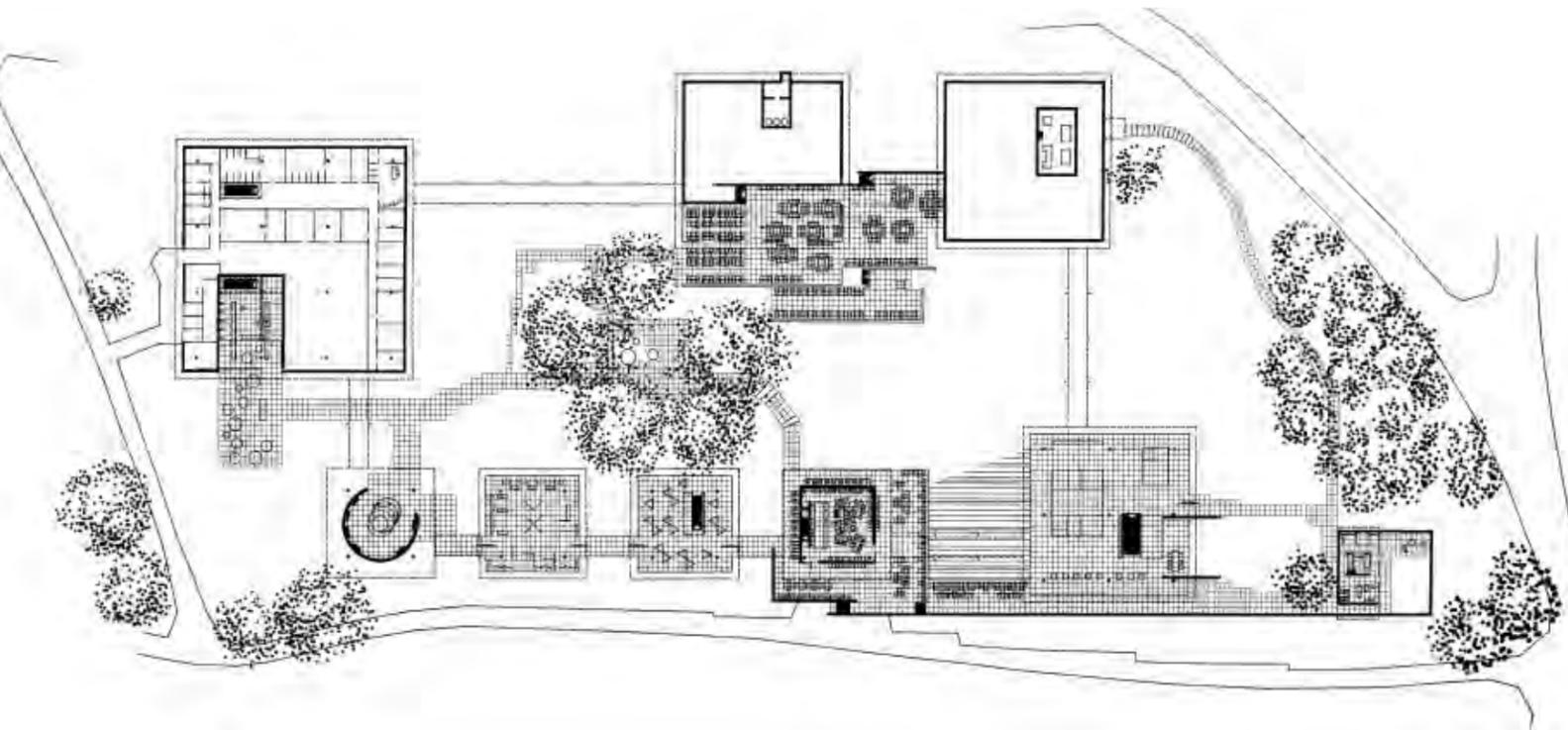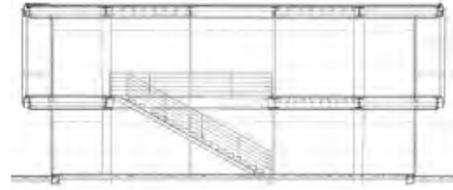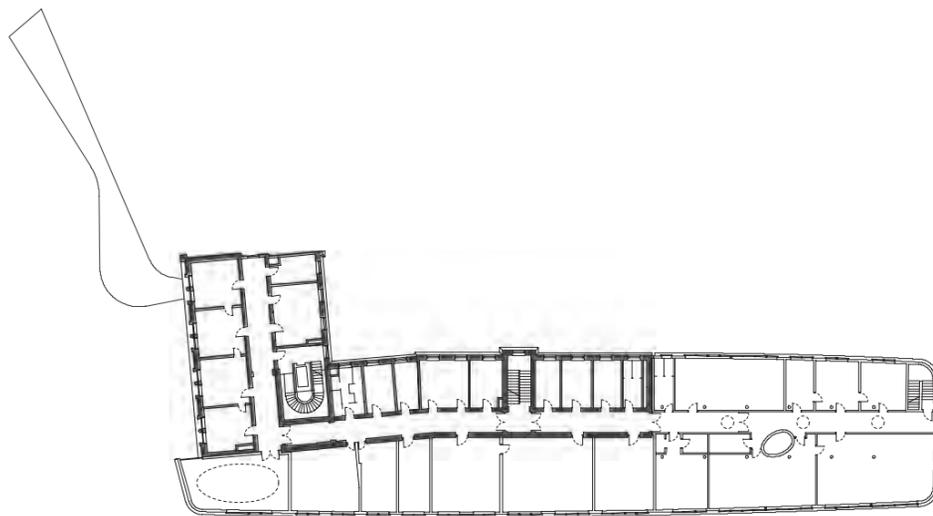

131. Sep Ruf and Egon Eiermann, German Pavilion at Brussels World Fair, Brussels, 1958. General view with double-layered façades, typical for Eiermann.
132. Sep Ruf and Egon Eiermann, German Pavilion at Brussels World Fair, Brussels. Site plan.
133. Sep Ruf and Egon Eiermann, German Pavilion at Brussels World Fair, Brussels. Section.
134. Norman Foster, Sainsbury Centre for Visual Arts, Sainsbury, England, 1978. Façade sketch.
135. Norman Foster, Sainsbury Centre for Visual Arts, Sainsbury, England. Façade.
136. Norman Foster, Sainsbury Centre for Visual Arts, Sainsbury, England. Axonometric drawing of the structure and the layered skin.
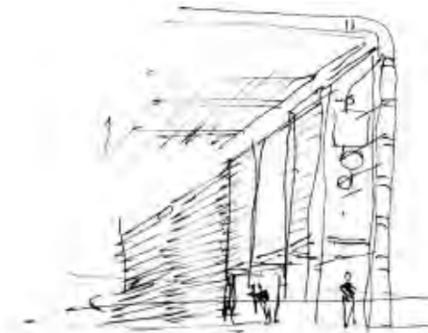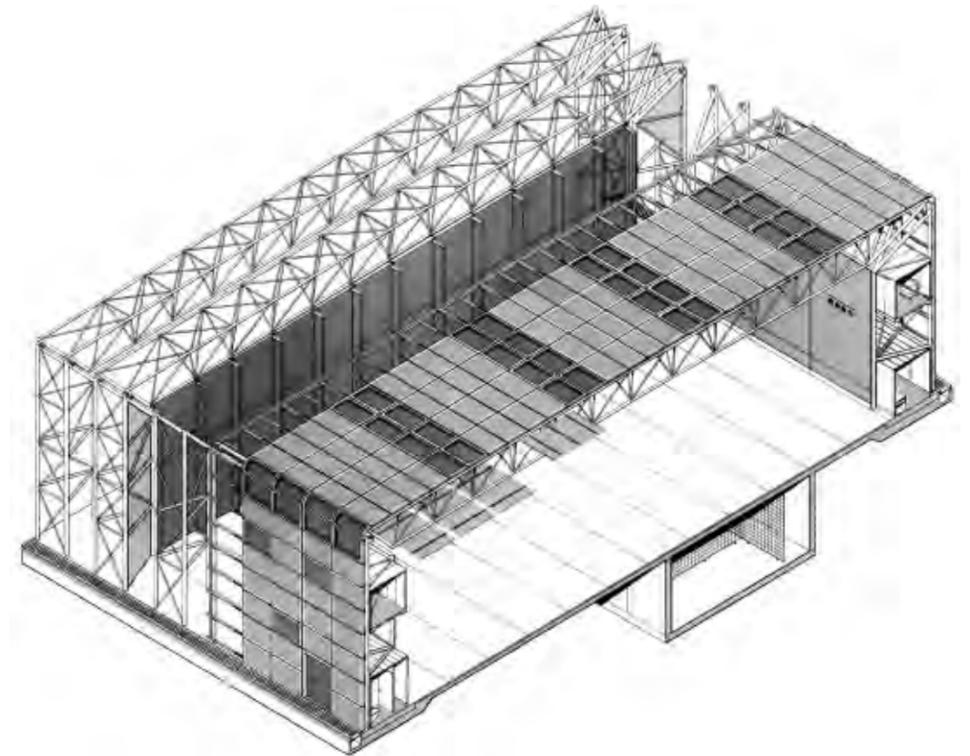
One example of the façade taking on a multitude of functions is **Norman Foster**'s Sainsbury Centre of the University of East Anglia, completed in 1978. This building exhibits the beginning of a long research endeavor for multiple-layered skins. In the project, all facilities and installations are moved into the space created by the structural frame, creating a free plan for the museum inside but also articulating those elements within the area of the façade.

The colorful gradations of the skins in the work of **Sauerbruch Hutton** have eliminated formal exuberance,[139] being less interested in a signature sculpture than in a smart and often playful system, which is consciously integrated into the urban context. In such a design, the skin is presented as an intelligent wrapper that has to be examined more closely to grasp its details and that offers a close link to Modernism with simple volumes and modular curtain walls. Sauerbruch and Hutton have succeeded in creating low-consumption buildings by harnessing the façades and their elements. According to architecture theorist Barry Bergdoll, »Over and over again the unloved legacy of discredited Modernism and urban renewal strata are found to be ›almost alright‹ by Sauerbruch Hutton, taken up in a new design that transcends them, re-contextualizes them, without condescension or nostalgia.«[140] The fire and police station in Berlin contrasts a new glazed volume with a glass façade ranging from a variety of reds to multiple greens with an existing structure. The low horizontal volume complements and contrasts the existing structure. The offices for the kfW Bankengruppe feature a layered façade providing ventilation space as well as a complex texture defining the character of the building. Many of Sauerbruch Hutton's buildings present as well-integrated precious packages that fit tightly into an urban or natural landscape. The patterns, colors, and materials suggest a glittering optic game until one approaches the buildings more closely and the intrinsic dynamicism of the parts becomes clear.