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THE FIFTH SENSE OF ARCHITECTURE

DIGITAL ARCHITECTURE:

A NEW AESTHETICS OF TOTAL SURREALISM

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ABSTRACT

In the historical Development from static to dynamic perception of space, there are concomitant changes in the concept of architectural style. Materials become lighter, structures more kinetic, and spaces less bounded and more energetic. Beyond the traditional static perception of space, our task is to examine the influence of digitization on architecture. It would be more significant to construct a new idea of anachronistic architecture, by exploring the borders between the material and the cyber world. Advanced concepts of equilibrium and a new sense of weight (anti-gravity architecture), would finally lead to a new concept of space expressing the essence of movement; yielding to a new concept of beauty based on energy.

Energy is the basic element of this new language, since it is capable of articulating force and dynamic space in a new architectural form, where elementary themes from static compositions arranged on basic tectonic principles are significantly altered to become a new theme for a new dynamic composition, where mobility and immateriality are its main tendencies. Turbulence and explosion of architectural volumes become a recurrent theme in the flow of surfaces, creating a new sense of equilibrium which we may call: "fragile equilibrium."

KEY WORDS

digitization, fragile equilibrium, static, dynamism, oblique, Energy.

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1. DIGITAL TECHNOLOGIES AND THE TURBULENCE OF ARCHITECTURAL FORM.

Digital technologies are rapidly transforming the field of architecture making a radical change in the architectural form. From a simple tectonic manually generated to unexpected extraordinary forms that are computationally generated.

Our aim is to explore the radical changes brought up by the information technology to architectural concepts. Digital architecture will be the language of the future, where the virtual and the physical bodies will overlap leading to a new space concept of multi-curvature. New forms will be generated, that are composed algorithmically. We model numerically, we build robotically (new tectonics); we inhabit interactively (intelligent spaces); we inform immersively (liquid architecture) and we avert virtually (Trans-architecture). This novel architecture heralds the end of modernity, where the usual architectural response no longer suffices. Ordinary forms appear inadequate in dealing with these new challenges. This marks our time: the emergence of a new notion of aesthetics where space is dimensionless and no longer involves measurement. It entails an integration of theories that are non Cartesian and non dualistic. Hyper surface theory evacuates the dualism between real and virtual in favor of a more opened ended architecture that is inclusive and inviting to the media. It is upon these new erupting and fluctuating surfaces, that future architecture would be predicted. Parametric, animated, metamorphic, isomorphic, topological, per formative and algorithmic architecture, are new concepts that are radically changing contemporary architecture.

2. ENFOLDMENT OF SPACE TIME AND ENERGY.

Digital Technology is rapidly transforming the field of architecture, making a radical change in architectural forms. From a simple platonic manually generated to unexpected extraordinary forms computationally generated. This new type of design started to create and shape new concepts in architecture. This digital generative process is opening up new theories, concepts, forms and explorations in space. Digital architecture will be the language of future architecture, where the virtual body of the electron and the physical body of the human body will overlap. The final space will be an electronic multi dimensional, multi curved space that would yield to a new concept of beauty based on energy. Unimpeded by memories of ancient styles, a new architectural style based on language of media and information would evolve. Elementary themes from static compositions arranged on the basic tectonic principles are significantly altered to become a new theme for a new dynamic composition, where mobility and immateriality are its new tendencies.

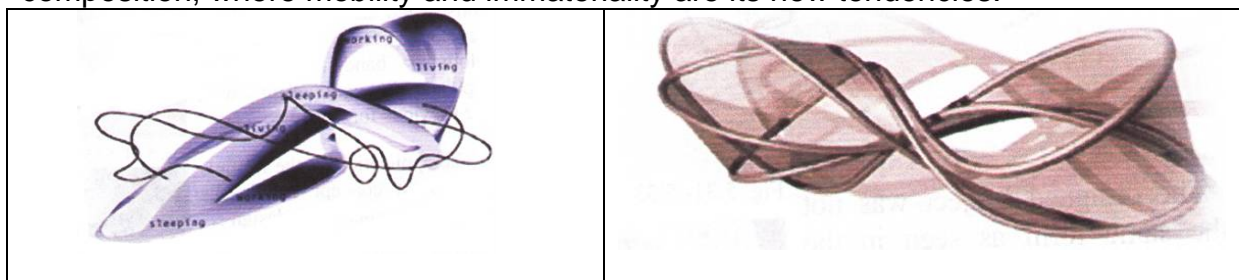


Figure 1. New architectural forms based on the language of media and information.

Turbulence and explosion of architectural volumes become a recurrent theme in the flow of surface. Thus a new spatial, temporal and energetic coordinate system is suitable for such a new style. This system would lead to the enfoldment of both space, time and energy in one continuum, introducing the Vectorial coordinates in presenting architecture. Axes are changed with energy in different directions. It is a new architecture of exploded forms, overlapping volumes and a new sense of instability of the whole form. Information technology tools are used as a generative tool for the derivation of new architectural forms and their transformations to fulfill the new concepts of design. In this radical change from traditional to innovative concepts, new architectural forms are developed. These processes are opening up a new architectural concepts, forms and explorations. The use of algorithms creates new forms of buildings, free from the constraints of conventional nature and techniques. Algorithms form generation can create very complex forms and three dimensional curves. One of the most famous software is " Mathematica" which is based on the idea of describing three dimensional surfaces by parameterized function. Algorithms used for creating architectural form are time / energy based, that are generated in real time. In their engagement a new architecture is produced based on inclined shapes, ruptured forms and planes. Each point in space falls within five quadrants (x, y, z, t, e), thus an inherited sense of motion and instability is obtained. Axes are changed with energy in different directions, thus producing a sense of instability in the whole form. It is a new metaphysics in the architectural language. New designs approaches that depart from the deconstructive logic of conflict and contradiction to a more fluid logic of spaces is the response to this digital era and ideas. This is manifested through a design strategy that departs from Euclidean geometry to discrete volumes represented in space employing continuous curves and mathematically described surfaces described as Nurbs: Non uniform rational splines. Nurbs makes the heterogeneous forms of space computationally possible. The introduction of digital modeling in architectural design provided a departure from the Euclidean geometry represented in the Cartesian space to highly curved surfaces. NURBS make the construction of these forms attainable by means of computer numerically controlled machinery (CNC). The NURBS can be changed by control points associated with weights and knots. Each determines the extent of its influence over the curve itself. The final figure is modified by the force exerted on each control point. Accordingly, the final topology of architecture will be changed. Architectural thinking throughout the centuries was based on Euclidean Geometry with its platonic solids: cylinder, pyramid, cube, prism and sphere as its major vocabulary. Due to the advent of digital technology with its great potentials using Nurbs, architecture has started to use forms based on Non-Euclidean Geometry.

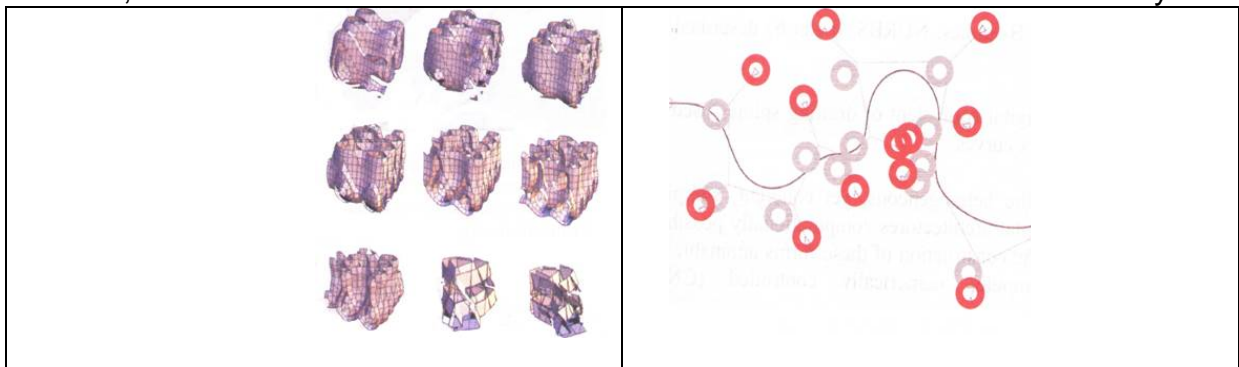


Figure 2. Nurbs makes the architectural heterogeneous forms computationally possible...

According to its mathematical definition Euclidean geometry asserts that two lines are parallel if there is a third line that intersects them in the perpendicular direction. It is known as the flat or parabolic geometry. Non-Euclidian geometry is described through both hyperbolic and elliptical spaces. The essential differences between Euclidean and non- Euclidean geometry are the nature of parallel lines. In the first case we can draw only one line that is parallel to the other line. In hyperbolic geometry, by contrast, there are infinite numbers of lines that are parallel to the original one. In the elliptical geometry, parallel lines don't exist, where the distance between any two points is always a curved one, not a flat straight distance. Another interesting concept is the idea of curvature of space whether it is either positive or negative curvature. What makes these types of geometry interesting from an architectural point of view is the possibility of mapping – objects between them, thus providing a radically different concept of space based on a new forms and ideas. Spaces constructed based on Non- Euclidean geometry will give rise to new architectural forms. On the assumption that the visual space is hyperbolic and the physical space is Euclidean, one can get a visual sense of how objects of the physical space will be different if seen in the space of Non- Euclidean geometry.

Generally speaking, space in the age of information is not the neutral container that is uniform in all three dimensions of the Cartesian coordinates, but it has densities, directions and center of gravity and a point of interest (prelude, climax and final). While architectural form is not designed in a fixed and stable medium but rather a dynamic medium full of energy. This shift from a passive space of static coordinates to an active space of interactions implies a shift from autonomous purity to contextual specificity. In this architecture, the architect doesn't design the form itself but he designs the virtual atmosphere of the project. The form can be changed if the designer changes the atmosphere of designs (direction of force, densities and interesting of force). By morphing shape and volumes with each other, hybrid forms would result by using the technique of hybridization. New geometrical objects will be realized, or what Greg Lynn would define as: blob surfaces. The blob is an index of a high degree of information. They are nothing more than mathematical formulas that perform logical operations. This method is called mathematically constructive solid geometry (CSG). At the level of imagination these blobs lead to a new architecture of isomorphic space and volumes, and thus a new space concept.

The usual architectural response no longer suffices. Ordinary forms appear inadequate in dealing with digital architectural challenges. We are carried away from a wired information society to a society of a wireless global virtuality. There are numerous ways of achieving this: liquid forms could be frozen and constructed, information could be projected upon hyper surfaces, data driven mechanical space and surface structures can be used to create a new digitally inter activated and kinetic tectonic architectural forms. Clearly the most daring is to render the virtual, present and precise.

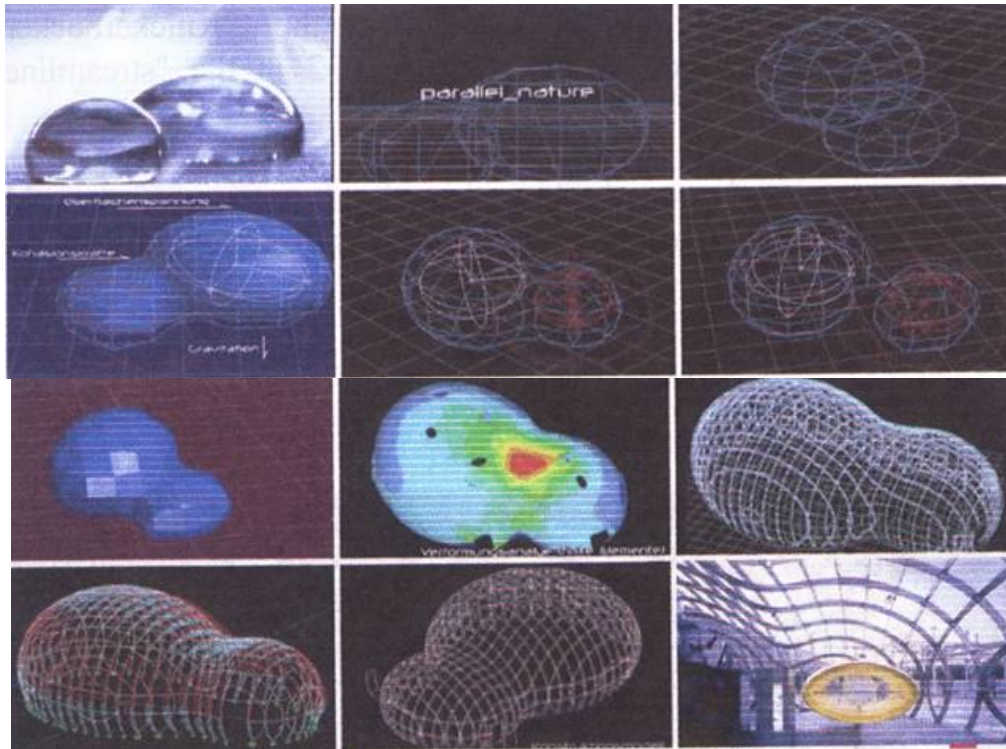


Figure 3. Blob architectural form: An index of high degree of information.

For architecture it proposes the notion of invisible architecture, for art the notion of invisible sculpture and for technology the notion of invisible interfaces. Architecture becomes animated and unpredictable. The media revolution is becoming a tangible reality. Architecture and design have their own special role to play in the new information age, creating the promising visual setting that provides a foretaste of the virtual delights. The digital revolution is based on immateriality, immediacy and. What we are seeking is not illusion or simulation if reality, but a new immaterial reality of its own kind. This marks our time, by a re-emergence of a new notion of aesthetics, where space is dimensionless and no longer involved measurements. It is upon these new erupting and fluctuating surfaces, that future architecture would be predicted. Like the surrealists, architects are determined to blur the space between reality and dream state. For all of us there is a trend towards new architectural forms, where architecture will lose its definition and fade into a new kind of nirvana.

3. NEW ARCHITECTURAL DESIGN APPROACHES

New concepts of creating architectural forms are radically different from previous methods (which depend on architectural sketches and physical forms). The architectural forms are based mainly on various computational methods, such as Parametric, Animate, Metamorphic, Isomorphic, Topological, Performative, and Evolutionary (Genetic algorithms) architecture.

1) Parametric Architecture: Parametric architecture can provide a powerful conception of architectural form by describing a range of possibilities. In it, the parameters are declared, by assigning different values to them, different objects or configurations can be created through equations.

2) Animate Architecture: It is defined by the co-presence of motion and force at the moment of formal conception. Force as an initial condition, changes the atmosphere, which affects both motion and particular inflections of form. Architecture can be modeled as participation immersed within the dynamical flow, instead of a neutral abstract space for design. Traditionally, in architecture, the abstract space is conceived as a neutral space of Cartesian coordinates. However, in animate architecture, design space is conceived as an environment of force rather than as a neutral vacuum.

3) Isomorphic Architecture: The geometric objects of the isomorphic architecture (known as blobs) are defined with a center, surface area, a mass relative to other object, and a field of influence. The field of influence defines a rational zone within which the blob will fuse, or will be influenced by other blobs. When two or more blobs are linked, they will either:


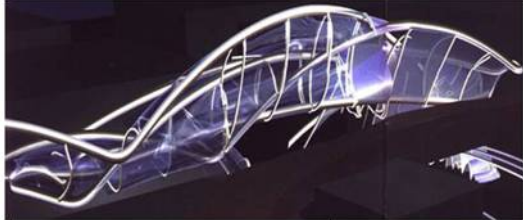

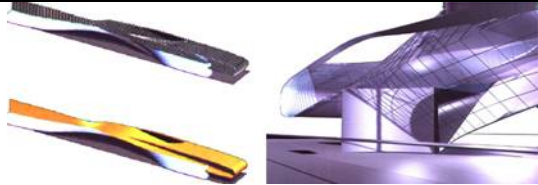
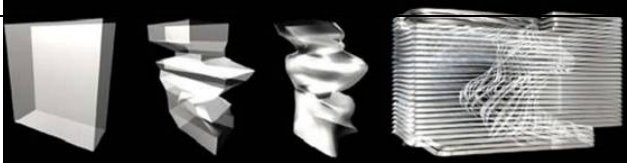
- a. Mutually redefine their own surface based on their particular gravitational properties.
- b. Actually fuse into one adjoining surface defined by the interaction of their centers and zones of inflection and fusion.

4) Metamorphic Architecture: It represents the concept of creating a simple form, and then selects the suitable transformation modifier, such as bending, torsion, morphing, etc, to change the form. This modifier is selected based on the concept of adding a fourth temporal dimension (time) to the deformation process.

5) Topological Architecture: It is an architectural approach that moves away from deconstructive logic of conflict and contradiction to develop a more fluid logic of connectivity. This new fluidity is manifested through a design strategy that departs from Euclidean geometry of discrete volumes represented in Cartesian space, and employs, a new concept of geometry based on continuous curves and surfaces that are mathematically described as NURBS.

6) Performative Architecture: It is the architecture, which utilizes building performance as a guiding principle and adopts a new list of performance based priorities for the design of buildings, landscapes, and infrastructures. This new kind of architecture utilizes digital technologies of quantitative performance to offer a comprehensive new approach to the design of the built environment.

7) Evolutionary Architecture: It is the architecture based on a field of computer programming called: genetic algorithms. It is based on the theory of natural selection and evolution. Architectural objects are given parameters and enclosed into a string like structure. The value of these parameters, change during the computation process, similar to the genetic rules of all biological creatures.

Design Concept	Architectural examples and projects.
<p>1-Parametric Architecture:</p>	 <p>Paracube, a parametric architecture project designed by Marcos Novak</p>
<p>2-Animate Architecture:</p>	 <p>Port Authority Gateway, USA, 1995. Designed by Greg Lynn.</p>
<p>3-Isomorphic Architecture:</p>	 <p>BMW pavilion, Germany, 1999. Designed by Greg Lynn</p>
<p>4-Topological Architecture:</p>	 <p>Yokohama Ocean Liner Terminal by Winka Dubbeldam</p>
<p>5-Metamorphic Architecture:</p>	 <p>Cocoon : Fashion and design center, Busan. Designed by Bernhard</p>

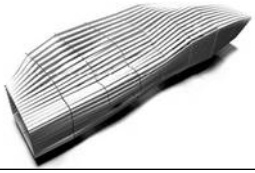

<p>6-Performative Architecture:</p>	 <p>E-motive house 2002. Designed by Architect K. Oosterhuis.</p>
<p>7-Evolutionary Architecture:</p>	 <p>X-Phylum genetic space. Designed by Karl. S Chu.</p>

TABLE 1. New design concepts for creating different digital architectural forms.

The Mediatheque building, designed by Toyo Ito in Sendia, could be considered as an entirely new building type appropriate for the new age of information. It presents new paradigms and challenges not only how we design buildings, but also how we manufacture them. The task of Toyo Ito was to introduce the value of technology that engage the tectonics of the building, based on an innovative structural system and a new concept of sharing information through the latest digital and media means. Fluidity between the digital and technology are the main themes behind the design of this hybrid public building. Ito pared down his architecture to three fundamental elements: plates, tubes and skins. He developed the elements into a building system consisting of honeycomb slabs, hollow tubes that run in an irregular vertical course and transparent exterior walls. Mediatheque's most extraordinary feature is its 13 structural tubes that hold up the entire building. These tubes, each differently shaped and irregularly placed- seems to undulate as they thread between the different floor slabs. As they rise, the center point shifts from side to side, giving the impression of tilting. It is considered as the antitheses of the conventional solid column. From roof to basement, the tubes retain their airy fluid image. The profile and position of each tube was a challenging puzzle that required balancing structural loads with, different functional roles. Capped by rotating mirrored panels on the roof, two tubes guide shafts of daylight down into the center of the building. Other tubes act as conduits for mechanical systems, in addition to their structural role. The roof of the building which is treated as the building fifth façade is covered with a louvered metal screen that hovers overhead as if to contain the tubes jutting out from below. In Ito's design, he expressed the static composition in a structural dynamic process. His work is not about finding final solution, but rather it is concerned with flow, change, intuition and finally finding the balance between the romantic view of architecture and technology.

This structure stands as a sign for the beginning of a new era. This floating space could be considered the starting point of the information age in the digital practice. We are witnessing a reversal of the paradigm of making drawings to convey information. The model has taken the place of the construction drawings, while digital models are used to extract information. The result is a new dialogue between models, drawings and data, a dialogue that has led to a new concept of cross-hybridization between drawing and digitization.

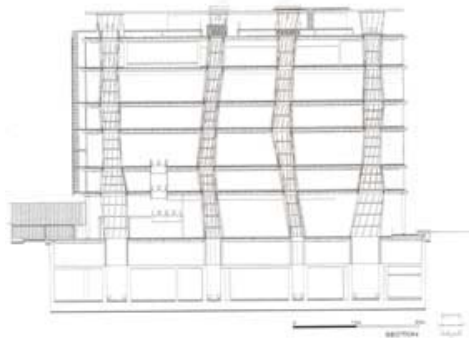


Figure 4. Mediatheque section showing undulating tubes

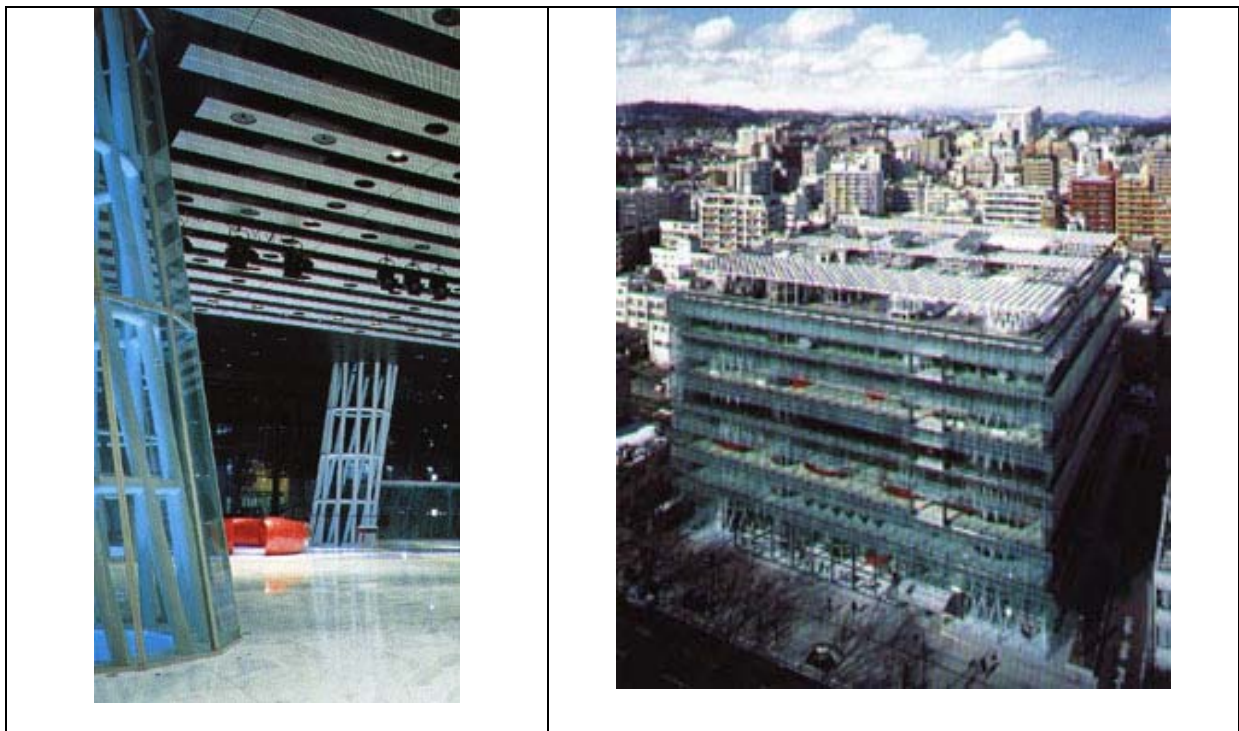


Figure 5. Mediatheque, Sendai, Japan. Architect: Toyo Ito.

Figure 6. Double skin and hollowed columns..

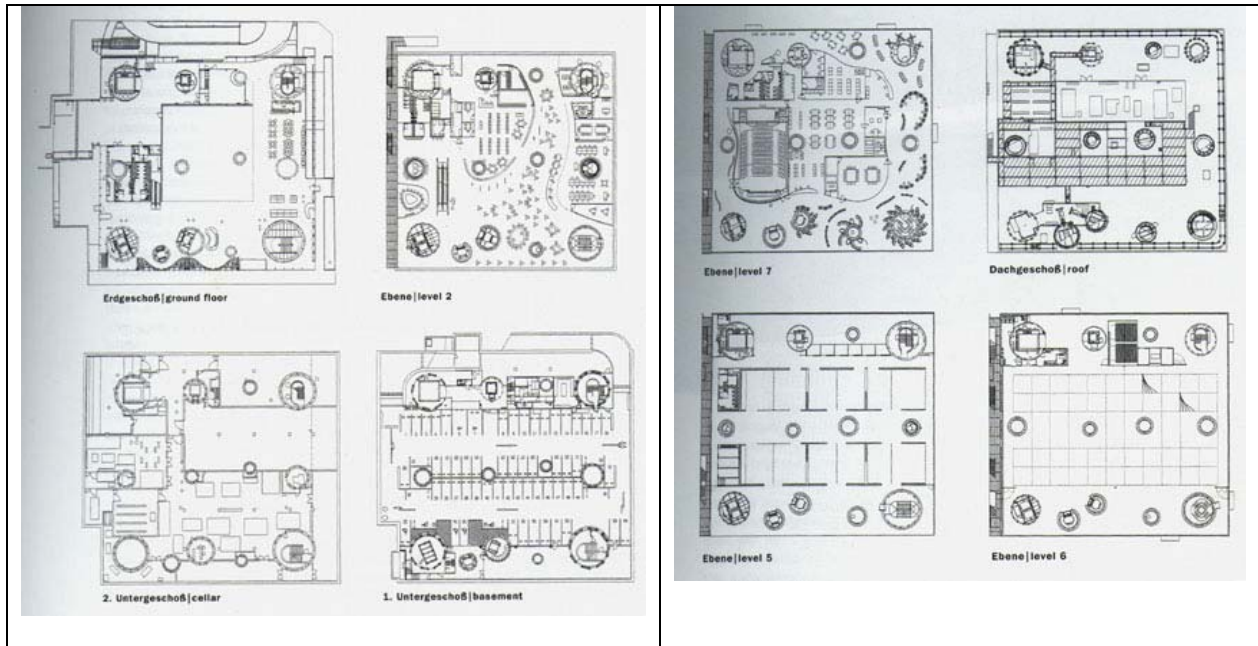


Figure 7. Different floor plans.

4. CONCLUSION

Finally, we are approaching to a new architectural style manifested in animation, growth, vitality, and motion. The language of architecture is changing to a new concept of timelessness that overcomes the traditional idea of static to a more advanced system of dynamic organization. The design space is conveyed as an environment of force and vectors rather than the neutral vacuum of Cartesian coordinates. Thus the final topology will of architecture will change. Architecture will be conceived and shaped in association with virtual motion and force. It is a new concept of aesthetics based a motion and a complex concept of gravity based on flow and extension.

Historically, Baroque architectural space was defined by multiple radii based on a discrete geometry and a highly continuous shapes and volumes. Topological surfaces generated by digitization and computation, is a modern interpretation of the Baroque. We may name it, Electronic Baroque architecture, since it retains composite entities and multiple radii. As Francesco Bromine's Quattro Fontane Church in Rome, with tangentially aligned spaces and volumes producing dynamic surfaces, digital architectural space is also defined by points and centers that are characterized by flexible surfaces and dynamic volumes. This will finally lead to a new architecture of dynamic space.

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