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Perception of Space in Topological Forms

Dinçer Savaşkan

Syracuse University School of Architecture, Fall 2012

Syracuse NY

THESIS

Topological forms in architecture create a new era in the understanding the phenomena of spatiality however in digital age, the perception of space in computer generated forms is still a question. Cinematic techniques of collage can create a methodology in exploration of architectural experience thorough interaction, movement and program in this unpredictable forms.

In architecture we can see examples of capturing motion in space in cubist and futurist approaches. Object and time can be captured in the same space. Topological forms change the notion of space from neutral and timeless Euclidian spaces to dynamic non-Euclidian spaces. Developments in digital technologies lead to design dynamic forms in architecture. Architecture is detached from the tactility of paper and depend more on software's, computer screens and the virtual environments. According to De Landa in *Immanence and Transcendence in the Genesis of Form*, morphogenetic process of physical assemblages occurs as "abstract machines". Abstract machines can be defined as systems that control certain parameters, which create dynamic structure generating process. In nature this parameters can be identified as field gradients; temperature, pressure, volume, speed, density, etc. Change in parameters creates variations and new possible forms. Outside forces, field gradients and matter intertwine to create natural structures. This creates a fundamental relationship between material and the generating form. Material systems have the capacity for differentiation, and variation. Systematical approaches to building form with pattern correlations are manipulated to shape different areas. It is possible to adapt same approach in development of architectural form with the help of diagramming.

According to Dalibor Vesely, the ground is the first reference in spatial un-

derstanding. Epistemological ground reveals in the process of taking place in continuous references. It is possible to approach architecture as this sequences of references in the ground. Path sequences have been researched by different architectural groups like Situationist International and Bernard Tschumi. Tschumi created his practice based on cinematic techniques of montage and collage of Sergei Eisenstein.

First phase of the research is going to focus on digital technologies and fabrication techniques. Digital technologies change language-based architecture to performative architecture. Architecture is detached from the tactility of paper and depend more on software's, computer screens and the virtual environments. Scripting tools such as, 3ds Max Script, Rhino Script, Grasshopper, Generative Tools, Processing allow to model and produce very complex forms that is not possible to produce with traditional ruler and pencil drawing techniques.

The second phase is going to research the field gradients that are going to materialize the form. The diagram in design creates flexibility and become a medium to produce loose structure, and unplanned form. The diagram reflects potentiality of the field gradients and through loose fit of the program instead of a type driven historical approach create more dynamic relational spaces in terms of programs which neither form nor program is superior to other. It is possible to evaluate the building the outcome form by its activity and its performance, which is directly related to material. Diagram is a set of instructions that underlies organizes expression material. Field gradient approach to generate form and development is discussed by Deluze. He describes in *The Diagram*, Francis Bacon's painting process. Bacon explores non-figurative aspects of abstract painting. He starts randomly painting lines and areas, non-representative brushstrokes and colors. Diagram proposes new possibili-

ties throughout the painting, which is not a representation of an object but a opportunity of the object.

The final phase is going to be about researching material form relations and its interaction to the sequential space and movement. It is possible to study the experience of space by framing it like in cinematography.

With recent development of computer technologies there has been change in our notion of materiality. We can define our age as flow of information and architecture capture this flow and creates more complex conceptions and interactions through the space. Recent researches on materialism, typological forms, field gradients and diagramming define a new methodology in design approach, which can respond the dynamism and flow. However architectural form is still inseparable from the way we experience the world, which involves our senses and perceptions. It is possible to adopt cinematic techniques of collage and sequencing in computer-generated forms to create continuous references in spatial understanding.

METHODOLOGY

Architecture and urban planning disciplines have changed during the last century. Their relationships for creating the urban form have integrated more. Urban planning as a profession that controlling the future development is not useful any more in 21st century cities. Postindustrial cities lost their population to suburban surroundings. Cities are getting more similar to each other. In dense urban fabric public spaces are threatened as extended vegetation. Architecture as a monolithic buildings that fit into urban matrix simply doesn't responsive to the dynamism of the city.

Through nineteenth century, cities were suffering from dense urban fabric and its unwanted effects like pollution, health and stress. Landscape provides a relief from all those unwanted effects of the city. One of the best examples of this is Central Park by Olmsted. Central park not just create a healthy environment for the dense city fabric, it also had a real estate effect that added value to all its surrounding buildings. We still have the conception of having buildings and landscape as separate units however this relationship can be developed into more complex relationships. offers a more creative and suitable solutions for the 21th century cities than the separate disciplines can offer. It has ability to respond different scales and give opportunity to design dynamic natural or environmental relationships.

STRADA AND MESHWORK

In *A Thousand Plateaus*, Deleuze categorizes the genesis of natural structures in two types: strata and meshwork. Meshwork reveals through Interconnection of heterogeneous elements by overlapping and interlocking and creates stable behavioral patterns. While strata emerge from homogeneous elements. Neither meshwork, nor strata occur in pure form in nature, it is always a mixture of two. According to De Landa in *Immanence and Transcendence in the Genesis of Form*, morphogenetic process of physical assemblages occurs as “abstract machines”. This creates a new materialist philosophy, new materialism in which raw matter and energy flow through self-organizing process and morphogenesis generates this natural structures. Abstract machines can be defined as systems that control certain parameters, which create dynamic structure generating process. In nature this parameters can be identified as field gradients; temperature, pressure, volume, speed, density, etc. Change in parameters creates variations and new possible forms. Outside forces, field gradients and matter intertwine together to create natural structures. Forces and relationships create a ground for new events and occupancies.

FIGURE 1.

Soap Bubbles



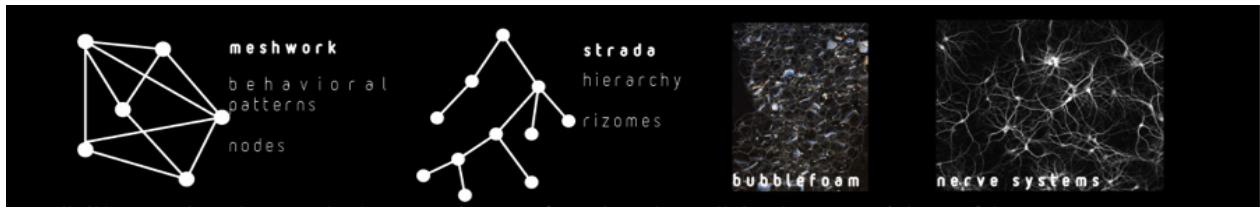
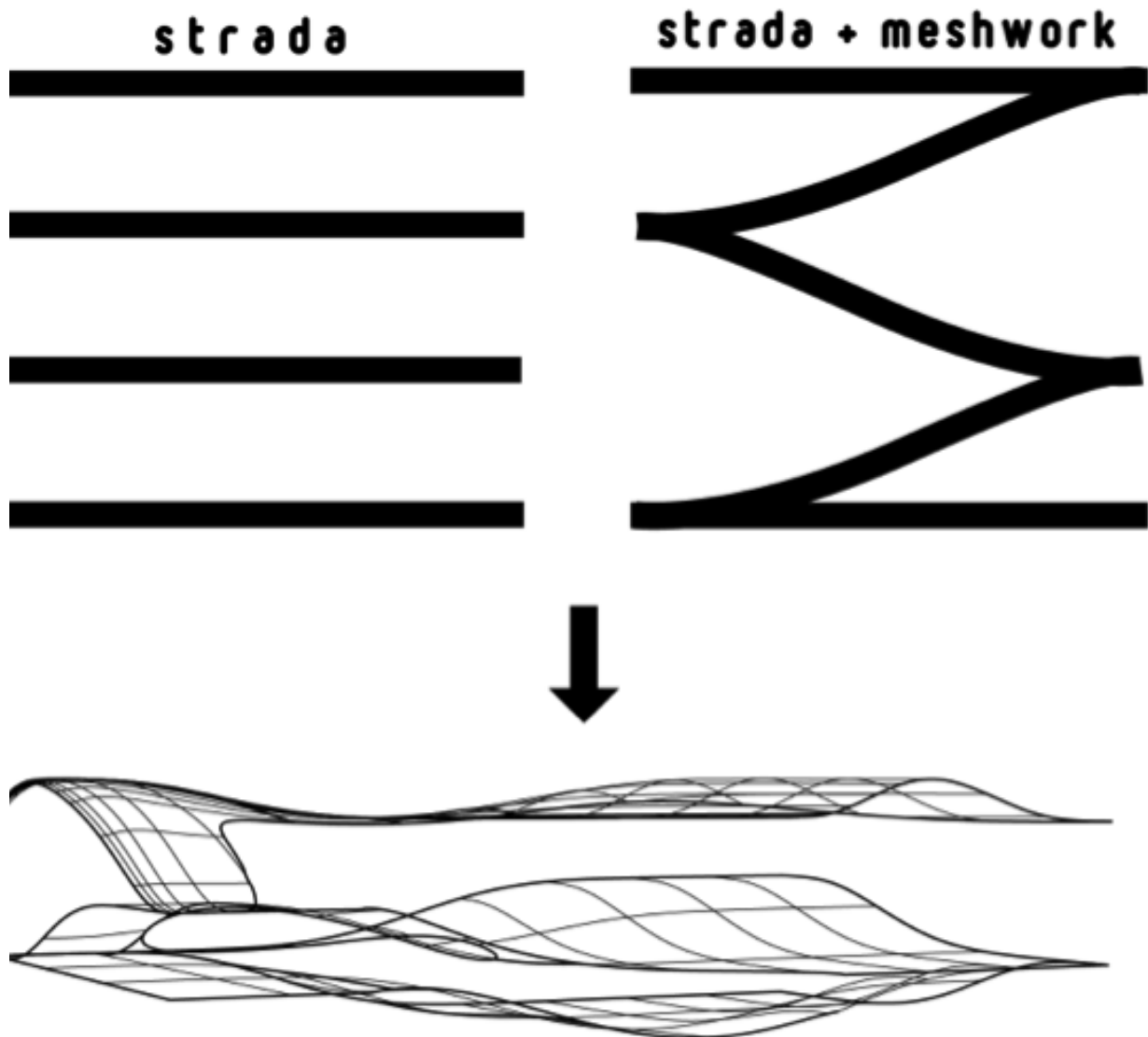


FIGURE 2.
Meshwork, Strada

FIGURE 3.
Hybridization of
Strada and
Meshwork

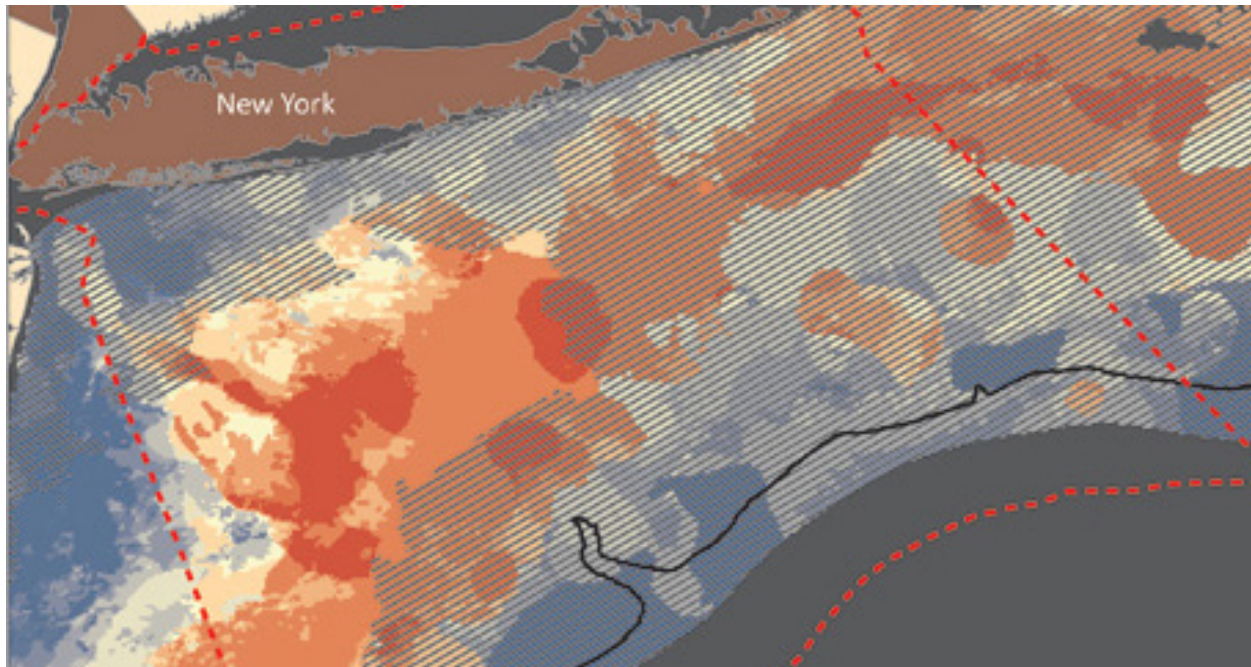


FIELD GRADIENTS

The modern urban planning was all about containing the multiplicity in a fixed rigid spatial frame like in the case of Manhattan grid. However it can be suggested that this rigid frame can be redefined through the field gradients, forces through diagramming and create a better understanding the cities events and context. David Harvey, cultural geographer, suggests that new urbanism should revive from the process, the work of space – time rather than form and aesthetics. Ecology in this sense become useful understanding in this new urbanism. All life and systems are into dynamic relationships. Dynamic relationships in ecological thinking is not in particular form rather they are in process of becoming something else. However even though new urbanism can be suggested in the perspective of ecology or in other words “nature”, field gradients are not just consist of natural systems like, sun paths, wind direction, etc. The cultural, social, political, economic gradient maps are also embedded in this natural systems.

FIGURE 4.

NYC Wind Map



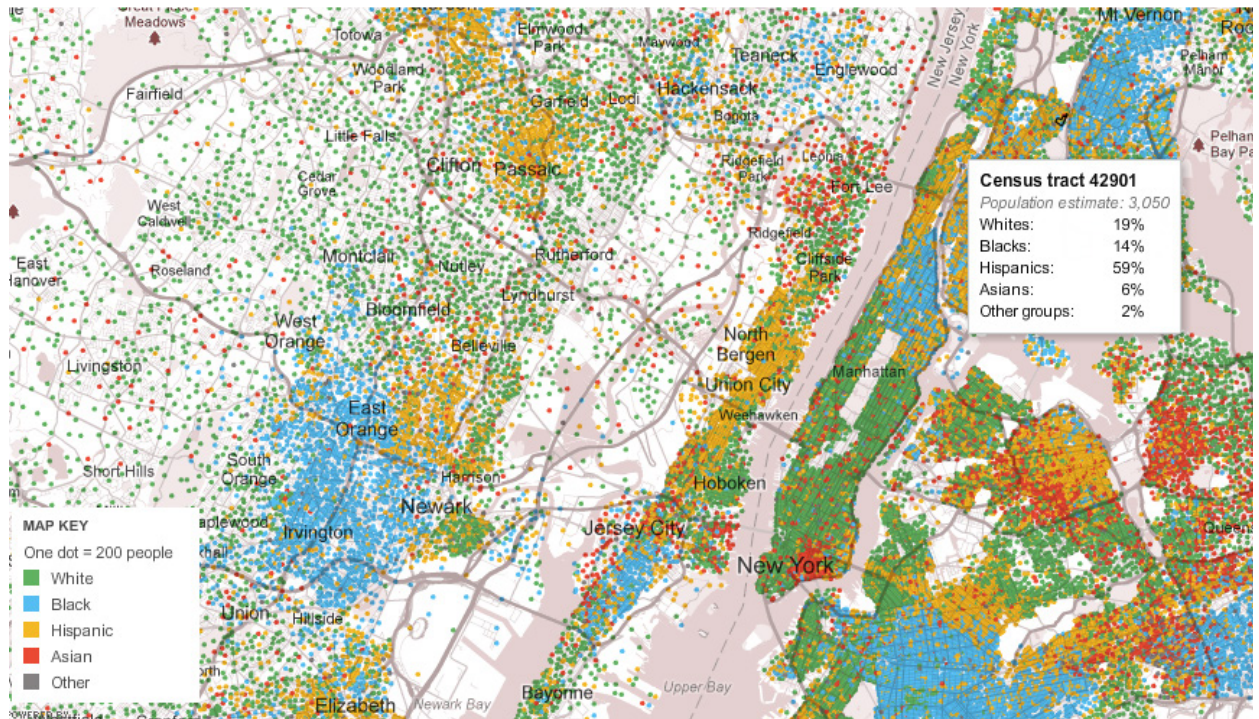
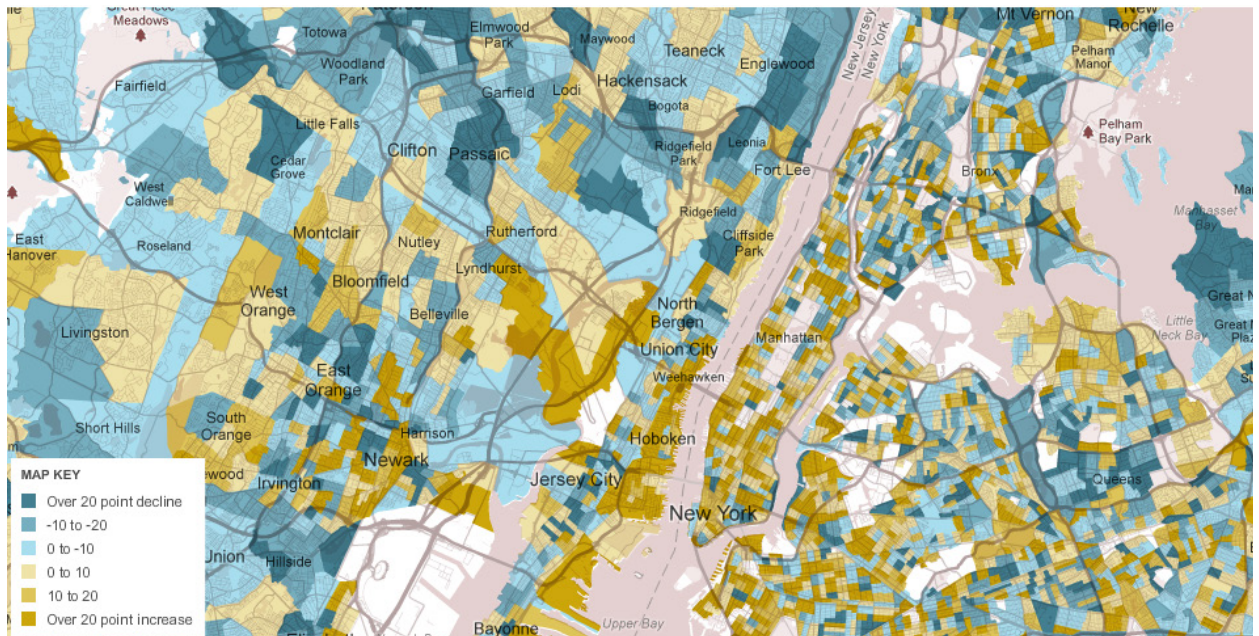


FIGURE 5.
 NYC Ethnical
 Races and Groups

FIGURE 6.
 NYC Change of
 Median Income



DIAGRAM

Field gradients as development strategy provides multiple possibilities and creates different forms that can respond to it. Field gradient approach to generate form and development is discussed by Deluze, *The Diagram*. Media has a virtual and informing potential that operate through diagram. He describes Francis Bacon's painting process as an exploration of non-figurative aspects of abstract painting. Bacon starts randomly painting lines and areas, non-representative brushstrokes and colors. Diagram proposes new possibilities throughout the painting, which is not a representation of an object but a opportunity of the object.

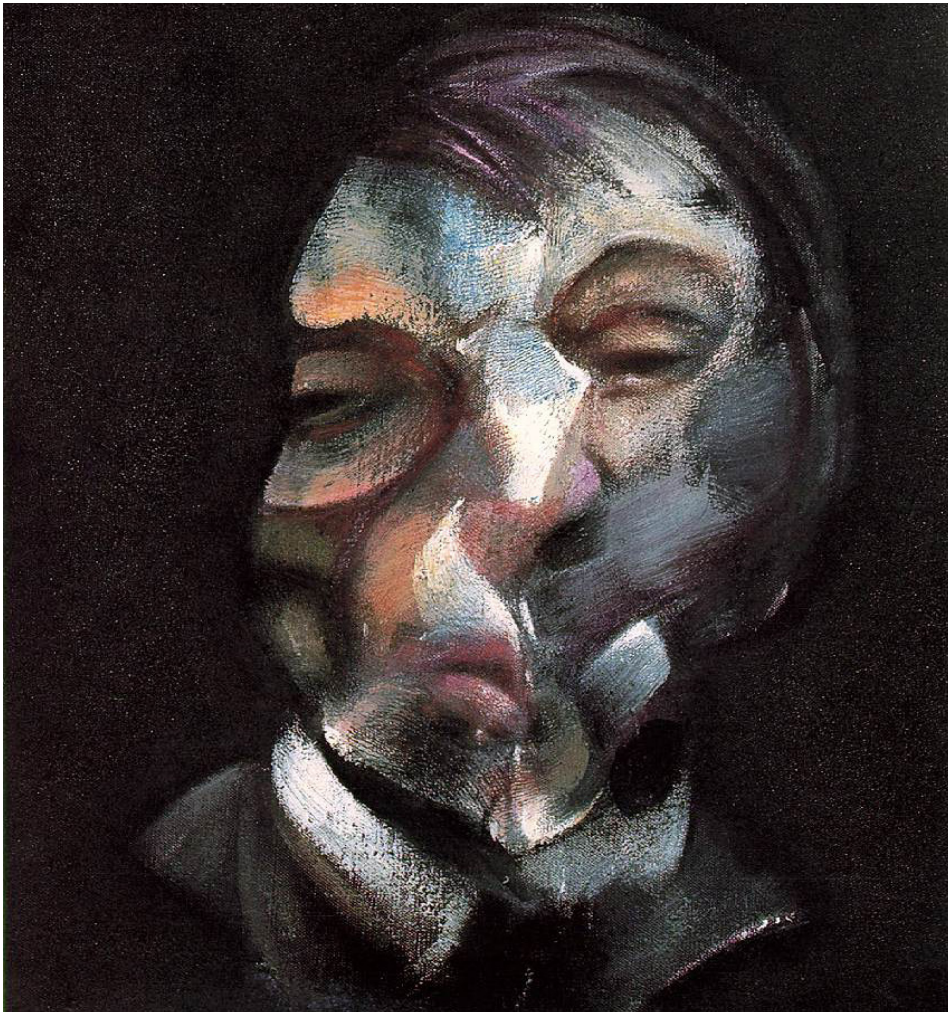


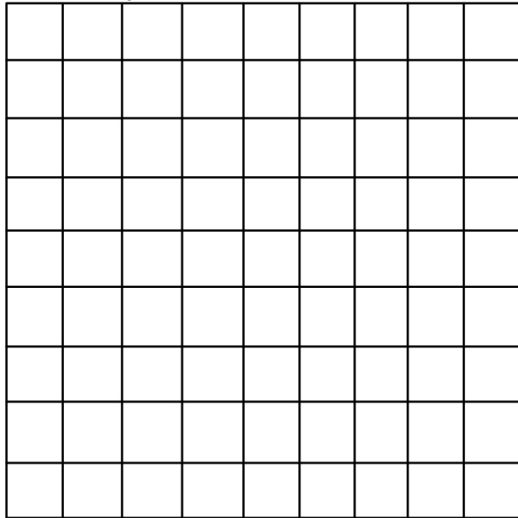
FIGURE 7.
Francis Bacon
Self Portrait

TOPOLOGICAL SURFACES

Continuous surfaces (a.k.a. Topological forms) create a certain kind of fluidity where roofs and grounds unified. This surfaces blurs the separate entities of building and landscape and become one. Surface becomes the urban infrastructure. Topological forms allow incorporation of single moment but rather multiplicity of vectors, in a multiplicity of times in a single continuous surface.

Digital technologies also altered the traditional notions of space, which remained as a Cartesian space until recently. Digital tools allow capturing motion in space through calculus and to explore this calculus based forms rather than the Euclidian spaces. Object in time are captured and bring together in same space. Integral or Calculus form depend on variables and time. Continuous masses in space changes from neutral and timeless to temporally dynamic spaces. With calculus time and motion can engage in architectural forms. This is a shift from volumetric approach of Euclidian spaces with Cartesian coordinates to time based system of flexible surfaces. Instead of abstract space, form derives directly from contextual forces. Form can store this information of forces in itself that the viewer who is in motion can interact with the form in multiple states. Our experience and movement create a dynamic relationship with the form and the virtual space is mobilized with both time and force. Urban surface, create a stage that creates interactions between different events in different times. So Landscape urbanism creates the potential and become the medium for different events.

Euclidian Space - Cartesian System



Non-Euclidian Space - Calculus Form

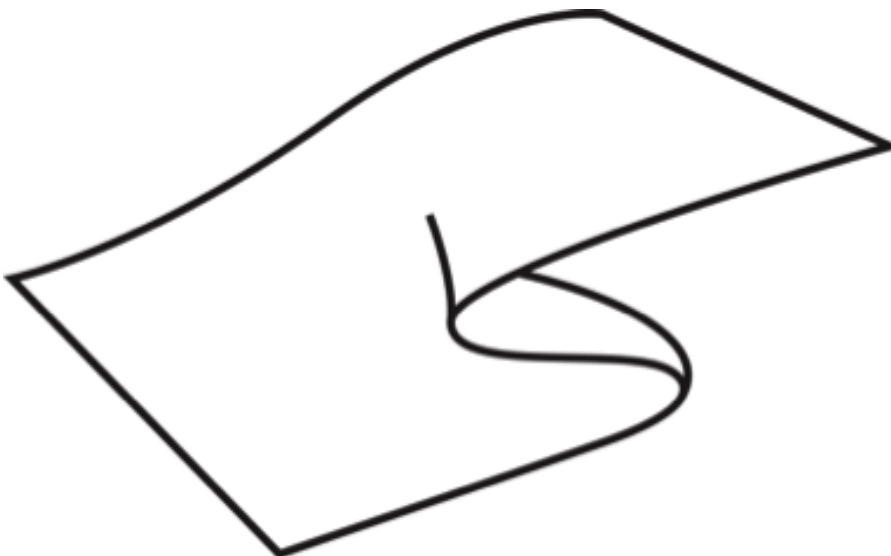
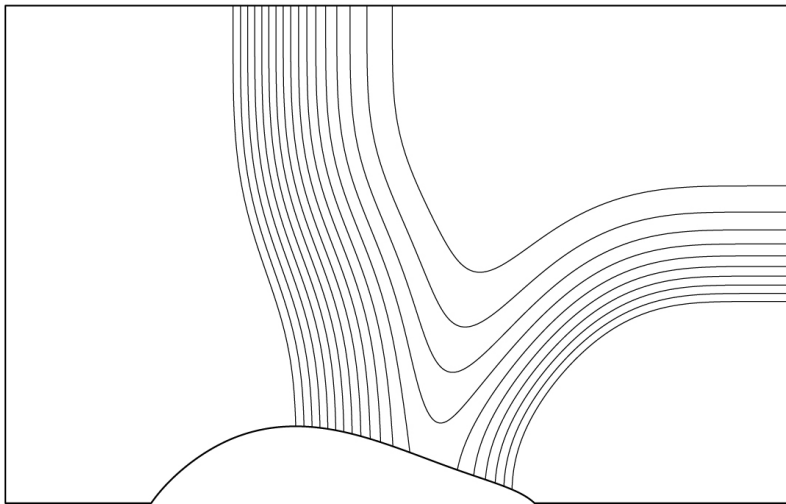


FIGURE 8.
Euclidian Space
Non Euclidian
Space

FIGURE 9.
Folding -
Calculus form

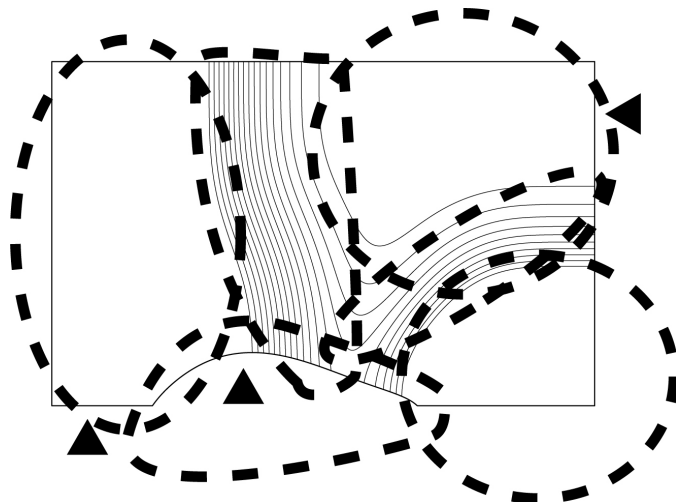
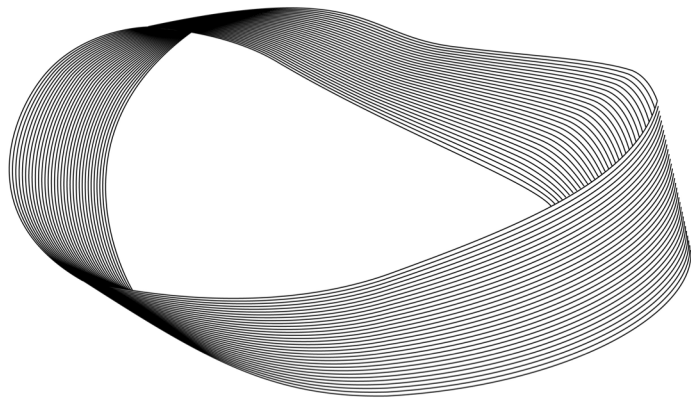
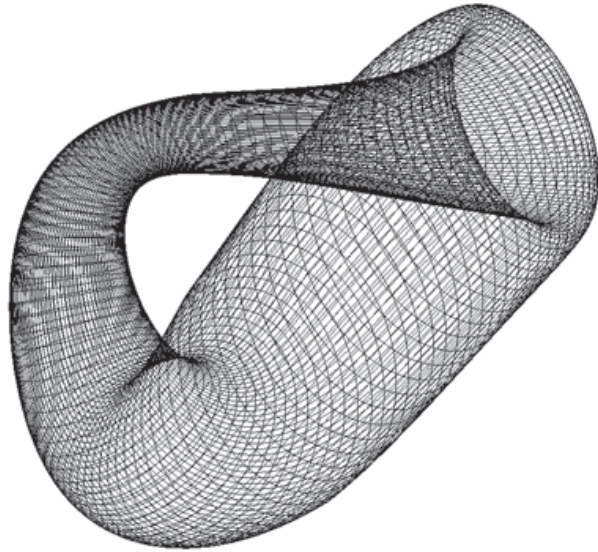


FIGURE 9.
Klein Bottle

FIGURE 10.
Möbius Strip

FIGURE 11.
Event spaces

OBLIQUE VIEW

Phenomenology is one of the contemporary architectural approaches that also have roots in philosophy, based on experience of the space through material and time. In phenomenology a work of architecture is always located on a site and within a setting. Large modern cities are generally designed as monolithic, isolated buildings enveloped in residual space. To redesign and create public space, instead of maximizing floor-area ratios or building on the lost lines of a city grid, Phenomenology resists the language-based approach of the deconstructivists and focus experience. The Perception and senses are intertwined with the time, material, space of form. The individual monolithic forms, spaces do not monopolize one's thoughts. Concentration of the viewer always is on the relationships between forms, space, topography, light and axes of movement. Spatial perception and development require a three-dimensional, sectional approach that gives primary importance to the viewers who move around ground planes and experience the city from different angles. The experience of parallax enriches when the movement leave the horizontal dimension and move on vertical or oblique directions. Space forms a psychological field when simultaneous interaction of program, section, and material interrelates. The relation between things is the focus, rather than object type. The problem of proposing an urban space is that its program elements, architectural and social aspects are unknown and may always be in some state of flux. This leads to the distribution of elements in a field with a sense of enclosure is imagined from the point of viewer. Oblique vertical or horizontal axes of movement enriches angle of view as it overlaps with other fields. The experience of the space is depended on movements of the body and changes of perception. Sections of buildings are greater than the dimensions of plans. Urban space is formed

by vertical grouping and the vertical dimension is more important than the horizontal. The experience a viewer-is transformed when movement axes leave the horizontal dimension. It is almost impossible to determine and animate a space that is going to give the same experience to each individual with different background. A spatial organization, a smell and sound may be imagined simultaneously but an individual's cultural background, recognition of materials and their sensory qualities, the physiological effects of space all depend on individual limitations. The viewer's angle of vision and prejudice are open to the unforeseen associations. Rather than allowing preconception to be a determinant of the space, program associations can be altered by heightening the possible number of programs.

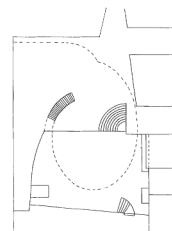
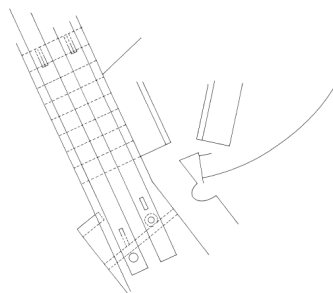
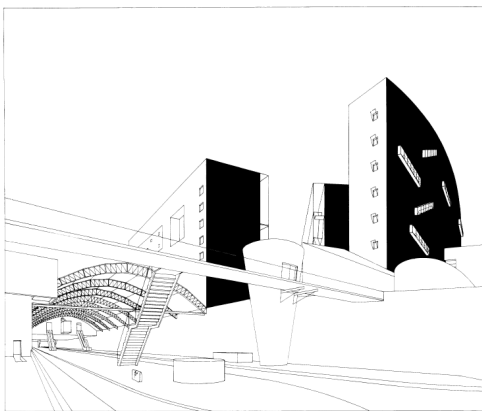
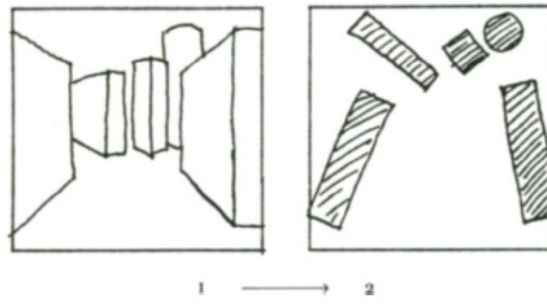
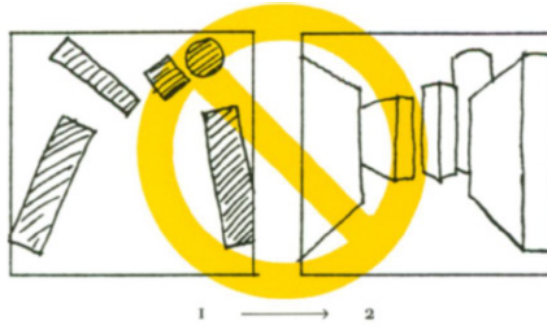
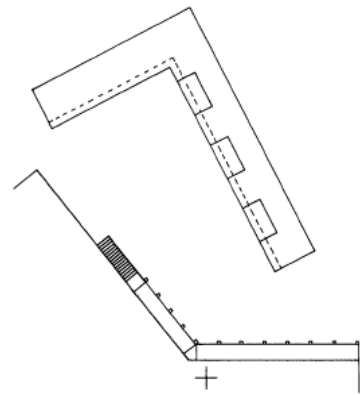
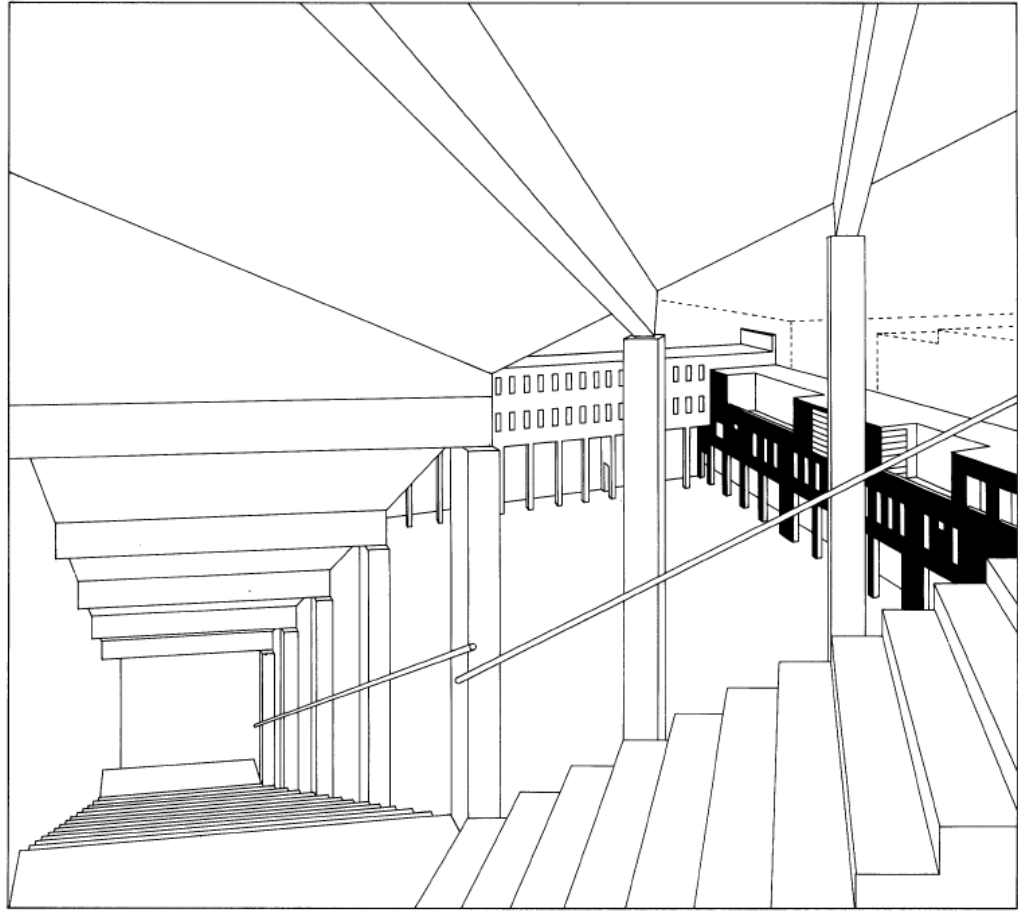


FIGURE 12- 13 - 14 -15.
 Steven Holl - Parallax
 Oblique Approach
 From perspective to
 plan



HYBRIDISATION

New hybrid morphologies in urban form as part city part landscape, part building. It creates a new methodology as inter-discipline and an opportunity to create a system that integrates natural systems, technology, infrastructure and architecture into one entity that can create multiple interactions and events that are more responsive to the postindustrial 21st century city.



FIGURE 16.

Planes

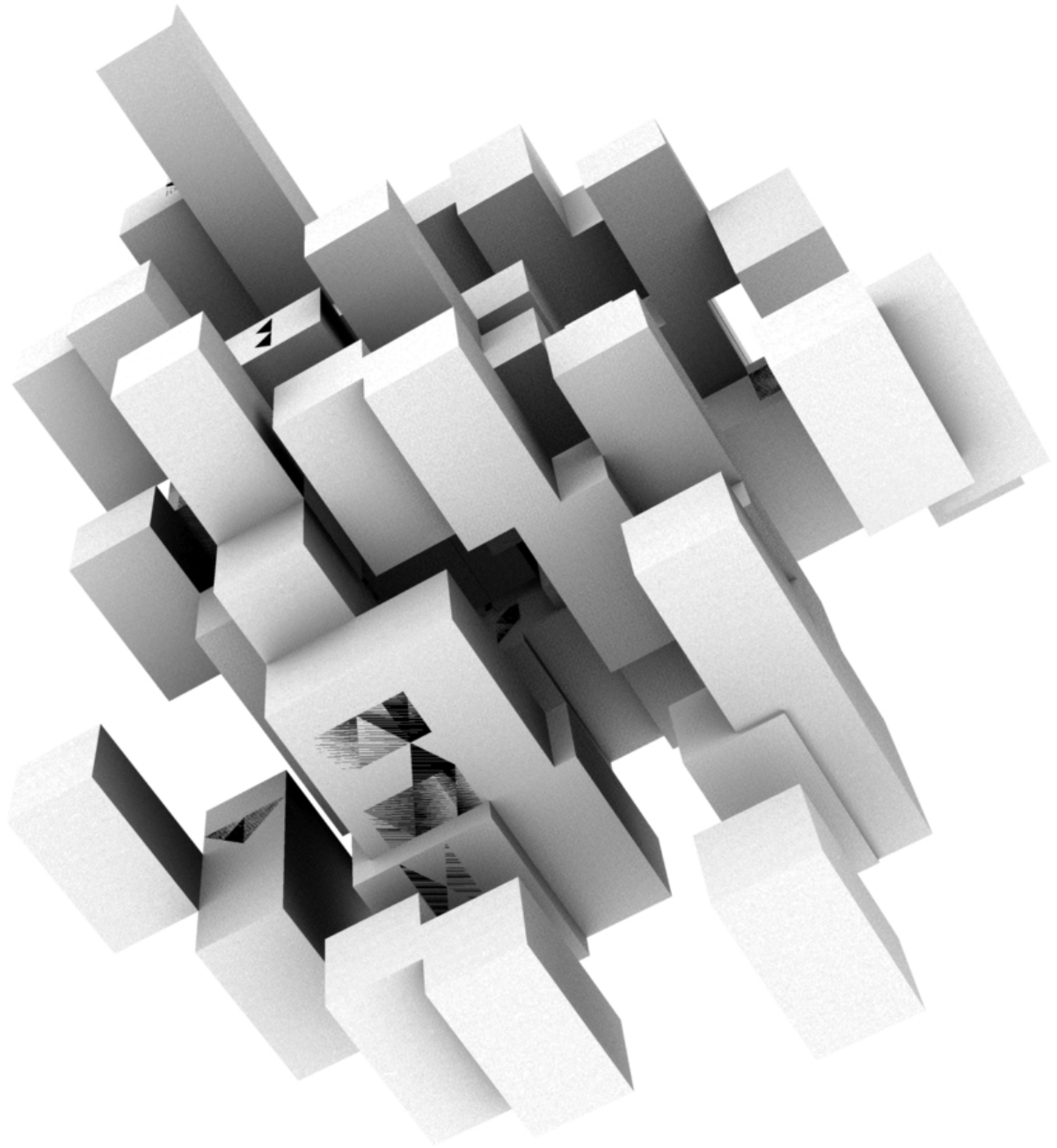


FIGURE 17.

Volumes

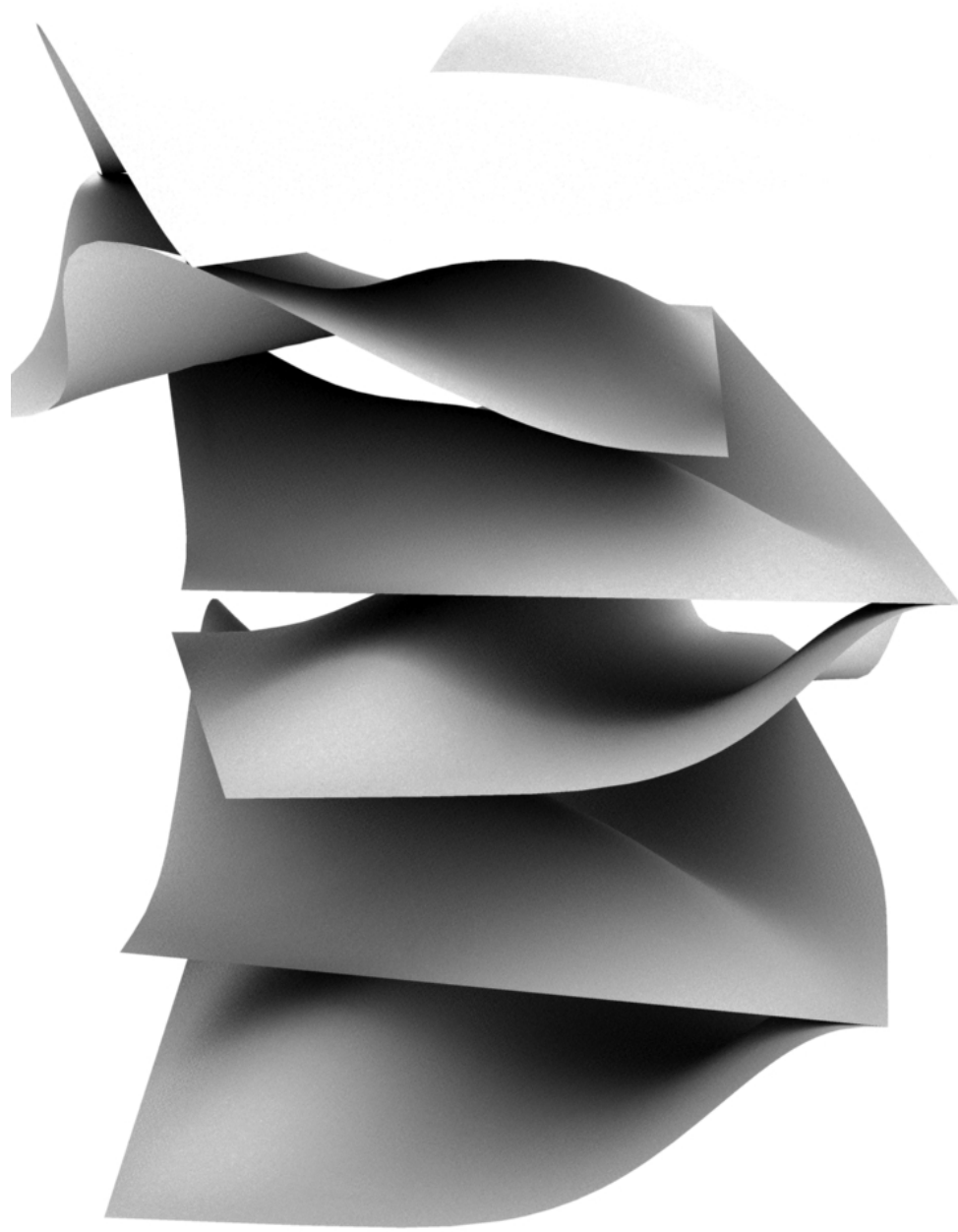


FIGURE 18.
Topological
Surfaces



FIGURE 19.
Hybridization of
forms

PRECEDENTS

PARK DE LA VILLETTE COMPETITION

La Villette, made a competition for an “Urban Park for the 21st Century” in Paris. The competition entries have been discussed many times in architectural discourse. The winning scheme by Bernard Tschumi, formulated a landscape as a medium for a change over time programmatically and socially. He stated in his competition entry that no landscape witnessed an interest in the activities in the city. Many designs from 70s are focused on the formal logic and typology but no interest in organization of functions. The second prize by Rem Koolhaas’s OMA was also equally significant. Koolhaas designed the landscape as parallel strips of programs juxtaposed various vertical programs. The park organized to support unknown changes in the future. So the changes can occur in the park without damaging the initial concept of it. Tschumi’s and Koolhaas’s competition entries for Pac de la Villette offered a new kind of medium that is open to change over time, flexible, non hierarchical horizontal field that can respond to any kind of event that can occur over time. Landscape can offer a reciprocity between nature and infrastructure.

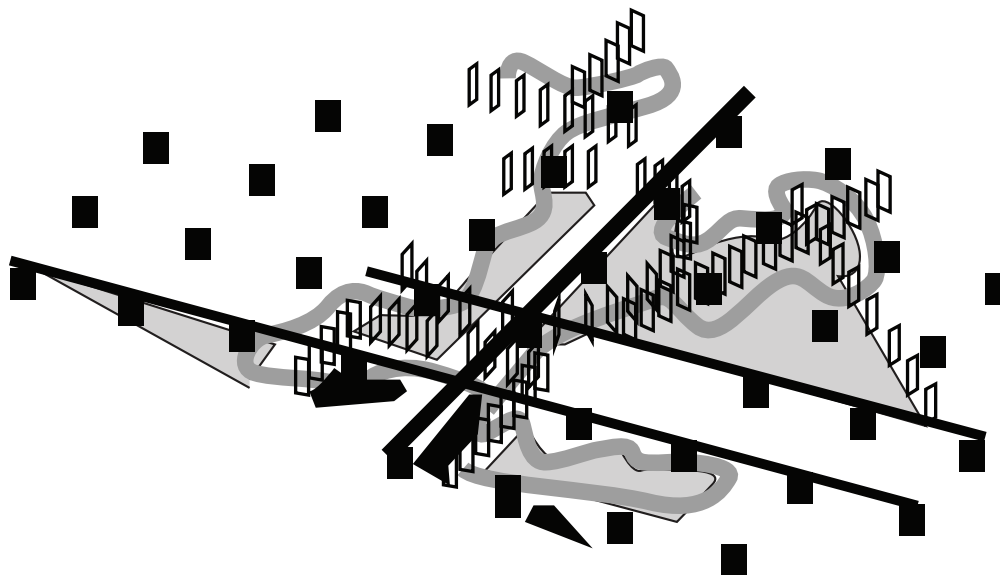
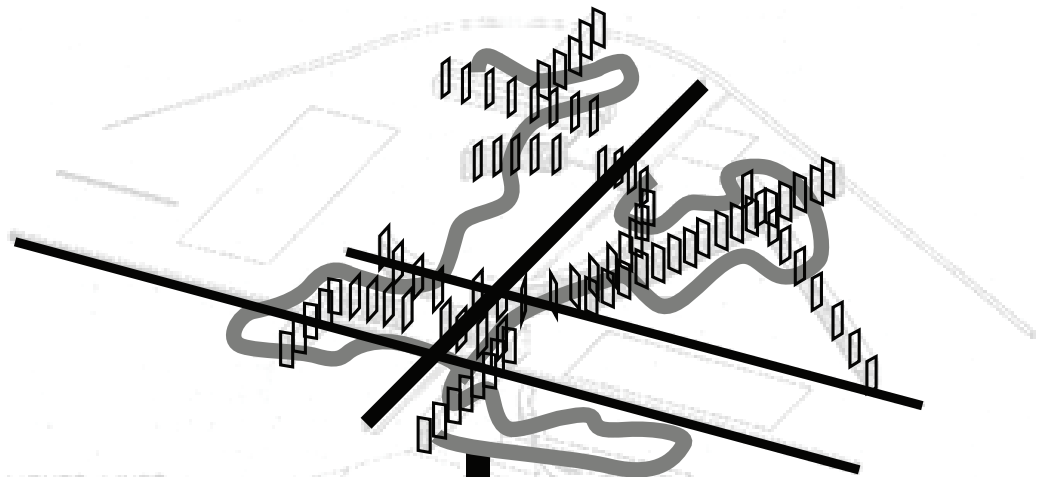
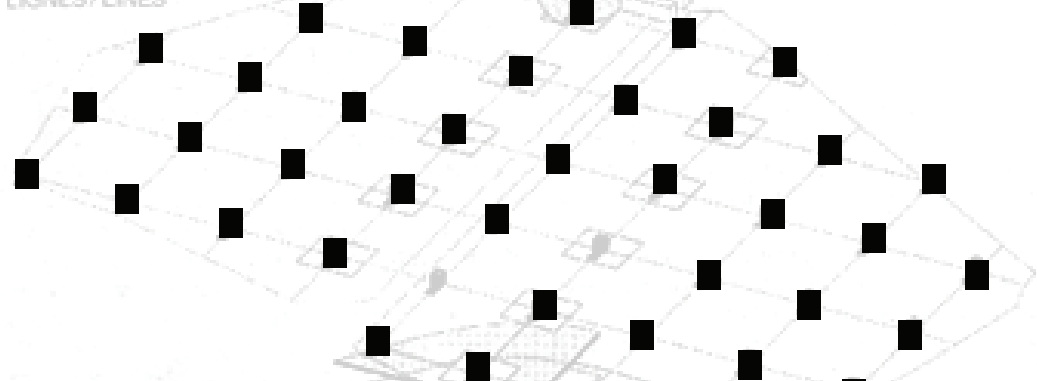


FIGURE 20 -21.

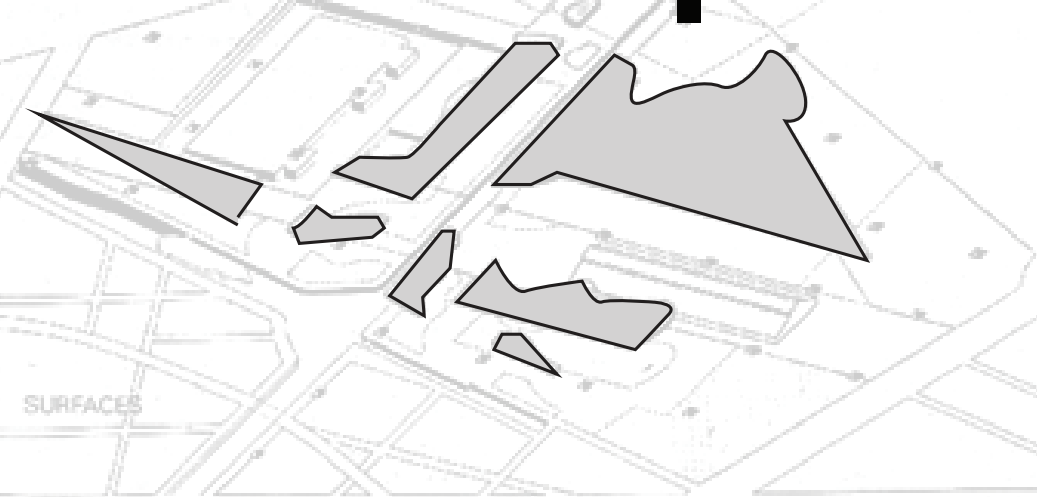
Bernard Tschumi
Park de La
Villette-
Overlap of Points,
Lines and Surfaces



LIGNES/LINES

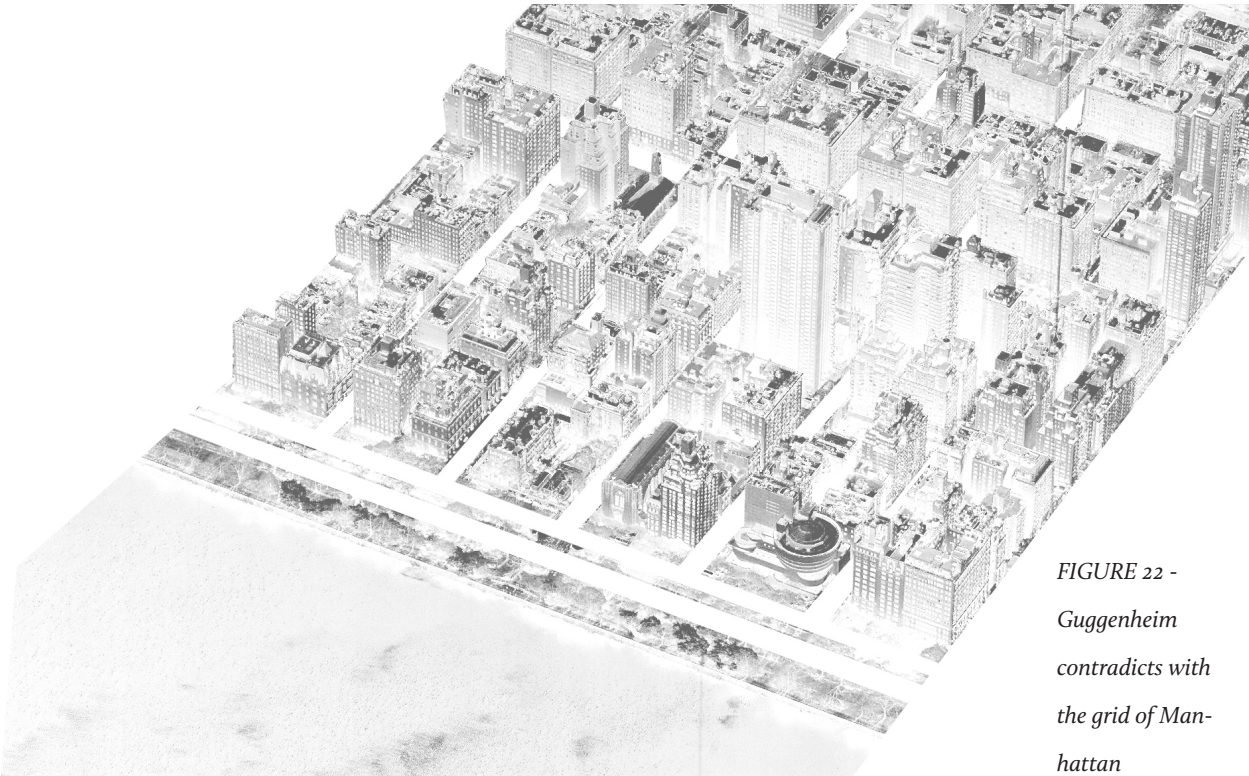


POINTS

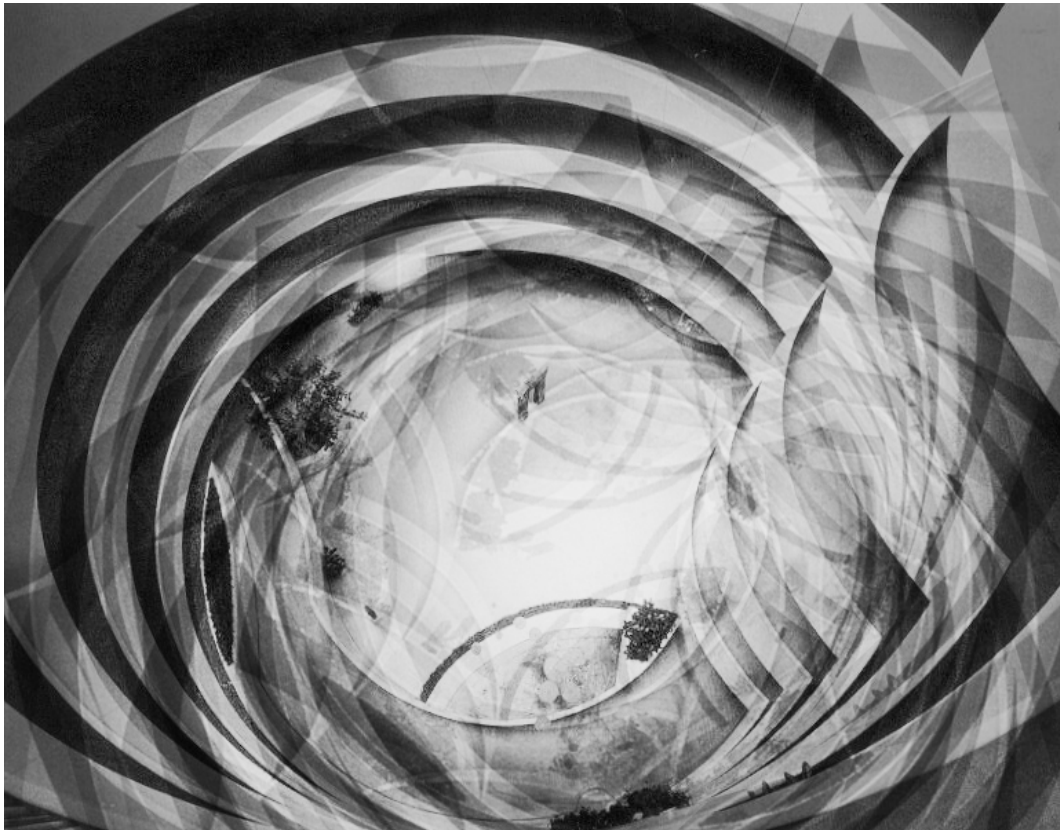


SURFACES

GUGGENHEIM MUSEUM, NEW YORK. FRANK LLOYD WRIGHT



*FIGURE 22 -
Guggenheim
contradicts with
the grid of Man-
hattan*



*FIGURE 23 -
Perception of
movement in
Guggenheim
Museum*

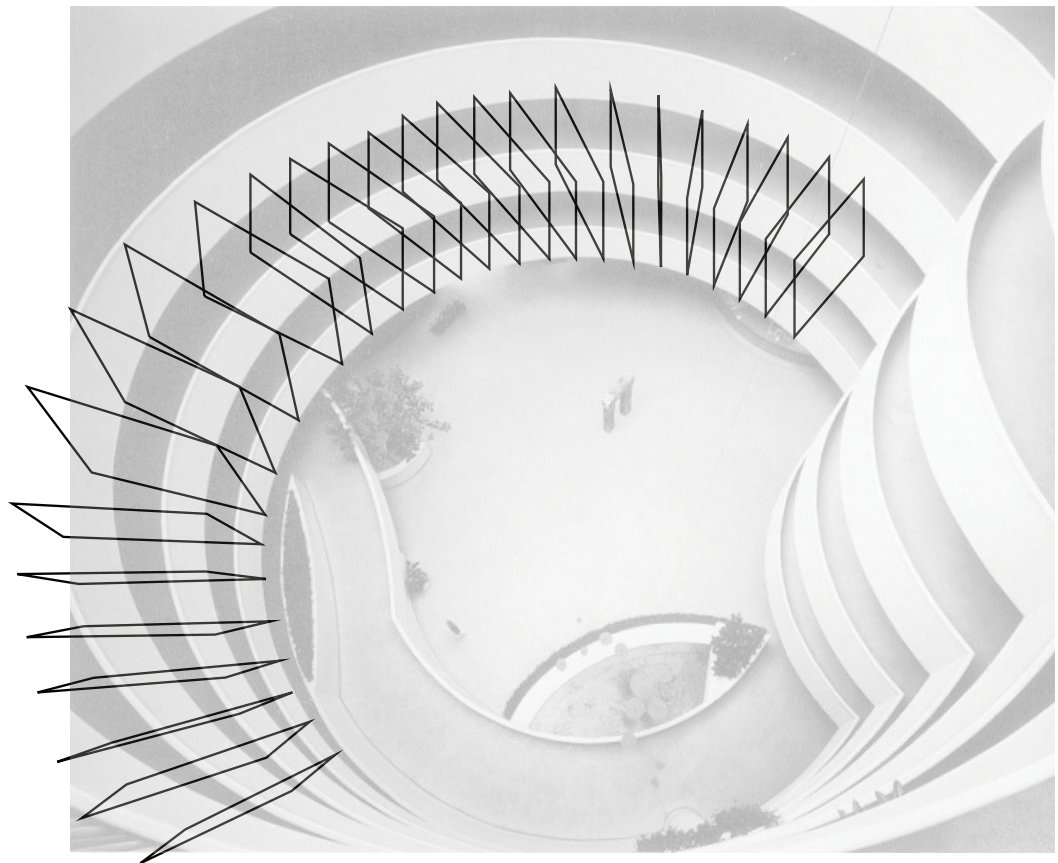
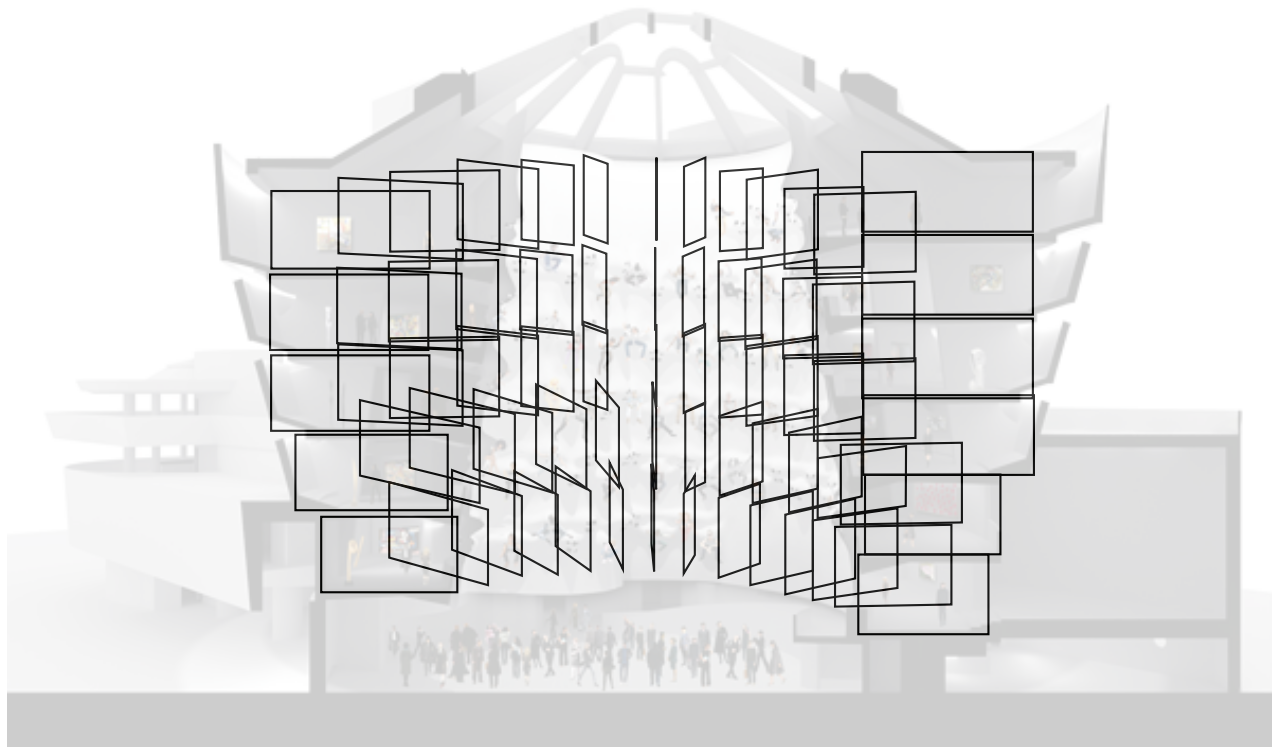


FIGURE 24-25.
Guggenheim Mu-
seum- Sequences
of movement

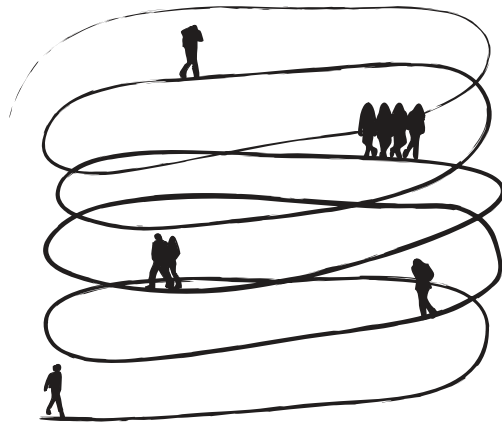


FIGURE 26.
Guggenheim
Museum
Movement analy-
sis in Z dimension

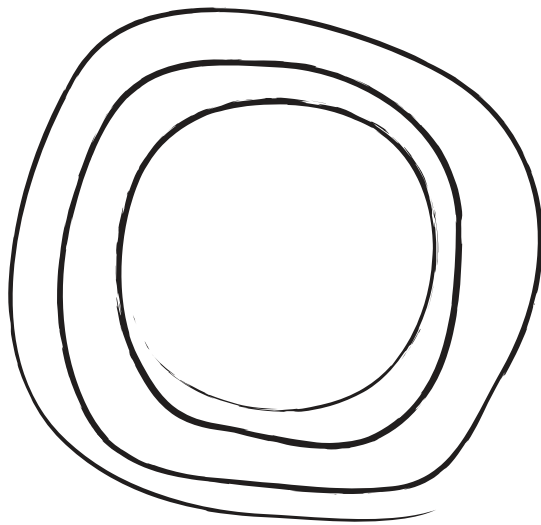


FIGURE 27.
Guggenheim
Museum
Movement
analysis in X-Y
dimensions

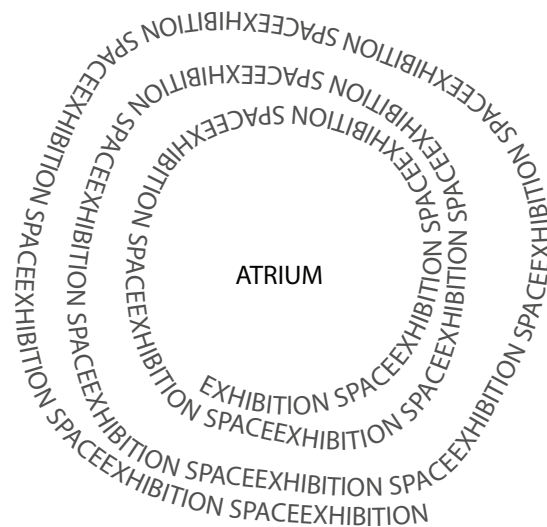


FIGURE 28.
Guggenheim
Museum
Program Analysis

FARNSWORTH HOUSE, MIES VAN DER ROHE



FIGURE 29.
Farnsworth House
Perspective



FIGURE 30.
Farnsworth House
Perspective



FIGURE 31.
Farnsworth House
Movement Analysis
in Z dimension

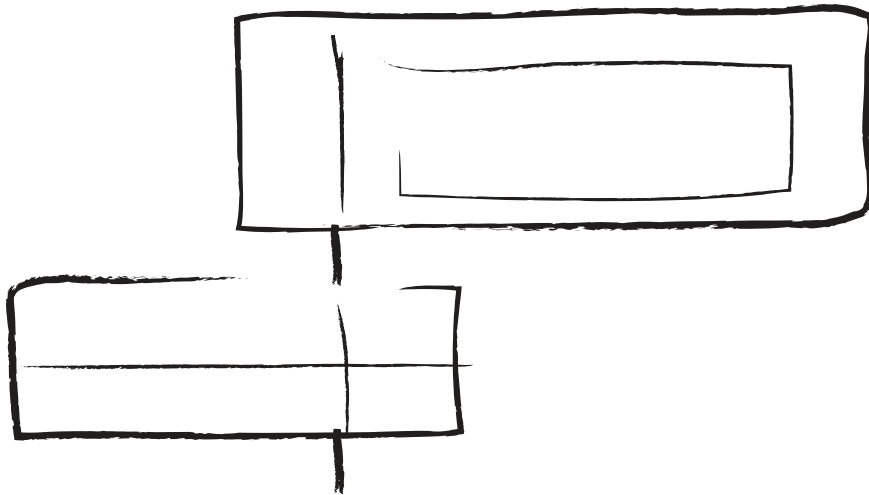


FIGURE 32.
Farnsworth
House Movement
Analysis in X-Y
dimension

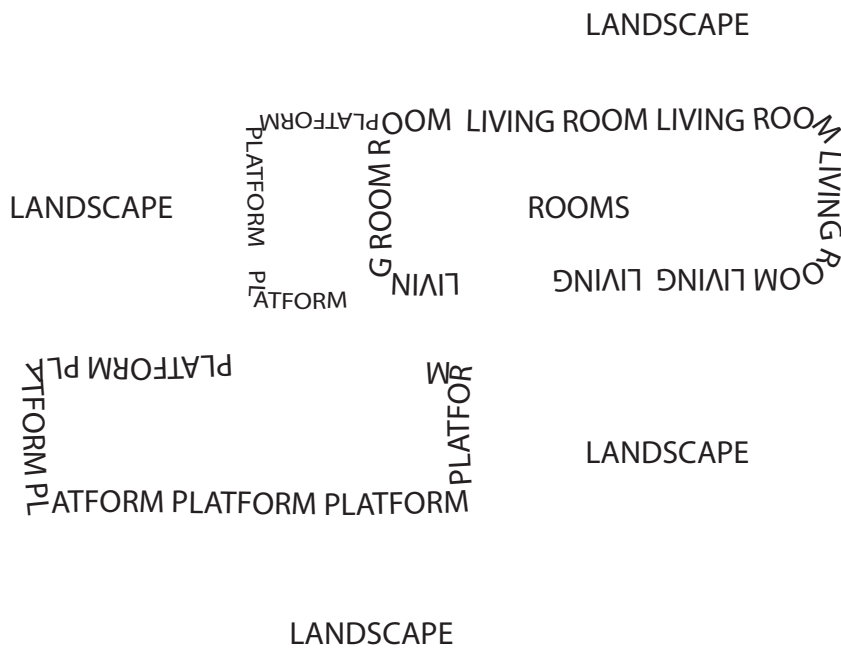


FIGURE 33.
Farnsworth House
Program Analysis

SAGAPONAC HOUSE, REISER AND UMEMOTO

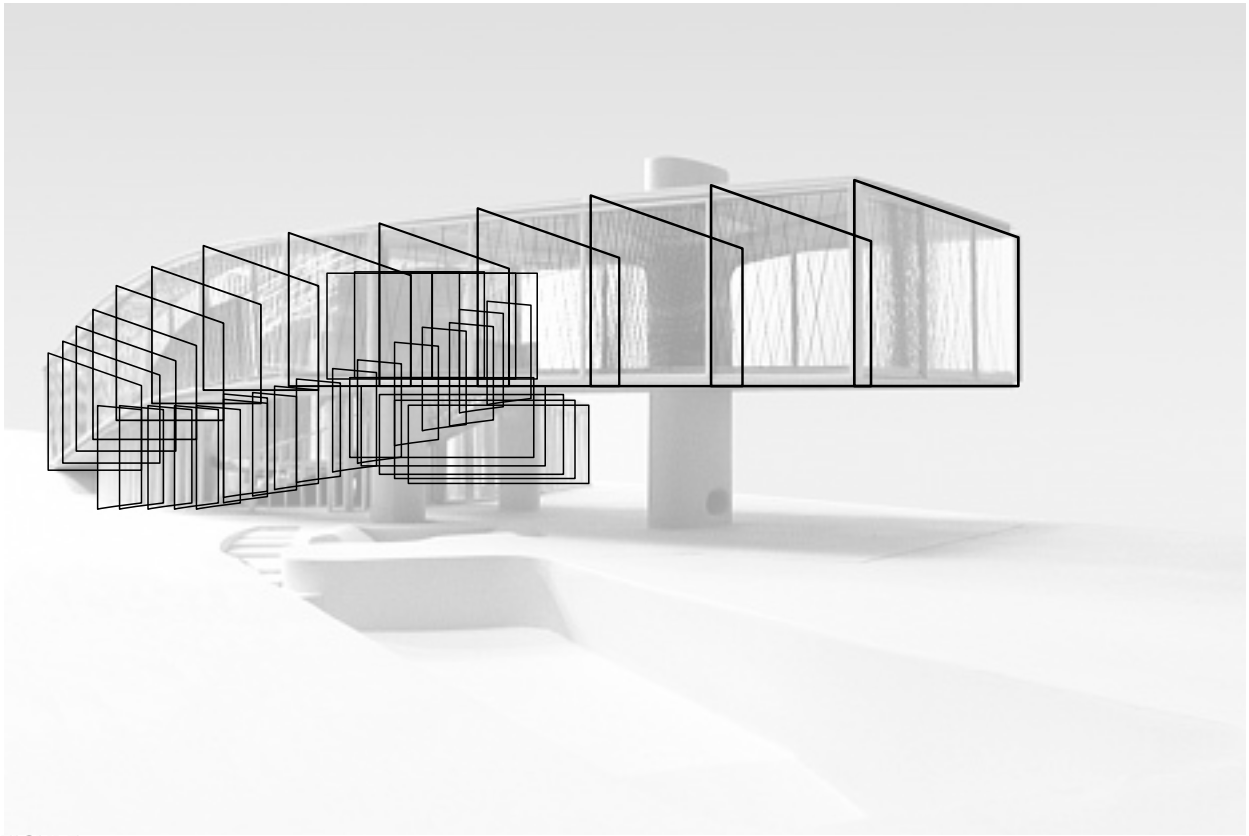
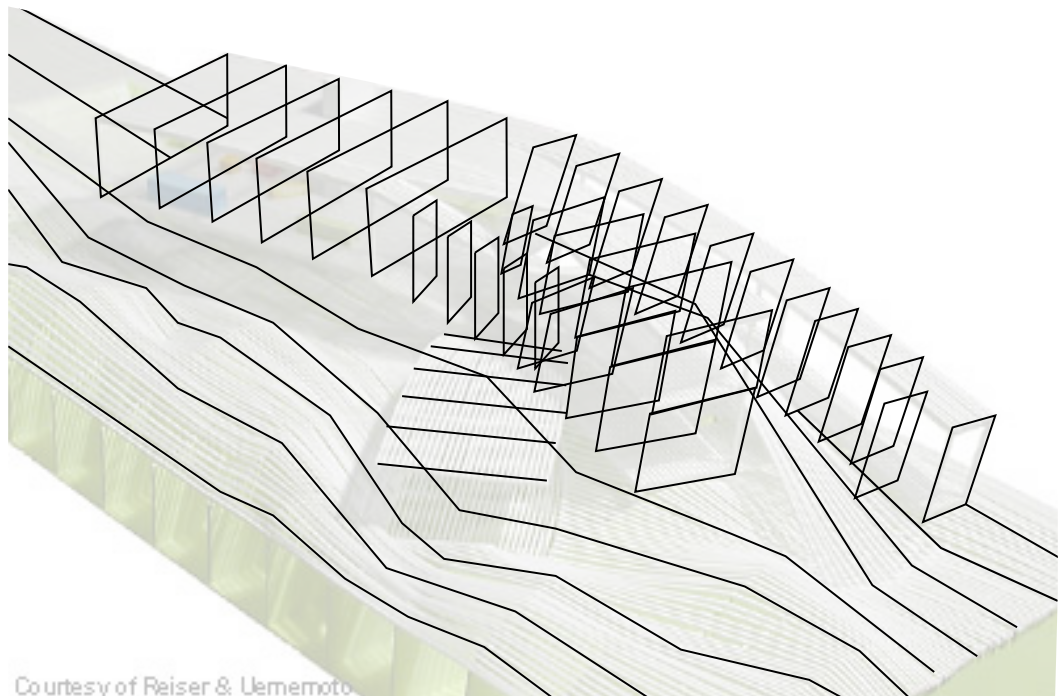


FIGURE 34-35.
Sagaponac House
Sequences of
Movement



Courtesy of Reiser & Umemoto

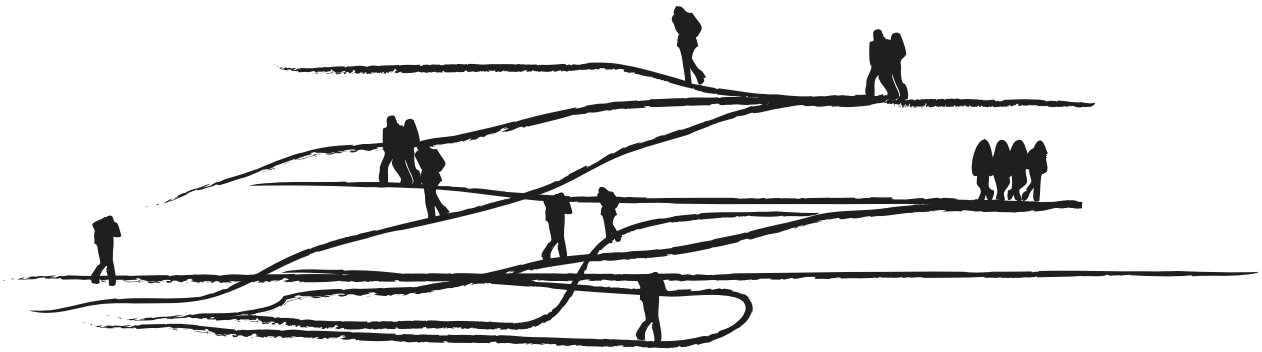


FIGURE 36.
Sagaponac House
Movement Analysis
in Z Dimension

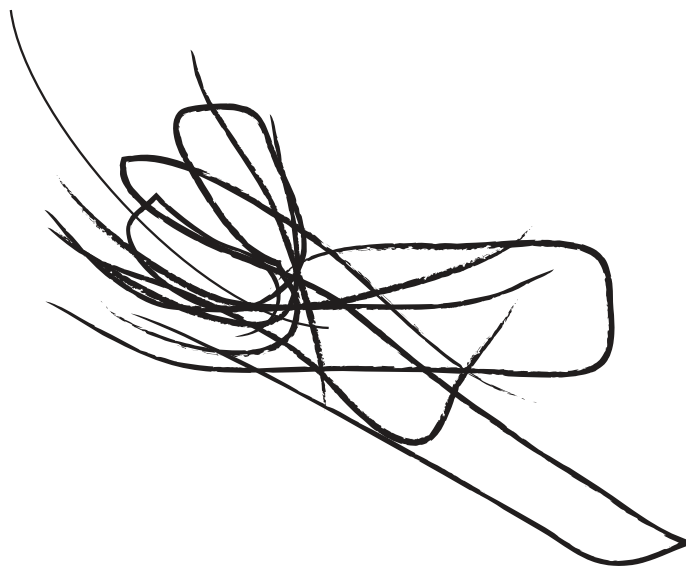


FIGURE 37.
Sagaponac House
Movement Analysis
in X-Y Dimension

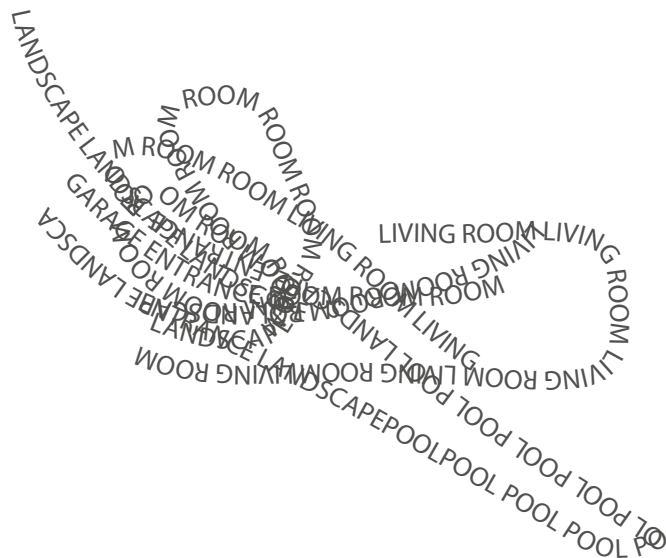


FIGURE 38.
Sagaponac House
Program Analysis

NEW BABYLON, CONSTANT

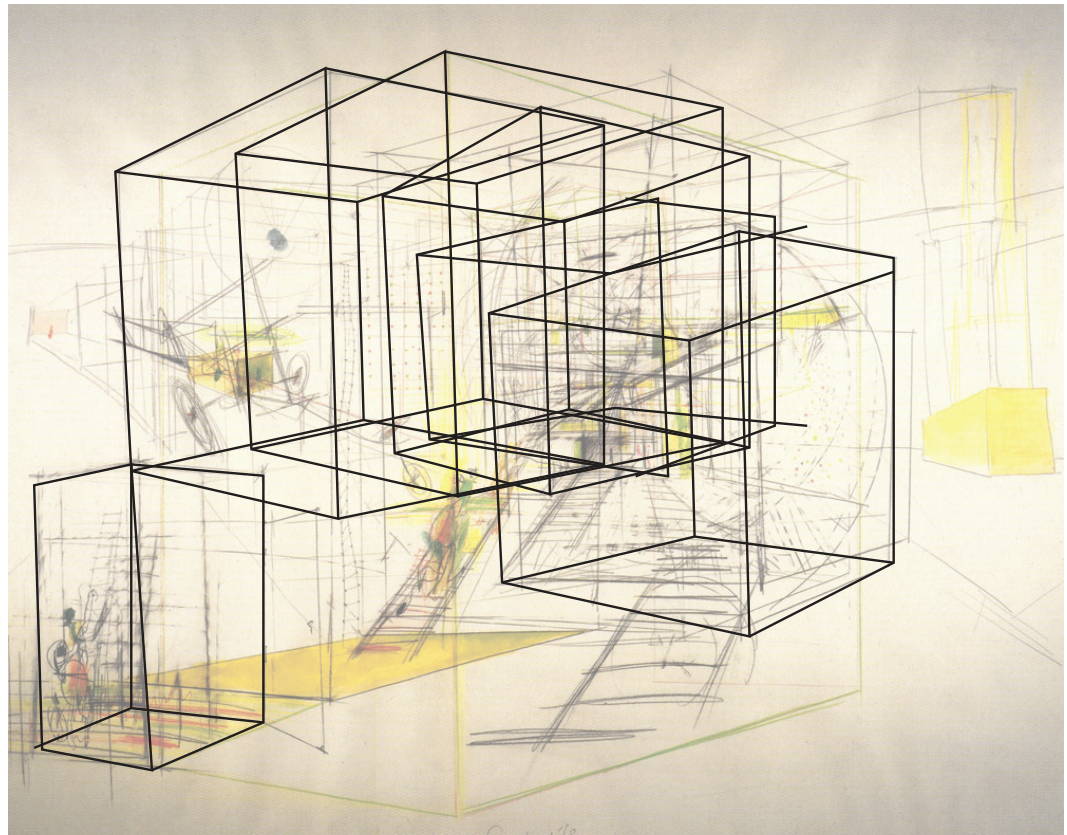
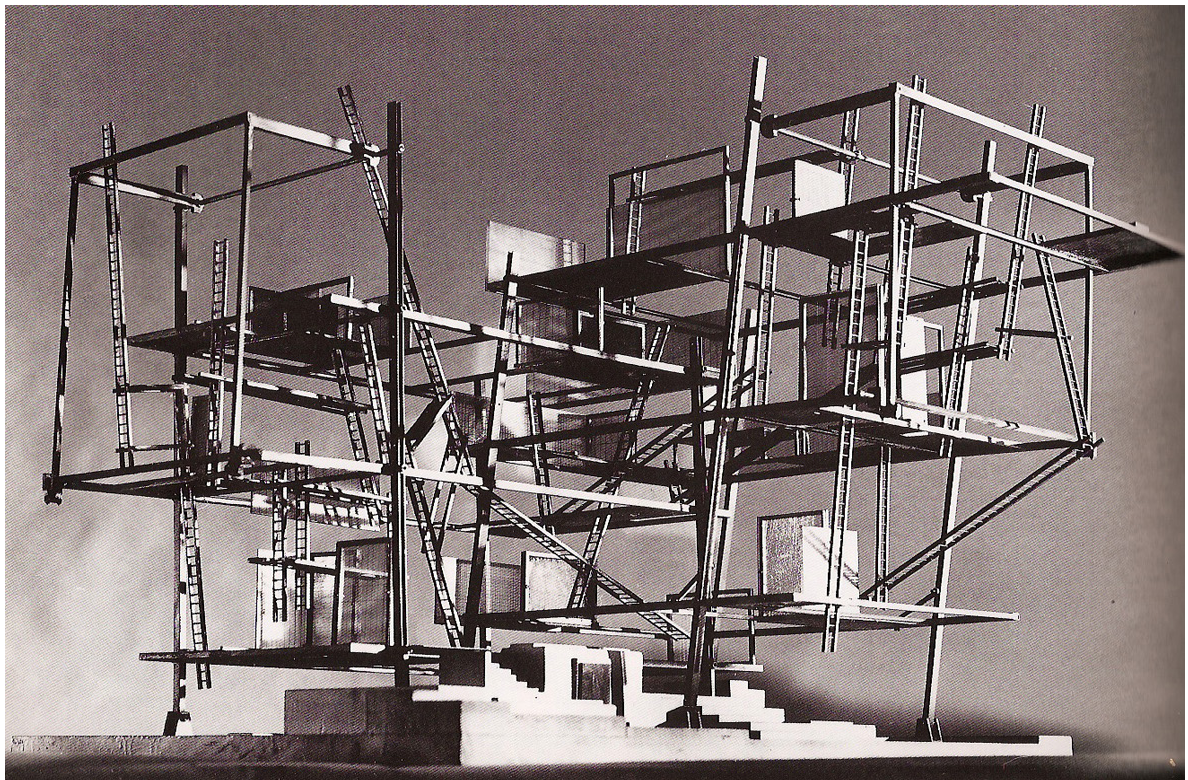


FIGURE 39.
*New Babylon,
Sequences of
Movement*

FIGURE 40.
*New Babylon,
Model*



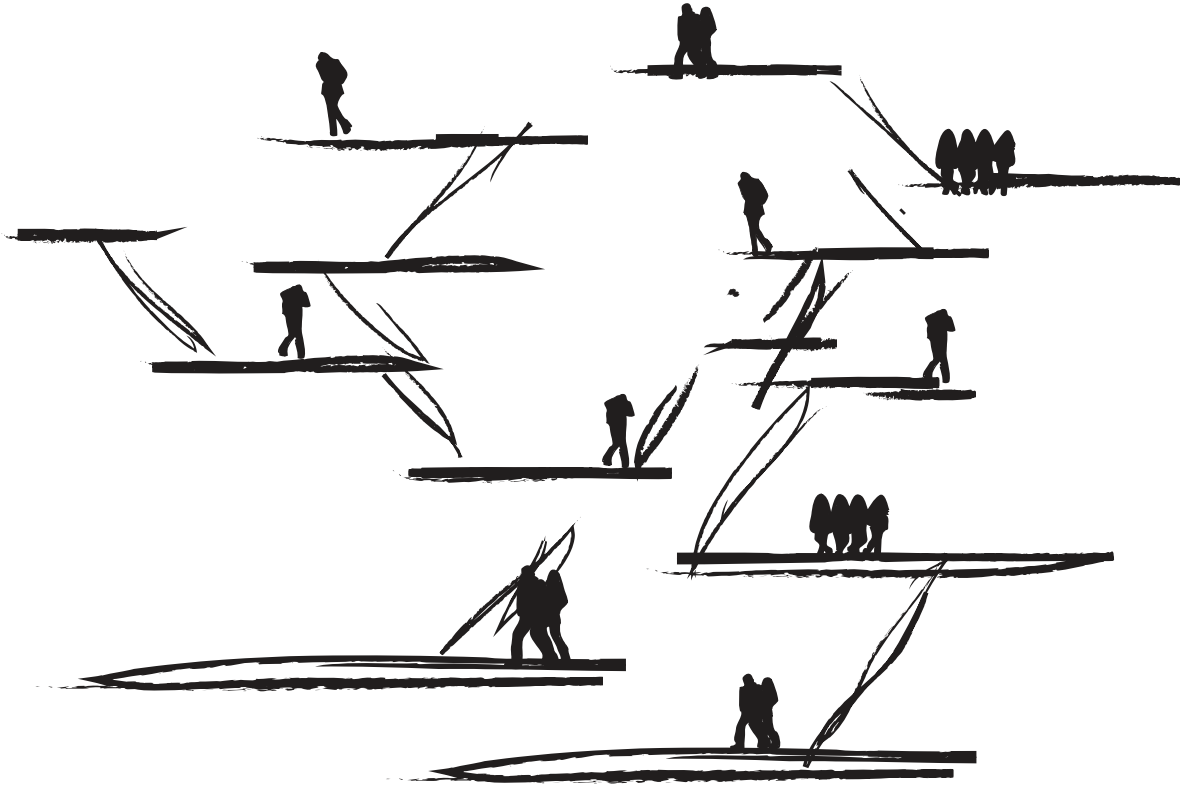


FIGURE 41.
New Babylon,
Movement Analysis
in Z Dimension

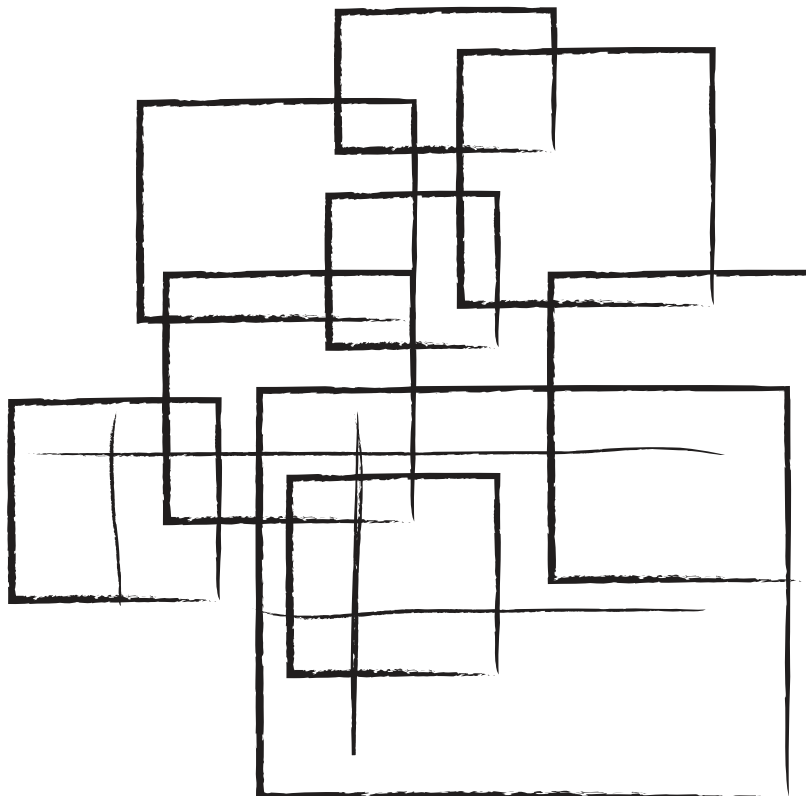


FIGURE 42.
New Babylon,
Movement Analysis
in X-Y Dimension

FIGURE CREDITS

FIGURE 1. Soap Bubbles - Rafael Rozandeaal

FIGURE 2. Author

FIGURE 3. Author

FIGURE 4. New York's Department of State and the National Oceanic and Atmospheric Administration

FIGURE 5. New York Times, <http://projects.nytimes.com/census/2010/>

FIGURE 6. New York Times, <http://projects.nytimes.com/census/2010/>

FIGURE 7. Francis Bacon, Self Portrait.

FIGURE 8. Author

FIGURE 9. Author

FIGURE 10. Author

FIGURE 11. Author

FIGURE 12. Holl Steven, *Parallax* (New York: Princeton Architectural Press, 2001)

FIGURE 13. Holl Steven, *Parallax* (New York: Princeton Architectural Press, 2001)

FIGURE 14. Holl Steven, *Parallax* (New York: Princeton Architectural Press, 2001)

FIGURE 15. Holl Steven, *Parallax* (New York: Princeton Architectural Press, 2001)

FIGURE 16. Author

FIGURE 17. Author

FIGURE 18. Author

FIGURE 19. Author

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FIGURE 21. 12.Tschumi, Bernard, "Sequences", in *Architecture and Disjunction*, Cambridge, MA, MIT Press, 1996.

FIGURE 22. Google Maps

FIGURE 23. Author

FIGURE 24. Author

FIGURE 25. Author

FIGURE 26. Author

FIGURE 27. Author

FIGURE 28. Author

FIGURE 29.

FIGURE 30.

FIGURE 31. Author

FIGURE 32. Author

FIGURE 33. Author

FIGURE 34. Author

FIGURE 35. Author

FIGURE 36. Author

FIGURE 37. Author

FIGURE 38. Author

FIGURE 39. New Babylon, Constant

FIGURE 40. New Babylon, Constant

FIGURE 41. Author

FIGURE 42. Author

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