dynamic stability:
a digital urban exhibition gallery in downtown Chicago

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"Nothing is permanent. Everything is in a constant state of flux and change. Through day and night, through summer and winter, year after year, from birth to death, life flows in a timeless cycle—life in soil and on the ground, in water and air, life of man and animal and plant—always in change and decline, so that in all nature nothing is the same at the day's end as it was at days beginning."

-Andreas Feininger
Forms of Nature and Life
acknowledgement

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thanks so much
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abstract

If we view things as connected (a whole)... not as static, but as a dynamic (living) system, we can begin to see where each "agent" or thing acts on and responds to other things in its environment and across many scales. Then we could begin to see the connections between how the behavior of the material, the behavior of the building, the community and ideas support (or negate) a kind of "ecology of mind and nature."

This book is a compilation of a semester's worth of research and development that ended in a architectural design that was meant to encompass some evolutionary principles that are found in nature everyday, but are very seldom implemented in the profession of architecture.

The final product is a digital urban exhibition gallery in downtown Chicago that portrays some of these evolutionary principles in a more abstract manner. The issues that are primary in my study are not meant to be literal interpretations of "natural kinetics" but more of a contemporary interpretation of what kinetics can mean in today's world of advanced technology.
background

"If nature has built, tested and perfected architectural structures for more than 5 billion years, then how would our human-made structures and environment be different if we directly applied this knowledge of nature? What would nature produce if it had to design for human beings? If we can assimilate the wisdom of nature's architecture and apply this wisdom to human-made architecture, then would we not benefit from this wisdom?"

-Eugene Tsui

Evolutionary Architecture

As we have reached the end of the 20th century, it is evident that our environmental concerns have become of greater importance than ever before. We, as people, are faced with a conglomerate of global problems that are detrimental to the biosphere and human life in alarming ways that may, quite soon become irreversible.

There are solutions to these problems that are quite attainable, if a change in perception is accepted. Consider this: condense the estimated existence of the planet (5 billion years) into a single year. If human beings first emerged 3 to 5 million years ago, then compared to the lifetime of the planet, we will have existed for about 1 hour and 50 minutes. If we then agree that civilized culture has existed as a cultured species for about 10,000 years, then we will have existed as a "cultured species" for approximately 13 seconds. To put it simply, human knowledge is minute and extremely limited in comparison to that of nature, and nature has "practiced" its ideas with astounding diversity and results. Such creative power and practical knowledge are almost incomprehensible. Given these facts, would it not make sense to look with greater insight and inquisitiveness into the wonder, beauty and intelligence of nature as an experienced practitioner of architecture?

As the new sciences of complexity are revealing, nearly all of the universe is self-organizing, unpredictable, creative, and maybe most importantly self-transforming. Ironically, in the modern era of
architecture, the machine was seen as a basis for design theories, which contain none of these qualities.

"We know that all living systems exhibit adaptive behavior. That is they possess and inherent ability to react to their environment in such a way that is favorable, in some sense, to the continued operation of the system. A self-organizing system maintains its existence through a continual interaction with its environment."

-Chris Abel
Evolutionary Planning

Architecture's newfound formal freedom is beginning to become indebted to factors other than new computer and digital methods. In design research, there is a major technological trend toward using nature as a basis for design - it's products and especially its processes. Recent important developments are "genetic algorithms" and "artificial life" programs that serve as computer-based design processes that imitate biological evolution and organic growth processes. Many science and nature magazines in the United States and Europe have been frequently reporting on experiments in biology and chemistry that are attempting to understand the deep logic of nature. Interdisciplinary teams of computer scientists, engineers, and material scientists are exploring building materials that use the molecular structure and behavior of organic matter as models to achieve higher structural performance and efficiency.

Experiments include materials implanted with sensors, capable of monitoring and responding to changes in pressure, temperature, light, and other variable conditions, as well as evaluating the consequences of change and considering the most efficient and natural ways to adapt. This is, in a sense, furthering the technology that is already in place, but the great difference is in the materials ability to self-react without the need for an engineer
or scientist to read data or devise responses. Other advances include self-healing materials that would react in a way similar to how a broken bone would self repair and self-forming materials would grow into structure. More realistic to the near future is biomimetic paint that can literally grow, beginning as a lump and spreading evenly like a skin over prescribed areas.

It’s ironic that the stability given by stone is false, because stone deteriorates in the pollution of our cities whereas a third of a millimeter of titanium is a hundred year guarantee against city-pollution. We have to rethink what represents stability.

-Frank Gehry

It is only a matter of time, and it is to our own benefit to plan for tomorrow...today.

The intent of my project was to take selected lessons from nature and apply them to a piece of built work. If these lessons from nature are explored and applied to our architecture, the results can only lead to the vast improvement of our built environment. The structure of natural systems is a vastly broad area of study, and an attempt to encompass this realm as a whole is unrealistic. However, my project was meant to focus on one issue that I anticipate will dovetail into other issues of "natural design" and will lead to a greater understanding of the power of nature in the design of the buildings that surround us.
My ultimate goal was to apply some of these evolutionary principles found in nature and use them in a way that serves as a design philosophy.

The key aspect that I focused on for my thesis project was what I call “dynamic stability”. I feel that the most impressive feature of the natural world is its ability to change and adapt itself. This makes nature an ideal example of sustainability and an applicable example of design. I view “dynamic stability” as a contemporary term for animated architecture that may not appear the same from one moment to the next - visually and experientially. If we as architects are to strive for sustainability we must understand that we are not to view stability as a static thing... but rather, as a living breathing entity that is inevitably going to change as time does. The world is in a continuous process of change and evolution, it only makes sense that our architecture applies these same principles. We are in a time where a rethinking of stability is essential and tradition must be challenged.

The issues that are primary in my study are not meant to be literal interpretations of “natural kinetics” but more of a contemporary interpretation of what kinetics can mean in our world of advanced technology. The issues that I intended to implement in this urban exhibition gallery are as follows:

- Kinetics of perception
- Use of layers as an ordering system
- Passive interaction of the users and its subsequent dynamics.
- Combining the modern ideal of the machine with the true nature of the organic.
Places which have this quality [natural and free], invite this quality to come to life in us. And when we have this quality in us, we tend to make it come to life in the towns and buildings which we help build. It is a self-supporting, self-maintaining, generating quality. It is the quality of life.

-Christopher Alexander
*The Timeless Way of Building*

My research was comprised mainly of the following precedent studies and the lessons learned from them.

My early precedent research was focused on architecture that had the ability to move and adapt to the physical surroundings and the users of the building. Such precedents came from architects such as Joppien Dietz, Steven Holl, Santiago Calatrava, Pierre Chareau, Enric Miralles and Eugene Tsui. The lessons learned from these fine architects were very valuable in the realm of kinetic architecture, but I felt that this type of architecture was too much of a literal interpretation of the evolutionary principles I was attempting to grasp.

Thus there was a shift in my focus.

My new direction of study was more focused on the type of architecture that demonstrated these same principles in a more virtual and theoretical manner. My new precedent studies were products of such designers as Bernard Tschumi, Peter Eisenman, Renzo Piano, Richard Rogers and Jean Nouvel. These precedents began to show me how I could achieve my goals through the use of creating perceptive windows for the users and viewers to pass through as well as use state of the art technology. This, I felt, had more theoretical depth and allowed me to reach my original evolutionary goals in a much broader sense then by simply moving and pivoting building elements.
Wind Chapel
Eureka Springs, Arkansas

This theoretical design for a chapel is intended to celebrate the wind and explore how the method of bricolage can enrich architectural design. Imagery of birds and musical instruments are fused together to demonstrate their fortuitous parallels. The dialogue of curved versus straight found in musical instruments and the incredible mechanistic thinness of birds with their graceful forms and movements compliment each other with great success.

Storefront for Art and Architecture
New York, New York
Steven Holl

This tiny wedge shaped space was redesigned by Steven Holl and artist Vito Acconci in the Soho Gallery area of Manhattan. Pivoting concrete-and-wood panels replace the old storefront. While this particular project does not emphasize its kinetic elements towards the changing needs of the user, but rather as a sculptural element in the Soho district, its dynamic applications can certainly be applied in many different ways.

Swissbau Pavilion
Basle, Spain
Santiago Calatrava

Such strong mechanical implications are not generally associated with architecture and mechanics is rarely recognized as a basis for architectural design. For Calatrava, however, mechanics is always a source of inspiration, and represents an entire field of invention. Static or dynamic, it is not only the transition between one type of movement and another, but also between one material and another.
Alfred Lerner Hall, Columbia University
New York, New York
Bernard Tschumi

Bernard Tschumi took the opportunity to create an active "hub" to connect two existing ends to Columbia University's student center. This animated hub is the heart and soul of the building and is meant to portray the movement of the users inside. All public spaces are placed in this area and connected with an intricate system of ramps that are clearly visible to any passers-by. With the light interior, the movement of the users become unidentifiable silhouettes that become part of an animated whole.

Dumont-Schauberg Headquarters
Cologne, Austria
Jean Nouvel

As many of Noulens works do, the Dumont-Schauberg Headquarters in Cologne, Austria is a prime example of an animate structure. By celebrating the movement of the users in the form of circulation, the facades are in a constant state of flux and therefore bring the building to life. A strong use of layers compliments this movement by allowing users as well as outside viewers to focus on different layers such as the light interior, the interior structure, the movement of the users or the screen printed text on the outside facades.
**Pompidou Centre**  
Paris, France  
Piano and Rogers

The well-known Pompiduo Centre in Paris is a prime example of turning what are normally private spaces into the celebrated concept of a fine piece of architecture. The building is turned inside out to allow for the exploitation of the building's systems as well as its circulation. This allows the machine aesthetic of the building to be animated by the visible movement of the users.

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**Groningen Video Pavilion**  
Groningen, Holland  
Peter Eisenman

Eisenman's Groningen Video Pavilion in Holland was part of an exposition involving some of the world's most highly regarded architects. This project was to be a processional path that followed a path similar to that of a video frequency wave. As the user turned each corner, they were presented with a new view of some type of digital media. The path is scarred and fragmented and is bottom-light to lead the users through the pavilion.
**Media Park**
Cologne, Austria

Jean Nouvel

This project serves as a multi-functional building in the heart of Cologne, Austria. This media park is a large scale office building and also serves a beacon of information to the surrounding area. Nouvel boldly uses interior lighting and transparent layers to communicate signage as well as animating the movement inside.

**SCI-Arc '00' Thesis**
Cyprus

Demitrios Avraamides

A strip of land known as the “Green Line” has divided Cyprus since 1974 and this thesis is an attempt to reconnect these two socially and culturally divided societies. This project allows for people to catch a glimpse of the “other’s” life, without having to deal with the established biases and misconceptions. A linear, layered structure with digital media walls serve as the new “Green Line” of Cyprus.

**Elegbra Auburn Avenue St. Museum**
Atlanta, Georgia

Verge Studios

The Auburn Avenue Street Museum is a project conceived by the city of Atlanta to develop the curatorial and conservation aspects of Auburn Avenue as the most significant street in the American Civil Rights Movement. Elegba is a multimedia production utilizing sound, imaging and interactive communications to tell the Auburn Avenue story. This project uses as its conceptual base the image of Atlanta as both a city of dreams and as a crossroads.
The site I chose for my project is on the north end of downtown Chicago. My particular site is a relatively small triangular lot in the middle of a medium scale commercial area. To the east of the site is Rush Street, an ever-changing Chicago thoroughfare that remains one of the cities most popular restaurant rows. To the west of the site is one of Chicago’s most heavily traveled north-south streets, State Street. The southern end of the site is bordered by a short connector street called Bellevue Avenue. Because the site is surrounded on all sides by busy streets, it lends itself well to the idea of “dynamic stability”, because of the constantly changing backdrop due to the heavy pedestrian and traffic flow. Layered views are seen in all directions with the visibility of 3-4 story commercial buildings in the foreground of some of the cities more well-known high-rises. The footprint of the site encompasses only 3,748 square feet.

This site allows me to grasp the existing kinetics of the site and to take advantage of them in an architectural manner. With this site, the dynamics of Chicago life can be accented in my architecture as well as be an ever-changing inspiration for its form.

As seen from the site photographs on the following pages, the site is at an instrumental place on the city grid. It’s location is on a visible axis from nearly all directions and has the potential to have great visual impact from blocks away or from its own curb.
View toward site from the northeast corner of Rush Street and Cedar Street.

View toward site from North State Street.

View toward site from southwest corner of Bellevue Avenue and State Street.
View toward site from West Maple St.

View toward site from Bellevue Avenue.

View toward site from northeast corner of Bellevue Avenue and State St.
process

and development

After preliminary research on my thesis issues, the design process for my exhibition gallery began with extensive site analysis. All site photos, maps of the area received from the university of Chicago and field notes were compiled and placed on boards for further analysis. Wind and sun conditions were considered as secondary factors in comparison to the dynamics of the heavy traffic and pedestrian flow in the area. As mentioned in the site study chapter, the existing kinetics of the area was seen as a premium opportunity as a jumping off point for creating a dynamic design and the movement patterns were paid close attention to. These physical, living dynamics were soon envisioned to be an exhibition themselves for the users on the site.

Following the site analysis phase of the project, I chose to design primarily in modeling form - physical and digital. I began the form generating process by doing several massing studies. The boundaries of my site provided a strong urban edge that would consequently form the exhibition gallery. With Chicago's north-south street grid, I felt that it was important to take advantage of Rush Streets skewed axis by celebrating it's interference of this grid. This axis served as the "primary" in the form generating process while State Street's north-south axis served as the "secondary."

My process models took the form of three layers that fused these two axis together. These layers all served different functions and each was significantly different from the other two. The Rush Street layer was the circulation layer, the State Street layer was the main gallery layer and between the two was the power and mechanical layer that served as the spine of the building. These three layers were seen as a whole but were also perceived as independent elements that appeared to act individually. The outer two layers were meant to appear to be sliding along the spine of the building to give it a stronger sense of stability and to emphasize the apparent motion of the circulation and gallery layers.
The massing phase of the process soon transformed into more of a circulation model of the gallery. This circulation model emphasized the movement of the users and played their dominance against varying types of media walls along Rush and State Street. These media walls were determined to be digitally generated by "digital artists" and served as a dynamic background for a kinetic layer of circulation.

These circulation models were subsequently analyzed and turned into a more architectural model of the exhibition gallery. This process model (found on the following page) was a composition of the earlier massing studies and the circulation studies. It was important to me to portray the materials I had in mind and especially demonstrate the transparency of the structure because the materials played an important role in the image of the building since it was a primary concern of mine to demonstrate how the true nature of the organic can be successfully fused with a contemporary machine aesthetic. This final process model also demonstrated more fully the distribution system of the digital means and the buildings impact on the street edge.

The process models that I built to this point led me to a more final, computer generated form portrayed in the design chapter.
There are several different approaches I could have taken to effectively address my selected issues. Therefore, I felt that with the issues at hand and the objectives that I intended to address the end product could have been one of many possibilities. I did not wish to follow a design approach that is suitable for only one or two building types, but rather, wanted to develop a way of thinking that can be applicable across many types and scales of design by making it non-building specific. While not all architecture calls for kinetic form and space at the same level, holistic efficiency of any building type could be vastly improved by its implications. It was, however, important to me to select an architectural project that symbolized kinetic form and space and would allow me the freedom to take the idea of "dynamic stability" as far as I could. Ultimately I chose to model several selected kinetic and evolutionary principles and apply them to an urban exhibition gallery in the heart of downtown Chicago.

The exhibition gallery is a public building that is open 24 hours a day, 7 days a week and will not be formally run by a group of museum curators, but by the public themselves. This public space is a type of "interior park" that is in a constant state of flux and will demonstrate the theory that architecture is a process, a continuum that is never the same from one moment to the next. It is a space that is perceptually adaptable and is manipulated passively by the users that pass through it. The gallery does not have strong commercial or retail motives and is not intended to be a space that is solely for viewing the exhibitions, but will be a place of impromptu activity such as resting, meeting and other leisurely interactions.

The focus of the exhibitions are of the electronic age by being primarily computer generated artwork from "digital artists". The intentions of this type of exhibition is to encourage us to look to the future and disintegrate the barriers that exist in our preconceptions. These barriers exist between the administrator of a building and its users, between
public and private space and between different media such as virtual images and printings. While I do not expect these barriers to be all together omitted, I hope to at least blur the edges of them significantly. I also hope by using a building with a machine aesthetic to display state of the art digital artwork this will demonstrate that we can successfully fuse together our advanced technology with evolutionary principles that have been prominent in nature since the beginning of time.

This approach also supports the theory that architecture is a life-long continuum that always changes over time. Eventually a physical building will emerge and, even then, modifications will arise with the introduction of new media. Thus there will be no end to our spatial experiences. We will be designing time as well as space.

The first issue that I implemented into my thesis project was that concerning the "kinetics of perception". The goal of this portion of my thesis was to give the user of the gallery as well as the people on the street multiple readings of the exhibitions in order to engage everyone that is near the site. It was my intention to fuse the virtual experience of the exhibitions with the "real" life of urban Chicago. This allowed the digital display to complement the "city" display and vice versa. The electronically mediated displays allowed for easily mediated space. With the digitally manipulated images that were projected onto the display screens of the gallery and through open gallery space, this created a type of dynamic space that would be ever-changing. These projections might pass through space and onto users that would make them a part of the exhibition themselves and creates a type of passive interaction that will be discussed later in this chapter. This contrast of changing virtual images and the static "real" environment of the structure speaks of the object and its opposite and creates a strong dynamism. This feeling of the object and its opposite modifies our perception and portrays the same feeling in us as would a piece of art.
The perception of the gallery also changes as time does. During daylight hours the gallery appears to be a tighter more bound space due to the ample amount of natural lighting that diffuses the projected images of the gallery space as well as the media wall that anchors the circulation ramp. As the natural lighting is transformed into vast darkness the imagery of the gallery becomes a great contrast to the Chicago context and begins to reach out into the city by expanding its visibility. At night the building further expands its presence as the projection towers project large scale images onto louvered screens attached to surrounding buildings in the area. The perception of the gallery to outside viewers also changes as does the lighting conditions. During the day the users of the building appear clearly as part of the animated images of the electronic exhibition and at times are somewhat hidden by the glistening of the sun on the glass facades of both the gallery space and the ramp. However, at night the users become more ambiguous silhouettes that appear to be interferences of the images and are clearly not interrupted by the façade due to its dissappearance after daylight hours.

The second implemented issue of my thesis was the use of layers as an ordering system. As discussed before in the process chapter, the massing of the exhibition gallery is reminiscent of a spine anchoring two sliding layers alongside, however, the concept of layers goes much deeper than that and carries through to nearly all scales of the project. The Rush Street layer alone has 6 sub-layers within. This circulation layer is comprised of the transparent glass curtain wall layer, the ramp circulation layer, the media screen layer, the structure layer, the opposite media screen layer and the opposite circulation layer. This system of layering gives a cinematic effect by emphasizing the interplay of kinetic layers with static layers. These same principles are applied in the gallery layer and the hierarchy of each sub-layer changes as time does (as discussed earlier in this chapter).
This layering system also reaches a more abstract level by creating visual layers and virtual layers. The visual layers are apparent in the presence of various information layers that may or may not be focused upon and thus change our perception. It is to the viewers discretion to focus on such layers as the digital surfaces, the movement layers of circulation or possibly the screen printed words placed at key points of the glazed facades. The virtual layers are significant in reference to what is real and what is not. For example the projected images of the gallery spaces versus the structural layers of the buildings spine.

A third issue I addressed in this project was that concerning the **passive interaction of the users** of the space. It was my first inclination to create a space that could be physically manipulated by the users and thus create a kinetic environment filled with user interaction. However, when my focus of study changed to a more virtual kinetics, my idea of user interaction changed as well.
elevated view of south facade

elevated view of southeast corner
elevated view of southeast corner

elevated view of Rush Street façade
I now felt that a passive interaction was more appropriate since I was attempting to create an environment with kinetics that didn't necessarily mean physically moving parts of the project. This way the users just being in the space and circulating around gave an added sense of vitality to the space and image. As they moved into and through the space their images and silhouettes would be captured throughout the gallery and ramp areas by interfering with the projections or animated images. This allowed for the users to be part of the experience without having to do anything but exist in the space.

The last issue that helped drive my project was an attempt to combine the modern ideal of the machine with the true nature of the organic. What I mean by this is that I felt it was of my best interest to create a tectonic image of the structure that was parallel with state of the art technology and the machine, while at the same time implementing the most impressive aspect of the natural process...change. My reasoning for this was to show how we, as contemporary architects living in a digital world, can apply natural, evolutionary principles to architecture that is current with today's advancements.

This thesis is just the first step into a direction that few architects of our time seem to venture into. I feel that by implementing these evolutionary and kinetic principles, our built environment can be vastly improved and become highly organic in a technological way.
street view of State Street facade

street view from south on Rush
elevated view of Rush Street ramp facade

street view from southeast corner of Rush and Bellevue
pedestrian view from across Bellevue Avenue and towards projected images on adjacent buildings

pedestrian view towards entrance ramp and projected images
pedestrian view from crosswalk towards entrance

pedestrian view towards south ramp façade and main gallery stair
pedestrian view from across Bellevue Avenue and towards projected images on adjacent buildings

pedestrian view from southeast corner of State and Bellevue
pedestrian view from southeast corner of State and Bellevue

pedestrian view from southeast corner of State and Bellevue
elevated view of State Street façade and projected images on adjacent buildings

street view from west on Maple Street
pedestrian view towards main gallery stair

view of main gallery stair
pedestrian view of street gallery

pedestrian view of street gallery and main gallery stair
pedestrian view from northwest corner of State and Cedar

pedestrian view of northwest corner
street view of northwest corner

elevated view of north ramp facade
elevated view of northeast corner

pedestrian view of State Street facade
Pedestrian view from north on Rush Street

Pedestrian view from across Rush Street
Pedestrian view from upper level ramp

Pedestrian view from main gallery space toward State Street below
pedestrian view from main gallery space toward Bellevue Avenue below

pedestrian view from upper level ramp toward Rush Street below
reflection

The last five months of my academic life have been an incredible learning experience and one that I will always carry with me throughout my professional career. I am deeply interested in the topics and issues discussed in this book and hope I am given the chance to further that investigation as I move forward in my career. This thesis is a compilation of all the struggles and triumphs of a long five years of architectural growth and am deeply appreciative of all who helped along the way.

"It's seizing the day and accepting responsibility for your future. It's seeing what other people don't see, and pursuing that vision no matter who tells you not to."

-Howard Schultz


